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A Starting Guide for Campus Sustainability

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Abstract

The concept of sustainability is getting popular in Northern American colleges and universities; however, its movement is still at the beginning phase. Currently, there is no definite answer of how an institution can reach sustainability in the most effective way. The specific answer depends on the various unique characteristics of an institution. However, many colleges and universities have taken similar steps towards sustainability. The purpose of this document is to explain the six foundation steps towards campus sustainability and provide suggested solutions for environmental sustainability problems in the areas of social, water, waste, and energy.
Capstone Design Project

This Major Qualifying Project is created following the “Criteria for Accrediting Engineering”. There are eight considerations which is described by the Accrediting Board for Engineering and Technology (ABET). Six out of eight fields were followed in this project. These six considerations are: Economic, Environmental, Sustainability, Health and Safety, Social, and Political. In addition to these fields, the roof of WPI Salisbury Lab is redesigned to support the green roof system to illustrate the sustainability method applied for campus buildings.

Economic Considerations
While pursuing green campus, economic is always a critical aspect to be considered to actually carry out a campus sustainability construction plan. In this document, for each possible solution to make campus sustainable, a feasibility discussion and real world examples were shown. In most cases, at the beginning phase of applying a green technology and renovating a building, a great money input are required. However, from the long term view, a green change will lead to great resource saving, such as energy and water consumption saving and these saving will balance the initial cost in several years to twenty years.

Environmental Consideration
The main goal of turning a campus to be green is to make this campus environmental friendly. A campus being green is equal to a campus being carbon neutral, which already tells the environmental benefit associated with a sustainable campus: reduced carbon emission. Global warming has become a more and more concerned environmental issue by the public and over emitted carbon dioxide is the major contribution to global warming. While a campus transits to be greener, less fossil fuel generated energy will be used and therefore, less carbon dioxide will be produced. In addition, problems such as other air pollutants, inefficient water usage and overloaded trash production and so on will be solved with establishing a green campus.

Sustainability Consideration
Being sustainable means to meet present generation’s need without compromising future generation’s need. A sustainable campus will have less natural resource consumption or/and renewable technology installation or research such as wind turbine installation, fuel cell technology research and application. All of these will result in saving natural resources or developing new usable natural resource for the future generations.

Health and Safety Considerations
Campus sustainability is a common trend among institutions. By making campus more sustainable, the students and faculties have a better studying and working place. Sustainable campus buildings would have better indoor environmental quality than existing buildings. These buildings with the improved air ventilation and sustainable material create healthy environment inside the building which helps to prevent respiratory diseases.

Social Considerations
The methodology for campus to be more sustainability requires the involvement of everybody, every department, every organization on campus. It also requires the strong
communication to get attention from everybody in school as well as public. By becoming green, the institution creates a better studying and working environment for students and faculty. The result of it is the productivity and the institution’s reputation can increase.

**Political Considerations**

Recently, the United States government has passed several sustainability acts in addition to local environmental regulations such as Energy Policy Act or local waste regulations. The methodology for campus to become more sustainable helps institutions to avoid some problems in the future. The proposed ideas for campus will allow the institution to be competitive with other schools.

**Salisbury Lab green roof**

The roof is designed based on the consideration of the water runoff rates, cost and heat island reduction. The current roof of the Salisbury lab most likely will not be able to support the additional loads due to the green roof weight. Therefore, the roof needs to be redesigned to have an adequate strength to support all the loads including the weight of the fully saturated soil. Putting up the green roof on top of the Salisbury Lab will help to reduce the water runoff in heavy rain days and lower the high temperature of the roof during hot summer days. This new roof design addressed environmental and sustainability issues through reducing the building’s energy usage and lessening the impact of heat island effect created by the city. This project also takes construction expenses into consideration. The cost to construct different types of green roof is a factor that affects the economical feasibility of the project.
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**Abbreviations**

**A**
AASHE: Association for the Advancement of Sustainability in Higher Education

ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers

**C**
CBSM: Community-Based Social Marketing

COP: Coefficient of performance

**D**
DOE: Department of Energy

**E**
EPA: Environmental Protection Agency

EER: Energy Efficiency Ratio

ERV: Energy Recovery Ventilators

EPAct 1992: The Energy Policy Act of 1992 which “created the framework for a competitive wholesale electricity generation market and established a new category of electricity producer, the exempt wholesale generator”

**F**
FCV: Fuel Cell Vehicle

**G**
GHG: Green House Gas

GSHP: Ground-Source Heat Pump

**H**
HGCI: Harvard Green Campus Initiative

HVAC: Heating Ventilating, and Air Conditioning

**L**
LEED: Leadership in Energy and Environmental Design

LED: Light emitting diodes

---

1 (Energy Information Administration, 2005)
O
OEE: Office of Energy Efficiency

P
PV: Photovoltaic

R
RECs: Renewable Energy Certificates

S
SHGC: Solar Heat gain coefficient

U
USGBC: U.S. Green Building Council

V
VT: visible transmittance
Introduction

Environmental issues have become more and more concerned by the public. Since the First Industrial Revolution in the 18th century, fast industrial development has brought unprecedented pollution to the earth—to its air, soil and ocean. This pollution caused many serious environmental issues, such as global warming, hole in ozone layer, acid rain and so on. To save the only land human being can live and rely on, a worldwide sustainability movement has begun. More and more government, non-government organizations and individual households are joining this movement. Colleges and Universities, as an educational group have the mission to act as a pioneer to lead and promote the movement. Nowadays, in North America, it has been a great trend that institutions try to seek for the best ways to make their campuses green and sustainable.

Sustainability Movement

The basic definition of “sustainable” is to extend the life of something. Being sustainable is a problem that has haunted man-kind for years. Families always try to have a steady income and food on the table for every meal. Business men prolong the life of their business by making sure there is a demand for their goods and services, sufficient work force is at hand, and enough resources are available to manufacture the product or to provide their services. This idea of prolonging the life of something has evolved into a larger world movement, which is trying to prolong the life of humans on earth.

The concern for the survival of human beings in the far and near future is a concern that shapes the sustainability movement in the twenty first century. With various world problems, such as global warming, the shortage of food or fresh water, many wonder if humans can prolong their life on this planet into the far future. The most popular definition for the current sustainability movement is found in “Our Common Future: The Report of the World Commission on Environment” and Development or known as the Brundtland Commission report.

1. **Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.** It contains within it two key concepts:
   a. The concept of ‘needs’, in particular the essential needs of the world’s poor, to which overriding priority should be given; and
   b. The idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs.

2. **Thus the goals of economic and social development must be defined in terms of sustainability in all countries...**

---

2 (Merriam-Webster)
3 (Global Reporting Initiative, 2006, p. 2)
3. ...Physical sustainability cannot be secured unless development policies pay attention to such considerations as changes in access to resources and in the distribution of costs and benefits. Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within generation.\(^4\)

As a way to further promote these ideas, an Earth Charter was created in 2000, as a way for nations to declare their recognition of current environmental issues, and provide guidance in the transition towards sustainable development. This charter is endorsed by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the World Conservation Union, and over 2,500 organizations worldwide.

The response to this Earth Charter by various countries has been very positive. In 2007, Brazilian Ministry of Environment made an agreement with other organizations to promote the Earth Charter in every sector of Brazil. Other countries have also declared that they will be incorporating the Earth Charter into many of their programs and policies. The support for the Earth Charter is increasing every year, demonstrating the world movement for sustainability practices.\(^5\)

The sustainability movement does not target a single person, organization, or country. Everyone is part of the movement, whether it is by recycling materials at home, or national greenhouse gas (GHG) emissions cap imposed by the government on all industries. Each person, organization, and country is viewed as having responsibility to reduce their negative impact on the earth and the human race.

**Definitions of Sustainability in Organizations**

![Sustainability Visual Chart](image)

The Global Reporting Initiative is a global multi-stakeholder network, which has developed a popular reporting guideline, setting the foundations for defining sustainability for any organization, known as G3.\(^6\) This standard is becoming popular among major organizations.

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\(^4\) (AASHE, 2008, p. 5)
\(^5\) (Earth Charter Initiative)
\(^6\) (Global Reporting Initiative)
around the world. In 2008, 688 new organizations had developed their reports using the G3 framework.\footnote{Global Reporting Initiative, 2008}

The G3 reporting framework categorizes sustainability into three sections, economical, environmental, and social (Figure 1: Sustainability Visual Chart). In the business terminology this is known as the triple bottom line, using the terms profits, planet, and people. The education sector uses the “Three Es”, economy, ecology, and equity. Although various terminologies are used, the theme of sustainability for organizations always contains three important themes: the economics, the environment, and the society.\footnote{AASHE, 2008, p. 6}

The three categories of sustainability help organizations define what role they play in the sustainability movement. The economical category investigates financial impacts the organization has on its stakeholders, and on local, national, and global economic systems. The environment section looks at the organization’s impact on the world, such as through pollution, energy consumption, waste production, and resource use. The environmental section is also helpful in checking if the organization is compliant with local and federal environmental laws. The organization’s impact on society, including labor practices, human rights, and product responsibility, is covered by the society category.\footnote{Global Reporting Initiative, 2006, pp. 25, 27, 29}

The G3 framework provides a broad definition of sustainability for any organization. This broad definition is to be used as the foundation for defining a more detailed definition that is more applicable to the specific organizations. Since each organization is unique, different detailed definitions are being developed and modified, such as the STARS inventory developed by the Association for the Advancement of Sustainability in Higher Education.\footnote{AASHE, 2008, pp. 3-7}

### Campus Sustainability

Colleges and universities play a special role in this movement because they are the leaders of education and are expected to lead the sustainability movement. To demonstrate their leadership, many institutions are taking steps to create sustainability master plans that will help them reduce their negative impact on the world and at the same time teach their campus community about sustainability.

Currently there is no official sustainability standard for colleges and universities, which allows institutions to create their own definition of campus sustainability. Two assessment frameworks, Sustainability Tracking, Assessment & Rating System (STARS) and the Campus Sustainability Assessment Framework (CSAF), were created in attempt to create a standard for campuses. Both of these definitions contain the three main elements of sustainability defined by the G3 but use different visual representations.

The STARS assessment was developed with the assistance of The Association for the Advancement of Sustainability in Higher Education (AASHE). The framework is still in the editing phase and is expected to be published in 2009. Using the G3 visual, the STARS assessment is broken into three categories, Education and Research, Operations, and Administration, and Finance.
The CSAF is based on a Master’s thesis by Lindsay Cole, which used a different visual to demonstrate campus sustainability, as shown in Figure 2. The inventory contains two major categories, the Ecosystem and the People. Under each category the topics are further split into sub-categories. For ecosystems they are air, water, land, materials, and energy. Under people they are knowledge, community, health and well-being, governance, and economy and wealth. Each of these categories needs to meet certain requirements in order for the campus to be sustainable. Although this is a different approach on campus sustainability, it still contains the three basic definition of sustainability: society represented by people, environment represented by ecosystem, and economics represented by the Economy & Wealth subcategory.11

The STARS and CSAF frameworks are the first steps in defining campus sustainability. They provide colleges and universities a starting point for participating in the world movement. Since the campus movement is still a new concept, the definition of campus sustainability is expected to evolve over time forcing campuses to develop their master plan accordingly. The campus sustainability master plan is defined as a fully integrated and comprehensive plan for every aspect of the institutional planning and operating to help campus become more sustainable in the future. The sustainability plan includes steps and sustainability practices which will help the institutions to achieve their sustainability goals.

**Greenhouse Gases**

The definition of sustainability for any organization typically includes a greenhouse gas (GHG) emissions component. Greenhouse gases, such as carbon dioxide, are increasing in concentration in the atmosphere causing the greenhouse effect, raising the temperature on earth over a period of time. This could lead to drastic changes on earth, such as global warming, ice caps melting, and changes in global weather patterns. With such drastic changes on earth, it is predicted that this will compromise “the ability of future generations to meet their own needs.”

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11 (Cole, 2003, pp. 2-3)
By reducing greenhouse gas emissions, the chances for these drastic changes to the earth can be reduced.

The sources of many greenhouse gases are from combustion of fossil fuels, such as operations of cars, industrial processes, and in production of electricity. The emission of gases that are of major concern today are carbon dioxide, methane, nitrous oxide, hydro fluorocarbons, per fluorocarbons, and sulfur hexafluoride. The last four gases are typical produced through industrial processes. With developing nations slowly expanding their industrial infrastructure, the emissions of greenhouse gases is expected to rise over time.\(^{12}\)

The Kyoto protocol, developed by the UN, addresses the issue of global warming. Thirty eight industrial countries have signed the document, committing to reduce the greenhouse gas emissions to be 5.2 percent lower than the 1990 levels by the year 2012.\(^{13}\) The Kyoto Protocol is aimed at large industries, but the trend of reducing greenhouse gas emissions in smaller organizations is slowly becoming popular, especially among colleges and universities.

Since colleges and universities provide a wide variety of services, such as housing, research, and dining, they are considered to be mini-cities. Their operations can contribute a significant amount of greenhouse emissions, which is recognized by the STARS and the CSAF frameworks. Each one suggests the campus to conduct a greenhouse gas inventory and set a target to reduce the emissions within a certain time period. Many campuses in United States and Canada already have taken the initiative of conducting a greenhouse gas inventory and taking action on their findings.

### Stantec and Campus Sustainability Construction Master Plan

**A. Stantec**

Stantec consulting firm was founded, in 1954, by Dr. Don Stanley, under the original company name of D.R. Stanely & Associates. He conducted feasibility studies of installing water and sewer systems for local towns in the region of Alberta, Edmonton. The business was a success from the start. Various towns contracted him to conduct feasibility studies for water and sewer system installation. Many of these towns later constructed these systems based on Dr. Stanely’s studies. In 1955, Louis Grimble and Herb Roblin joined D.R. Stanely & Associates team. Louis Grimble was a structural engineer and during this period was recognized as one of the top three bridge specialist. He assisted in the design for the replacement of the Peace River Bridge in Taylor, British Columbia. Herb Roblin was an expert in railroad design. With both a structural engineer and a railroad designer, the company now provided services in water and sewer system design and transportation engineering.

As the years went by the company expanded, providing additional design services, and contracting work overseas. One of the first major international studies conducted by D.R. Stanely & Associates was the Jamaica Four Towns Water Supply Studies in 1970. This study looked at a design of a water distribution system that would provide safe drinking water for the towns of Jamaica. Other well known projects of Stanely & Associates were the 4th Avenue Bow River Crossing in Calgary, Alberta, a 1,411 foot bridge that had a unique s-shaped design (1980). The light rail transit CTrain System extensions in Calgary, Alberta (1982). The Swans Hill Treatment Centre (1985), which is the only structure of its kind in Canada that treats hazardous

\(^{12}\) (Energy Information Administration, 2008)  
\(^{13}\) (Environment Canada)
waste. One of the greatest achievements considered by Stanley & Associates was the Confederation Bridge project. Built in 1987, it connected the provinces of Prince Edward Island and New Brunswick. It is an eight mile long bridge that crossed a body of water covered by ice majority for the year. This project received fifteen international honors as a reflection of their great accomplishment.

As the company grew it acquisitioned other firms and slowly expanded throughout North America. In 1998 Tony Franceschini became the CEO of the company and introduced a single identity name, Stantec, for the whole company and their acquisitions. Currently the company has over 9,000 employees, over 300 of which are LEED accredited professionals. More than 150 offices are scattered throughout North America, providing services in five departments, building, environmental, industrial, transportation, and urban land. In each department are various sectors that provide specialized services, such as design, project management, surveying, and feasibility studies.

With growing concern of global warming and environmental damage by humans, Stantec is a company that is finding solutions to these problems with every project. Stantec’s motto is “The world of Stantec is the water we drink, the roadways we travel, the buildings we visit, the industries in which we work, and the neighborhoods we call home.” Their motto describes the diverse services they provide which demonstrates their role in assisting North America to reach its goal of being greener (Stantec 2008).

B. Campus Sustainability Master Plan

Stantec Inc. found that to become a sustainable, green or carbon neutral campus has been an important goal among North America colleges and universities, and this creates a potential market for environmental consulting firms including Stantec Inc. Therefore, Stantec Inc. and Worcester Polytechnic Institute corporate to carry out a win-win student based project, in which Stantec Inc. wants to listen to what college students think a sustainable campus should be and what possible methods could be applied to achieve a sustainable campus. At the same time, WPI students obtain a good opportunity to solve a real world problem and get practice before graduation.

This project aims to create a master plan template for campus sustainability achievement. It has two goals. The first is to develop foundation steps institutions should follow to gain campus sustainability. The second goal is to provide suggested solutions for environmental sustainability problems in the areas of social, water, waste, and energy. To meet these two goals, our project was divided into two parts. Part 1, Steps of the Sustainability Master Plan, and Part 2, Suggested Sustainability Solutions. Part 1 covered six foundation steps for a sustainability master plan which would be used by an institution that is in the early stages of developing a sustainability program. Part 2 expanded on steps 1 through 4, providing more detailed information and suggestions of how these steps should be carried out and each suggestion’s feasibility. These suggestions were made based on what the leading sustainability institutions had already done, suggestions presented by various sustainability organizations, and interviews conducted to confirm the research. The topics covered in this project provide a basic overview of the campus sustainability movement, but more research needs to be done, on these topics, in order to fully understand how a college or university can become sustainable.
At last, a green roof redesign was conducted to the roof of Salisbury Lab at Worcester Polytechnic Institute, as an example to apply and check our suggested solution to address various aspects of environmental issues on campus.

Salisbury Lab is WPI's third building, completed in 1898. It is the home of WPI Humanities and Arts Department. Many classes are taught in this building. As WPI is trying to turn its campus to be sustainable, renovating buildings to be LEED certified or to be sustainable is one of the tasks. A sustainable roof such as green roof is one possible solution to make buildings be more environmental friendly. By installing green roof on Salisbury Lab, surrounding temperature in summer can be reduced, energy consumption in this building can be saved and the green roof can also be used for educational purpose.

Green Roof and Salisbury Lab

According to EPA, green roof is a roof that has a vegetative layer to reduce the temperatures of the roof surface and surrounding area through evapotranspiration. The plants on the roof absorb water through the root and emit it through leaves. This emitted water is evaporated by the heat of the surrounding area. Because of this reason, the temperature of the roof and the surrounding area is cooled down. Below are some components of the green roof:


Besides reducing roof and surrounding air temperature, green roof can also reduce the air pollution and green house gas emissions, reduce and slow the rainwater runoff. Because of the vegetative layer, green roof can convert carbon dioxide to oxygen to reduce the green house gas emissions. Due to the fact that, the green roof has growing medium to absorb rain water and maximize water retention. There are two types of green roof, extensive and intensive. The extensive green roof is much lighter than the intensive one due to the difference in the depth of the soil and types of plants. \[\text{14}\] Regular soil is can weigh up to 800 kg/m\(^3\) when saturated with water, which is too heavy for any existing roof to support. Recently companies have developed

\[\text{14}\] (EPA, 2008)
lightweight soil that only weighs 300 kg/m$^3$, when saturated with water, making green roof possible for existing buildings.$^{15}$

C. Heat Island Affect

According to EPA, in urban areas, during summer, the building roofs and pavement surfaces can be 50–90°F hotter than the surrounding air, whereas in suburban areas, the temperature is much cooler and close to air temperature. This is caused by less vegetation coverage and more pavement usage in cities. This phenomenon is called “Urban Heat Island Effect”.

Due to the features of heat island effect, it can bring many negative impacts to a community, such as elevated energy consumption, increased greenhouse gas emission and human illness and discomfort incurrence. With installation of green roofs onto a conventional roof, according to EPA, 20-80°F can be reduced at the surrounding temperature and therefore, energy usage and greenhouse gas will be greatly saved and higher quality of life in community will be provided.

Energy Saving

A simulation was made on the green roof of the City Hall in Chicago and it demonstrated that 1.2% cooling energy consumption reduction in the building would occur with every 1 °F drop in the surrounding air temperature. This study also demonstrated that if green roofs were installed onto all the buildings in Chicago, which equals to 30% of total area of Chicago city, after ten years, the decreased energy consumption in Chicago would lead to as much as $100,000,000 saving every year.

Air Pollutants Reduction

Because most of the power plants in the United States use conventional fossil fuel to generate electricity, chemicals including sulfur dioxide, nitrogen oxides and carbon monoxide

$^{15}$ (Peck & Kuhn)
are produced along the combustion of fossil fuels. These chemicals can harm human health and air pollution such as acid rain. In addition, carbon dioxide which is also discharged from electricity production is the main resource of greenhouse gas and contributes to the global warming. With the application of green roofs, electricity demand for building cooling will be reduced greatly and therefore air pollution and global climate will be helped.

**Human Health Improvement**

Under extraordinary high temperature and humidity in urban area, people usually feel uncomfortable and experience respiratory difficulties. This heat island effect can also bring sensitive populations fatal risks, such as the patients in hospitals, children and elders. As the data EPA provided, in middle July of 1995, 1,000 deaths were caused by an uncommon heat wave in the Midwest US.

**D. Peak Water Runoff**

Water runoff consists of rainwater that cannot penetrate the ground, and instead flows over the surface of it to get to the lowest point possible. With humans constructing buildings and paving roads on the surface, the water is unable to penetrate into the ground. This increases the volume of water runoff and it takes less time for the runoff to reach streams and rivers. With larger volumes entering the streams, flooding becomes an issue.\(^\text{16}\)

Green roofs provide a way to reduce the volumes of runoff in a short amount of time, by slowing down the flow of rainwater. The soil and plants on top of the roof act as a barrier for the rainwater, not allowing it to flow off the roof easily. It was estimated that the runoff could be reduced by 11\% to 15\% in the City of Portland, Oregon if all the buildings had a green roof.\(^\text{17}\)

**Methodology**

To corporate with Stantec and develop a template for North American campus sustainability master plan, we first did background research of Stantec Inc., to understand what type of business this company was running and what kind of result this company was going to expect from us, specifically, 1. how many and which aspects of campus sustainability construction they wanted us to include into the research and report, as not all topics can be discussed due to this project’s time constraint; 2. the audience of this report, so that we would know whether this project should be written in more technical way or our audience should be set as those with no or little campus sustainability knowledge. Then, we started researching for campus sustainability and the topics Stantec Inc expected us to talk about. Weekly conference call meeting with Stantec Inc. was held, during which we proposed our plan for this project and revised it based on every week’s feedback from Stantec Inc.

After our proposal was approved by Stantec Inc., we went to City of Edmonton, Canada where Stantec Inc.’s headquarter located for 8 weeks. In Edmonton, we worked like full time employees, going to office at 8 in the morning and leaving at 4:30 in the afternoon. In the 8 weeks, we continued doing research, having daily routine meeting inside team and discussion meetings with Stantec advisors and school advisors. Our final document contains into two parts,

\(^\text{16}\) (Perlman, 2008)

\(^\text{17}\) (Beck & Kuhn, p. 9)
Steps of the Sustainability Master Plan and Suggested Sustainability Solutions and a green roof design for Worcester Polytechnic Institute Salisbury Lab was also included as a real example to apply our recommended solution to campus sustainability development.

### Identifying Steps to College Sustainability

Foundation steps to obtain campus sustainability, which institutions at the beginning phase should follow, were recommended. They are step 1. Commit to Sustainability; step 2. Create Sustainability Committee; step 3. Create Sustainability Committee; step 4. Establish Immediate Policies; step 5. Create an Action Plan; step 6. Implement the Action Plan; step 7. Modify Action Plan. These seven steps were developed based on researching campus sustainability master plans of leading colleges and universities in North America and interviewing sustainability officers and student organizations in University of Alberta.

The official website of Association for the Advancement of Sustainability in Higher Education (AASHE) is one of the main sources we used. AASHE is a non government organization which works to promote green movement among campuses in North America. Many leading sustainable institutions, such as Harvard University and Dickinson College in the US and British Columbia University in Canada, joined AASHE as active members and share their experiences, knowledge and new discoveries. The Harvard Green Campus Initiative is another organization we could find many valuable recourses, articles and project reports. By reading, analyzing and summarizing sustainability projects which these leading green institutions have done and the problem which they have met, we came up with recommendations, which are the seven steps. These steps are aimed for campuses to refer to when they are making their own campus sustainability master plan.

Thereafter, we arranged interviews with sustainability officers and student sustainability organization leaders in University of Alberta. During the meetings, they first gave us a brief introduction about what actions University of Alberta had done to pursue campus carbon neutrality and what were their school’s future goals. Then, we presented our steps and asked for comments and suggestion. We found our recommendation were well accepted and welcomed and coincided with the actual steps University of Alberta was taking and was going to take.

### Green Roof Design

In order to design the green roof for Salisbury, the research about the green roof was conducted. This research includes the installation, benefits, and costs of the green roof. Based on the information, two major aspects of green roof were investigated for Salisbury Lab.

- Water run off
- Roof Structure

Before doing the analysis for the Salisbury green roof, the roof area which the green roof would be put on was identified. Because the water runoff reduction depends on which type of roof is chosen, choosing the type of green roof was the next step. In order to for the structure not to be collapsed, the roof structure needs to be strong enough to support the green roof loads when the soil is fully saturated in addition with the existing concrete slab. Due to the complexity of the
project and time constrain, the foundation and columns of the structure were not designed. Thus, designing the beams and girders system for the roof was the final step.

**Water runoff**

The current water runoff is calculated using the physical dimensions and properties of the building in the given CAD drawings. Two types of green roof designs were investigated, intensive and extensive. Soil depths from 2 to 50 centimeters were used in the analysis. In order to determine the total weight of the soil, the density of the soil used was multiplied by the required volume. The peak run off rate was calculated using equation 1.

\[
Q = 0.0028CiA
\]

Equation 1

- \( Q \) = peak runoff rate, m\(^3\)/s
- \( C \) = runoff coefficient
- \( i \) = average rainfall intensity, mm/h
- \( A \) = area of watershed, ha
- 0.0028 = conversion factor, m\(^3\)*h/mm*ha*s

The runoff coefficient for various roof designs, were taken from the *Green Roof Policies: Tools for Encouraging Sustainable Design* by Goya Ngan (Table 1).\(^{18}\)

### Table 1: Various Green Roof Designs

<table>
<thead>
<tr>
<th>Type of Greening</th>
<th>Thickness (cm)</th>
<th>Form of vegetation</th>
<th>Annual runoff coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive</td>
<td>2 - 4</td>
<td>Moss-sedum</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>4 - 6</td>
<td>Sedum-moss</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>6 - 10</td>
<td>Sedum-Mooss-herb</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>10 - 15</td>
<td>Sedum-herb-grass</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>15 - 20</td>
<td>Grass-herb</td>
<td>0.40</td>
</tr>
<tr>
<td>Intensive</td>
<td>15 - 25</td>
<td>Lawn-perennial-small shrub</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>25 - 50</td>
<td>Lawn-perennial-shrub</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>50 - 50</td>
<td>lawn-perennial-shrub-tree</td>
<td>0.10</td>
</tr>
</tbody>
</table>

The rainfall intensity for Massachusetts was found in the *Rainfall Frequency Atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years* report written by the Department of Commerce.\(^{19}\) The area of the watershed only included the area covered by the roof itself. The runoff coefficient used for the roof runoff was 0.80, which was taken from *Introduction to Environmental Engineering* by Davis and Cornwell.\(^{20}\) The area of which the green roof will cover on top of Salisbury Labs is smaller than the roof area itself. Five foot offset from the edge of the walls was considered.

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\(^{18}\) (Ngan, 2004, p. 22)
\(^{19}\) (Hershfield, 1963, p. 50)
\(^{20}\) (Davis & Cornwell, 2008, p. 118)
To determine the weight that needs to be supported for the various roof designs, a soil density of 292.6 kg/m$^3$ was used, which consists of sand, pumice, and compost, which was the exact soil used on a new library in Vancouver, British Columbia.\textsuperscript{21}

The costs of installing the roof were based on the average values presented in Design Guidelines for Green Roofs by Peck and Kuhn (Table 2).\textsuperscript{22}

**Table 2: Average cost range for installing Extensive and Intensive Roofs**

### Extensive Green Roof

<table>
<thead>
<tr>
<th>Component</th>
<th>Average Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design &amp; Specification</td>
<td>5-10% of total cost</td>
</tr>
<tr>
<td>Project Administration &amp; Site Review</td>
<td>2.5-5% of total cost</td>
</tr>
<tr>
<td>Re-roofing with root-repelling membrane</td>
<td>$100.00 - $160.00 per square meter</td>
</tr>
<tr>
<td>Green Roof System</td>
<td>$55.00 - $110.00 per square meter</td>
</tr>
<tr>
<td>Plants</td>
<td>$11.00 - $32.00 per square meter</td>
</tr>
<tr>
<td>Installation/Labor</td>
<td>$32.00 - $86.00 per square meter</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$13.00 - $21.00 per square meter for first 2 years</td>
</tr>
<tr>
<td>Irrigation System</td>
<td>$21.00 - $43.00 per square meter</td>
</tr>
</tbody>
</table>

### Intensive Green Roof

<table>
<thead>
<tr>
<th>Component</th>
<th>Average Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design &amp; Specification</td>
<td>5-10% of total cost</td>
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<tr>
<td>Project Administration &amp; Site Review</td>
<td>2.5-5% of total cost</td>
</tr>
<tr>
<td>Re-roofing with root-repelling membrane</td>
<td>$100.00 - $160.00 per square meter</td>
</tr>
<tr>
<td>Green Roof System</td>
<td>$160.00 - $320.00 per square meter</td>
</tr>
<tr>
<td>Plants</td>
<td>$54.00 - $2,150.00 per square meter</td>
</tr>
<tr>
<td>Installation/Labor</td>
<td>$85.00 - $195.00 per square meter</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$13.00 - $21.00 per square meter annually</td>
</tr>
<tr>
<td>Irrigation System</td>
<td>$21.00 - $43.00 per square meter</td>
</tr>
</tbody>
</table>

**Roof Structure**

Structural analysis was performed to choose the appropriate members and girder that have adequate strength to support the additional weight of the green roof. The members and girders sizes were chosen by using the LRFD (Load and Resistance Factor Design) method and Steel Manual. The live load of the roof was determined by using the Massachusetts State

\textsuperscript{21} (Peck & Kuhn, p. 11)  
\textsuperscript{22} (Peck & Kuhn, pp. 15-16)
Building Code. The dead load of the roof was the weight of the green roof and the concrete slab. It was assumed that the construction is shored. Beams and girders system was designed to be composite. It means the weight of the green roof is mostly carried by the beams and girders system and partially carried by the concrete slab. By using the combination loading equations, the moment capacity that the beams or girders can carry was determined. These numbers could be found in Table 3-19 of the *AISC Steel Construction Manual* to determine the adequate member sizes. After the member sizes were determined, the cost of the roof framing system was calculated based on *Building Construction Cost Data 2008*. 
Steps to Campus Sustainability

Due to the fact that the characteristics of each campus are unique, the sustainability master plans are different among campuses. Although, the steps of these master plans are similar, their contents and orders are different. Based on the research of the different campuses green movement, government information, and sustainability organizations this document introduces the master plan template which consists of six important foundation steps of the campus master plan.

The steps of the master plan template are shown in Figure 3. Committing to sustainability is the first step which demonstrates the determination publicly of going green and helps to get support from the campus community. After making a commitment, the institutions should create a committee which should be in charge of all sustainability actions and issues on campus such as incorporating departments, organizations. The third step is to establish policies that are created by a sustainability committee. These policies are the immediate actions to provide quick responses to the commitment. The next step is making the action plan. The practices that are in the action plan will provide a guide for a campus to reduce their impact on environment and achieve their goal. Once the action plan is made, it needs to be implemented. The sixth step of this master plan is to modify the action plan which repeats steps four and five. Because of the potential changing in green movement, the action plan needs to be modified over time. Thus, modifying the action plan and implementing it are repeated over and over again.

**Step 1 – Commit to Sustainability**

The first step of this master plan template is making a commitment. The campus sustainability commitment is defined as “a public declaration of university commitment to environmental protection and serves as frame work for decision making and goals.”\(^\text{23}\) Making a campus green cannot depend on one person or one organization. For instance, a college’s environmental department tries to apply a sustainability practice to the whole campus; however, the proposed ideal is refused by other department because it causes some inconvenience issues. The institutions need to propose their intentions to the whole campus and try to get the support from every department and organizations. They need to understand their role in this movement in order to help the institution to accomplish its commitment, without any limitations and delay.

\(^{23}\) (Creighton, 1998)
A commitment is one of the elements which helps turn sustainability intentions into actions. By having every parts of the campus work together, it also helps to strengthen the determination toward green movement. Currently, a majority of U.S. institutions have declared their determination for environmental sustainability.

In addition, colleges and universities, education leaders, are under pressure of green movement. They are expected to be the leaders in sustainability. Its success depends on behavior of people especially young generation such as students. By committing to sustainability, the colleges can show their awareness and determination of going green publicly, and help them build up the reputation.

There are two ways which the institutions can commit to sustainability. The first option is joining the network of colleges and universities to overcome the sustainability challenge together by signing public commitment such as “American Colleges and University Presidents Climate Commitment” (ACUPCC) and Talloires Declaration. These commitments will provide the framework and supports for colleges and universities to go sustainability. The second option for the institutions is making their own commitment and declaration. They can determine what they want to achieve and decide what they want to commit to themselves. More information about these options is presented in Appendix A in Step 1 – The Sustainability Commitment.

**Step 2 – Create a Sustainability Committee**

Once an institution commits itself to become sustainable, the next step is to establish a campus sustainability committee that will take charge of fulfilling the commitment. Having a committee work on campus sustainability is important because a committee reflects the whole community and consists of representatives from all sectors of campus which allows for good communication between different campus divisions and departments. In addition, the committee can collect suggestions from different parts of institution allowing the committee to create the most comprehensive and preferable recommendations for the campus. Consequently, school’s sustainability programs, that are committee approved, are more likely to have smooth development and implementation all over campus.

A committee is also important because it is usually empowered by top administrators which have the capability to guide and oversee implementation of institution’s commitment. Therefore, any feasible actions and principles delivered from this sustainability committee have more likelihood to be carried out. For instance, if funding is only available through the administration, a carbon neutral program will only be possible if the funds are approved, or the proposed plan is only a piece of paper without any practical value.

According to the ACUPCC, at least 604 out of 6000 accredited colleges and universities in America have created their own sustainability committees in two years. It can be seen that to create sustainability committee has been a common trend among institutions.24

Once a sustainability committee is established, the first task they should take care of is setting goals that will help achieve their commitment. Since there is not an official definition of campus sustainability, the sustainability committee need to create their own definition and use it as a guide for taking actions, such as creating a sustainability inventory and an action plan. STARS and CSAF sustainability assessment both help define campus sustainability and help establish the goals of a campus. These assessments are not already formally accepted as standards but are a good starting point for any sustainability committee that needs to define

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24 (ACUPCC)
sustainability for its own campus. This definition is important because it plays a role in defining all of the next foundation steps of a campus master plan.

Regarding the detail of how to construct a committee and the responsibilities a committee should take, refer to the section in Appendix A, Step 2 - How to Construct a Sustainability Committee and Its Tasks.

**Step 3 – Establish Immediate Policies**

After a committee is created, the organization should develop some immediate policies to provide some immediate action for their commitment. The time an institution needs to establish an action plan (Step 4 - Action Plan) can be as long as one to two years. Due to this long time requirement, some immediate policies are recommended to be implemented first.

According to the Oxford English Dictionary, a policy is “a written contract which is indented to influence and determine decisions of an organization and is a guiding principle considered advantageous.”

Campus sustainability policy consists of elaborated policies and immediate policies. Elaborated policies are usually expensive to implement and time consuming and they will be discussed more in the section Elaborated Policies in Appendix A.

Different from elaborated policies, immediate policies have following features:

- They are not time consuming.
- Most likely these kind of policies will not be changed even after an action plan is complete
- These policies are easy and cheap to be implemented.

There are benefits to implement immediate policies. By implementing immediate policies, it fills the gap or vacancy between commitment and a readily carried out action plan. Second, these policies are not ultimate solutions to resolve campus’ environmental issues, but rather a way for campus to show their determination while an action plan is being developed.

For example, an “anti-idling policy,” which is stated as “all the vehicles should be turned off whenever the driver leaves for any length of time,” can be an immediate policy. This kind of policy is cheap and easy to put into practice.

In regards to more examples of campus immediate policies, refer to the section Step 3 - Examples of Immediate Policies in Appendix A. Appendix I contains a list of both immediate and elaborate policies that should be considered.

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25 (Answers.com)
26 (University of Waterloo)
Step 4 – Create an Action Plan

The Action Plan step allows a sustainability committee to assess the institution’s current sustainability status, identify problem areas, identify possible solutions, and then develop an action plan that is to be implemented into Campus Sustainability Master Plan. The individual steps of an action plan are displayed in Figure 4. In order for a sustainability committee to implement sustainability solutions, a sustainability inventory needs to be conducted so raw data is available for analysis. After the data is analyzed the problem areas can be identified and a benchmark can be set in order to keep track of sustainability progress. With the problems identified, the committee needs to set goals that will resolve these problems and find solutions that will meet these goals. The solutions that are identified need to be incorporated into the action plan of the Campus Sustainability Master Plan.

E. Take Inventory of Campus

The selection of the inventory is important because it sets the foundation for the succeeding steps. By analyzing the data it allows for problem areas to be determined, develop an action plan, and is also used annually to measure progress over time. Many sustainability inventories contain elements known as indicators. Indicators require certain type of data to be collected in order to identify a problem area. The problem is identified when the data does not match the committee’s definition of campus sustainability. Many institutions defined carbon neutrality as part of their definition, so therefore an indicator would be established that would help compute the total greenhouse gas emitted. After taking the inventory, if greenhouse gas emissions are present then this would be defined as a problem area. For the indicators to be useful for a committee, they need to collect data that is relevant to the campus sustainability definition in order to determine the problem.

The first inventory conducted also sets a benchmark for the campus. With a benchmark set, the same inventory can be conducted annually and compared to the benchmark to show the progress made by the campus. The same inventory needs to be used in succeeding years to provide consistent data that can be easily compared the benchmark. Although with implementation of various sustainability solutions and changes in sustainability practices, will require various indicators in the inventory to be changed in the future. Any changes made should still allow the data to be compared to the benchmark, but this may not always be possible. If there is a drastic change to

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27 (Global Reporting Initiative, 2006, p. 4)
the inventory, then a record should be kept of what changes had been made so that anyone reviewing can assess the progress appropriately.28

The sustainability committee can create their own inventory or select one of the two currently available assessments available for campuses to use or as a model for developing their own. The sustainability committee can decide what indicators should be included or excluded from their inventory based on their definition of campus sustainability.29 Currently two inventory frameworks have been developed, the Sustainability Tracking, Assessment & Rating System (STARS) and Campus Sustainability Assessment Framework (CSAF). Many colleges in Canada have used the CSAF tool in their assessment or just used portions of the tool for their own needs, such as University of Ottawa, McGill University, Toronto University, and Royal Roads University.30 STARS is a tool that is still in development and has not had the time to establish itself as a recommended choice of sustainability frameworks. Both sustainability inventories are developed as guidelines that a campus can modify and model for their own needs.

Some campuses may find that these frameworks do not meet their needs and may decide to create their own inventory. The Global Reporting Initiative has published the Sustainability Reporting Guideline which provides a foundation for creating a sustainability report for any organization.31 It covers topics such as defining report content, strategy, analysis, stakeholder involvement, indicators selection, and assurance. The report can be viewed at www.globalreporting.org/.32 To learn more about selecting and taking the inventory go to Conducting a Campus Inventory under Step 4 – Action Plan in Appendix A.

If carbon neutrality is part of the institutions definitions of campus sustainability, then a greenhouse gas (GHG) calculator should also be selected at this stage. Many GHG calculators are available, but only the Cool Air Clean Planet is a calculator that was designed specifically for campus oriented operations. The calculator is very flexible and is marketed as a tool that even an undergraduate student could easily use. An institution that has not yet selected a GHG calculator should use the Cool Air Clean Planet one as a starting calculator until the needs are more fully defined.33 For more information about greenhouse gas calculators and the Cool Air Clean Planet calculator go to Options for Analyzing Data under Step 4 – Action Plan in Appendix A.

Once an inventory is selected or created, then preparations for conducting the inventory can begin. Before collecting any data, there needs to be a defined boundary for the inventory, a communication log created, and a protocol for gathering the information. When actual data gathering is started, one will find it is usually a challenge to actually find the data, if any data exists at all.

F. Analyze Data

Once the data is collected it can be analyzed and graphed for interpretation. If the committee decided to use CSAF or the STARS inventory then the analysis part is already incorporated into the framework. The incorporated analysis may not satisfy the committee’s definition of campus sustainability and other computations need to be incorporate.

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28 (Global Reporting Initiative, 2006, p. 14)
29 (Sierra Youth Coalition, 2007, pp. 1-23)
30 (Yann, 2007)
31 (Global Reporting Initiative)
32 (Global Reporting Initiative, 2006, p. 1)
33 (Cool Air Clean Planet, 2008, p. 2)
The data gathered needs to be analyzed in a way that helps identify the problems of the campus. The energy consumption of buildings potentially causes greenhouse gas emissions, a problem many institutions identify and declared. A committee may want to determine which building consumes the most amount of energy in order to give it priority for renovation, but comparing total usage of each building does not take into account that each building is different in gross floor area. Building with a larger gross floor area would most likely consume more energy than a building with a smaller floor area. A more useful representation of the data can be energy consumption per square feet, giving a less biased analysis. Although using this metric does not account for the type of building and the services it provides. The sustainability committee will need to decide which metrics best represents the issues they are trying to resolve based on the campus sustainability definition.

Once the data is analyzed it is very effective to use graphs to show the results. Visual representation provides an alternative way to show the sustainability of a campus, and assist in demonstrating the problem areas. It is also a good way to give a quick summary of results and conclusions to stakeholders that have time constraints. Graphs can represent trends, such as in waste production over a period of time, or a pie chart can represent the percentage of waste that is either recycled or diverted, showing progress the campus. Figure 5 shows a graph of carbon dioxide emissions (CO$_2$) for Indiana University of Bloomington. From the graph it can be easily seen that transportation is slowly increasing in CO$_2$ production and therefore the university should investigate solutions to this problem.  

![Figure 5: Indiana University of Bloomington CO2 Emissions by Sources, 1990-2007.](image)

The analyzed data can also be used for social marketing solutions. Waste production could be presented as tons per capita, representing how much trash is produced by individual person. Using this information as a tool to educate people about the negative effects of waste and how much they are individually contributing to the problem will hopefully make them want to live more sustainable life. In the end this helps the campus become an emerging leader in educating sustainability concepts.

To see an example of how a committee could analyze their data, go to Options for Analyzing Data under Step 4 – Action Plan in Appendix A.

34 (Indiana University Task Force on Campus Sustainability, 2008, p. 38)
G. Identify Problem Areas

Once the data is analyzed the problem areas can be identified. Since each campus is unique in its location, size, and in other characteristics, the problem areas will be defined differently for each campus. The problem areas for environmental sustainability assessment are typically split into three categories, water, waste, and energy. To identify a problem area, a campus should see if they first meet all local and federal laws, then compare the results to their definition of sustainability, and observe trends of sustainability that may cause problems in the future.

The various levels of government are getting involved in waste reduction and are assisting with this trend. The province of Ontario, Canada had passed a bill that required 50% reduction in waste by the year of 2000. Greater Vancouver Regional District, had banned corrugated carboard from the waste stream in 1997. The ban was extended to include office paper and newspaper in March 1, 1999. Any hauler that hauls any of these banned items is require to pay a fee of $32.50 per metric ton. June 1, 2006, a ban was placed on yard and garden waste by the province of British Columbia. There also has been a ban on all recycled material since 1991. If the results of the data gathered indicate the institution is no compliant with these regulations, then this should be identified as a problem area.

If all local and federal laws are met, then the campus needs to look at its commitment and identify which of the three, or all, of the problem categories need attention to meet the campus goals. Many campuses are committed to reducing green house gas emissions which are linked to energy consumption, and so energy category would be identified as a possible problem area. The next step is to try and pinpoint the actual cause of the problem from the analyzed data provided. For the energy and water category, a committee may wish to identify which building consumes the most amounts of energy and water. The buildings that consume the most amounts of energy and water should be given priority over other buildings for sustainability solutions. A problem in waste can be identified by the percentage of the material that is diverted from the waste stream. If this is a low percentage, then this should be considered a problem. The source of the waste problem may not be clearly identified from the inventory and so further assessments specified in waste may need to be conducted.

Another indicator for a problem area is the trends or global movements of sustainability. With the Kyoto Protocol passed by the UN, a trend is seen in placing a cap on green house gas emissions by various countries. Although the Kyoto Protocol is targeting larger industries, campuses in the future may face the same fate. The Canadian Province of British Columbia already passed a bill requiring an 80% reduction of greenhouse gas emissions by 2050. These types of trends should be linked to possible problem areas on campus, so that solutions can be implemented before the trend or regulation of sustainability practices becomes a reality.

The committee may also consider comparing their results to other institutions to assess their sustainability status, but this is not a reliable method. Campuses located in colder climates will consume more energy for heating than a campus located in warmer climates. Campuses with larger population may produce more waste than a campus with a smaller population. Also, each

35 (UW Waste Management)
36 (Webb, 1999)
37 (Capital Regional Distric, pp. 1-2)
38 (Izard, 2007)
campus creates their own definition of sustainability and comparing them would be a challenge of its own. Until a standard is created for campuses, a problem should be identified based on the relevant sustainability laws, the institutions definition of sustainability, and the current trends of sustainability.

Examples of how a committee could define problem areas are demonstrated in Examples of Identifying Problem Areas under Step 4 – Action Plan in Appendix A.

H. Set Goals and Targets

The problem areas already identified, the sustainability committee needs to set more specific goals and targets. The commitment, in step one, declared some basic goals for a campus, but in this step specific goals that pertain to specific problem areas are established. With set goals and targets, it forces the institution to fulfill these promises and not delay the action on their declared commitment. Michigan State University established goals for year one, year five and year ten for each problem area. For waste reduction they set a 2% reduction on the first year, 10% by the fifth year, and 25% by the tenth year.\(^39\)

There is no standard of what reduction targets a campus should set, since it all derives from what the committee has defined to be sustainability. These targets will also depend on the characteristics of a campus, such as financial status, campus environment, available resources, and the actual commitment of the campus.

These targets are not just useful in accomplishing sustainability but can be used as a tool for other reasons. For social marketing strategies, the institution can advertise these targets to inform and unite the community about the movement occurring on campus. The targets are also useful to celebrate accomplishments when they are achieved again unifying the campus community and demonstrating the institution’s commitment.\(^40\)

I. Create an Action Plan

The goals and targets set in the previous step can now be used to investigate solutions that are feasible for the institution to implement. Each campus is unique and many variables need to be considered when selecting a solution, and therefore not the same solutions can be applied to every campus. Solutions can be categorized into two types, social and technological. The social solutions involve the educating and training people to live sustainable lives, while the technological solutions do not involve human behavior.

The type of solution the committee needs to use will depend on the problem area defined and the goals that were set based on the inventory. If a recycling program is selected to be a solution then this would require a social program that will educate the community how to recycle. An institution that wants to be carbon neutral that uses fossil fuels as a source of energy will require a technological solution, such wind turbines. Sometimes a social and technological solution can be used to resolve the same problem area.

An example of problem area that can be resolved using social and technological solution is when an institution wishes to reduce electricity consumption of a building. A possible social solution would be to educate people to turn off the lights when they leave a room. The concept of this solution is simple and fairly cheap, but can be very difficult to implement because the

\(^{39}\) (Michigan State University, 2008, p. 101)
\(^{40}\) (Cool Air Clean Planet, 2008)
success of the program depends on the people actually practicing what they have learned. This transition into a new lifestyle may take a while and therefore the results will not be instantaneous. For a technological solution, motion detectors can be placed in all the rooms of a building, which will automatically shut off the lights when the room is not occupied. This provides instantaneous solution with immediate results, but requires an investment. The type of solution best for an institution will depend on the characteristics of the campus, the definition of sustainability, and various other deciding factors.

Once the solutions are selected, the sustainability committee will need to create an action plan that defines the solutions, when, and how they will be implemented. This action plan is incorporated into the Sustainability Master Plan and should be available for the public, such as through a website. Having the document public shows to the public that the institution is following through with its commitment and demonstrates the steps it plans to take.

For various solutions that a committee could consider for implementation, go to Solutions to Problem Areas under Step 4 – Action Plan in Appendix A.

**Step 5 – Implement the Action Plan**

Once a plan is created, the next step is to implement the plan. The implementation of the plan maybe a difficult task or it may go very smoothly. Funding is usually the main issue of any initiative on campus, and many projects may also require approval from the administration office.

Depending on a solution, different methods can be used to implement them. If a social solution is selected then a faculty member or a campus organization can be put in charge of developing that program. Faculty members, along with students, can conduct surveys and investigations on social sustainability behavior on campus, and test various tools used in educating the community. If technology is selected to be a solution, then a consulting firm may need to be hired to conduct detailed feasibility studies and create a written report on their recommendations. Then contracts with other companies may be required to fabricate and install the technology.

**Step 6 – Modify the Action Plan**

The initially created action plan will not get the campus to be sustainable right away. The action plan will need to be modified over time to meet new targets, new commitments, and new trends in sustainability. Annually the sustainability committee should conduct the same inventory to measure progress and reassess the problem areas. Based on these results the action plan should be modified to incorporate new solutions and project areas. As these steps are repeated, the institution will become more and more sustainable and closer to reaching its initial sustainability commitments.

**Conclusion**

Institution that wish become more sustainable are encouraged to use these six steps as the foundation of their master plan. These steps allow an institution to demonstrate to the world their commitment for sustainability, allow immediate action to be taken, and provides a method to find solutions that reflect their definition of sustainability. Because each institution can be vastly
different each college and universities will complete each step differently, but no matter how they complete these steps; any institution can implement these steps to become more sustainability effectively.

**Case Study: Indiana University Bloomington**

Many colleges have used similar steps that were presented in Part 1. Indiana University Bloomington started their program by establishing the Sustainability Task Force. Their role is to take annual inventory of the campus, define campus sustainability, make sustainability recommendations, and educate the community about sustainable practices. The institution did not make a public declaration of their commitment, but the Task Force is recommending their institution to join either the Talloires Declaration or the ACUPCC. In order to develop their action plan an inventory was conducted and the reports made public. In their 2008 annual sustainability report, provides the analysis results they had obtained. Their definition of campus sustainability requires a campus to be carbon neutral, and therefore they have identified greenhouse gas emissions as one of their problem areas. With the problem identified, targets were set for reducing greenhouse gas emissions by 20% in 10 years, based on the 1990 average. For the problem areas, solutions are recommended which will help achieve the established target, such as installing solar water heating as a renewable energy source. Since annual inventories are conducted, the graphs are displayed showing the progress made in reducing emissions based on the 1990 benchmark. The solutions that are identified are presented to appropriate party, such as the President, Provost, and Vice President of the University. 41

**Green Roof Design**

Due to the fact that the roof of the Salisbury Lab is separated into different levels and areas, the roof of the fourth floor will be chosen. The red area in Figure is the area that the green roof will be placed on top. It has 12,008 ft² in area

![Figure 6: Salisbury Slab](image)

41 (Indiana University Task Force on Campus Sustainability, 2008, pp. 4-14, 34-46)
The green roof will be placed on the area that has 5ft offsets from the edges so that the green roof area can be accessible. Therefore, the actual area of the green roof is 9,350 ft$^2$. It’s illustrated as a shaded region in Figure 7.

Figure 7: Salisbury Roof Plan

The new designed roof is made of 4 inches concrete slabs with normal strength of 4000 psi and no mechanical systems on the roof. The columns which support the roof system are placed 30 feet or 25 feet vertically and 34 feet or 35 feet horizontally away from each other. Thus, the spacing between horizontal girders is 30 feet or 25 feet and the spacing between vertical girders is 34 feet or 35 feet. The beams are placed horizontally and 5ft spacing center to center. It is illustrated in Figure 8 and Figure 9.
Figure 8: Roof framing system
Figure 9: Roof framing system (3D)
Due to the fact that different thickness of the soil could provide different amount of water runoff reduction, two typical soil thickness for extensive and intensive green roof were selected, 0.66ft (20cm) soil thickness for extensive roof and 1.64ft (50cm) for intensive roof. The results for beam and girder size by using the LRFD method are presented in Table 3. (Refer to Appendix P for more detail of how to calculate rainwater runoff and how to design composite beams and girders for this roof)

<table>
<thead>
<tr>
<th>Table 3: Roof framing system and water runoff results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Form of vegetation</strong></td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Extensive roof</td>
</tr>
<tr>
<td>Intensive roof</td>
</tr>
</tbody>
</table>

The typical beam size is used for all the horizontal beams with 5 feet spacing. The typical exterior girder size is used for all the girders that run along the edge of the roof and typical interior girder size is used for the rest of the girders. As expected, the beams and girders sizes for intensive roof are bigger than those for extensive roof. With intensive roof, the beams and girders need to be bigger to support more loads from the thicker soil and heavier vegetation of intensive roof. Because of the different in thickness of soil and form of vegetation, the extensive roof reduces 30% less rainwater than the intensive roof.

The total cost estimate for two types of green roof is present in Table 4 and Table 5. The cost to construct the intensive green roof is more than triple the cost for extensive green roof.

<table>
<thead>
<tr>
<th>Table 4: Extensive Green roof Total Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Concrete Slab</td>
</tr>
<tr>
<td>Beams and Girder</td>
</tr>
<tr>
<td>Green roof construction</td>
</tr>
<tr>
<td>Construction Cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5: Intensive Green Roof Total Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Concrete Slab</td>
</tr>
<tr>
<td>Beams and Girder</td>
</tr>
<tr>
<td>Green roof construction</td>
</tr>
<tr>
<td>Construction Cost</td>
</tr>
</tbody>
</table>
Based on the results which are presented above, it’s recommended to choose the extensive green roof for WPI Salisbury Lab. It is more economical feasible than intensive green roof. It costs about $500,000 and can reduce 39% of rainwater runoff. There is less maintenance and fewer problems to deal with in the future.
Works Cited


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Images

Figure 1: Sustainability Visual Chart
<http://upload.wikimedia.org/wikipedia/commons/7/70/Sustainable_development.svg>

Figure 2: CFAS Sustainability Visual
<www.umoncton.ca/symbiose/files/CSAF.pdf>

Figure 5: Indiana University of Bloomington CO2 Emissions by Sources, 1990-2007.

Figure 13: The U.S. Waste Production Rates 1960-2007
<http://www.epa.gov/osw/images/wastegen.jpg>

Figure 14: Percentage of Various Materials Making up the 2007 U.S. Waste Stream
<http://www.epa.gov/osw/images/piechart.jpg>

Figure 15: U.S. Municipal Solid Waste Recycling Rates 1960-2007
<http://www.epa.gov/osw/images/recrates.jpg>

Figure 20: Window Heat Flow

Figure 21: Green roof layout

Figure 22: Annual Rainfall Map of North America
<http://www.buildingscience.com/bsc/designsthatwork/rainfall.htm>

Figure 23: Rain harvesting systems of Winrock International Global
<Guide book to sustainable Design>
Appendix A – Suggested Sustainability Solutions

Based on various researches, this Appendix is developed by our student team to provide more options that the institution can become sustainable. The research is done by looking at the experiences from different institutions.

Step 1 - The Sustainability Commitment

There are two options for institutions to commit to sustainability. They can either sign the public commitment or make their own commitment. There are currently two major public commitments, the American Colleges and University President Climate Commitment (ACUPCC) and the Talloires Declaration. The ACUPCC is trying to deliver the global warming issues to society, especially colleges and universities. The institutions that have carbon neutrality as one of the goals for campus sustainability are recommended to sign this commitment. By signing this commitment, the presidents promise to eliminate their contribution to global warming by reducing green house gases emission. The commitment requires specific actions to be taken and reported. These actions are listed as follows:

- Establishing an institutional structure to oversee the development and implementation of the schools’ program to comply with the ACUPCC;
- Completing an emissions inventory within one year;
- Establishing a climate action plan that includes a target date and interim milestones for becoming climate neutral within two years;
- Taking immediate steps to reduce greenhouse gas emissions by implementing at least two of a list of seven tangible actions while the climate action plan is being developed;
- Integrating sustainability into the curriculum and making it a part of the educational experience; and
- Making their inventory, climate action plan, and progress reports publicly available.

Even though the organization was created in June 2007, it has gained steadily momentum and captured widespread attention from colleges and universities all around America. The numbers of signatories has increased to 582 over the period of one year. Although the ACUPCC is focused on the institutions in the United States, international institutions can also join this organization. Currently three international institutions have joined and one of them is the Canadian college called Confederation College. Figure 6 shows the distribution of signatories in the United States by region.

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42 (American College & University Presidents Climate Commitment, 2007)
43 (American College & University Presidents Climate Commitment)
44 (ACUPPCC; American College & University Presidents Climate Commitment, 2007)
The Pacific region, as the chart above shows, has the most signatories, which consists mostly of the campuses from California and Washington. In the Eastern region, New York and Massachusetts contain the most signatories. The organization is trying to seek commitment from 1000 colleges and universities by the end of 2009.

One other public commitment is the Talloires Declaration. While ACUPCC is the effort to reduce the campus environmental impact, the Talloires Declaration is “a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities.” It provides the important base ideals that colleges and universities consider when creating their own plans. This commitment was created in 1990 in Talloires, France, and is intended to be used by all the institutions in the world. Since its creation, over 350 university presidents and chancellors in over 40 countries have signed this commitment. By signing this commitment, the institutions can show their determination globally.\footnote{45 (Association of University Leaders for a Sustainable Future )} The ten point action is listed below:

- Increase Awareness of Environmentally Sustainable Development
- Create an Institutional Culture of Sustainability
- Educate for Environmentally Responsible Citizenship
- Foster Environmental Literacy For All
- Practice Institutional Ecology
- Involve All Stakeholders
- Collaborate for Interdisciplinary Approaches
- Enhance Capacity of Primary and Secondary Schools
- Broaden Service and Outreach Nationally and Internationally
- Maintain the Movement\textsuperscript{46}

The institution can also make its own sustainability commitment. The institution can base on elements of the public commitment to make their own commitment to suit their purposes. The advantage of making its own commitment is the institutions know what they are committing to and have the flexibility of what they want to do for sustainability. One of the examples is Tufts University’s commitment which is presented in Appendix N.

\textsuperscript{46} (Association of University Leaders for a Sustainable Future )
Step 2 - Elements and Tasks of a Sustainability Committee

Elements of a Committee:

- Because a committee and decision made by this committee need to be supported by the whole campus, a committee shall be constituted of representatives from different community sectors. It should at least consist of students, faculty, staff and administrators. The committee can also include trustees, alumni, local government official or other participants who represent the community.

- The committee should be empowered the authority, by top administrators, to guide and supervise all the sustainable programs on campus.

- An institutional committee can be a pre-existing campus group who is capable to take on the responsibility of the school’s sustainable development, or can be in the form of a task force or a council which is built to specifically implement the commitment in the institution.

The Tasks of a Committee:

The task of a committee includes but is not limited to:

- Bring environmental awareness to the whole campus and help people fully understand how their environmental responsibilities are related to their daily work and life.
- Bridge a good communication between different departments and among students, faculty and staff to foster the development of the school’s climate neutrality programs.
- Establish a comprehensive sustainability action plan for the campus in different disciplines, such as energy, waste management, transportation, curriculum and procurement.
- Guide and oversee the implementation of the school’s greening projects.
- Start carrying out some quick actions at campus wide, such as applying some community-based social marketing strategies on campus.
- Provide annual inventory and progress report to the public.

Case Studies:

*University Environmental Improvement Committee, Tufts University*

Tufts University established a committee named as the University Environmental Improvement Committee. Their main task was to develop a campus sustainability commitment for Tufts and then to implement it. The committee members met twice a month and shared their new findings with each other. With this committee built, many problems had been discovered before the real situation happened. This committee also provided suggestions to other Tufts environmental groups.  

(Creighton, 1998, pp. 22-23)
University of Pennsylvania signed the Presidents’ Climate Commitment, which required UPenn to create an action plan to meet the commitment. Therefore, the ESAC was formed and was in charge of advising their President with campus sustainability construction and making a comprehensive action plan applicable to UPenn. The ESAC consists of representatives from all sectors of campus such as students, faculty and staff. It has six subcommittees, which are Academic, Built Environment, Energy and Utilities, Waste Management and Recycling, Transportation, and Communications. These subcommittees make suggestions to ESAC to help it complete the action plan.\textsuperscript{48}

\textsuperscript{48} (UPenn Green Campus Partnership)
Step 3 – Examples of Immediate Policies

Immediate policies require little or no cost and don’t need inventory analysis, so that they can be developed and implemented before sustainability committee completes their inventory. As an example, an institution can start reducing campus GHG emission without waiting for a detailed action plan. In this part, some immediate policies applicable to campus will be listed as examples.

Energy Efficiency and Conservation Policy

Most of this kind of policies can be applicable for the whole campus’ buildings and offices. In addition, by implementing these policies, it can help to reduce the energy consumption on campus, which is also the GHG emission. Examples of energy efficiency and conservation policy are as following.

- Space Temperature Control Policy:

  “Unless special needs are required, the following minimum and maximum room temperatures shall be maintained, in as far as reasonably possible, in all university department areas:

  During “Occupied” Hours: Heating - 72 Deg. F and Cooling - 75 Deg. F
  During “Unoccupied” Hours: Heating - 60 Deg. F and Cooling - 85 Deg. F”\(^{49}\)

- Facility Operation Policy:

  “The following equipment and components will be switched off at the end of each work day when feasible:
  * Office Lights
  * Office Computers, Printers and Monitors
  * Office Copy Machines
  * All Other Electronically Operated Equipment”\(^{50}\)

Transportation Policy

On the aspect of transportation, policies such as anti-idling policy can be considered as immediate policy. Anti-idling policy will help reduce the fuel consumption and is applied to all the vehicles coming into campus, which include both campus fleets and private vehicles. Putting signs to remind drivers can be one practice of this policy.

\(^{49}\) (University of South Carolina Office of Facility Service)
\(^{50}\) (University of South Carolina Office of Facility Service)
Case Studies:

University of Waterloo

“All vehicles should be turned off when not in use or when the driver leaves the unit for any length of time.”

University of Washington

“No vehicle operator in charge of a motor vehicle shall permit it to stand unattended without first stopping the engine, locking the ignition, removing the key and effectively setting the brake, and, when standing upon any perceptible grade, turning the front wheels to the curb or side of the roadway.”

Waste Minimization Policy

Waste minimization policies should be developed to reduce waste output on campus, such as in dormitories and offices. Some examples in source reduction are as following.

Case Study: University of California, San Diego (UCSD)

Has established relevant policies shown below:

“Documents

All forms used on the campus should include only the necessary information and number of copies. Instruction sheets, if necessary, shall be printed on the back of the last page of the form. Whenever possible, forms should be filled out and processed electronically.

All departments shall encourage two-sided copying. Whenever practical, scrap paper printed only on one side shall be used for producing rough drafts. Paper printed only on one side shall also be used as scratch paper.

Letters, reports and documents produced by campus administrative departments should be printed on both sides

Correspondence

Whenever feasible, electronic correspondence shall replace written correspondence. Unnecessary printed copies of electronic correspondence are discouraged.

51 (University of Waterloo)
52 (University of Washington Facilities Services)
Newsletters

The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department."53
Step 4 - Action Plan

A. Conducting a Campus Inventory

In order to assess the sustainability situation of a campus, an inventory needs to be created or selected by the sustainability committee. Once an inventory is selected, a few guidelines should be followed in order to come up with a valuable report, such as establishing a communication log and protocols for data gathering. Many institutions will face the problem of data not being available, such as energy consumption of individual buildings. These topics are discussed in this section.

Selection of Sustainability Inventory

A sustainability committee currently have three choices when selecting their inventory, they can model one of the two frameworks already established, the Sustainability Tracking, Assessment & Rating System (STARS) or the Campus Sustainability Assessment Framework (CSAF), or create their own framework.

The STARS inventory was produced with the assistance of The Association for the Advancement of Sustainability in Higher Education (AASHE), which is still in the editing phase and is expected to be published in 2009. The STARS inventory is broken into three categories, Education and Research, Operations, and Administration, and Finance, which corresponds to the G3 sustainability visual of three circles represented by each section. Table 6 shows the subcategories of each section. Each section contains credits (indicators) that allow certain amount of points that can be earned. Any areas that receive a low score represent a possible problem area that a campus should address. Based on the points, the AASHE will give an individual ranking of progress, but this rank is not intended to be compared to other institutions, but instead to demonstrate the progress an institution has made. This ranking system is still in development with little information of how it may work. In order to be ranked a fee payment maybe required to be paid by the institution.

Table 6: STARS Inventory Breakdown

<table>
<thead>
<tr>
<th>Education and Research</th>
<th>Operations</th>
<th>Administration and Finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Co-Curricular Education</td>
<td>- Buildings</td>
<td>- Investment</td>
</tr>
<tr>
<td>- Faculty and Staff - Development and Training</td>
<td>- Dining Services</td>
<td>- Planning</td>
</tr>
<tr>
<td>- Research</td>
<td>- Energy and Climate</td>
<td>- Sustainability</td>
</tr>
<tr>
<td></td>
<td>- Grounds</td>
<td>- Infrastructure</td>
</tr>
<tr>
<td></td>
<td>- Materials, Recycling, and Waste</td>
<td>- Community Relations and Partnerships</td>
</tr>
<tr>
<td></td>
<td>- Minimization</td>
<td>- Diversity, Access, and Affordability</td>
</tr>
<tr>
<td></td>
<td>- Purchasing</td>
<td>- Human Resources</td>
</tr>
<tr>
<td></td>
<td>- Transportation</td>
<td>- Trademark Licensing</td>
</tr>
</tbody>
</table>
The Campus Sustainability Assessment Framework (CSAF) is a sustainability inventory based on a Master’s thesis by Lindsay Cole. The purpose of the framework is to try to establish a standard for campus sustainability so that institutions may compare their results. The inventory has two major categories, the Ecosystem and People. Under each category the topics are further split into sub-categories. For ecosystems it is air, water, land, materials, and energy. Under people it is knowledge, community, health and well-being, governance, and economy and wealth. The whole assessment contains 170 indicators. Each section also includes recommended short and long term goals. The sustainability status of a campus is determined by comparing the data for the indicators to the goals that are suggested, and a problem is defined if the two do not match.

Both the STARS and the CSAF frameworks are good sustainability inventory for any campus, but do have their own weaknesses and strengths. The STARS assessment is flexible in how the data is gathered and analyzed. The framework does not specify how each category should be calculated, besides a few minor exceptions, such as when the population of a campus is calculated. The framework also includes sections where an institution can explain their programs in more detail to demonstrate the sustainability commitments, such as of an institution’s recycling program.

The CSAF has a more numerical approach in defining the status of campus sustainability. Equations that should be used are already defined leaving little flexibility for any exceptions that may need to be considered in order to properly compare the results, such as greater energy consumption for campuses located in colder climates. There is no defined section where it allows an institution to define those exceptions, but since this inventory is not for review by any sustainability organization, an exception section can be included in the final report. The CSAF inventory has been used by various colleges in Canada. The campus should choose which inventory fits them best in their goals. Both the STARS and CSAF cover the three main categories of sustainability: society, economics, and environment.

One of the weaknesses of both the STARS and the CSAF sustainability assessments is their lack of assessment of individual buildings for water and energy consumption. This type of data is valuable because it allows a campus to identify buildings that are performing poorly becoming possible barriers for a campus to fulfill its commitment. In order to resolve this weakness, a sustainability committee may wish to include the Building Owners and Managers Association’s (BOMA) Best Go Green Plus Assessment Questionnaire to their inventory. BOMA is an international association that focuses on operations of commercial buildings, and had developed a building assessment questionnaire in response to the green building movement.

If a committee decides they want to develop their own inventory it is recommended to use the Global Reporting Initiatives’ published G3 Sustainability Reporting Guideline when creating a new framework. (www.globalreporting.org). An alternative to creating an inventory is to take the existing frameworks and combine them into a useful framework. As an example, a Sample Campus Inventory was created combining the STARS, CSAF, and BOMA frameworks to demonstrate how data could be analyzed and problems identified in later sections of this document. The next section briefly describes how the Sample Campus Inventory would be used.

The inventory that should be selected for the campus will depend on the needs from the inventory and what the campus wants to accomplish. A more detailed inventory such as the CSAF will help a campus easily identify more specific problems, but these problems may not be

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56 (Cole, 2003, pp. 2-3)
57 (BOMA)
defined properly because of exceptions. For more of a basic inventory report, the STARS framework maybe more useful but specific problems are not really defined. If a committee has the resources and time to create their own inventory, then this would be the best way to get a framework that works well with the specific institution’s characteristics, and may last much longer than the STARS or the CSAF. Both of these frameworks clearly state these are not the final frameworks and may drastically change in the future.

Data Gathering Using Sample Campus Inventory

S2 - Scope 2

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2-1</td>
<td>Purchased Electricity</td>
<td>kWh</td>
<td></td>
</tr>
<tr>
<td>S2-2</td>
<td>Purchased Steam</td>
<td>MMBtu</td>
<td></td>
</tr>
<tr>
<td>S2-3</td>
<td>Chilled Water</td>
<td>MMBtu</td>
<td></td>
</tr>
<tr>
<td>S2-4</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2-5</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2-6</td>
<td>Format of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2-7</td>
<td>The boundaries of the data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2-8</td>
<td>Process of getting data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2-9</td>
<td>Repeatability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2-10</td>
<td>Other comments or issues</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 11: Sample Inventory Section

Figure 11 shows a sample section of the inventory. Each section is labeled with a code, such as “S2” for “Scope 2.” The first column contains the section code following with a question number. This coding system is used in the Problem Area and Solution to Problem Area sections in order to easily refer to the inventory. The next column is the question or requested data. The third column represents the units to be used when recording the data and the final column is used to record the data. Each section contains seven similar questions to assess the validity of the data, which are represented by questions S2-4 to S2-10 in Figure 11.

Question S2-4 requests information about the source of the data. The name of the person contacted and their contact information should be recorded there.

Question S2-5 asks how reliable and accurate the data is based on the judgment of the person in charge of the inventory or they may use the error of margin that is available. A rating 1-5 is to be used, 5 being very reliable.

Question S2-6 asks what format the data was acquired in. Was it an excel spreadsheet? Was the data gathered from a bill or maybe directly taken from a meter?

Question S2-7 determines the boundaries of the data. For this question, explain what the boundaries of this data are. Which buildings are included? What portion of transportation fuel consumption was ignored and why?

Question S2-8 requests an explanation of how the data was gathered. Was there any mathematical calculations done? Where there any assumptions done? Explain anything that could potential affect the accuracy and reliability of the data.

Question S2-9 asks if the inventory was taking again at a later date, will the same method of acquiring the data be possible? If not, then comparing the results with later inventories maybe difficult, because of no consistency. A policy or a standard of gathering data with consistency and ease may need to be implemented.

The last Question, S2-10, allows for extra comments or problems to be stated.
The building worksheet (Appendix D – Sample Building Inventory Worksheet) asks information about the individual buildings. For every building that is within the selected boundary of the inventory a copy of the worksheet should be filled out. Any data that is unavailable should be noted and explained why the information was not available in the comments sections. Once the individual building inventories are complete, then the data from these inventories can be used to answer questions in the Sample Campus Inventory Worksheet.

**Before Data Gathering**

Before data is actually gathered for the inventory, a few protocols need to be followed in order to increase the reliability and efficiency of data gathering. Developing a communication log, setting boundaries, and consideration for data accuracy are the three items a sustainability committee should consider before actually conducting the inventory.

**Communication Log**

A communication log is a valuable reference, especially for an institution conducting their first inventory. Many people will be contacted in order to gather all the data, sometimes certain data, such as fuel consumption of vehicles, may require contacting various departments on campus and outside agencies. After many phone calls and e-mails, it becomes difficult to keep track of who was contacted and what was discussed. Many employees and staff on campus are overwhelmed with their own work, and being contacted repeatedly for the same information may result with the contact not cooperating in the future. To avoid this type of situation a communication log should be created in order to keep a record of who was contacted, when they were contacted, how they were contact, and a summary of the conversation. A sample communication log from a university can be viewed in Error! Not a valid bookmark self-reference., which also demonstrates the confusion of data gathering.

The communication log may also be used as a reference in the future for data verification. Questions may be asked about how certain data was gathered or more supporting details about the data maybe requested, and the communication log will provide the direct contact for that information. Since the sources for the data are already defined in the log, it will also make collecting data for annual inventory assessments more efficiently.⁵⁸

**Boundary Setting**

The inventory should have a well defined boundary of what it covers. If an inventory was created by the institution then the boundary should have been defined through the creation process. If the STARS or CSAF frameworks were selected, then a more detailed boundary may need to be established for each indicator. The following are some example questions that should be considered when defining a boundary.

- Should satellite campuses be included?
- If an equity-share exists for an operation of a campus, how should the responsibility of the mutual operation be shared in terms of sustainability? Such as energy consumption?

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⁵⁸ (Cool Air Clean Planet, 2008, pp. 13-14)
• Should the campus only take inventory of items and events they have direct control over, or should indirect things, such as faculty commuting to work be part of the inventory?59

The answers to these questions will all be unique for each campus, and will reflect their sustainability goals and commitment. When things are excluded from the inventory, it is important to explain, in the final report, the reason why these items were not included. This will make the final report more reliable for determining the sustainability status of a campus in respects to the boundary set.

Data Accuracy

The accuracy of the data gathered should be recorded in order to assess the reliability of the final sustainability report. Accurate data is reliable when it supports the defined problem areas while not having a marginal error that overlaps satisfactory and unsatisfactory values. Overlapping marginal area is useless because it relies on human judgment and intuition to estimate the true values which does not strongly support the problem areas defined. It only suggests that more accurate data needs to be collected.

If the campus is conducting their benchmarking inventory, the accuracy of the data will generally be very low. In many cases the quantitative margin of error will not always be available for every data that is collected, and a personal judgment will need to be used. Personal judgment does not represent the data accurately but demonstrates some idea of how reliable it is.

A college or university that is just beginning its sustainability program will not need very accurate data, since quantities will general be so large it will represent unsatisfactory values even if the margin of error was considered. As sustainability solutions are implemented over time, the accuracy of the data should also improve. For example, when energy consumption is reduced for a building, the data will follow the same trend but if a large marginal error remains constant, then the marginal error will overlap satisfactory and unsatisfactory values. This poses some questions for the sustainability committee: Did the campus reach its target goal? Should the campus invest more money in order to have the margin of error range be below the target? With accurate data, these questions can be avoided and the level of sustainability can be reported with more confidence.

The accuracy of the data can be determined by the precision of the measuring devices and also how the data is analyzed. For example, using the weight of fuel purchased for electricity production in chemical reaction calculations may not accurately reflect the actual amount of electricity consumed, since the amount purchased is not precisely measured and the efficiency of the electric plant is not considered. With this information it is hard to determine if problem of energy consumption is with buildings’ efficiency or the efficiency of the electric plant. To resolve this problem, a meter should be placed at the power plant and at each individual building. This will determine the efficiency of the power plant and also accurately measure the energy consumption of buildings.60

If accuracy of the data collected is known to be unsatisfactory, then a policy should be established to assist in the investment of technology and or to create gathering procedures which

59 (Cool Air Clean Planet, 2008, pp. 7-8)
60 (WBCSD and WRI, 2004, pp. 55-56)
allow for accurate data to be gathered in the next inventory. The accuracy data supports the defined problem areas making the argument more convincing to take action on those problems.\(^{61}\)

**Gathering Data**

Finding the source of the data is a major issue that any institutions will face when conducting their benchmarking inventory. Since the structure of each institution is different, the source of the data will also vary. **Error! Reference source not found.** provides a starting point for acquiring the data for certain aspects of the inventory, but is not an official list of sources.\(^{62}\) In order to narrow down the location of the data a communication log is a useful tool that will keep track of where the data is not located or where it was found.

When the data is found, certain steps should be taken in order to reassure the data is reliable and credible. The documents that contain the data should be copied for easy access in the future. Taking notes of how the data was gathered and the accuracy of the data is also important. With this information the credibility and the reliability of the data can be defined and supported if it is ever challenged.\(^{63}\)

Not all the data will be available for the inventory. Data such as energy consumption for each building may not exist because the individual buildings are not metered. For data that is missing, it should be noted what barriers prevented the data from being collected. If the data is important for determining the problem area of a campus, then a solution needs to be found and implemented so data can be collected in the future. Some solutions maybe simple, such as implementing a policy requiring data to be gathered weekly or monthly for how much material is composted. Others may require investment in technologies such as installing meters on every building to measure water consumption.

Energy and water consumption of individual buildings is the data that is missing or not presented in many campuses’ sustainability reports. Since buildings are responsible for majority of the consumption of water and energy it is important to understand how these buildings are operating to pinpoint the problem areas.\(^{64}\) One way to identify a problem with meters would be to see how much energy the building is consuming when it is not occupied. If the energy consumption is high, then the building is probably not operating efficiently.

Metering systems can also be connected to a computer network which can show real time consumption of each building. This information can be shared with the campus community, on the institution’s website, which allows the campus residence and workers to see their wasteful behaviors, and encourage them to live more sustainable lives. The sustainability committee can also encourage the administration to develop energy and water bills, based on the meters, for individual departments, as another incentive for staff a faculty to have a sustainable working lifestyle.

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\(^{61}\) (Global Reporting Initiative, 2006, p. 15)
\(^{62}\) (Cool Air Clean Planet, 2008, pp. 32-39)
\(^{63}\) (Global Reporting Initiative, 2006, p. 17)
\(^{64}\) (EPA, 2004, pp. 1-5)
Table 7: Sources for Inventory Data

<table>
<thead>
<tr>
<th>Data Needed</th>
<th>Source of data/Person to Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget</td>
<td>Controller’s Office, Accounting</td>
</tr>
<tr>
<td>Population</td>
<td>Registrar, Human Resources</td>
</tr>
<tr>
<td>Physical Size of Campus</td>
<td>Institutional Research and Assessment, Energy Manager, Director of Facilities</td>
</tr>
<tr>
<td>On Campus Stationary Fuel Usage</td>
<td>Energy Manager, Director of Facilities, Fuel Purchasers</td>
</tr>
<tr>
<td>Direct Transportation Fuel Usage</td>
<td>Director of Transportation</td>
</tr>
<tr>
<td>Purchased Electricity</td>
<td>Energy Manager, Director of Facilities</td>
</tr>
<tr>
<td>Purchased Steam/Chilled Water</td>
<td>Energy Manager, Director of Facilities, Steamed or Chilled water Provider</td>
</tr>
<tr>
<td>Commuting Figures</td>
<td>Director of Transportation, Human Resources, Registrar, Institutional Research and Assessment</td>
</tr>
<tr>
<td>Travel paid by the Campus</td>
<td>Directory of Transportation, University Travel Office, Travel Agent</td>
</tr>
<tr>
<td>Study Abroad Travel</td>
<td>Study Abroad Office</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>Waste Management Supervisor, Grounds and Roads Department, or Director of Facilities</td>
</tr>
<tr>
<td>Offsets</td>
<td>Campus Sustainability Coordinator, Energy Manager, Director of Facilities</td>
</tr>
</tbody>
</table>

Case Studies:

*Indiana University of Bloomington (‘‘Smart Metering’’)*

More advanced computer run metering can be installed that provides real time usage of energy and water, known as “smart meters.” Three types of software packages could be purchased, one that is integrated with existing building automation systems, an off the shelf vendor package, or custom designed software. Indian University Sustainability Report suggest that a good software package should be able to incorporate a large variety of metering data, work with the existing building automation systems, collect weather and climate data, have an easy user interface, and allow a centralized reporting and billing options. An off the shelf software program is priced about $250,000 or more. Some smart metering packages also allow for central control of lighting, ventilation, and air conditioning, for when rooms or buildings are not occupied, thus reducing energy and water consumption.

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65 (Indiana University Task Force on Campus Sustainability, 2008, pp. 74-76)  
66 (BIOL 4861, 2004, p. 75)
College of New Jersey

College of New Jersey, a campus located on a 2.5 million square foot plot of land contains fifty buildings, which have been incorporated with a smart metering system in 1999. The system was integrated with the existing automations systems and used the existing campus copper-wire network. The system allowed the campus to monitor energy consumptions of individual buildings, allow management of electricity usage, develop custom reports, and also keep records of previous energy consumption data all from a central location. The system allows the campus to manage heating/cooling and electricity more efficiently while still meeting the need of the campus. The price of the whole system was roughly $200,000. It is estimated that 2400 tons of CO₂ emissions had be reduced annually and an annual savings of $300,000 is achieved. With such success of metering electricity, the College is looking to invest in meters for steam and chilled water.67

University of British Columbia

With smart metering, real time consumption can be shared with the community to encourage sustainability. Sustainability Office of University of British Columbia has implemented a real time consumption display on their Sustainability Website, which can be seen at www.sustain.ubc.ca.

Smart Metering in Residential Areas

Electricity smart metering is being implemented in residential and commercial zones in California, Georgia, Pennsylvania, and Florida. In Pennsylvania, 1.35 million smart meters have been installed by Pennsylvania Power and Light. With real time power usage displayed, Georgia saw a 20-30% decrease in demand during peak hours.68

67 (NJHEPS)
68 (Smith & Hargroves, 2007, pp. 1-2)
B. Options for Analyzing Data

After the data is collected, it will need to be analyzed to so that problem areas can be identified. The STARS and CSAF inventory provide analysis guidelines differently. The STARS inventory does not specifically define what equations need to be used to determine the results, but just request certain calculated values in order to rate the institution’s performance. The CSAF provides detailed equations that need to be used with little flexibility. If the committee created their own inventory then they will need to create their own analysis framework.

As an example, the Sample Analysis Worksheet (Appendix E) shows how data could be analyzed using the Sample Campus Inventory Worksheet (Appendix C). Figure 12 shows the energy analysis table in the worksheet. The column on the left is the code for each analysis, which is used in the Problem Area section. The “requested” column is the information requested. The third column shows the equation that should be used and what values need to be inserted from the Sample Inventory (Appendix C). The final column is for the result of the analysis of which some are used in the next section Identifying Problem Areas to show examples of how a problem area can be determined.

Many institutions that have publicly signed the ACUPCC commitment, or wish to be carbon neutral will need to calculate their greenhouse gas emissions. The STARS and the CSAF inventories also include an emissions component. In order to determine that value a greenhouse gas calculator needs to be selected or created by the committee.

Green House Gas Calculators

When assessing greenhouse gas (GHG) emissions, the carbon dioxide equivalent in tons is used as a metric. The carbon dioxide equivalents (CO₂e) represent the amount of carbon dioxide that would have the same warming potential as the actual gas being emitted. The tons represent the volume of carbon dioxide equivalents that is being emitted.

In order to calculate the tons of carbon dioxide equivalents, various types of calculators are available. Each one is typical made for certain organization that focuses on their main sources of emissions. Such as an industry calculator would focus on the GHG emissions from manufacturing processes, while a campus calculator focuses on GHG emissions from campus vehicles, business travel, and energy production sources. The foundation for many of these calculators comes from the Greenhouse Gas Protocol for Project Accounting, created by the World Resource Institute (WRI) and World Business Council for Sustainable Development (WBCSD). The Greenhouse Gas Protocol establishes a reporting standard for greenhouse gas
emissions, which has been adopted by the International Organization for Standard as the basis for ISO 14064-1.\(^{69}\) (www.ghgprotocol.org)

The GHG Protocol is split into three scopes, direct emissions, indirect emissions, and other indirect emissions. The direct emissions refer to the actual GHG an organization emits directly, whether it is using coal to produce electricity or maybe using trucks to transport goods. The indirect emissions include usage of electricity or services that emits GHG emissions and is produced by an outside company, but the organization has complete control over how the services are used. For example, purchasing electricity from a coal power plant is an indirect emission of GHG, but the organization has control of how much they use and how they use it. The third scope, other indirect emissions, includes the actions of an organization that comes from sources of which the organization has no ownership or direct control over, such as assembly of purchased products or taking business trips by airplane.\(^{70}\)

**Cool Air Clean Planet GHG Calculator**

Cool Air Clean Planet, a non-profit organization, created a GHG calculator that focuses on campus emissions. The calculator can keeps track of annual emissions as far back as 1991. It is estimated that over 500 schools in North America have used this calculator in some sort of way to identify their impact on the world. The calculator includes the six Kyoto Protocol Gases, which are CO\(_2\), CH\(_4\), N\(_2\)O, HFC and PFC, and SF\(_6\). It is based on the spreadsheets developed by the Intergovernmental Panel on Climate Change (IPCC).

The calculator was designed using Microsoft Excel and is intended to be very flexible and easy to use. It can be modified to fit the needs of a college, such as adding other sources of GHG emissions or typing in the exact fuel mixtures used for producing electricity. The coefficients, used in the calculations, come from various well known organizations, such as NASA and the EPA, and can also be modified if a more accurate value is known. If a committee decides they want to use a different equation to calculate a specific value, then the equation can be changed with very little restriction. All the equations used in the calculator are explained in the reference tab.

Once the data is entered the values are automatically calculated and various graphs are produced for interpretations. Since the calculator keeps records of emissions from previous years, trends of emissions is also graphed to determine if the institution is making any progress towards carbon neutrality.\(^{71}\)

Campuses that have not selected or developed a GHG calculator are recommended to use the Cool Air Clean Planet calculator as a starting point. If the current configuration of the calculator does not meet the needs of the committee, it can always be modified in order to meet those requirements. The calculator can be downloaded at www.cleanair-coolplanet.org. To learn more about the calculator see Appendix I for the Clean Air Cool Planet Carbon Calculator User’s Guide.

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\(^{69}\) (GHG Protocol)

\(^{70}\) (World Resource Institute and World Business Council for Sustainable Development, pp. 2, 27-29)

\(^{71}\) (Cool Air Clean Planet, 2008, p. 2)
C. Examples of Identifying Problem Areas

Each sustainability committee will define their problem areas differently depending on their local laws, sustainability trends, and their definition of campus sustainability. Below shows some examples of how a committee could possibly define a problem area for a campus if they used the Sample Campus Inventory (Appendix C), Sample Building Inventory Worksheet (Appendix D) and the Sample Analysis Worksheet (Appendix E). Each example refers to the inventory or analysis worksheet by code or title of table. Afterwards, a description is provided, of what values maybe unsatisfactory for a campus trying to fulfill their commitment, and why they are unsatisfactory.

Energy, water and waste are typically the three major problem areas, but social is also a problem area. Since the sustainability movement is only recently becoming popular by the general public, many people do not fully understand or know how to live a sustainable life. Living a wasteful lifestyle only contributes to problems in the energy, water, and waste areas. The social area is not defined in any of the inventories presented in this document, but it is an area that a committee should consider as a separate problem area.

1) Energy

- What is the percent of renewable energy used on campus?

*Sample Analysis Worksheet Question AE-1 through AE-7.*

GHG emission contributes to the increased average surface temperature of our earth and then leads to global warming. On campuses GHG is emitted mostly from their daily consumption of fossil fuels, such as electricity generation, heating, and vehicle fuel. Fossil fuels are nonrenewable resources which are predicted to be exhausted very soon. Various documents show that crude oil will be exhausted around 2050 and coal will be exhausted around 2100.  

The Sample Analysis Worksheet questions AE-1 through AE-7 provide the total amount of energy consumption for the campus, and the total percent of renewable energy being used. Such as, the percent of renewable fuel applied into the campus’ fleet and the percent of renewable electricity consumed on campus. From these results, the sustainability committee can decide if the percentage of renewable energy used has met with the campus’ expected percentage. A low percentage of renewable energy is an indicator that this is a problem area for the institution, especially if the campus relies on fossil fuels and therefore indirectly emitting GHG.

*Recommendations for Selecting Renewable Energy Technologies* section in Part 2 introduces different renewable energy technologies which can be applied to campuses. The section also recommends which renewable energy technologies should be considered first.

- What building on campus is consuming the most amount of energy?

*Analysis Worksheet Question: Campus Buildings Comparison Question B*

Based on the statistic from U.S. Green Building Council (USGBC), in the United States, buildings account for 72% of electricity consumption, 39% of energy use, and 38% of all carbon

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72 (Terresacree.org) (Fleetnews)
dioxide (CO₂) emissions. The U.S. government recognizes the problem of building efficiency and is considering passing newer regulations for all the buildings in the U.S. One of the first regulations passed was on, December 27, 2007, when the U.S. Department of Energy (DOE) established regulations that requires all new federal buildings to achieve 30% energy efficiency, which is higher than the existing building codes.⁷³ Currently, there is no regulation for energy efficiency of the campus building, but this regulation may become a reality in the future.

For institutions that wish to be carbon neutral will, in most cases, need to install renewable technology. Renewable technology cannot always be applied to every campus and is an expensive investment. As an alternative to reducing greenhouse gas emissions the building efficiency would be identified as the problem area.

By looking at the Campus Buildings Comparison section in the Sample Analysis Worksheet, the energy usage of individual building can be seen. It is recommended for the most energy consuming building to be given priority for improvements. For more information about energy efficiency technologies available for campus buildings, go to Campus Building section under Energy in Solutions to Problem Areas of Part 2.

2) Water

- Which part of the campus consumes more water, buildings or irrigation?
- Which building is consuming the most amount of water?

Sample Analysis Worksheet Question: W1-4: Campus Buildings Comparison.

Water is becoming more and more important to sustainability. Water resources are being stretched increasingly thin. Of all the Earth’s water, only 2.5 percent is fresh water. In some of the regions in United States, the ground water is being depleted faster than it is replenished. One typical example is the Diamond Valley, near Las Vegas, where the water level has dropped over 100 feet during the 1970s and 1980s and continues to drop today.⁷⁴ The availability of drinkable water will be critical as water supplies become more stressed and population growth places greater demand.

The two parts of the campus that consume water are buildings and landscape irrigation. According to the EPA, buildings accounted for 12.2 percent of the estimated total water consumed in the United States per day in 1995.⁷⁵ Thus, the design of plumbing fixtures, mechanical equipment for sustainable building must be efficient in order to carry out the goal of reducing potable water needs of buildings. The water consumption for a building will depend on the type of service the building provides, the occupancy, the location, and the size. Irrigation for landscaping is also a major consumer of potable water on campus that can be defined as a problem area.

Based on the Sample Campus Inventory, sustainability committee can identify which part of campus consumes the most water, buildings or irrigation. The building, on campus, that consumes the most water can be found at the building comparisons table in the Sample Analysis.

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⁷³ (DOE, 2007)
⁷⁴ (Kibert, 2005)
⁷⁵ (EPA, 2004)
Worksheet. Based on these answers, the committee can set priority and find appropriate solutions that will help reduce the water consumption of campus.

For solutions of water efficiency, go to Water section under Solutions to Problem Areas.

3) Waste

- What is the campus total waste production?

Sample Analysis Worksheet Question AWS-1: ______

Waste reduction is a movement that has existed for a while but is not very obvious movement such as the greenhouse gas reduction movement. Waste is an issue today, because every time waste is produced, more resources from the earth are used to produce new products instead reusing the already extracted material from the waste stream. The affects of extraction, of non-renewable materials creates a potential of running out of these materials and also create environmental impacts such as open pit mines that leave craters in the land. Waste also contains many types of toxic chemicals that can cause harm to the environment, such as cleaning products and paints by getting into water supplies and streams.76

- Where does the Campus Waste Go?

Sample Analysis Questions AWS-4 through AWS-10:

| % Recycled: | ________________ |
| % Composted: | ________________ |
| % Reused: | ________________ |
| % Re-sold: | ________________ |
| % Donated: | ________________ |
| % Diverted: | ________________ |
| % Land filled/Incinerated: | ________________ |

Disposing of waste also requires investment in landfills and transportation costs.77 Many landfills are closing down because they have reached their capacity. Densely populated areas, such as Northeast, are predicted to ship their waste towards the western states where there is more room. The costs of transport will directly increase the waste removal costs in the future.78

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76 (EPA, 2008)
77 (BIOL 4861, 2004, p. 21)
78 (Facilities Maintenance Operations, 2008)
In 2007, the United States as a whole produced 254 million tons of municipal solid waste (MSW), roughly 4.6 pounds of waste per person per day. The amount of waste produced has been an increasing trend as depicted by Figure 13.

![Figure 13: The U.S. Waste Production Rates 1960-2007](image)

- **How much paper is purchased per capita on Campus?**

  *Sample Analysis Worksheet Question AWS-12:_______*

  The pie chart in Figure 14 shows the percentage of various materials that made up the 2007 waste stream, before it was recycled. The major contributor to waste is paper, which can be recycled, and is typically the first step a campus will take in order to reduce their waste. Other items such as glass, metals, and plastics may also be recycled. The yard trimmings and food scraps can be composted and then used as rich organic soil for landscaping.

![Figure 14: Percentage of Various Materials Making up the 2007 U.S. Waste Stream](image)

- **Regulations on Waste**

  Although the amount of waste being produced has increased, the rate of recycling has also increased over the years (Figure 15), and will most likely follow this trend.\(^\text{79}\) The various levels

\(^{79}\) (EPA - Waste, 2008)
of government are getting involvement in waste reduction and are assisting with this trend. The province of Ontario, Canada had passed a bill that required 50% reduction in waste by the year of 2000. Greater Vancouver Regional District, had banned corrugated cardboard from the waste stream in 1997. The ban was extended to include office paper and newspaper in March 1, 1999. Any hauler that hauls any of these banned items is required to pay a fee of $32.50 per metric ton. June 1, 2006, a ban was placed on yard and garden waste by the province of British Columbia. There also has been a ban on all recycled material since 1991.

States in the US are also following the same trend of banning certain materials from the waste stream. Massachusetts developed a Waste Disposal Ban Regulation which bans the items listed in Table 3 from the waste stream since January 1, 2000. Seattle, Washington is also working on a regulation that bans the use of paper and plastic bags used in restaurants and grocery stores, and impose a twenty cent fee everytime they are used.

### Table 8: Banned Recycled Goods in Massachusetts

<table>
<thead>
<tr>
<th>Item</th>
<th>Table 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Batteries</td>
<td>Wood</td>
</tr>
<tr>
<td>Leaves</td>
<td>Metal</td>
</tr>
<tr>
<td>Tires</td>
<td>Recyclable Paper</td>
</tr>
<tr>
<td>White goods</td>
<td>Cathode Ray Tubes</td>
</tr>
<tr>
<td>Other Yard Waste</td>
<td></td>
</tr>
<tr>
<td>Metal or Glass</td>
<td></td>
</tr>
<tr>
<td>Metal</td>
<td>Single Polymer Plastics</td>
</tr>
<tr>
<td>Aluminum Containers</td>
<td></td>
</tr>
<tr>
<td>Asphalt Pavement, Brick</td>
<td></td>
</tr>
<tr>
<td>and Concrete</td>
<td></td>
</tr>
</tbody>
</table>

Waste reduction is not only an emerging environmental movement but also is being enforced by various governments. Although regulation may not be implemented every, it is shown that the trend of recycling is going up and many governments are enforcing the practice with penalties. A campus may identify waste as their problem area when a waste reduction program does not exist on campus, the waste removed does not meet local regulation, or the campus just does not demonstrate their participation or leadership in the current trend of waste management.

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80 (UW Waste Management)
81 (Webb, 1999)
82 (Capital Regional District, pp. 1-2)
83 (310 CMR 19.017: Waste Disposal Ban Regulation)
84 (Seattles Times Staff Reporter, 2008)
4) **People’s Attitude and Behavior Alteration**

- Has the whole campus fully realized their obligation to the environment?

According to a scientific research conducted by the American Geophysical Union (AGU), a worldwide scientific society with members of 50,000 researchers, teachers, has found that natural factors are not responsible for environmental crisis, like global warming, but human activities are the true source. Mankind contributed to climate problems through industrial development, excessive waste production, land alteration, and many other activities. For our society to become sustainable, it is important to alter the people’s attitude towards sustainability.

People need to be educated about the environmental crisis faced by this world and realize their individual responsibility. With the power of education, it is expected everyone will start taking action and contribute himself/herself to the worldwide sustainable movement. In this way, sustainable transition in our society will be achieved. Data from the US Environmental Protection Agency (EPA) has found that simple individual behavior alterations in energy usage, recycling and transportation choice will result in 32% reduction of personally generated greenhouse gas emission.85

Even with education readily available, a lot of people are still unaware of the necessity to protect our environment and their responsibility. The approach of how to educate the campus can be a problem. For example, it can be seen that on many campuses, students do not separate their trash into the respective recycling and trash bins, even though they have been instructed on how to do it. On the other hand, inappropriate awareness promotion or instruction may lead people to react emotionally. For example, some flyers stating that “driving equals killing your children” did not really arouse people’s environmental awareness, but made people develop disgust for them. In order to effectively persuade people to alter their attitude towards sustainability and a lifelong commitment, the “community-based social marketing” (CBSM) is an emerging solution for successfully leading people to engage in sustainable behaviors. CBSM section in this document provides the detailed discussion on CBSM strategies, which can be found under Solutions to Problem Areas.

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85 (Sharp, The Harvard Green Campus Initiative: A Case Study in Organizational Change for Sustainability, 2008)
D. Solutions to Problem Areas

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1) Elaborated Policies

After the sustainability committee takes inventory, and identifies their problems areas, policies established based on inventory analysis and cost assessment are then able to be carried out through certain school process. These policies serve as goals for the committee to follow and to choose specific solutions to meet the policies. For example, after a green energy production policy is created, the committee will start to search for and install the most applicable green energy technology device on campus to meet this policy. These kinds of policies are called as “elaborated policies”. Different from immediate policies, elaborated policies have following features:

- Elaborated policies are usually not cheap to implement, so that it is harder and usually takes longer time for the board or the committee to decide the adoption of an elaborated policy. For example, the green energy device implementation policy may require millions of dollars to build a renewable energy plant such as a large scale wind turbine.
- They are time consuming and usually require long time to implement a certain elaborated policy, such as a “green energy device installation” policy which needs time to choose the most suitable green energy source for campus, needs time to install the device.
- Elaborated policies serve as the first part of the solution section of an action plan. Elaborated policies are policies created after an institution takes an inventory. This is because from inventory completion and analysis, the institution is able to identify its problem areas, such as high energy consumption in residence buildings or lack of a recycling program on campus, and therefore the institution is able to establish a series of detailed policies targeted to resolve these problems and achieve carbon neutral on campus

Recommendation about Developing Elaborated Policies

Elaborated policies can be developed on various aspects of campus, such as energy conservation or water conservation. We recommended institutions to first develop the ones which can resolve the biggest sustainable problems existing on their campuses based on the inventory analysis. For example, if energy consumption out of the four problem areas\(^86\) is the most urgent problem needing to be addressed, the institution can consider establishing policies on “energy management” and “building” first and implement them as soon as possible. Thereafter, the second important policies should be created corresponding to institution’s second biggest problem areas, such as “waste minimization” policies corresponding to campus waste production problem.

As following, this document will introduce example elaborated policies in six disciplines, building, energy management, carbon offset, waste minimization, transportation and green purchasing, which are all aimed at resolving the four problem areas.\(^87\)

Green Building Policy

This policy can be the ones that require all the new constructions on campus should meet the LEED Silver Standard (a commonly accredited green building standard for campus buildings) at

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\(^{86}\) Information about the four problem areas, please refer to “Problem Area” section in this report

\(^{87}\) Information about the four problem areas, please refer to “Problem Area” section in this report
minimum and require all the main buildings on campus shall be renovated to be sustainable. Renovation on the major existing buildings is required to meet the LEED certification.

**Case Studies:**

*Clemson University*

“All new facilities over 5,000 gross square feet and major capital renovations costing more than 50% of building replacement value shall seek to acquire LEED Silver rating at a minimum.”

*Northwestern University*

“All new buildings will be LEED-certified at a minimum; each project will be assessed on an individual basis for further certification at the Silver or Gold levels.”

**Green Energy Production/Purchasing Policy**

The institution can create policies to increase the percent of renewable energy usage on campus by either installing renewable energy devices on campus or purchasing renewable energy generated by off-site plants, such as the renewable energy credits (RECs) provided by the school’s utility supplier.

Policies on this theme are rarely published, but many projects or actions implemented on campuses can prove the existence of related policies in institutions, such as the following examples:

**Case Studies:**

*Wind Turbine, University of Minnesota, Morris*

A 1.65 MW wind turbine is working on the campus of University of Minnesota, Morris. The annual power output from this turbine is 5.6 MkWh, which is over half of the school’s electricity demand.

*Renewable Energy Credits (REC) Purchasing, New York University*

In 2006, 118,000,000 KWh of wind power RECs, equivalent to 100% of the university’s electricity need, was purchased by New York University.

**Carbon Offset Policy**

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88 (Clemson University)  
89 (Northwestern University)  
90 (West Central Research and Outreach Center)  
91 (New York University Public Affairs Office)
From research, many schools set policies on carbon offset purchasing to offset unavoidable greenhouse gas emission generated by the school activities, such as all the campus air travel paid by school.

Associated with this policy, the institution should first estimate the amount of school’s annual GHG emission, which can be obtained through Sample Campus Inventory, and then decide the quantity of offsets they need to purchase.

**Case Study: College of the Atlantic**

College of the Atlantic established a policy that states:

“In College of the Atlantic, emissions that cannot be avoided will be offset by investing in energy efficiency and renewable energy production in such manner as to reduce actual emissions to the atmosphere in an amount that equals or exceeds emissions generated by College of the Atlantic activities. All offsets will be quantifiable and verifiable according to international standards and best practices.”

**Transportation Policy**

Possible transportation policies include: Public Transit Policy, Car Share Policy and Bicycle Share Policy.

**Public Transit Policy**

![UNC Chapel Hill Bus Program](image)

**Figure 16:** UNC Chapel Hill Bus Program

Policies on public transit are rarely published, but many projects or actions implemented on campuses can prove the existence of related policies in institutions, such as the following examples:

---

92 (College of the Atlantic)
Case Studies:

*Lewis & Clark College*
A fare-free shuttle is provided on campus, which can give faculty, staff and students access to the local neighborhoods, the downtown area and grocery stores.  

*University of Colorado at Boulder*
University of Colorado at Boulder provides faculty, staff and students with unlimited usage of fare-free transit passes, which is called “Ecopasses”, within the campus and surrounding neighborhoods. A mandatory student fee approved by the students funds the student part of this “Ecopasses”.  

*Car Share Policy*

![Figure 17: UNC Chapel Zipcar Program](image)

Policies on Car Share are rarely published, but many projects or actions implemented on campuses can prove the existence of related policies in institutions.

Case Studies:

*Zipcar Programs, American University*
American University started a zipcar program on campus, which is available 24 hours per day, 7 days per week. The annual fee for this program is $25. The only requirement for faculty, staff and students is that their age has to be over 21.  

*Hourcar, Augsburg College*
A hourcar hub funded by institution was established at Augsburg College in 2006 and was expected to keep active for the next three years.  

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93 (Lewis & Clark College) 
94 (CU-Boulder Parking and Transportation Services) 
95 (American University) 
96 (Augsburg College)
Bicycle Share Policy

Figure 18: University of Alberta Bike Library

Policies on bicycle share are rarely published, but many projects or actions implemented on campuses can prove the existence of related policies in institutions, such as the following examples:

Case Study: Bike Library, University of Alberta
University of Alberta launched a bike library program in 2005. The bike library provides approximately 30 bikes for rental every month and the bikes “ranges from mountain bikes, cruisers, road bikes and various hybrids”. Each of the bikes is “equipped with a U-lock, front and back light, and a bell”. “$40 deposit is required to ensure the bike is returned in good working condition” and the “hours of operation vary depending on the time of year and the client demand”.

Green Purchasing Policy

Colleges and universities usually have the demand for a large amount of items, and the environmental impact associated with the items can be greatly reduced by altering institution’s purchasing choice. Green purchasing policies are intended to set rules for campus to follow and to turn purchasing choice more sustainable. In this way, institutions is able to minimize the environmental harm associated with purchased products, such as vehicle exhaust associated with non-local food transpiration and energy dissipation associated with non energy efficient appliance. For those institutions that have their own stores on campus, a marketing strategy to encourage people to choose the environmentally friendly products should be also included in this policy.

Following are some sample green purchasing policies, including paper, appliance, food and general purchasing policies.

Case Studies:

Paper Purchasing Policy, Hampshire College
Hampshire College’s paper purchasing policy states that

97 (U of A Students Union)
"Effective on July 1, 2003, Hampshire College will begin purchasing 100% post consumer content, 100% processed chlorine free recycled paper" to "be used campus wide on all convenience copiers and office printers whenever possible." Besides, “Colored paper and paper of other sizes will be purchased as a 30% or higher post consumer waste, 100% processed chlorine free paper.”

Appliance Purchasing Policy, University of California, Davis

"The University is committed to purchase energy efficient equipment that meets EPA Energy Star requirements. These include but are not limited to personal computers, printers, copiers, faxes, laboratory equipment, lighting, refrigerators, and HVACs ."

Food Purchasing Policy, Harvard University

Harvard’s food purchasing policy requires Harvard alter its food choices to be locally and organically produced products. Based on this policy, Harvard changed its wholesalers to be ones who cooperate with local farmers and now most of products purchased by Harvard is organic and Integrated Pest Management (IPM)

General Green Purchasing Policy, Duke University

Duke University established a comprehensive green purchasing policy, in which they set detailed criteria Duke should follow when selecting products. Besides, Duke made its own strategies to apply in Duke’s stores to promote environmentally friendly products on campus. To see the complete Duke Green Purchasing Policy, please go to Integrated Campus Sustainability Policy is organized into six disciplines, building, energy management, carbon offset, waste minimization, transportation and green purchasing.

Green Building Policy

This policy can be the ones that require all the new constructions on campus should meet the LEED Silver Standard at minimum and require all the main buildings on campus shall be renovated to be sustainable. Renovation on the major existing buildings is required to meet the LEED certification.

Example: Clemson University

“All new facilities over 5,000 gross square feet and major capital renovations costing more that 50% of building replacement value shall seek to acquire LEED Silver rating at a minimum.”

98 (Hampshire College)
99 (UCDavis Materiel Management)
100 (Sharp, The Harvard Green Campus Initiative: A Case Study in Organizational Change for Sustainability, 2008)
Example: Northwestern University

“All new buildings will be LEED-certified at a minimum; each project will be assessed on an individual basis for further certification at the Silver or Gold levels.”

Energy Management Policy

Energy management policy will be divided into two parts, energy efficiency and conservation policy, and green energy production/purchasing policy.

Energy Efficiency and Conservation Policy

To develop energy efficiency and conservation policies, sustainability committee should roughly analyze the campus’ unique energy consumption circumstances first, and then develop as many effective strategies as possible on energy conservation, such as making a “space temperature control policy” for all the buildings on campus. More examples are shown as following:

- Lighting Level Control Policy:

  “Lighting Levels - Unless special needs are required, lighting levels shall be maintained at the following average level of foot candles:

  **Classrooms** - 40 foot candles  
  **Offices & Conference rooms** - 30 foot candles  
  **Reception Areas & Lounges** - 20 foot candles  
  **Corridors** - 10 foot candles  
  **Kitchens** - 50 foot candles  
  **Cafeterias** - 20 foot candles  
  **General & Other** - 20 foot candles”

- Space Temperature Control Policy:

  “Unless special needs are required, the following minimum and maximum room temperatures shall be maintained, in as far as reasonably possible, in all university department areas:
During “Occupied” Hours: Heating - 72 Deg. F and Cooling - 75 Deg. F
During “Unoccupied” Hours: Heating - 60 Deg. F and Cooling - 85 Deg. F”

- Facility Operation Policy:

“The following equipment and components will be switched off at the end of each work day when feasible:
* Office Lights
* Office Computers, Printers and Monitors
* Office Copy Machines
* All Other Electronically Operated Equipment”

Green Energy Production/Purchasing Policy

The institution can create policies to increase the percent of renewable energy usage on campus by either installing renewable energy devices on campus or purchasing renewable energy generated by off-site plants, such as the renewable energy credits (RECs) provided by the school’s utility supplier.

Published policies on this theme are hard to find, but we are able to find many projects or actions implemented under their related policies, such as the following examples:

Wind Turbine, University of Minnesota, Morris
A 1.65 MW wind turbine is working on the campus of University of Minnesota, Morris. The annual power output from this turbine is 5.6 MWh, which is over half of the school’s electricity demand.

Renewable Energy Credits (REC) Purchasing, New York University
In 2006, 118,000,000 KWh of wind power RECs, equivalent to 100% of the university’s electricity need, was purchased by New York University.

Carbon Offset Policy

From research, many schools set policies on carbon offset ² purchasing to offset unavoidable greenhouse gas emission generated by the school activities, such as all the campus air travel paid by school.

Associated with this policy, school should also set up a tracking system to estimate the amount of school’s annual GHG emission and to decide the quantity of offsets that need to be purchased.

Example: College of the Atlantic
College of the Atlantic established a policy that states
“In College of the Atlantic, emissions that cannot be avoided will be offset by investing in energy efficiency and renewable energy production in such manner as to reduce actual emissions to the atmosphere in an amount that
equals or exceeds emissions generated by College of the Atlantic activities. All offsets will be quantifiable and verifiable according to international standards and best practices.”

Transportation

Transportation policies will be discussed in four aspects: Anti-Idling Policies, Public Transit Policy, Car Share Policy and Bicycle Share Policy.

Anti-Idling Policies

Example: University of Waterloo
"All vehicles should be turned off when not in use or when the driver leaves the unit for any length of time."

Example: University of Washington
"No vehicle operator in charge of a motor vehicle shall permit it to stand unattended without first stopping the engine, locking the ignition, removing the key and effectively setting the brake, and, when standing upon any perceptible grade, turning the front wheels to the curb or side of the roadway."

Public Transit Policy

Published public transit policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

Example: Lewis & Clark College
A fare-free shuttle is provided on campus, which can give faculty, staff and students access to the local neighborhoods, the downtown area and grocery stores.

Example: University of Colorado at Boulder
University of Colorado at Boulder provides faculty, staff and students with unlimited usage of fare-free transit passes, which is called “Ecopasses”, within the campus and surrounding
neighborhoods. A mandatory student fee approved by the students funds the student part of this “Ecopasses”.

**Car Share Policy**

Published car share policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

Example: **Zipcar Programs**, American University

American University started a zipcar program on campus, which is available 24 hours per day, 7 days per week. The annual fee for this program is $25. The only requirement for faculty, staff and students is that their age has to be over 21.

Example: **Hourcar**, Augsburg College

A hourcar hub funded by institution was established at Augsburg College in 2006 and was expected to keep active for the next three years.

**Bicycle Share Policy**

Published bicycle share policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

Example: **Bike Library**, University of Alberta

University of Alberta launched a bike library program in 2005. The bike library provides approximately 30 bikes for rental every month and the bikes “ranges from mountain bikes, cruisers, road bikes and various hybrids”. Each of the bikes is “equipped with a U-lock, front
and back light, and a bell”. “$40 deposit is required to ensure the bike is returned in good working condition” and the “hours of operation vary depending on the time of year and the client demand”.

Green Purchasing Policy

Colleges and universities usually have the demand for a large amount of many items, and the environmental impact associated with the items can be greatly reduced by altering the schools’ purchasing choice. Therefore, green purchasing policies are intended to set the rules for campus to follow to turn their purchasing choice more sustainable and to minimize the environmental harm brought from products purchased, such as the products of paper, appliance and food. For those schools that have their own stores on campus, a marketing strategy to encourage people to choose the environmentally friendly products should be included in this policy, too. Following are some sample green purchasing policies, including paper, appliance, food and general purchasing policies.

Paper Purchasing Policy, Hampshire College
Hampshire College’s paper purchasing policy states that
"Effective on July 1, 2003, Hampshire College will begin purchasing 100% post consumer content, 100% processed chlorine free recycled paper” to "be used campus wide on all convenience copiers and office printers whenever possible." Besides, “Colored paper and paper of other sizes will be purchased as a 30% or higher post consumer waste, 100% processed chlorine free paper.”

Appliance Purchasing Policy, University of California, Davis
"The University is committed to purchase energy efficient equipment that meets EPA Energy Star requirements. These include but are not limited to personal computers, printers, copiers, faxes, laboratory equipment, lighting, refrigerators, and HVACs.”

Food Purchasing Policy, Harvard University
Harvard’s food purchasing policy requires Harvard alter its food choices to be locally and organically produced products. Based on this policy, Harvard changed its wholesalers to be ones who cooperate with local farmers and now most of products purchased by Harvard is organic and Integrated Pest Management (IPM)

General Green Purchasing Policy, Duke University
Duke University established a comprehensive green purchasing policy, in which they set detailed criteria Duke should follow when selecting products. Besides, Duke made its own strategies to apply in Duke’s stores to promote environmentally friendly products on campus. To see the complete Duke Green Purchasing Policy, please go to Appendix I
Waste Minimization Policy

For this policy, the institution needs to develop a series of effective strategies to minimize their campus’ waste. It can be realized by establishing policies about source reduction, recycling program and participating in the national wide campus recycling and waste reduction competition, such as the RecycleMania.

The following are some examples of campus policies on source reduction, recycling and waste minimization competition.

Source Reduction

Example: Source Reduction Policies, University of California, San Diego (UCSD)

To reduce UCSD’s waste source, UCSD created policies which require campus use durable and reusable products, require the vendors provide products with minimal and reusable packaging to UCSD, encourage paper reuse in offices, and encourage campus to use electronic bulletin boards to distribute newsletters and so on.

As below, we will demonstrate part of the UCSD source reduction policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which sources reduction policy is located, please go to Appendix I.

1. Durable and Reusable Products

Whenever possible, UCSD and external contractors will promote the use of durable and reusable products, i.e., reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.

4. Packaging Minimization
Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.

6. Newsletters

The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department.

Recycling

Example: Recycling Policy, University of California, San Diego (UCSD)

UCSD established recycling policies regarding new construction, building materials, and require all the employees in UCSD to be instructed with general practices of recycling, such as giving lectures in new employee job orientation.

As following, we will demonstrate part of the UCSD recycling policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which recycling policy is located, please go to Appendix I

1. General Practices

   General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

   The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials

   Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.”

Waste Minimization Competition Policy
Published policy about waste minimization competition is hard to find, but we are able to find many programs implemented on campus due to their related policies, such as the following example:

Example: University of Texas at Austin

University of Texas at Austin launched many waste reduction programs on campus and in 2007; they recycled around 40% of its waste and won the Waste Minimization Competition in “RecycleMania”.
Appendix K – Campus Policy Case Studies

Below are some campus policy examples from several leading sustainable institutions in North America. It shows us how a campus sustainability policy could be established. These examples are from selected institutions’ websites.

Green Purchasing Policy, Duke University

“Duke Stores will give preference to environmentally superior products, where quality, function and cost are equal or superior. Products and packaging materials will contain a prescribed minimum post-consumer recycled content and will be minimized and/or substituted with more environmentally appropriate alternatives whenever possible. All products will be chosen based on efficient use of energy, natural resources, and potential for safe, non-hazardous disposal.

Duke Stores will inform all suppliers / vendors of products and services about the policy and will work with them to meet its criteria.

Where practical and cost effective, products will be ordered in appropriate quantities to avoid having to dispose of obsolete products.

‘Whenever practicable,’¹ products should be purchased which meet the criteria specified in the EPA’s Environmentally Preferable Purchasing (EPP) database which is available on the EPA website (www.epa.gov).

When a candidate product meets some of the EPP criterion but not others, preference will be given in the following order:
1) The highest percentage of post-consumer² * recovered material available in the marketplace; and
2) The highest percentage of pre-consumer recovered material available in the marketplace

¹ “Whenever practicable” means a) the recycled products can perform the function intended at least as well as a product produced from only virgin material, and b) the cost of the recycled product reasonably approximates the cost of the product produced from only virgin materials.

² “Post-consumer” materials are those materials that have been used by consumers, collected by recycling programs and then remanufactured into a new product. “Pre-consumer” material consists of the leftover scraps from milling and industrial processes. While both are environmentally preferable to virgin materials, post-consumer recycled material is given priority because it supports local recycling programs by creating demand for the materials collected.

In addition to the recovered material content of a product, the EPP database specifies other important criteria that should be considered in selecting products:
1) The ability of a product and its packaging to be reused, reconditioned for use, or recycled through existing recycling collection programs; and
2) The volume and toxicity of waste and by-products a given product and its packaging generate in their manufacture, use, recycling and disposal.
Equipment purchased or rented by Duke Stores are to be compatible, whenever practicable, with the use of recycled-content products (e.g. photocopy machines). Product specifications and requisitions for products must conform to the following guidelines:

1) Specifications and requisitions shall not require the exclusive use of products made from virgin materials, nor specifically exclude the use of recycled-content products;
2) Performance standards must be reasonable and related to function, and shall not be designed to exclude the purchase of recycled-content products;
3) To the extent such information is known, Duke Stores staff shall identify in the purchase requisition products available with recycled content and vendors from whom such products are available; and
4) The Purchasing Agent has the authority to specify a minimum recycled-content standard in bid solicitations.

Duke Stores will promote this green purchasing policy on its website, inside its stores and within its marketing materials.

Duke Stores will promote environmentally preferable products within its stores through green tagging, preferential shelf placement and special displays. Within its catalog, environmentally preferable products will be denoted through a green labeling scheme.”

UCSD WASTE PREVENTION AND RECYCLING POLICY

I. RELATED POLICIES AND PROCEDURES

UCSD Policy and Procedure Manual (PPM)

520-4 Use of Disposable Polystyrene Products

II. SCOPE

This policy applies to all facilities under the jurisdiction of UCSD, including the La Jolla campus, the UCSD Medical Centers, Hillcrest, Mt. Soledad, Nimitz Marine and the Elliott Field Station. This policy applies to office practices and purchases made both through the Purchasing office and by individual departments.

III. POLICY

UCSD recognizes its role as a leader in the community with regard to environmental policies and, with the adoption of this policy, demonstrates its intention to ensure responsible stewardship of the environmental resources under its influence. More
specifically, the purpose of this policy is to set forth standards and organizational processes aimed at: 1) reducing waste at the source; 2) encouraging the purchase and use of durable and reusable products; 3) encouraging the purchase of high post-consumer content recycled products; 4) increasing the total volume of waste materials diverted from landfills to recycling processes; 5) ensuring the long term viability of campus recycling operations through appropriate educational programs, coordination, management and oversight; and 6) remaining in compliance with Federal and state mandates.

IV. PROCEDURES

The following practices shall be implemented and maintained throughout all UCSD operations.

A. Source Reduction

1. Durable and Reusable Products

Whenever possible, UCSD and external contractors will reduce the use of nonrecyclable materials and products, and promote the use of durable and reusable products, i.e., manila envelopes, reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.

2. Copying and Printing

Employees will reuse office paper whenever practical. Office papers shall be recycled. All departments shall encourage two-sided copying. Whenever practical, scrap paper printed only on one side shall be used for producing rough drafts. Paper printed only on one side shall also be used as scratch paper.

3. Documents

All proposals and reports received from outside vendors and consultants should be printed on both sides using recycled content paper that meets standards established in IV. B. below. Furthermore, the documents shall be clearly marked to indicate that they are printed on recycled content paper.

Letters, reports and documents produced by campus administrative departments should be printed on both sides using recycled paper that meets the standards established in IV.B. below. To the extent possible, academic activities shall also be encouraged to meet these standards.

All forms used on the campus should include only the necessary information and number of copies. Instruction sheets, if necessary, shall be
printed on the back of the last page of the form. Whenever possible, forms should be filled out and processed electronically.

4. Packaging Minimization

Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.

5. Correspondence

Whenever feasible, electronic correspondence shall replace written correspondence. Unnecessary printed copies of electronic correspondence are discouraged.

6. Newsletters and Mailing Lists

The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department. Printed copies should be routed or posted for interested parties to read. Annually, staff shall review mailing lists and delete out of date subscribers.

7. Student Phone Books

All phone books shall be distributed to students only once per calendar year.

B. Standards and Specifications

UCSD shall, at a minimum, conform to the federal purchasing guidelines developed by the Environmental Protection Agency (EPA). Standards and specifications for additional recycled content products as established by the EPA and all such standards shall be reviewed and revised on an ongoing basis by the Waste Minimization Advisory Committee. See Supplement I for a listing of the most common recyclable materials.

C. Purchasing

1. General

UCSD shall continue to improve its efforts toward recycling and waste reduction goals by defining purchasing policies aimed at encouraging the procurement of recycled products.
Because they are by far the largest volume recycled commodity handled by the campus, these purchasing policies will initially focus on paper products. Additional detailed purchasing policies shall be considered in the future by the Waste Minimization Advisory Committee described in Section V. of this policy.

2. Purchasing Authority

Purchasing authority for all campus paper products purchased through the Purchasing Department should remain consolidated under one contract administrator within the Purchasing Department. This consolidation of purchasing power allows for economies of scale in paper purchases to offset any potential price differentials between recycled and virgin products. Further it enables the campus to significantly increase recycled content paper purchases while reducing costs. Letter and legal size paper purchases should not be made through the use of Low Value Purchase Orders (LVPO's).

3. Requirement to Purchase Recycled Paper Products

The UCSD Storehouse should be used for the purchase of all paper products which include but are not limited to: cut paper for copiers and laser printers, computer paper and custodial paper products. The Storehouse provides the service of procuring, storing and distributing all types of paper supplies for UCSD. With the ability to negotiate purchases through an annual high volume purchase program the price stabilization of paper products is favorably maintained for UCSD. The long term goal is to pursue the commitment to obtain and supply recycled paper products through all available sources.

The UCSD Storehouse shall strive to procure paper products with the highest percentage of recycled content available providing these products meet established performance standards and are within 5% of the price of virgin paper products.

4. Elimination of Prohibitions

Upon review and update of any University policy, limitations which restrict the purchase or use of recycled product shall be amended to encourage use of recycled products wherever possible, providing the necessary performance standards can be met.

D. Recycling
   1. General Practices
All University employees shall be instructed with regard to their responsibility to participate in campus recycling efforts. General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials

Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.

E. Education

1. Faculty and Staff

Physical Plant Services will be responsible for providing educational programs and materials for faculty and staff including a discussion of UCSD's commitment and responsibilities regarding waste prevention and recycling instructions on how various commodities can be recycled, information contacts and phone numbers, and any applicable incentives. Educational programs shall be implemented under the advice and guidance of the Waste Minimization Advisory Committee described in Section V. Responsibilities.

2. Departmental Contacts

Each Department should appoint a recycling contact person who will serve as the primary contact person for the Department.

3. Students

Educational presentations regarding the need for recycling and waste reduction and ways to participate in campus recycling efforts will be made to all new students as part of their orientation. Additional educational programs shall be devised and implemented under the advice and guidance of the Waste Minimization Advisory Committee as described in Section V. Responsibilities.

V. RESPONSIBILITIES

A. Waste Prevention and Recycling Coordinator
Coordination - The coordination of the following waste reduction, reuse and recycling programs shall be consolidated under the Waste Prevention and Recycling Coordinator:

Aluminum Cardboard Computer paper Glass Yard Wastes Mixed paper
Newspaper Plastic White paper Metal Tin & Steel cans Building Materials Oil
and Batteries Reuse Programs Ship & Vehicle Waste

The campus Coordinator shall oversee the day to day operations of UCSD's recycling programs, maintain records of recycling activities, and staff the Waste Minimization Advisory Committee.

B. Departments and Organizations

All departments and organizations engaged in individual recycling programs shall provide records of their operations to the campus Waste Prevention and Recycling Coordinator on a quarterly basis within fifteen days following the end of each calendar quarter. Individual program record keeping shall be computerized if possible, and shall be done in a uniform format to be supplied by the coordinator, by all departments and organizations engaged in recycling efforts addressed under this policy. Data shall include the commodity, the quantity (in lbs/month), revenues, vendors and expenses.

C. Waste Minimization Advisory Committee

UCSD shall maintain a standing "Waste Minimization Advisory Committee" to provide guidance and oversight for the campus waste prevention and recycling operations. The Waste Minimization Advisory Committee shall be advisory to the Vice-Chancellor-Business Affairs. The Committee shall be appointed on an annual basis and shall include representatives from the faculty, staff and student body. The Waste Minimization Advisory Committee shall be responsible for staying abreast of current regulations, technologies, and opportunities in recycling, and shall support and direct the implementation of recycling education programs.

The Waste Minimization Advisory Committee shall review quarterly recycling reports and determine whether any commodities should be added to or deleted from UCSD's recycling operations. The Committee shall also prepare an annual report to the Vice-Chancellor-Business Affairs by June 30 each year, summarizing the campus waste prevention and recycling activities and progress, and include any suggestions for improvements to recycling programs.

Supplement I (Page 1 of 3)
### EPA STANDARDS AND SPECIFICATIONS

#### FOR RECYCLED CONTENT PRODUCTS

**Recommended Recovered Fiber Content Levels For Uncoated**

**Printing and Writing Papers**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reprographic Paper (e.g. mimeo and duplicator paper, high-speed copier paper, and bond paper) (1)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Offset Paper (e.g., offset printing paper (1), book paper, bond paper (1))</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Table Paper (e.g., office paper such as note pads, stationery (1) and other writing papers)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Forms Bond (e.g., forms, computer printout paper, ledger) (1)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Envelope paper:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wove</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Kraft:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White and colored (including manila)</td>
<td>10-20</td>
<td>10-20</td>
</tr>
<tr>
<td>Unbleached</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Cotton Fiber Paper (e.g., cotton fiber papers, ledger (1), stationery (1) and matching envelopes, and other writing (1) papers)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Text &amp; Cover Paper (e.g., cover stock, book paper (1), stationery (1) and matching envelopes, and other writing (1) paper)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Supercalendered</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Machine finish groundwood</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Paperties</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Check Safety Paper</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

(1) These items can be made from a variety of printing and writing papers, depending on the performance characteristics of the item. Some of the papers are a commodity-type and some are specialty papers. EPA recommends that...
procuring agencies determine the performance characteristics required of the paper prior to establishing minimum content standards. For example, bond, ledger, or stationery made from cotton fiber paper or a text & cover paper have different characteristics than similar items made from commodity papers.

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Supplement I (Page 2 of 3)

**Recommended Recovered Fiber Content Levels**

for **Coated Printing and Writing Papers**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coated Printing Paper</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Carbonless</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

**Recommended Recovered Fiber Content Levels for Bristols**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Folders (Manila and Colored)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Dyed Filing Products</td>
<td>20-50</td>
<td>20</td>
</tr>
<tr>
<td>Cards (index, postal, and other, including index sheets)</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Pressboard Report Covers and Binders</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Tags and Tickets</td>
<td>20-50</td>
<td>20</td>
</tr>
</tbody>
</table>

---

Supplement I (Page 3 of 3)

**Recommended Recovered Fiber Content Levels**

for **Paperboard and Packaging Products**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrugated containers: (1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

89
<table>
<thead>
<tr>
<th></th>
<th>(&lt;300 psi)</th>
<th>(300 psi)</th>
<th>25-50</th>
<th>25-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Fiber Boxes</td>
<td></td>
<td></td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Folding cartons (2)</td>
<td></td>
<td></td>
<td>100</td>
<td>40-80</td>
</tr>
<tr>
<td>Industrial paperboard (e.g., tubes, cores, drums, and cans)</td>
<td></td>
<td></td>
<td>100</td>
<td>45-100</td>
</tr>
<tr>
<td>Miscellaneous (e.g., pad backs, covered binders, book covers, mailing tubes, protective packaging)</td>
<td></td>
<td></td>
<td>90-100</td>
<td>75-100</td>
</tr>
<tr>
<td>Padded mailers</td>
<td></td>
<td></td>
<td>5-15</td>
<td>5-15</td>
</tr>
<tr>
<td>Carrier board (3)</td>
<td></td>
<td></td>
<td>10-100</td>
<td>10-15</td>
</tr>
<tr>
<td>Brown papers (e.g., wrapping paper and bags)</td>
<td></td>
<td></td>
<td>5-40</td>
<td>5-20</td>
</tr>
</tbody>
</table>

(1) The recovered fiber and postconsumer fiber content is calculated from the content of each component relative to the weight each contributes to the total weight of the box.

(2) The recommended content ranges are not applicable to all types of paperboard used in folding cartons. Cartons made from solid bleached sulfate or solid unbleached sulfate contain no or small percentages of postconsumer fiber, depending on the paperboard source.

(3) Carrier board made from unbleached draft contains up to 25% recovered fiber, while carrier board made from recycled paperboard contains up to 100% recovered fiber.

**MISCELLANEOUS:**

Recommended Recovered Fiber Content Levels for Miscellaneous Paper Products, Commercial/Industrial Sanitary Tissue Products, Traffic Cones, Traffic Barricades, Running Tracks, Playground Surfaces Floor Tiles and Patio Blocks are also available.
Appendix L – Windows Selection

This Appendix was developed by Efficient Windows to help institutions have some ideas about choosing the appropriate windows for campus buildings.

The U.S. region is broken down in the figure below:

![Energy Star Zones Map](http://www.efficientwindows.org/factsheets/MultiBenefitsFactsheet.pdf)

**Figure L-1**


Based on these regions, the recommended windows properties are presented in the chart below:

**Table 16: Window’s properties**

<table>
<thead>
<tr>
<th>Regions</th>
<th>U-value</th>
<th>SHGC</th>
<th>VT</th>
<th>Air leak (AL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Climate Zone</td>
<td>0.35 or less</td>
<td>To reduce heating, select the highest SHGC you can find so that winter solar gains can offset a portion of the heating energy</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td>Select windows with an AL of 0.30 or less.</td>
</tr>
<tr>
<td></td>
<td>If air conditioning loads are minimal, windows with U-factors as high as 0.40 are also</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Zone</td>
<td>SHGC Limit</td>
<td>VT Limit</td>
<td>AL Limit</td>
<td>Additional Considerations</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>----------</td>
<td>----------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>North/Central</td>
<td>0.40 or less</td>
<td>0.55 or less</td>
<td>0.40 or less</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
</tr>
<tr>
<td></td>
<td>A low U-factor is useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South/Central</td>
<td>0.40 or less</td>
<td>0.40 or less</td>
<td>0.30 or less</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
</tr>
<tr>
<td></td>
<td>A low U-factor is</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern</td>
<td>0.65 or less</td>
<td>0.40 or less</td>
<td>0.30 or less</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
</tr>
<tr>
<td>Climate Zone</td>
<td>A low U-factor is useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates. Select windows with a U-factor lower than 0.65 and preferably lower than 0.60.

with a SHGC of less than 0.40. A low SHGC is the most important window property in warm climates.

daylight and view, or less.

Source: efficient windows collaborative
Waste Minimization Policy

Figure 19: Help Waste Lose Weight
For this policy, the institution needs to develop a series of effective strategies to minimize their campus’ waste. This can be realized by establishing policies about source reduction, recycling program and participating in the national wide campus recycling and waste reduction competition, such as the RecycleMania. The following are some examples of campus policies on source reduction, recycling and waste minimization competition.

Source Reduction Policy

Case Study: Source Reduction Policies, University of California, San Diego (UCSD)

To reduce UCSD’s waste source, UCSD created policies which require campus use durable and reusable products, require the vendors provide products with minimal and reusable packaging to UCSD and encourage paper reuse in offices and so on.

As below, we will demonstrate part of the UCSD source reduction policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which sources reduction policy is located, please go to Integrated Campus Sustainability Policy is organized into six disciplines, building, energy management, carbon offset, waste minimization, transportation and green purchasing.

Green Building Policy

This policy can be the ones that require all the new constructions on campus should meet the LEED Silver Standard at minimum and require all the main buildings on campus shall be renovated to be sustainable. Renovation on the major existing buildings is required to meet the LEED certification.

101 (Duke University)
102 (RecycleMania)
Example: Clemson University

“All new facilities over 5,000 gross square feet and major capital renovations costing more that 50% of building replacement value shall seek to acquire LEED Silver rating at a minimum.”

Example: Northwestern University

“All new buildings will be LEED-certified at a minimum; each project will be assessed on an individual basis for further certification at the Silver or Gold levels.”

Energy Management Policy

Energy management policy will be divided into two part, energy efficiency and conservation policy, and green energy production/purchasing policy.

Energy Efficiency and Conservation Policy

To develop energy efficiency and conservation policies, sustainability committee should roughly analyze the campus’ unique energy consumption circumstances first, and then develop as many effective strategies as possible on energy conservation, such as making a “space temperature control policy” for all the buildings on campus. More examples are shown as following:

- Lighting Level Control Policy:

  “Lighting Levels - Unless special needs are required, lighting levels shall be maintained at the following average level of foot candles:

  - Classrooms - 40 foot candles
  - Offices & Conference rooms - 30 foot candles
  - Reception Areas & Lounges - 20 foot candles
  - Corridors - 10 foot candles
  - Kitchens - 50 foot candles
Space Temperature Control Policy:
“Unless special needs are required, the following minimum and maximum room temperatures shall be maintained, in as far as reasonably possible, in all university department areas:
During “Occupied” Hours: Heating - 72 Deg. F and Cooling - 75 Deg. F
During “Unoccupied” Hours: Heating - 60 Deg. F and Cooling - 85 Deg. F”

Facility Operation Policy:
“The following equipment and components will be switched off at the end of each work day when feasible:
* Office Lights
* Office Computers, Printers and Monitors
* Office Copy Machines
* All Other Electronically Operated Equipment”

**Green Energy Production/Purchasing Policy**

The institution can create policies to increase the percent of renewable energy usage on campus by either installing renewable energy devices on campus or purchasing renewable energy generated by off-site plants, such as the renewable energy credits (RECs) provided by the school’s utility supplier.

Published policies on this theme are hard to find, but we are able to find many projects or actions implemented under their related policies, such as the following examples:

**Wind Turbine, University of Minnesota, Morris**
A 1.65 MW wind turbine is working on the campus of University of Minnesota, Morris. The annual power output from this turbine is 5.6 MkWh, which is over half of the school’s electricity demand.

**Renewable Energy Credits (REC) Purchasing, New York University**
In 2006, 118,000,000 KWh of wind power RECs, equivalent to 100% of the university’s electricity need, was purchased by New York University.

**Carbon Offset Policy**

From research, many schools set policies on carbon offset purchasing to offset unavoidable greenhouse gas emission generated by the school activities, such as all the campus air travel paid by school.
Associated with this policy, school should also set up a tracking system to estimate the amount of school’s annual GHG emission and to decide the quantity of offsets that need to be purchased.

Example: College of the Atlantic
College of the Atlantic established a policy that states
“In College of the Atlantic, emissions that cannot be avoided will be offset by investing in energy efficiency and renewable energy production in such manner as to reduce actual emissions to the atmosphere in an amount that equals or exceeds emissions generated by College of the Atlantic activities. All offsets will be quantifiable and verifiable according to international standards and best practices.”

Transportation

Transportation policies will be discussed in four aspects: Anti-Idling Policies, Public Transit Policy, Car Share Policy and Bicycle Share Policy.

Anti-Idling Policies

Example: University of Waterloo
"All vehicles should be turned off when not in use or when the driver leaves the unit for any length of time."

Example: University of Washington
"No vehicle operator in charge of a motor vehicle shall permit it to stand unattended without first stopping the engine, locking the ignition, removing the key and effectively setting the brake, and, when standing upon any perceptible grade, turning the front wheels to the curb or side of the roadway."

Public Transit Policy

Published public transit policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:
Example: Lewis & Clark College
A fare-free shuttle is provided on campus, which can give faculty, staff and students access to the local neighborhoods, the downtown area and grocery stores.

Example: University of Colorado at Boulder
University of Colorado at Boulder provides faculty, staff and students with unlimited usage of fare-free transit passes, which is called “Ecopasses”, within the campus and surrounding neighborhoods. A mandatory student fee approved by the students funds the student part of this “Ecopasses”.

**Car Share Policy**

![Car Share Policy](image1)

Published car share policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

Example: **Zipcar Programs**, American University

American University started a zipcar program on campus, which is available 24 hours per day, 7 days per week. The annual fee for this program is $25. The only requirement for faculty, staff and students is that their age has to be over 21.

Example: **Hourcar**, Augsburg College

A hourcar hub funded by institution was established at Augsburg College in 2006 and was expected to keep active for the next three years.

**Bicycle Share Policy**

![Bicycle Share Policy](image2)
Published bicycle share policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

Example: **Bike Library, University of Alberta**

University of Alberta launched a bike library program in 2005. The bike library provides approximately 30 bikes for rental every month and the bikes “ranges from mountain bikes, cruisers, road bikes and various hybrids”. Each of the bikes is “equipped with a U-lock, front and back light, and a bell”. “$40 deposit is required to ensure the bike is returned in good working condition” and the “hours of operation vary depending on the time of year and the client demand”.

**Green Purchasing Policy**

Colleges and universities usually have the demand for a large amount of many items, and the environmental impact associated with the items can be greatly reduced by altering the schools’ purchasing choice. Therefore, green purchasing policies are intended to set the rules for campus to follow to turn their purchasing choice more sustainable and to minimize the environmental harm brought from products purchased, such as the products of paper, appliance and food. For those schools that have their own stores on campus, a marketing strategy to encourage people to choose the environmentally friendly products should be included in this policy, too. Following are some sample green purchasing policies, including paper, appliance, food and general purchasing policies.

**Paper Purchasing Policy, Hampshire College**

Hampshire College’s paper purchasing policy states that

“Effective on July 1, 2003, Hampshire College will begin purchasing 100% post consumer content, 100% processed chlorine free recycled paper” to “be used campus wide on all convenience copiers and office printers whenever possible.” Besides, “Colored paper and paper of other sizes will be purchased as a 30% or higher post consumer waste, 100% processed chlorine free paper.”

**Appliance Purchasing Policy, University of California, Davis**

“The University is committed to purchase energy efficient equipment that meets EPA Energy Star requirements. These include but are not limited to personal computers, printers, copiers, faxes, laboratory equipment, lighting, refrigerators, and HVACs.”

Food Purchasing Policy, Harvard University

Harvard’s food purchasing policy requires Harvard alter its food choices to be locally and organically produced products. Based on this policy, Harvard changed its wholesalers to be ones who cooperate with local farmers and now most of products purchased by Harvard is organic and Integrated Pest Management (IPM)
General Green Purchasing Policy, Duke University
Duke University established a comprehensive green purchasing policy, in which they set detailed criteria Duke should follow when selecting products. Besides, Duke made its own strategies to apply in Duke’s stores to promote environmentally friendly products on campus. To see the complete Duke Green Purchasing Policy, please go to Appendix I

Waste Minimization Policy

For this policy, the institution needs to develop a series of effective strategies to minimize their campus’ waste. It can be realized by establishing policies about source reduction, recycling program and participating in the national wide campus recycling and waste reduction competition, such as the RecycleMania.

The following are some examples of campus policies on source reduction, recycling and waste minimization competition.

Source Reduction

Example: Source Reduction Policies, University of California, San Diego (UCSD)

To reduce UCSD’s waste source, UCSD created policies which require campus use durable and reusable products, require the vendors provide products with minimal and reusable packaging to UCSD, encourage paper reuse in offices, and encourage campus to use electronic bulletin boards to distribute newsletters and so on.

As below, we will demonstrate part of the UCSD source reduction policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which sources reduction policy is located, please go to Appendix I

1. Durable and Reusable Products
Whenever possible, UCSD and external contractors will promote the use of durable and reusable products, i.e., reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.

4. Packaging Minimization

Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.

6. Newsletters

The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department.

Recycling

Example: Recycling Policy, University of California, San Diego (UCSD)

UCSD established recycling policies regarding new construction, building materials, and require all the employees in UCSD to be instructed with general practices of recycling, such as giving lectures in new employee job orientation.

As following, we will demonstrate part of the UCSD recycling policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which recycling policy is located, please go to Appendix I

1. General Practices

General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials
Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.”

**Waste Minimization Competition Policy**

Published policy about waste minimization competition is hard to find, but we are able to find many programs implemented on campus due to their related policies, such as the following example:

Example: University of Texas at Austin

University of Texas at Austin launched many waste reduction programs on campus and in 2007; they recycled around 40% of its waste and won the Waste Minimization Competition in “RecycleMania”.
Appendix K – Campus Policy Case Studies

Below are some campus policy examples from several leading sustainable institutions in North America. It shows us how a campus sustainability policy could be established. These examples are from selected institutions’ websites.

Green Purchasing Policy, Duke University

“Duke Stores will give preference to environmentally superior products, where quality, function and cost are equal or superior. Products and packaging materials will contain a prescribed minimum post-consumer recycled content and will be minimized and/or substituted with more environmentally appropriate alternatives whenever possible. All products will be chosen based on efficient use of energy, natural resources, and potential for safe, non-hazardous disposal.

Duke Stores will inform all suppliers / vendors of products and services about the policy and will work with them to meet its criteria.

Where practical and cost effective, products will be ordered in appropriate quantities to avoid having to dispose of obsolete products.

‘Whenever practicable,’¹* products should be purchased which meet the criteria specified in the EPA’s Environmentally Preferable Purchasing (EPP) database which is available on the EPA website (www.epa.gov).

When a candidate product meets some of the EPP criterion but not others, preference will be given in the following order:
1) The highest percentage of post-consumer² * recovered material available in the marketplace; and
2) The highest percentage of pre-consumer recovered material available in the marketplace

¹*“Whenever practicable” means a) the recycled products can perform the function intended at least as well as a product produced from only virgin material, and b) the cost of the recycled product reasonably approximates the cost of the product produced from only virgin materials.

²*“Post-consumer” materials are those materials that have been used by consumers, collected by recycling programs and then remanufactured into a new product. “Pre-consumer” material consists of the leftover scraps from milling and industrial processes. While both are environmentally preferable to virgin materials, post-consumer recycled material is given priority because it supports local recycling programs by creating demand for the materials collected.

In addition to the recovered material content of a product, the EPP database specifies other important criteria that should be considered in selecting products:
1) The ability of a product and its packaging to be reused, reconditioned for use, or recycled through existing recycling collection programs; and
2) The volume and toxicity of waste and by-products a given product and its packaging generate in their manufacture, use, recycling and disposal.
Equipment purchased or rented by Duke Stores are to be compatible, whenever practicable, with the use of recycled-content products (e.g. photocopy machines). Product specifications and requisitions for products must conform to the following guidelines:
1) Specifications and requisitions shall not require the exclusive use of products made from virgin materials, nor specifically exclude the use of recycled-content products;
2) Performance standards must be reasonable and related to function, and shall not be designed to exclude the purchase of recycled-content products;
3) To the extent such information is known, Duke Stores staff shall identify in the purchase requisition products available with recycled content and vendors from whom such products are available; and
4) The Purchasing Agent has the authority to specify a minimum recycled-content standard in bid solicitations.

Duke Stores will promote this green purchasing policy on its website, inside its stores and within its marketing materials.

Dukes Stores will promote environmentally preferable products within its stores through green tagging, preferential shelf placement and special displays. Within its catalog, environmentally preferable products will be denoted through a green labeling scheme.”

UCSD WASTE PREVENTION AND RECYCLING POLICY

VI. RELATED POLICIES AND PROCEDURES

UCSD Policy and Procedure Manual (PPM)

520-4 Use of Disposable Polystyrene Products

VII. SCOPE

This policy applies to all facilities under the jurisdiction of UCSD, including the La Jolla campus, the UCSD Medical Centers, Hillcrest, Mt. Soledad, Nimitz Marine and the Elliott Field Station. This policy applies to office practices and purchases made both through the Purchasing office and by individual departments.

VIII. POLICY

UCSD recognizes its role as a leader in the community with regard to environmental policies and, with the adoption of this policy, demonstrates its intention to ensure responsible stewardship of the environmental resources under its influence. More
specifically, the purpose of this policy is to set forth standards and organizational processes aimed at: 1) reducing waste at the source; 2) encouraging the purchase and use of durable and reusable products; 3) encouraging the purchase of high post-consumer content recycled products; 4) increasing the total volume of waste materials diverted from landfills to recycling processes; 5) ensuring the long term viability of campus recycling operations through appropriate educational programs, coordination, management and oversight; and 6) remaining in compliance with Federal and state mandates.

IX. PROCEDURES

The following practices shall be implemented and maintained throughout all UCSD operations.

A. Source Reduction

1. Durable and Reusable Products

Whenever possible, UCSD and external contractors will reduce the use of nonrecyclable materials and products, and promote the use of durable and reusable products, i.e., manila envelopes, reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.

2. Copying and Printing

Employees will reuse office paper whenever practical. Office papers shall be recycled. All departments shall encourage two-sided copying. Whenever practical, scrap paper printed only on one side shall be used for producing rough drafts. Paper printed only on one side shall also be used as scratch paper.

3. Documents

All proposals and reports received from outside vendors and consultants should be printed on both sides using recycled content paper that meets standards established in IV. B. below. Furthermore, the documents shall be clearly marked to indicate that they are printed on recycled content paper.

Letters, reports and documents produced by campus administrative departments should be printed on both sides using recycled paper that meets the standards established in IV.B. below. To the extent possible, academic activities shall also be encouraged to meet these standards.

All forms used on the campus should include only the necessary information and number of copies. Instruction sheets, if necessary, shall be
printed on the back of the last page of the form. Whenever possible, forms should be filled out and processed electronically.

4. Packaging Minimization

Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.

5. Correspondence

Whenever feasible, electronic correspondence shall replace written correspondence. Unnecessary printed copies of electronic correspondence are discouraged.

6. Newsletters and Mailing Lists

The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department. Printed copies should be routed or posted for interested parties to read. Annually, staff shall review mailing lists and delete out of date subscribers.

7. Student Phone Books

All phone books shall be distributed to students only once per calendar year.

B. Standards and Specifications

UCSD shall, at a minimum, conform to the federal purchasing guidelines developed by the Environmental Protection Agency (EPA). Standards and specifications for additional recycled content products as established by the EPA and all such standards shall be reviewed and revised on an ongoing basis by the Waste Minimization Advisory Committee. See Supplement I for a listing of the most common recyclable materials.

C. Purchasing

1. General

UCSD shall continue to improve its efforts toward recycling and waste reduction goals by defining purchasing policies aimed at encouraging the procurement of recycled products.
Because they are by far the largest volume recycled commodity handled by the campus, these purchasing policies will initially focus on paper products. Additional detailed purchasing policies shall be considered in the future by the Waste Minimization Advisory Committee described in Section V. of this policy.

2. Purchasing Authority

Purchasing authority for all campus paper products purchased through the Purchasing Department should remain consolidated under one contract administrator within the Purchasing Department. This consolidation of purchasing power allows for economies of scale in paper purchases to offset any potential price differentials between recycled and virgin products. Further it enables the campus to significantly increase recycled content paper purchases while reducing costs. Letter and legal size paper purchases should not be made through the use of Low Value Purchase Orders (LVPO's).

3. Requirement to Purchase Recycled Paper Products

The UCSD Storehouse should be used for the purchase of all paper products which include but are not limited to: cut paper for copiers and laser printers, computer paper and custodial paper products. The Storehouse provides the service of procuring, storing and distributing all types of paper supplies for UCSD. With the ability to negotiate purchases through an annual high volume purchase program the price stabilization of paper products is favorably maintained for UCSD. The long term goal is to pursue the commitment to obtain and supply recycled paper products through all available sources.

The UCSD Storehouse shall strive to procure paper products with the highest percentage of recycled content available providing these products meet established performance standards and are within 5% of the price of virgin paper products.

4. Elimination of Prohibitions

Upon review and update of any University policy, limitations which restrict the purchase or use of recycled product shall be amended to encourage use of recycled products wherever possible, providing the necessary performance standards can be met.

D. Recycling
   1. General Practices
All University employees shall be instructed with regard to their responsibility to participate in campus recycling efforts. General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials

Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.

E. Education

1. Faculty and Staff

Physical Plant Services will be responsible for providing educational programs and materials for faculty and staff including a discussion of UCSD's commitment and responsibilities regarding waste prevention and recycling instructions on how various commodities can be recycled, information contacts and phone numbers, and any applicable incentives. Educational programs shall be implemented under the advice and guidance of the Waste Minimization Advisory Committee described in Section V. Responsibilities.

2. Departmental Contacts

Each Department should appoint a recycling contact person who will serve as the primary contact person for the Department.

3. Students

Educational presentations regarding the need for recycling and waste reduction and ways to participate in campus recycling efforts will be made to all new students as part of their orientation. Additional educational programs shall be devised and implemented under the advice and guidance of the Waste Minimization Advisory Committee as described in Section V. Responsibilities.

X. RESPONSIBILITIES

A. Waste Prevention and Recycling Coordinator
Coordination - The coordination of the following waste reduction, reuse and recycling programs shall be consolidated under the Waste Prevention and Recycling Coordinator:

- Aluminum
- Cardboard
- Computer paper
- Glass
- Yard Wastes
- Mixed paper
- Newspaper
- Plastic
- White paper
- Metal
- Tin & Steel cans
- Building Materials
- Oil and Batteries
- Reuse Programs
- Ship & Vehicle Waste

The campus Coordinator shall oversee the day to day operations of UCSD's recycling programs, maintain records of recycling activities, and staff the Waste Minimization Advisory Committee.

B. Departments and Organizations

All departments and organizations engaged in individual recycling programs shall provide records of their operations to the campus Waste Prevention and Recycling Coordinator on a quarterly basis within fifteen days following the end of each calendar quarter. Individual program record keeping shall be computerized if possible, and shall be done in a uniform format to be supplied by the coordinator, by all departments and organizations engaged in recycling efforts addressed under this policy. Data shall include the commodity, the quantity (in lbs/month), revenues, vendors and expenses.

C. Waste Minimization Advisory Committee

UCSD shall maintain a standing "Waste Minimization Advisory Committee" to provide guidance and oversight for the campus waste prevention and recycling operations. The Waste Minimization Advisory Committee shall be advisory to the Vice-Chancellor-Business Affairs. The Committee shall be appointed on an annual basis and shall include representatives from the faculty, staff and student body. The Waste Minimization Advisory Committee shall be responsible for staying abreast of current regulations, technologies, and opportunities in recycling, and shall support and direct the implementation of recycling education programs.

The Waste Minimization Advisory Committee shall review quarterly recycling reports and determine whether any commodities should be added to or deleted from UCSD's recycling operations. The Committee shall also prepare an annual report to the Vice-Chancellor-Business Affairs by June 30 each year, summarizing the campus waste prevention and recycling activities and progress, and include any suggestions for improvements to recycling programs.

Supplement I (Page 1 of 3)
EPA STANDARDS AND SPECIFICATIONS
FOR RECYCLED CONTENT PRODUCTS

Recommended Recovered Fiber Content Levels For Uncoated

Printing and Writing Papers

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reprographic Paper (e.g. mimeo and duplicator paper, high-speed copier paper, and bond paper)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Offset Paper (e.g., offset printing paper (1), book paper, bond paper (1)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Table Paper (e.g., office paper such as note pads, stationery (1) and other writing papers)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Forms Bond (e.g., forms, computer printout paper, ledger) (1)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Envelope paper: Wove</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Kraft:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White and colored (including manila)</td>
<td>10-20</td>
<td>10-20</td>
</tr>
<tr>
<td>Unbleached</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Cotton Fiber Paper (e.g., cotton fiber papers, ledger (1), stationery (1) and matching envelopes, and other writing (1) papers)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Text &amp; Cover Paper (e.g., cover stock, book paper (1), stationery (1) and matching envelopes, and other writing (1) paper)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Supercalendered</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Machine finish groundwood</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Papteries</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Check Safety Paper</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

(1) These items can be made from a variety of printing and writing papers, depending on the performance characteristics of the item. Some of the papers are a commodity-type and some are specialty papers. EPA recommends that
procuring agencies determine the performance characteristics required of the paper prior to establishing minimum content standards. For example, bond, ledger, or stationery made from cotton fiber paper or a text & cover paper have different characteristics than similar items made from commodity papers.

Supplement I (Page 2 of 3)

**Recommended Recovered Fiber Content Levels**

for Coated Printing and Writing Papers

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coated Printing Paper</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Carbonless</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

**Recommended Recovered Fiber Content Levels for Bristols**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Folders (Manila and Colored)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Dyed Filing Products</td>
<td>20-50</td>
<td>20</td>
</tr>
<tr>
<td>Cards (index, postal, and other, including index sheets)</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Pressboard Report Covers and Binders</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Tags and Tickets</td>
<td>20-50</td>
<td>20</td>
</tr>
</tbody>
</table>

Supplement I

(Page 3 of 3)

**Recommended Recovered Fiber Content Levels**

for Paperboard and Packaging Products

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrugated containers: (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25-50</td>
<td>25-50</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>(&lt;300 psi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(300 psi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid Fiber Boxes</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Folding cartons (2)</td>
<td>100</td>
<td>40-80</td>
</tr>
<tr>
<td>Industrial paperboard (e.g., tubes, cores, drums, and cans)</td>
<td>100</td>
<td>45-100</td>
</tr>
<tr>
<td>Miscellaneous (e.g., pad backs, covered binders, book covers, mailing tubes, protective packaging)</td>
<td>90-100</td>
<td>75-100</td>
</tr>
<tr>
<td>Padded mailers</td>
<td>5-15</td>
<td>5-15</td>
</tr>
<tr>
<td>Carrier board (3)</td>
<td>10-100</td>
<td>10-15</td>
</tr>
<tr>
<td>Brown papers (e.g., wrapping paper and bags)</td>
<td>5-40</td>
<td>5-20</td>
</tr>
</tbody>
</table>

(1) The recovered fiber and postconsumer fiber content is calculated from the content of each component relative to the weight each contributes to the total weight of the box.

(2) The recommended content ranges are not applicable to all types of paperboard used in folding cartons. Cartons made from solid bleached sulfate or solid unbleached sulfate contain no or small percentages of postconsumer fiber, depending on the paperboard source.

(3) Carrier board made from unbleached draft contains up to 25% recovered fiber, while carrier board made from recycled paperboard contains up to 100% recovered fiber.

**MISCELLANEOUS:**

Recommended Recovered Fiber Content Levels for Miscellaneous Paper Products, Commercial/Industrial Sanitary Tissue Products, Traffic Cones, Traffic Barricades, Running Tracks, Playground Surfaces Floor Tiles and Patio Blocks are also available.
Appendix L – Windows Selection

This Appendix was developed by Efficient Windows to help institution have some ideas about choosing the appropriate windows for campus buildings.

The U.S. region is broken down in the figure below.

![Energy Star Zones](http://www.efficientwindows.org/factsheets/MultiBenefitsFactsheet.pdf)

**Figure L-1**


Based on these regions, the recommended windows properties are presented in the chart below.

**Table 16: Window’s properties**

<table>
<thead>
<tr>
<th>Regions</th>
<th>U-value</th>
<th>SHGC</th>
<th>VT</th>
<th>Air leak (AL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Climate Zone</td>
<td>0.35 or less</td>
<td>To reduce heating, select the highest SHGC you can find so that winter solar gains can offset a portion of the heating energy</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td>Select windows with an AL of 0.30 or less.</td>
</tr>
<tr>
<td></td>
<td>If air conditioning loads are minimal, windows with U-factors as high as 0.40 are also</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### North/Central Climate Zone

<table>
<thead>
<tr>
<th>SHGC Value</th>
<th>VT Value</th>
<th>AL Value</th>
<th>Selection Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.40 or less</td>
<td>0.55 or less</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td></td>
</tr>
<tr>
<td>A low U-factor is useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### South/Central Climate Zone

<table>
<thead>
<tr>
<th>SHGC Value</th>
<th>VT Value</th>
<th>AL Value</th>
<th>Selection Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.40 or less</td>
<td>0.40 or less</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td></td>
</tr>
<tr>
<td>Select windows with a SHGC of 0.40 or less. A low SHGC is the most important window property in warm climates.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Southern Climate Zone

<table>
<thead>
<tr>
<th>SHGC Value</th>
<th>VT Value</th>
<th>AL Value</th>
<th>Selection Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.65 or less</td>
<td>0.40 or less</td>
<td>Select windows with a higher VT to maximize</td>
<td></td>
</tr>
<tr>
<td>Select windows with an AL of 0.30 or less.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates. Select windows with a U-factor lower than 0.65 and preferably lower than 0.60.

| with a SHGC of less than 0.40. A low SHGC is the most important window property in warm climates. | daylight and view, or less. |

Source: efficient windows collaborative
“Durable and Reusable Products

Whenever possible, UCSD and external contractors will promote the use of durable and reusable products, i.e., reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.

Packaging Minimization

Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.”

Recycling Policy

Case Study: Recycling Policy, University of California, San Diego (UCSD)

UCSD established recycling policies regarding new construction, building materials, and require all the employees in UCSD to be instructed with general practices of recycling, such as giving lectures in new employee job orientation.

As following, we will demonstrate part of the UCSD recycling policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which recycling policy is located, please go to Integrated Campus Sustainability Policy is organized into six disciplines, building, energy management, carbon offset, waste minimization, transportation and green purchasing.

Green Building Policy

This policy can be the ones that require all the new constructions on campus should meet the LEED Silver Standard at minimum and require all the main buildings on campus shall be renovated to be sustainable. Renovation on the major existing buildings is required to meet the LEED certification.

Example: Clemson University

“All new facilities over 5,000 gross square feet and major capital renovations costing more that 50% of building replacement value shall seek to acquire LEED Silver rating at a minimum.”

103 (UCSD)
Example: Northwestern University

“All new buildings will be LEED-certified at a minimum; each project will be assessed on an individual basis for further certification at the Silver or Gold levels.”

Energy Management Policy

Energy management policy will be divided into two parts, energy efficiency and conservation policy, and green energy production/purchasing policy.

Energy Efficiency and Conservation Policy

To develop energy efficiency and conservation policies, sustainability committee should roughly analyze the campus’ unique energy consumption circumstances first, and then develop as many effective strategies as possible on energy conservation, such as making a “space temperature control policy” for all the buildings on campus. More examples are shown as following:

- **Lighting Level Control Policy:**

  “*Lighting Levels - Unless special needs are required, lighting levels shall be maintained at the following average level of foot candles:*

  *Classrooms - 40 foot candles
  *Offices & Conference rooms - 30 foot candles
  *Reception Areas & Lounges - 20 foot candles
  *Corridors - 10 foot candles
  *Kitchens - 50 foot candles
  *Cafeterias - 20 foot candles
  *General & Other - 20 foot candles”

- **Space Temperature Control Policy:**

  “*Unless special needs are required, the following minimum and maximum room temperatures shall be maintained, in as far as reasonably possible, in all university department areas:*
During “Occupied” Hours: Heating - 72 Deg. F and Cooling - 75 Deg. F
During “Unoccupied” Hours: Heating - 60 Deg. F and Cooling - 85 Deg. F

• Facility Operation Policy:

“The following equipment and components will be switched off at the end of each work day when feasible:
* Office Lights
* Office Computers, Printers and Monitors
* Office Copy Machines
* All Other Electronically Operated Equipment”

Green Energy Production/Purchasing Policy

The institution can create policies to increase the percent of renewable energy usage on campus by either installing renewable energy devices on campus or purchasing renewable energy generated by off-site plants, such as the renewable energy credits (RECs) provided by the school’s utility supplier.

Published policies on this theme are hard to find, but we are able to find many projects or actions implemented under their related policies, such as the following examples:

Wind Turbine, University of Minnesota, Morris
A 1.65 MW wind turbine is working on the campus of University of Minnesota, Morris. The annual power output from this turbine is 5.6 MkWh, which is over half of the school’s electricity demand.

Renewable Energy Credits (REC) Purchasing, New York University
In 2006, 118,000,000 KWh of wind power RECs, equivalent to 100% of the university’s electricity need, was purchased by New York University.

Carbon Offset Policy

From research, many schools set policies on carbon offset ² purchasing to offset unavoidable green house gas emission generated by the school activities, such as all the campus air travel paid by school.

Associated with this policy, school should also set up a tracking system to estimate the amount of school’s annual GHG emission and to decide the quantity of offsets that need to be purchased.

Example: College of the Atlantic
College of the Atlantic established a policy that states

“In College of the Atlantic, emissions that cannot be avoided will be offset by investing in energy efficiency and renewable energy production in such manner as to reduce actual emissions to the atmosphere in an amount that
equals or exceeds emissions generated by College of the Atlantic activities. All offsets will be quantifiable and verifiable according to international standards and best practices.”

Transportation

Transportation policies will be discussed in four aspects: Anti-Idling Policies, Public Transit Policy, Car Share Policy and Bicycle Share Policy.

Anti-Idling Policies

Example: University of Waterloo
"All vehicles should be turned off when not in use or when the driver leaves the unit for any length of time."

Example: University of Washington
"No vehicle operator in charge of a motor vehicle shall permit it to stand unattended without first stopping the engine, locking the ignition, removing the key and effectively setting the brake, and, when standing upon any perceptible grade, turning the front wheels to the curb or side of the roadway."

Public Transit Policy

Published public transit policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

Example: Lewis & Clark College
A fare-free shuttle is provided on campus, which can give faculty, staff and students access to the local neighborhoods, the downtown area and grocery stores.

Example: University of Colorado at Boulder
University of Colorado at Boulder provides faculty, staff and students with unlimited usage of fare-free transit passes, which is called “Ecopasses”, within the campus and surrounding
neighborhoods. A mandatory student fee approved by the students funds the student part of this “Ecopasses”.

**Car Share Policy**

Published car share policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

**Example: Zipcar Programs, American University**

American University started a zipcar program on campus, which is available 24 hours per day, 7 days per week. The annual fee for this program is $25. The only requirement for faculty, staff and students is that their age has to be over 21.

**Example: Hourcar, Augsburg College**

A hourcar hub funded by institution was established at Augsburg College in 2006 and was expected to keep active for the next three years.

**Bicycle Share Policy**

Published bicycle share policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

**Example: Bike Library, University of Alberta**

University of Alberta launched a bike library program in 2005. The bike library provides approximately 30 bikes for rental every month and the bikes “ranges from mountain bikes, cruisers, road bikes and various hybrids”. Each of the bikes is “equipped with a U-lock, front
and back light, and a bell”. “$40 deposit is required to ensure the bike is returned in good working condition” and the “hours of operation vary depending on the time of year and the client demand”.

Green Purchasing Policy

Colleges and universities usually have the demand for a large amount of many items, and the environmental impact associated with the items can be greatly reduced by altering the schools’ purchasing choice. Therefore, green purchasing policies are intended to set the rules for campus to follow to turn their purchasing choice more sustainable and to minimize the environmental harm brought from products purchased, such as the products of paper, appliance and food. For those schools that have their own stores on campus, a marketing strategy to encourage people to choose the environmentally friendly products should be included in this policy, too. Following are some sample green purchasing policies, including paper, appliance, food and general purchasing policies.

Paper Purchasing Policy, Hampshire College
Hampshire College’s paper purchasing policy states that
"Effective on July 1, 2003, Hampshire College will begin purchasing 100% post consumer content, 100% processed chlorine free recycled paper” to "be used campus wide on all convenience copiers and office printers whenever possible." Besides, “Colored paper and paper of other sizes will be purchased as a 30% or higher post consumer waste, 100% processed chlorine free paper.”

Appliance Purchasing Policy, University of California, Davis
"The University is committed to purchase energy efficient equipment that meets EPA Energy Star requirements. These include but are not limited to personal computers, printers, copiers, faxes, laboratory equipment, lighting, refrigerators, and HVACs."

Food Purchasing Policy, Harvard University
Harvard’s food purchasing policy requires Harvard alter its food choices to be locally and organically produced products. Based on this policy, Harvard changed its wholesalers to be ones who cooperate with local farmers and now most of products purchased by Harvard is organic and Integrated Pest Management (IPM)

General Green Purchasing Policy, Duke University
Duke University established a comprehensive green purchasing policy, in which they set detailed criteria Duke should follow when selecting products. Besides, Duke made its own strategies to apply in Duke’s stores to promote environmentally friendly products on campus. To see the complete Duke Green Purchasing Policy, please go to Appendix I
Waste Minimization Policy

For this policy, the institution needs to develop a series of effective strategies to minimize their campus’ waste. It can be realized by establishing policies about source reduction, recycling program and participating in the national wide campus recycling and waste reduction competition, such as the RecycleMania

The following are some examples of campus policies on source reduction, recycling and waste minimization competition.

Source Reduction

Example: Source Reduction Policies, University of California, San Diego (UCSD)

To reduce UCSD’s waste source, UCSD created policies which require campus use durable and reusable products, require the vendors provide products with minimal and reusable packaging to UCSD, encourage paper reuse in offices, and encourage campus to use electronic bulletin boards to distribute newsletters and so on.

As below, we will demonstrate part of the UCSD source reduction policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which sources reduction policy is located, please go to Appendix I

1. Durable and Reusable Products

Whenever possible, UCSD and external contractors will promote the use of durable and reusable products, i.e., reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.

4. Packaging Minimization
Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.

6. Newsletters

The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department.

Recycling

Example: Recycling Policy, University of California, San Diego (UCSD)

UCSD established recycling policies regarding new construction, building materials, and require all the employees in UCSD to be instructed with general practices of recycling, such as giving lectures in new employee job orientation.

As following, we will demonstrate part of the UCSD recycling policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which recycling policy is located, please go to Appendix I

1. General Practices

General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials

Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.”

Waste Minimization Competition Policy
Published policy about waste minimization competition is hard to find, but we are able to find many programs implemented on campus due to their related policies, such as the following example:

Example: University of Texas at Austin

University of Texas at Austin launched many waste reduction programs on campus and in 2007; they recycled around 40% of its waste and won the Waste Minimization Competition in “RecycleMania”.
Appendix K – Campus Policy Case Studies

Below are some campus policy examples from several leading sustainable institutions in North America. It shows us how a campus sustainability policy could be established. These example are from selected institutions’ websites.

Green Purchasing Policy, Duke University

“Duke Stores will give preference to environmentally superior products, where quality, function and cost are equal or superior. Products and packaging materials will contain a prescribed minimum post-consumer recycled content and will be minimized and/or substituted with more environmentally appropriate alternatives whenever possible. All products will be chosen based on efficient use of energy, natural resources, and potential for safe, non-hazardous disposal.

Duke Stores will inform all suppliers / vendors of products and services about the policy and will work with them to meet its criteria.

Where practical and cost effective, products will be ordered in appropriate quantities to avoid having to dispose of obsolete products.

‘Whenever practicable,’¹* products should be purchased which meet the criteria specified in the EPA’s Environmentally Preferable Purchasing (EPP) database which is available on the EPA website (www.epa.gov).

When a candidate product meets some of the EPP criterion but not others, preference will be given in the following order:
1) The highest percentage of post-consumer² * recovered material available in the marketplace; and
2) The highest percentage of pre-consumer recovered material available in the marketplace

¹* “Whenever practicable” means a) the recycled products can perform the function intended at least as well as a product produced from only virgin material, and b) the cost of the recycled product reasonably approximates the cost of the product produced from only virgin materials.

²* “Post-consumer” materials are those materials that have been used by consumers, collected by recycling programs and then remanufactured into a new product. “Pre-consumer” material consists of the leftover scraps from milling and industrial processes. While both are environmentally preferable to virgin materials, post-consumer recycled material is given priority because it supports local recycling programs by creating demand for the materials collected.

In addition to the recovered material content of a product, the EPP database specifies other important criteria that should be considered in selecting products:
1) The ability of a product and its packaging to be reused, reconditioned for use, or recycled through existing recycling collection programs; and
2) The volume and toxicity of waste and by-products a given product and its packaging generate in their manufacture, use, recycling and disposal.
Equipment purchased or rented by Duke Stores are to be compatible, whenever practicable, with the use of recycled-content products (e.g. photocopy machines). Product specifications and requisitions for products must conform to the following guidelines:
1) Specifications and requisitions shall not require the exclusive use of products made from virgin materials, nor specifically exclude the use of recycled-content products;
2) Performance standards must be reasonable and related to function, and shall not be designed to exclude the purchase of recycled-content products;
3) To the extent such information is known, Duke Stores staff shall identify in the purchase requisition products available with recycled content and vendors from whom such products are available; and
4) The Purchasing Agent has the authority to specify a minimum recycled-content standard in bid solicitations.

Duke Stores will promote this green purchasing policy on its website, inside its stores and within its marketing materials.

Dukes Stores will promote environmentally preferable products within its stores through green tagging, preferential shelf placement and special displays. Within its catalog, environmentally preferable products will be denoted through a green labeling scheme.”

UCSD WASTE PREVENTION AND RECYCLING POLICY

XI. RELATED POLICIES AND PROCEDURES

UCSD Policy and Procedure Manual (PPM)
520-4 Use of Disposable Polystyrene Products

XII. SCOPE

This policy applies to all facilities under the jurisdiction of UCSD, including the La Jolla campus, the UCSD Medical Centers, Hillcrest, Mt. Soledad, Nimitz Marine and the Elliott Field Station. This policy applies to office practices and purchases made both through the Purchasing office and by individual departments.

XIII. POLICY

UCSD recognizes its role as a leader in the community with regard to environmental policies and, with the adoption of this policy, demonstrates its intention to ensure responsible stewardship of the environmental resources under its influence. More
specifically, the purpose of this policy is to set forth standards and organizational processes aimed at: 1) reducing waste at the source; 2) encouraging the purchase and use of durable and reusable products; 3) encouraging the purchase of high post-consumer content recycled products; 4) increasing the total volume of waste materials diverted from landfills to recycling processes; 5) ensuring the long term viability of campus recycling operations through appropriate educational programs, coordination, management and oversight; and 6) remaining in compliance with Federal and state mandates.

XIV. **PROCEDURES**

The following practices shall be implemented and maintained throughout all UCSD operations.

A. **Source Reduction**

1. **Durable and Reusable Products**

   Whenever possible, UCSD and external contractors will reduce the use of nonrecyclable materials and products, and promote the use of durable and reusable products, i.e., manila envelopes, reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.

2. **Copying and Printing**

   Employees will reuse office paper whenever practical. Office papers shall be recycled. All departments shall encourage two-sided copying. Whenever practical, scrap paper printed only on one side shall be used for producing rough drafts. Paper printed only on one side shall also be used as scratch paper.

3. **Documents**

   All proposals and reports received from outside vendors and consultants should be printed on both sides using recycled content paper that meets standards established in IV. B. below. Furthermore, the documents shall be clearly marked to indicate that they are printed on recycled content paper.

   Letters, reports and documents produced by campus administrative departments should be printed on both sides using recycled paper that meets the standards established in IV.B. below. To the extent possible, academic activities shall also be encouraged to meet these standards.

   All forms used on the campus should include only the necessary information and number of copies. Instruction sheets, if necessary, shall be
printed on the back of the last page of the form. Whenever possible, forms should be filled out and processed electronically.

4. Packaging Minimization

Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.

5. Correspondence

Whenever feasible, electronic correspondence shall replace written correspondence. Unnecessary printed copies of electronic correspondence are discouraged.

6. Newsletters and Mailing Lists

The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department. Printed copies should be routed or posted for interested parties to read. Annually, staff shall review mailing lists and delete out of date subscribers.

7. Student Phone Books

All phone books shall be distributed to students only once per calendar year.

B. Standards and Specifications

UCSD shall, at a minimum, conform to the federal purchasing guidelines developed by the Environmental Protection Agency (EPA). Standards and specifications for additional recycled content products as established by the EPA and all such standards shall be reviewed and revised on an ongoing basis by the Waste Minimization Advisory Committee. See Supplement I for a listing of the most common recyclable materials.

C. Purchasing

1. General

UCSD shall continue to improve its efforts toward recycling and waste reduction goals by defining purchasing policies aimed at encouraging the procurement of recycled products.
Because they are by far the largest volume recycled commodity handled by the campus, these purchasing policies will initially focus on paper products. Additional detailed purchasing policies shall be considered in the future by the Waste Minimization Advisory Committee described in Section V. of this policy.

2. Purchasing Authority

Purchasing authority for all campus paper products purchased through the Purchasing Department should remain consolidated under one contract administrator within the Purchasing Department. This consolidation of purchasing power allows for economies of scale in paper purchases to offset any potential price differentials between recycled and virgin products. Further it enables the campus to significantly increase recycled content paper purchases while reducing costs. Letter and legal size paper purchases should not be made through the use of Low Value Purchase Orders (LVPO's).

3. Requirement to Purchase Recycled Paper Products

The UCSD Storehouse should be used for the purchase of all paper products which include but are not limited to: cut paper for copiers and laser printers, computer paper and custodial paper products. The Storehouse provides the service of procuring, storing and distributing all types of paper supplies for UCSD. With the ability to negotiate purchases through an annual high volume purchase program the price stabilization of paper products is favorably maintained for UCSD. The long term goal is to pursue the commitment to obtain and supply recycled paper products through all available sources.

The UCSD Storehouse shall strive to procure paper products with the highest percentage of recycled content available providing these products meet established performance standards and are within 5% of the price of virgin paper products.

4. Elimination of Prohibitions

Upon review and update of any University policy, limitations which restrict the purchase or use of recycled product shall be amended to encourage use of recycled products wherever possible, providing the necessary performance standards can be met.

D. Recycling
   1. General Practices
All University employees shall be instructed with regard to their responsibility to participate in campus recycling efforts. General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials

Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.

E. Education

1. Faculty and Staff

Physical Plant Services will be responsible for providing educational programs and materials for faculty and staff including a discussion of UCSD's commitment and responsibilities regarding waste prevention and recycling instructions on how various commodities can be recycled, information contacts and phone numbers, and any applicable incentives. Educational programs shall be implemented under the advice and guidance of the Waste Minimization Advisory Committee described in Section V. Responsibilities.

2. Departmental Contacts

Each Department should appoint a recycling contact person who will serve as the primary contact person for the Department.

3. Students

Educational presentations regarding the need for recycling and waste reduction and ways to participate in campus recycling efforts will be made to all new students as part of their orientation. Additional educational programs shall be devised and implemented under the advice and guidance of the Waste Minimization Advisory Committee as described in Section V. Responsibilities.

XV. RESPONSIBILITIES

A. Waste Prevention and Recycling Coordinator
Coordination - The coordination of the following waste reduction, reuse and recycling programs shall be consolidated under the Waste Prevention and Recycling Coordinator:

- Aluminum
- Cardboard
- Computer paper
- Glass
- Yard Wastes
- Mixed paper
- Newspaper
- Plastic
- White paper
- Metal
- Tin & Steel cans
- Building Materials
- Oil and Batteries
- Reuse Programs
- Ship & Vehicle Waste

The campus Coordinator shall oversee the day to day operations of UCSD's recycling programs, maintain records of recycling activities, and staff the Waste Minimization Advisory Committee.

B. Departments and Organizations

All departments and organizations engaged in individual recycling programs shall provide records of their operations to the campus Waste Prevention and Recycling Coordinator on a quarterly basis within fifteen days following the end of each calendar quarter. Individual program record keeping shall be computerized if possible, and shall be done in a uniform format to be supplied by the coordinator, by all departments and organizations engaged in recycling efforts addressed under this policy. Data shall include the commodity, the quantity (in lbs/month), revenues, vendors and expenses.

C. Waste Minimization Advisory Committee

UCSD shall maintain a standing "Waste Minimization Advisory Committee" to provide guidance and oversight for the campus waste prevention and recycling operations. The Waste Minimization Advisory Committee shall be advisory to the Vice-Chancellor-Business Affairs. The Committee shall be appointed on an annual basis and shall include representatives from the faculty, staff and student body. The Waste Minimization Advisory Committee shall be responsible for staying abreast of current regulations, technologies, and opportunities in recycling, and shall support and direct the implementation of recycling education programs.

The Waste Minimization Advisory Committee shall review quarterly recycling reports and determine whether any commodities should be added to or deleted from UCSD's recycling operations. The Committee shall also prepare an annual report to the Vice-Chancellor-Business Affairs by June 30 each year, summarizing the campus waste prevention and recycling activities and progress, and include any suggestions for improvements to recycling programs.
EPA STANDARDS AND SPECIFICATIONS
FOR RECYCLED CONTENT PRODUCTS

Recommended Recovered Fiber Content Levels For Uncoated

Printing and Writing Papers

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reprographic Paper (e.g. mimeo and duplicator paper, high-speed copier paper, and bond paper)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Offset Paper (e.g., offset printing paper (1), book paper, bond paper (1))</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Table Paper (e.g., office paper such as note pads, stationery (1) and other writing papers)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Forms Bond (e.g., forms, computer printout paper, ledger) (1)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Envelope paper:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wove</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Kraft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White and colored (including manila)</td>
<td>10-20</td>
<td>10-20</td>
</tr>
<tr>
<td>Unbleached</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Cotton Fiber Paper (e.g., cotton fiber papers, ledger (1), stationery (1) and matching envelopes, and other writing (1) papers)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Text &amp; Cover Paper (e.g., cover stock, book paper (1), stationery (1) and matching envelopes, and other writing (1) paper)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Supercalendered</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Machine finish groundwood</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Papteries</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Check Safety Paper</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

(1) These items can be made from a variety of printing and writing papers, depending on the performance characteristics of the item. Some of the papers are a commodity-type and some are specialty papers. EPA recommends that
procuring agencies determine the performance characteristics required of the paper prior to establishing minimum content standards. For example, bond, ledger, or stationery made from cotton fiber paper or a text & cover paper have different characteristics than similar items made from commodity papers.

Supplement I (Page 2 of 3)

**Recommended Recovered Fiber Content Levels**

for Coated Printing and Writing Papers

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coated Printing Paper</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Carbonless</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

**Recommended Recovered Fiber Content Levels for Bristols**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Folders (Manila and Colored)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Dyed Filing Products</td>
<td>20-50</td>
<td>20</td>
</tr>
<tr>
<td>Cards (index, postal, and other, including index sheets)</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Pressboard Report Covers and Binders</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Tags and Tickets</td>
<td>20-50</td>
<td>20</td>
</tr>
</tbody>
</table>

Supplement I (Page 3 of 3)

**Recommended Recovered Fiber Content Levels**

for Paperboard and Packaging Products

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrugated containers: (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(300 psi)</td>
<td>25-50</td>
<td>25-30</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Solid Fiber Boxes</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Folding cartons (2)</td>
<td>100</td>
<td>40-80</td>
</tr>
<tr>
<td>Industrial paperboard (e.g., tubes, cores, drums, and cans)</td>
<td>100</td>
<td>45-100</td>
</tr>
<tr>
<td>Miscellaneous (e.g., pad backs, covered binders, book covers, mailing tubes, protective packaging)</td>
<td>90-100</td>
<td>75-100</td>
</tr>
<tr>
<td>Padded mailers</td>
<td>5-15</td>
<td>5-15</td>
</tr>
<tr>
<td>Carrier board (3)</td>
<td>10-100</td>
<td>10-15</td>
</tr>
<tr>
<td>Brown papers (e.g., wrapping paper and bags)</td>
<td>5-40</td>
<td>5-20</td>
</tr>
</tbody>
</table>

1. The recovered fiber and postconsumer fiber content is calculated from the content of each component relative to the weight each contributes to the total weight of the box.

2. The recommended content ranges are not applicable to all types of paperboard used in folding cartons. Cartons made from solid bleached sulfate or solid unbleached sulfate contain no or small percentages of postconsumer fiber, depending on the paperboard source.

3. Carrier board made from unbleached draft contains up to 25% recovered fiber, while carrier board made from recycled paperboard contains up to 100% recovered fiber.

**MISCELLANEOUS:**

Recommended Recovered Fiber Content Levels for Miscellaneous Paper Products, Commercial/Industrial Sanitary Tissue Products, Traffic Cones, Traffic Barricades, Running Tracks, Playground Surfaces Floor Tiles and Patio Blocks are also available.
Appendix L – Windows Selection

This Appendix was developed by Efficient Windows to help institutions have some ideas about choosing the appropriate windows for campus buildings.

The U.S. region is broken down in the figure below:

![Energy Star Zones](http://www.efficientwindows.org/factsheets/MultiBenefitsFactsheet.pdf)

Figure L-1

Source: http://www.efficientwindows.org/factsheets/MultiBenefitsFactsheet.pdf

Based on these regions, the recommended windows properties are presented in the chart below:

Table 16: Window’s properties

<table>
<thead>
<tr>
<th>Regions</th>
<th>U-value</th>
<th>SHGC</th>
<th>VT</th>
<th>Air leak (AL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Climate Zone</td>
<td>0.35 or less</td>
<td>To reduce heating, select the highest SHGC you can find so that winter solar gains can offset a portion of the heating energy</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td>Select windows with an AL of 0.30 or less.</td>
</tr>
<tr>
<td></td>
<td>If air conditioning loads are minimal, windows with U-factors as high as 0.40 are also</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Climate Zone</td>
<td>SHGC Value</td>
<td>VT Value</td>
<td>AL Value</td>
<td>Selection Criteria</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>------------</td>
<td>----------</td>
<td>----------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>North/Central</td>
<td>0.40 or less</td>
<td>0.55 or less</td>
<td></td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select windows with a SHGC less than 0.55.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>If you have significant air conditioning costs or summer overheating problems, look for SHGC values of 0.40 or less. If you also have moderate air conditioning requirements, select windows with a SHGC of 0.55 or less. While windows with lower SHGC values reduce summer cooling and overheating, they also reduce free winter solar heat gain.</td>
</tr>
<tr>
<td>South/Central</td>
<td>0.40 or less</td>
<td>0.40 or less</td>
<td></td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select windows with a SHGC of 0.40 or less.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select windows with a SHGC of 0.40 or less.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A low U-factor is useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates.</td>
</tr>
<tr>
<td>Southern</td>
<td>0.65 or less</td>
<td>0.40 or less</td>
<td></td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select windows with a SHGC of 0.40 or less.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select windows with a SHGC of 0.40 or less.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A low U-factor is useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates.</td>
</tr>
</tbody>
</table>

energy-efficient if the Solar Heat Gain Coefficient is 0.50 or higher. need. If cooling is a significant concern, select windows with a SHGC less than 0.55.

Select windows with an AL of 0.30 or less.
useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates. Select windows with a U-factor lower than 0.65 and preferably lower than 0.60.

with a SHGC of less than 0.40. A low SHGC is the most important window property in warm climates.

daylight and view or less.

Source: efficient windows collaborative
“1. General Practices

General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials

Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.”

Waste Minimization Competition Policy

Policies about waste minimization competition are rarely published, but many projects or actions implemented on campuses can prove the existence of related policies in institutions, such as the following examples:

Case Study: University of Texas at Austin

University of Texas at Austin launched many waste reduction programs on campus and in 2007, they recycled around 40% of its waste and won the Waste Minimization Competition in “RecycleMania”.

2) Energy

The ultimate goal of solving energy problems is to reduce the green house gas emission. The only solution for this problem is completely using the renewable energy sources. If the renewable energy is the energy source of the campus and there is no usage of fossil fuel, the campus is carbon neutral. It’s recommended to campus to implement as much renewable energy as it can to replace the usage of fossil fuel. However, the renewable energy technologies are currently costly. If the renewable energy is not the solution for institutions, they can reduce carbon footprint by reducing the energy usage of the campus buildings. This section will first introduce the technologies and options that campus can implement for renewable energy. The
second part of this section will be campus buildings which offer variety of technologies to reduce the energy usage of campus buildings.

**Recommendations for Selecting Renewable Energy**

Although energy conservation and human behavior change can make tremendous reduction of energy usage, the committee still needs to be concerned about the environmental impact from the energy the campus needs to consume. Most of the energy in the United States comes from fossil fuel, which is the main source of green house gas (GHG) emissions.

Renewable energy is a natural source of energy, such as heat from the earth, water, or wind, which can be converted into usable energy without contributing to the GHG generation. Renewable energy includes solar, wind, water, hydrogen, geothermal, biomass, and biodiesel. As an alternative, institutions may also purchase renewable energy credits or offsets to help reduce the impact on the environment. With these solutions implemented, the percentage of renewable energy usage is increased, which is one of the priorities for a leader sustainable institution.

Renewable energy technologies can be categorized into three groups, renewable energy for electricity, renewable energy for space and water heating, and renewable energy for vehicle fuel. If applicable, institutions should choose to first implement the technologies which can resolve the biggest problem on campus in terms of energy consumption. For example, electricity consumption may be found to be the greatest contributor to GHG emissions. Therefore, renewable energy technologies for electricity are recommended to be implemented first. Once the institution can provide renewable energy for needs of all buildings on campus, then the committee should focus on renewable energy technologies for propelling vehicles.

For each of the three groups of renewable energy technologies, more recommendations and comparisons among different technologies in each group are stated below. In each comparison, the common campus-applicable technologies belonging to each group will be listed and introduced first. Thereafter, comparisons based on criteria will be shown in tables. In each table, from the left to the right, the first column shows all the criteria and the following three columns are respectively the first, second and third recommendation corresponding to the criteria.

**Renewable Technologies for Electricity**

**List of Common Campus-Applicable Renewable Technologies for Electricity:**

- **Photovoltaic (PV) System**: Photovoltaic System is used to convert sun’s energy into electricity. Most application of PV panels on campus is to supply power for one or more buildings.
- **Solar Glass**: a type of thin-film PV panel glass, which can be incorporated into campus buildings’ windows, skylights, awnings, balcony rails, and building walls. Same concept as PV systems, the solar glass is used to convert the sun’s energy into electricity.
- **Wind**: Large or small scale wind which convert wind energy into electricity.
- **Fuel Cell Device**: A fuel cell is an electrochemical device deriving power from a chemical reaction of a fuel and an oxidant. Fuel cells using hydrogen as fuel are cleanest application. The product of hydrogen fueled cell reaction is water. Fuel cell is especially suitable for providing power in remote places, such as campuses in rural areas.
**Biomass:** Biomass technology produces energy by burning biological products, such as agriculture waste and dead trees. It can be used to produce electricity, provide space heating, and heat water for a campus.

*Comparison:*

As one example of explaining the Table 4, when it comes to environmental benefit, wind and solar technologies (including PV panels and solar glass) are recommended as the first choices, fuel cell the second and biomass the third.

Wind and solar technologies was placed first because they use wind and sun as energy sources which result in zero GHG production.

The energy source for fuel cell technology can be hydrogen, hydrocarbon, natural gas, gasoline and alcohol. Fuel cells run on hydrogen are the cleanest application which produces only water as an exhaust; however, fuel cells that run on other energy sources could potentially generate some environmentally harmful products, but still can greatly reduce GHG emission compared to the traditional fossil fuel.

For biomass technology, it is said that CO2 is absorbed when plants grow and then is released when the biomass is burned. This process produces no net release of CO2, and so biomass is commonly regarded to be a carbon neutral source of energy. However, actually, biomass technology is producing GHG, but still much less than traditional fossil fuels.

<table>
<thead>
<tr>
<th>Rating Criteria</th>
<th>First Choice</th>
<th>Second Choice</th>
<th>Third Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Efficiency</td>
<td>Large Scale Wind Turbine; Biomass</td>
<td>Small Scale Wind Turbine</td>
<td>PV panels</td>
</tr>
<tr>
<td>Electricity Output per kW</td>
<td>Biomass</td>
<td>Large Scale Wind Turbine</td>
<td>PV panels</td>
</tr>
<tr>
<td>Reliability</td>
<td>Biomass</td>
<td>Fuel Cell</td>
<td>Wind; Solar</td>
</tr>
<tr>
<td>Environment Beneficial</td>
<td>Wind; Solar</td>
<td>Fuel Cell</td>
<td>Biomass</td>
</tr>
</tbody>
</table>

**Table 9:** Comparison between Electricity Renewable Energy Technologies

*Renewable Energy for Water and Space Heating*

*List of Common Campus-Applicable Renewable Technologies for Water and Space Heating:*

- **Ground-Source Heat Pump (GSHP):** In GSHP system, stable heat from earth’s crust is utilized to provide campus with heating, cooling and hot water.
- **Solar Thermal:** Unlike PV panels for producing electricity, solar thermal technology is used to convert sun’s energy into heat. It can be used to heat water for a campus (domestic hot water or pool) and provide space heating. The most cost-effective application of solar thermal for campus was recognized to be for swimming pool heating.
- **Bioheat**: Bioheat is a mixture of biodiesel and heating oil. Biodiesel is a type of oil made from soybean, palm, canola and vegetable oil.
- **Biomass**: Biomass technology produces energy by burning biological products, such as agriculture waste and dead trees. It can be used to produce electricity, provide space heating, and heat water for a campus.

**Comparison**: 

As one example of explaining the Table 5, when it comes to the criterion “reliability”, biomass, GSHP and bioheat are recommended to be the first choices, as energy sources required for them can be provided continuously at most of time. The solar energy is not reliable because the system will stop working during lack of sunshine such as during the night and cloudy days.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>First Choice</th>
<th>Second Choice</th>
<th>Third Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Biomass; Ground-Source Heat Pump(GSHP); Bioheat</td>
<td>Solar Thermal</td>
<td></td>
</tr>
<tr>
<td>Environment Beneficial</td>
<td>Solar Thermal</td>
<td>Ground-Source Heat Pump(GSHP)</td>
<td>Bioheat; Biomass</td>
</tr>
<tr>
<td>If heating boiler was used on campus</td>
<td>Bioheat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If geothermal source is abundant around campus ([refer to Appendix N, Figure 16, 17])</td>
<td>Ground-Source Heat Pump(GSHP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If wood source is abundant around campus ([Appendix N, refer to Figure 18 and 19])</td>
<td>Biomass</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 10**: Comparison between Heating Generation Renewable Energy Technologies

**Renewable Technologies for Vehicle Fuel**

**List of Common Campus-Applicable Renewable Technologies for Vehicle Fuel**: 

- **Hybrid Vehicle**: Hybrid vehicle is an automobile that uses both electric motor and diesel internal combustion engine (or gasoline compression ignition engine) for propulsion.
• **Biofuel (Biodiesel) Vehicle**: Biofuel is a mix of biodiesel and petroleum diesel. Biodiesel is a type of oil made from soybean, palm, canola and vegetable oil.

• **Electric Vehicle**: An electric vehicle is powered by electricity via an electric motor and the electricity is stored in rechargeable battery packs.

• **Fuel cell Vehicle**: Fuel cell propels the vehicle by creating electricity through the chemical reaction from hydrogen and oxygen.

**Comparison**

As one example of explaining the following Table 6, when it comes to “development level of technology,” hybrid vehicles are the first, biodiesel and electric vehicles are second, and fuel cell vehicles are the third. Hybrid technology has been widely applied on different brands and kinds of vehicles, such as the gasoline-electric hybrid cars of Toyota and Honda. Biodiesel and electric technologies have not been widely used in vehicles because of their unsolved technical problems, such as having driving range of 150 miles before the need for recharging and also the high-priced battery packs need to be replaced often. Fuel cell is still an emerging technology, but is very expensive to be applied into vehicles, making it not feasible for many campuses.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>First Choice</th>
<th>Second Choice</th>
<th>Third Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Hybrid</td>
<td>Biodiesel Vehicle; Electric Vehicle</td>
<td>Fuel Cell Vehicle</td>
</tr>
<tr>
<td>Development Level of Technology</td>
<td>Hybrid</td>
<td>Biodiesel Vehicle; Electric Vehicle</td>
<td>Fuel Cell Vehicle</td>
</tr>
<tr>
<td>Reliability</td>
<td>Hybrid</td>
<td>Electric Vehicle; Biodiesel Vehicle; Fuel Cell Vehicle</td>
<td>Biodiesel Vehicle</td>
</tr>
<tr>
<td>Environment Beneficial</td>
<td>B100 Biodiesel Vehicle; Fuel Cell Vehicle</td>
<td>B100 Biodiesel Vehicle</td>
<td>Electric Vehicle</td>
</tr>
</tbody>
</table>

**Table 11: Comparison between Vehicles Renewable Fuel Technologies**

**RECs and Carbon Offsets**

RECs are Renewable Energy Certificates which represent the tradable renewable energy that are generated and sold from a utility supplier or a local eligible renewable energy plant (a solar or biomass plant etc.). These certificates are regarded as the attributes of environment, such as reducing the pollution from burning coals or oil and reducing GHG emission due to the utilization of renewable sources. A carbon offset is a payment that a purchaser makes to counter
balance his or her GHG emissions” and this payment will go to projects which will result in reducing emission.

It is recommended that the institutions should consider installing renewable energy devices on campus grounds and generating their own renewable energy first and then purchase RECs or carbon offsets as a last resort. This is because the markets for RECs and offsets are still new and no strict standards have been developed. Both the assessment about the quality of sold RECs and offset and the likelihood of RECs and offsets being double counted are also a risk. There is no current way that RECs and offsets can be ensured the intentions of the investment are going to the right cause.

Appendix L, “Detailed Research of Renewable Energy Technologies” goes into greater detail of strengths, weakness, types, average cost, life span, estimated installation time for each of renewable energy technologies, and provides more information about RECs, and offsets.
Campus Buildings

Having a “green” building is one of the most efficient methods of reducing consumption of energy while still ensuring the health and safety of occupants and surrounding community. A green building is a structure that is designed, built, renovated, operated, or reused in an ecological and resource-efficient manner\textsuperscript{106}. Green buildings are constructed using recycled materials and rely on clean power sources such as solar power, hydro power, wind power, etc… The design of the green building can be extremely challenging due to the fact that it’s still a new concept.

This chapter offers various technology options that colleges and universities can implement to solve the energy usage problems of the building. It is divided into two sections: Campus Green Building Technologies and Existing building Renovation Guideline. Campus Green Building Technologies section will focus on technologies that the designer should consider when they constructing new buildings or renovate the existing buildings. Existing building renovation guideline section states the elements that are recommend for renovating the existing building.

\textbf{Campus Green Building Technologies}

This section will introduce the technologies for campus buildings to reduce the energy usage for heating, cooling, and electricity. These technologies can be implemented both in new building construction and major existing building renovation. Due to the fact that constructing new buildings and upgrading existing buildings have the same design concepts, this section first shows the general design of all campus buildings and then breaks down to specific building types typically found on campuses.

(i) \textit{General Design}

The building on a campus usually need energy for electricity, heating, and cooling. In order to minimize the usage of conventional energy for campus buildings, there are three major parts of a building that should be considered during the design process. They are Building envelope, Mechanical systems, and Electrical systems. These sections introduce the current sustainable technologies options for each of these components and how they can be implemented in new and existing buildings to reduce the energy for heating, and cooling, electricity.

(a) \textit{Building Envelope}

In order to minimize the energy usage in heating/cooling process, building envelope plays an important role to reduce the heat loss of the building. There are three components of the building envelop that can be improved, wall systems, windows, and roof. By reducing heat loss of the building, the energy that is used for heating will also reduce dramatically. The heat loss through a building envelope is due to infiltration, the process of air passage through the building envelope. Infiltration includes both inward air leakage and outward air flow. It is responsible for 15\% of the total heating energy and 4\% of the total cooling energy for U.S. office building\textsuperscript{107}. Based on Office of Energy Efficiency (OEE) 65\% of Gas usage for a typical Canadian College is for heating. This number can be reduced by well insulating the building. Well insulating the

\textsuperscript{106} (U.S. Green Building Council)
\textsuperscript{107} (Emmerich & Persily, 1998)
buildings envelope by 25% to 50% will have potential energy saving of 26% for heating load and 15% for cooling load. Since it is costly and difficult to tighten the building envelope for existing building, it is best to construct a well insulated building envelope during the original construction.

The first component of the building envelope is wall systems. When selecting or upgrading walls for a building, it’s important to choose the proper insulation. Low insulation levels and gaps can provide paths which air and heat can easily flow in or out of the building, resulting in more energy use to keep a constant temperature. It is best to eliminate the air and heat path through the wall systems by choosing the right insulation.

The basic approach of choosing the right insulation is based on the requirement of the local building codes and standards. Building codes and standards require a minimum insulation level for each component of the building envelope and these levels vary from state to state. In order to make the building more energy efficient, the level of insulation needs to be higher than the building codes and standards. The insulation materials are rated according to their thermal resistance, R-value. “The higher the R-value, the greater the insulating effectiveness.” Table 7 shows average R-value per inch of common insulating materials.

<table>
<thead>
<tr>
<th>Insulating Material</th>
<th>Avg. R-Value Per Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Batts or Blankets</strong></td>
<td></td>
</tr>
<tr>
<td>· Mineral fiber (rock, slag or glass)</td>
<td>3.25</td>
</tr>
<tr>
<td><strong>Loose Fill</strong></td>
<td></td>
</tr>
<tr>
<td>· Mineral fiber (rock, slag or glass)</td>
<td>2.2</td>
</tr>
<tr>
<td>· Cellulose (milled paper and wood pulp)</td>
<td>3.4</td>
</tr>
<tr>
<td>· Vermiculite, exfoliated</td>
<td>2.13</td>
</tr>
<tr>
<td>· Perlite, expanded</td>
<td>2.7</td>
</tr>
<tr>
<td><strong>Rigid Board and Slabs</strong></td>
<td></td>
</tr>
<tr>
<td>· Expanded polystyrene, extruded (cut-cell surface) and molded bead-type</td>
<td>4.0</td>
</tr>
<tr>
<td>· Expanded polystyrene, extruded (smooth-cell surface)</td>
<td>5.0</td>
</tr>
<tr>
<td>· Expanded polyurethane, refrigerant 31 exp.</td>
<td>6.25</td>
</tr>
<tr>
<td>· Polyisocyanurate</td>
<td>7.04</td>
</tr>
<tr>
<td><strong>Building Board Sheathing, regular density</strong></td>
<td>2.64</td>
</tr>
</tbody>
</table>

Source: Progress energy

When constructing a new building or renovating an existing building, it is recommended for campus to choose the insulation materials with a higher R-value than ASHRAE standard. This is the standard for the HVAC of all the buildings in the U.S. to become sustainable. Wall thermal resistance becomes more important the further north the building is located in North America.

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108 (C.L.I Group)
109 (Oak Ridge National Laboratory)
110 (Progress Energy)
Therefore, the campus buildings that are located in northern part of North America are recommended to select the wall systems with insulation containing a higher R-value. Due to the fact that it’s costly to demolish the walls systems of the existing building and rebuilding it, it is easier to add interior and exterior insulation to the wall which exceed the ASHRAE standard.

Window is another factor that is responsible for the heat loss through building envelope. Similar to wall systems, infiltration is the main source for heat loss. The thermal resistance of the window is determined by a U value which is an insulation rating for transparent objects. It is opposite of the R-value for wall system because the material with lower U-value is rated to be the better insulator. However, selecting windows for green building is not only based on U-value. A window also allows the passage of light which add several other factors to be considered. They are the solar heat gain coefficient (SHGC), the visible transmittance (VT), the thermal U value of the window assembly, and the infiltration or leakiness character of the window assembly.\footnote{\cite{Kibert2005}}

![Figure 20: Window Heat Flow](image)

SHGC and VT are usually used to express the performance of windows because they represent the two important properties of the window, solar heat gain and visibility. The lower the SHGC, the less solar heat the window transmits through the glazing from exterior to the interior. For example, the windows facing East or West should have lower SHGC assemblies to reduce high levels of solar energy in the morning and afternoon. As the Figure 16 shows, the solar radiation is the heat from the sun. It usually creates uncomfortably hot space. The VT is Visible Transmittance in fraction of incident visible radiation. It ranges from 0 to 1. When daylight is desired, windows with high VT coefficient would be a best choice.

Table 8 shows different types of windows and its SHGC, VT value.

\footnote{\cite{Kibert2005}}
Table 13: Window Types

<table>
<thead>
<tr>
<th>Window Type</th>
<th>Glazing</th>
<th>SHGC</th>
<th>VT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-glazed</td>
<td>Clear</td>
<td>0.79</td>
<td>0.69</td>
</tr>
<tr>
<td>Double-glazed</td>
<td>Clear</td>
<td>0.58</td>
<td>0.57</td>
</tr>
<tr>
<td>Double-glazed</td>
<td>Bronze</td>
<td>0.48</td>
<td>0.43</td>
</tr>
<tr>
<td>Double-glazed</td>
<td>Spectrally selective</td>
<td>0.31</td>
<td>0.51</td>
</tr>
<tr>
<td>Triple-glazed</td>
<td>Low-e</td>
<td>0.37</td>
<td>0.48</td>
</tr>
</tbody>
</table>

Source: sustainable construction\textsuperscript{112}

Since the energy efficient performance of windows varies by climate condition, the National Fenestration Rating Council labels on windows unit giving rate for U value, SHGC, VT, and Air leak. The National Fenestration Rating Council is a non-profit organization supported by U.S Department of Energy. According to this organization, selecting windows will depend on region. The U.S. is broken down to four regions. Window’s properties for each region will vary. For more detail of what the four regions and window’s properties for each region are, refer to Appendix K.

Selecting windows is important to the campus building because it could affect the productivity of the students and faculties. With more sun light in the room, people tend to work more effectively\textsuperscript{113}. Based on the climate conditions and types of building, the building designers can select the appropriate types of windows for campus building. For instance, the academic building’s windows should have a high VT coefficient to maximize the visibility of the sun.

The roof of the building is the most important part because it is a major area for heat loss or heat gain due to its generally large area and greater exposure to the outside environment. The building roof could be very hot during summer in southern region of North America or could be extremely cold in northern region of North America\textsuperscript{114}. Selecting an appropriate roof could be a challenging task because of its complicated design which may need feasibility studies. By selecting the appropriate type of roof, the campus building can reduce the energy for heating and cooling. Some types of roof that help reduce the energy usage in the building are listed below.

The insulation of the regular roof can be improved. Similar to wall systems and windows, using higher insulation properties than building code or standard for roof could reduce the energy for heating of the building. The ASHREA has requirements for the thermal resistance coefficient for building envelopes insulation that include roof insulation.

The second technology for roof is the cool roof. Cool roof has highly reflective and emissive material that has the ability to reflect the sunlight and heat away from the building. The materials to construct a cool roof are usually bright white in color. This type of roof is best used:

- In a climate with hot and sunny weather during at least part of the year.
- When Significant cooling energy is used

The initial cost for installing cool roof varies from $0.50 to $6.00 per square feet. More information about the cost of different types of cool roof is provided on EPA website. According

\textsuperscript{112} (Kibert, 2005)
\textsuperscript{113} (Kibert, 2005)
\textsuperscript{114} (Kibert, 2005)
to EPA, average reduction of energy usage is about 20% for the buildings that have a cool roof installed.\textsuperscript{115}

The third roof technology is green roof. A green roof, or rooftop garden, is a vegetative layer grown on a rooftop. It can be used to reduce energy needed to provide cooling and heating due to the fact that the structure of green roofs help it absorb heat and act as insulators for buildings. In the summer time, the green roof surface can be cooler than the outside air temperature. For example, based on a Canadian model for heating and cooling of 32,000 square foot green roof on a one story commercial building Toronto, green roof can save about 6% of total cooling and 10% of heating energy usage.\textsuperscript{116} Figure 17 shows typical layers of a green roof.

![Figure 17: Green roof layout](image)

The cost of the green roofs varies depending on its components. One of the report on 2001 estimated that the initial cost varies from $10 per square foot to $25 per square foot. The savings will also vary depending on local climate, individual building, and roof characteristics. There are currently two types of green roofs, extensive and intensive. The extensive green roof is much lighter than the intensive one due to the difference in the depth of the soil and types of plants. The extensive green roof costs range from $8-$20 per square foot while the intensive green roof can cost from $15 to $25 per square foot.\textsuperscript{117}

Similar to choosing windows, selecting roof for campus buildings depends on the climate conditions. The campus that is located in the hot climate region can install the cool roof a building in order to reduce the energy consumption for cooling during the summer. The green roof is the opposite of the cool roof, which will work best for campus buildings in the cold weather regions.

**Case study:** Hamilton Hall- Harvard University.

This building is LEED Gold certified. The New insulation was added throughout the building: on the interiors of the exterior masonry walls, and on the attic ceiling. Well insulated

\textsuperscript{115} (EPA)  
\textsuperscript{116} (EPA)  
\textsuperscript{117} (Great Lake Water Institute)
walls on the interior, insulated ceiling at the attic level and new insulated glass for all window openings contribute to 22.1% better performance in Energy usage than ASHRAE 90.1-1999 standard\textsuperscript{118}.

**Case study: Blackstone – Harvard University**

This building has been through a major renovation and certified as LEED Platinum. The windows were replaced with operable, double pane, argon-filled low e glass, U-value of 0.25 windows. The windows’ replacements contribute to 42% energy usage reduction above the code in the summer.

Cool/high-albedo roof is used in this building to reduce heat island effect and cooling load. It contributes to 42% energy saving above the ASHRAE standard code in the summer.\textsuperscript{119}

(b) **Mechanical Systems**

The mechanical system of the building is HVAC system (heating, ventilating, and air conditioning). According to the Office of Energy Efficiency (OEE), HVAC system use approximately 35% of total electrical energy on campus in Canada. Making HVAC system more efficient will reduce energy usage. In addition, high efficiency HVAC also provides the good indoor quality enhancing the comfort for the occupants. It also can reduce the operating expenses.\textsuperscript{120}

(i) **Heating**

Most of the energy, consumed by buildings in Northern American, is used to heat water and air. High demand for hot water is usually found in athletic centers with pools, residence halls, and services buildings. A typical heating system of a building contains a boiler, radiators, and pipes. The boiler is used to heat the municipal water supply. The hot water is distributed throughout the whole building via pipes, transferring the heat through radiators. This heated water is also commonly used for supplying showers and kitchens with hot water.

Upgrading to high efficiency boilers offer significant potential to reduce energy expenses and consumption. High efficiency boilers can reduce heating costs by 10 percent but in some cases by as much as 20 to 30 percent. Standard conventional boilers usually have approximately 80% efficiency while energy efficient boilers have approximately 90%.\textsuperscript{121} Besides using high efficiency boiler system, campus can also use solar water heating systems or tankless water heating systems.

Solar water heating systems can reduce the use of electricity or fossil fuels by as much as 80 percent. This is the most likely to be cost effective for facilities with high demand on hot water compared to the old conventional water heating systems. Depending on the application, these systems will have a payback time from 5-10 years. It cost approximately $3,500 per solar collectors\textsuperscript{122}.

Tankless water heating system uses a heater to heat the water when it is needed. It’s different from the traditional water heating systems because they store the heated water for later use.

\textsuperscript{118} (Harvard University, 2008)  
\textsuperscript{119} (Harvard University, 2008)  
\textsuperscript{120} (Office of Energy Efficiency)  
\textsuperscript{121} (Alliant Energy)  
\textsuperscript{122} (Cape System, LTD.)
Thus, tankless water heating system eliminates the need for hot water storage and the issue of standby heat loss is eliminated. Tankless water heaters have payback time ranging from approximately 5.5 to 11 years in low-water-use applications compared to approximately 3 to 7.5 years in high-water-use applications. The initial costs range from $500 to $1750 and the life time of the systems range from 6-20 years.

High efficiency and tankless water heating system are recommended for campuses. This will reduce the energy used for heating. Depends on the budget, solar water heating systems are preferred to use since it uses renewable energy.

**Case study: North Boulder Recreation Center, Boulder, Colorado**

This building uses 6,000 square feet of solar panels to pre heat the water for center two swimming pools and for domestic use. It can reduce the natural gas consumption by 50 percent. Also, new boilers with 90% efficient were installed to replace 70% efficient old boiler. These technologies contribute to $56,000 annual saving based on energy model\(^{(123)}\).

\(\text{(ii) Cooling/air conditioning}\)

Chillers are machines that use water or air to provide cooling for the building. Lawrence Berkeley national laboratory’s Energy Environmental Technologies stated that chiller are consuming 23 percent of total building energy. With combination of new technologies such as direct digital control and variable frequency drives with improved design, commissioning, and operation, chiller plant efficiency can be improved by more than 50 percent.\(^{(124)}\)

There are two types of chillers, air-cooled, and water-cooled. An air-cooled chiller uses air to remove the heat from the condenser while the water-cooled chiller uses water. The efficiency of these chillers is measured based on the cooling capacity versus the required input power into the chiller. These measurements are: the Energy Efficiency Ratio (EER), coefficient of performance (COP), and Operating efficiency (KW/ton). The higher the numbers are, the better the performance of the chiller.

**Table 14: Chiller Efficiencies**

<table>
<thead>
<tr>
<th>Chiller Efficiencies</th>
<th>EER</th>
<th>COP</th>
<th>kW/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air-cooled</strong> (including condenser power &gt;150 tons)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASHRAE Standard 90.1 1999</td>
<td>9.6</td>
<td>2.8</td>
<td>1.26</td>
</tr>
<tr>
<td>Good</td>
<td>9.9</td>
<td>2.9</td>
<td>1.21</td>
</tr>
<tr>
<td>Best</td>
<td>10.6</td>
<td>3.1</td>
<td>1.13</td>
</tr>
<tr>
<td><strong>Water-cooled</strong> (&gt;300 ton centrifugal)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{(123)}\) (South East Energy Efficiency Project)
\(^{(124)}\) (Kibert, 2005)
| Source: alliant energy | 125 |

By looking at the table 9, water-cooled chiller is far more efficient solution. The EarthWise centrifugal chiller, rated at 0.45 KWh/ton, has the highest efficiency of this major category of HVAC equipment. Because the EarthWise chiller is the best, campus cooling systems are recommended to use this equipment.

**Case study: Five Cowperthwaite Street – Harvard**

This building is LEED Gold certified. This building has a high efficiency chiller installed. This 180 ton chiller contributes to 28.2% energy saving more than ASHRAE standard code.  

(iii) **Ventilation**

Another major electricity energy consumer in modern building is the air distribution systems that include air handlers, electric motors, ductwork, air diffusers, registers and grilles, energy and humidity exchangers, control boxes, and its control system. Choosing high efficiency ventilation systems can lower operating cost by up to 30% a year. However, selecting appropriate ventilation systems require professional mechanical experts.  

One of the most important goals of green buildings is a healthy indoor quality. To create a healthy indoor environment, fresh air outside needs to be brought inside to dilute the buildup of potentially toxic components of indoor air such as carbon dioxide emitted from human breathing. ASHRAE Standard 62.1-2001, requires, based on the building size, a certain quantity of fresh air to be brought inside the building.  

In addition to healthy indoor environment, indoor thermal comfort also plays an important role in indoor quality. In order to create indoor thermal comfort, the outside air stream needs to be cooled down in the summer and warmed up in the winter before being sent into the building. There are two technologies that are available to use outside air for conditioning and to exchange energy between fresh air intakes and exhaust air streams, and they are economizers and energy recovery ventilators (ERV).

Economizers detect the outside air temperature and humidity. When it’s appropriate, it will deliver the outside air into the building to replace the indoor airstreams. For instance, when the...
outdoor air is cooler than the inside air of a building, the outside air will be transported inside to help cool down the building. With this technology installed, chillers and chilled water pumps can be turned off when the economizer is activated, therefore saving approximately 20-30 percent of energy. Approximate cost for this device is $6000 and the payback time is less than a year.

Energy Recovery Ventilator is an energy and humidity exchanger. It’s placed between the fresh outdoor air and indoor air stream so that energy and humidity between the two can be exchanged to save energy. Additionally, similar to economizers, by bringing fresh outdoor air inside, the indoor air quality can also be improved. This device could save over 15% of commercial HVAC energy used nationwide\(^\text{130}\). It typically costs from $2000 to $4000 per unit.\(^\text{131}\) Because of its importance, high efficiency ventilation systems with Energy Recovery Ventilator are recommended for all of buildings on campus.

**Case study: Blackstone – Harvard**

This building uses Enthalpy wheel for latent and sensible heat recovery. The ventilation of the building provides approximately 5,100 CFM 100% outside air. The efficiency of the exchange heat between fresh outside air and exhausted inside air for this system is 80%.\(^\text{132}\)

(c) **Electrical System**

Lighting and electric motors are major consumers of electrical energy. According to Office of Energy Efficiency (OEE) in Canada, lighting account for 40% of the electric usage for typical Canadian college.\(^\text{133}\) By using efficient lighting and lighting control, energy consumption can be reduced dramatically. Electric motors in the buildings drive fans, pump, and other devices. Using the most energy-efficient motor can result in substantial energy savings.

The first component of electrical system is lighting systems. To reduce the amount of energy consumption for lighting, it’s best to reduce dependence on artificial light and to maximize the use of day lighting. Maximizing the use of day lighting depends on the selection of windows. Selecting high efficiency light fixtures and lamps inside the building will help save electrical energy used for lighting.

According to Energy Star, fluorescent lighting is up to four times more efficient than incandescent lamp which is the regular lamp. An Energy efficient fluorescent lighting system use T5 or T8 lamps which offer improved efficiency, higher intensity, and potential longer life. Changing from T12 fluorescent lamps to T8 lamps could save 35% of energy consumption.\(^\text{134}\)

Fiber-optic lighting is a single high efficiency light source feeds multiple remotely placed fixtures. This lighting source is generally a halogen or metal halide lamp. The installation is costly. Using the fiber optic lighting systems eliminate many problems encountered with conventional lighting systems such as no voltage is required at the fixture, no heat is emitted.

Light emitting diodes for lighting systems are evolving very rapidly. LEDs last 20 times longer than incandescent light bulbs and two to three times longer than fluorescent lights. One

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\(^\text{130}\) (AirXchange)  
\(^\text{131}\) (Power House)  
\(^\text{132}\) (Harvard University, 2008)  
\(^\text{133}\) (Office of Energy Efficiency)  
\(^\text{134}\) (Kibert, 2005)
example for use of LED lights is in the traditional exit sign. LEDs are an emerging technology and expected to be widely used in the near future.\textsuperscript{135}

In addition to high performance lighting systems, occupancy sensors can also reduce energy consumption by turning lights on/off in response to presence of occupants. Research has shown that this technology has potential to reduce the electrical energy consumption in office building by as much as 50\%. This technology is very useful for colleges because of occupancy hours of buildings on campus. For administrative building, the occupancy hours usually go from 7am to 5pm.\textsuperscript{136}

Electric motors are important components of buildings, as they drive fans, pumps, elevators, and a host of other devices. Over half of all electrical energy in the United States is consumed by electric motors. Motors typically consume 4 to 10 times their purchase cost in energy each year, so energy efficient models often make economic sense.\textsuperscript{137}

Lighting consumes the most electrical energy of the building on campus. Therefore, it’s recommended for all buildings on campus to use high efficiency lighting and lighting control devices. Since LEDs are emerging technology and have a fairly high cost, fluorescent lighting is a better solution for campuses. It’s recommended to purchase high efficient models of electric motors. It will help reduce green house gas emission.

**Case study: 90 Mount Auburn Street – Harvard**

This building is certified LEED Gold. The lighting system of the building is mostly fluorescent. Lighting controls are installed for different zones of open areas. This design contributes to 32\% energy efficient than an ASHRAEE 90.1-1999 standard.\textsuperscript{138}

(ii) **Campus Building types**

Although, each campus is structured differently, they all have six major building types in common. They are Academic building, Administrative building, Residence building, Athletic building, Services building, Laboratory building. Mix type building, wet lab, and dry lab are acknowledged but will not be included in this section due to the complexity of the design. However, the sustainability design trends for Academic building, Administrative building, Residence building, Services building are similar, but Athletic building and Laboratory building need to be designed differently because of their high energy consuming characteristics.

(a) **Academic building, Administrative building, Residence Building, Services Building:**

These buildings characteristic is similar to the commercial building type. There are a lot of activities happening during the business hours in these building types except for residence building type. These building types require good indoor environment during business hour. For non business hours, the lighting systems and HVAC systems can be turned off. Residence building type is opposite to the rest of the building types in this group due to the fact that the

\begin{footnotesize}
\textsuperscript{135} (Kibert, 2005)  
\textsuperscript{136} (Kibert, 2005)  
\textsuperscript{137} (Kibert, 2005)  
\textsuperscript{138} (Harvard University, 2008)
\end{footnotesize}
activities mostly occur during non business hours. However, lighting systems and HVAC system could be turned off during the business hours.

(b) **Laboratory building:**

Labs require sophisticated HVAC systems to maintain optimum research conditions while protecting occupants. It usually requires 100% of the ventilation air to be exhausted at all the time. Labs that involve in chemical use require fume hoods. Because labs tend to have large quantities of heat generating equipment, the HVAC systems should be designed appropriately.

(c) **Athletic building:**

One of the important things in this building type is hot water for pool. Solar heating systems should be used to reduce the heating energy for water. Because of intensity of body heat generating, ventilation is important to create good indoor environment.

**Existing building renovation**

(iii) **Renovation vs. Demolition**

One of the controversial topics is “renovating vs. demolishing an existing building”. There are two ways that can make an existing building become more sustainable, renovation and demolition. They both have their own advantages and disadvantages. The advantages of renovating existing buildings are:

- Reduce the need for new construction
- Minimize the need to employ new materials
- Historic preservation

The disadvantages are:

- The monetary cost of major renovation or rehabilitation of existing buildings maybe the same as, or even greater than, the cost of new building
- Rehabilitation maybe difficult if the environmental gains are not qualified\(^{139}\).

Due to the existing design of the old building, there are limitations for sustainability practices to be integrated. One typical example is installing the green roof to an existing building. Adding a green roof to existing building means the existing roof has to carry an extra load of the green roof. The old design might not be sufficient to support the extra load. Therefore, demolishing and rebuilding the building can eliminate those limitations and maximize all the sustainability best practices to help the building become more sustainable.

Solving this problem is extremely difficult task. The colleges/ universities could make this decision by conducting studies and having committee meetings. There is a proposed method called embodied energy measure that could help the studies. “Embodied energy is the amount of

\(^{139}\text{(Pfaehler, 2008)}}
labor and energy consumed in the production of a building, from the harvesting of natural resources to the fabrication and delivery of materials to the installation of these materials and products”[140]. Evaluating an existing building based on this concept will help determine renovation or demolition. To measure embodied energy, Athena Institute, a non-profit organization located in Ontario Canada, has created a free web base measurement tool that estimate the demolition cost.

(iv) **Building Renovation Guideline**

If an institution decides to renovate an existing building, instead of demolishing it, there are three elements, based on Energy Star building Five Stage Approach, to make the building as green as possible. The first element is lighting systems. The lighting systems of the existing building should be renovated first due to its large electrical energy consumption. To reduce the heating and cooling energy, building tunes up and upgrading the HVAC systems are the next steps. The institution can choose either option to carry out.

**Lighting systems**

The question B20 – B24 in the inventory shows what lighting system exists in the campus building currently. If the building has the traditional lighting systems, it is recommended to replace them with high efficiency lighting systems such as fluorescent lighting. Maximizing lamp and ballast efficiency, using occupancy sensors, using appropriate quantity are the design strategy. With efficient lighting systems, campus can significantly reduce the electrical and cooling loads.

**Building Tune ups**

The location of the building can be identified through question in the inventory. Based on the location of the building, the level of insulation for the building can be found by looking up the ASHRAE standard. From the level of insulation for each part of the building envelope, the designer should make a building tune ups strategy. This strategy is to minimize the heat loss through the building envelope. It can be done by applying all the technologies that are listed under General Design section

+ Replacing high efficiency windows
+ Upgrading the roofs
+ Adding insulation to the walls systems

**HVAC systems upgrade**

HVAC systems are the essential parts of the campus building. It also controls indoor environment of the building. Upgrading HVAC systems are very important to existing buildings. It can not only reduce the energy but also create a good healthy indoor environment. Upgrading old boilers and chillers with high efficiency products can help reduce the energy usage of the building. The efficiency of the old boilers and chillers that currently installed in the campus

[140] (Pfaehler, 2008)
building can be found in question of the inventory. The Energy Recovery Ventilator is a trend that many buildings are installing to create healthy indoor environment by bringing the fresh outdoor air to indoor.
3) Water

This chapter introduces current practices for water conservations. The water consumption of the campus can be divided into two sections, in-door and out-door. In door water usage is mostly for domestic use such as toilets, urinals, showers, etc… Thus, the in-door section of this chapter will cover the technologies that can be implemented inside the building such as dual flush toilets, waterless urinals, etc… The out-door water usage is mostly for irrigation. Therefore, the out-door section covers the technologies to harvest and collect rainwater for irrigation and prevent water runoff.

In-door

This section introduces technologies that can be implemented to reduce campus building water consumption. By controlling the flush and flow of the plumbing fixtures, the building water consumption can be reduced greatly. The U.S. Environment Protection Agency passed the EAPAct 1992 which set requirements for water fixtures. All the water fixtures must be manufactured based on these requirements.

The first component of the water fixtures in the building is the toilets and urinals. They account for nearly one-third of a building’s total water consumption. This is the simplest and lowest cost areas to target water saving. According to Plumbing foundation, if all existing toilets are replaced with 1.6 gallon per flush model, it would save almost 5,500 gallons of water per person each year. The standard usage for urinals listed above is 1.0 gallon per flush. The water conservation can go well beyond this standard by using waterless urinals. Also, automated controls for toilets and urinals can help reduce water consumption dramatically.

There are several technologies of 1.6 gallons toilets available:

- Gravity-tank toilets: same design with older toilets but with steeper sides to allow more rapid cleaning. Its cost ranges from $75 to $150 for two-piece toilets.
- Dual-flush toilets: have two level flushing, one for minimal needs such as urine (1.0 gallon/flush) other for maximum flow (1.6 gallon/flush). Its cost start at about $200 and can go up to $3,800.
- Flushometer toilets: pressure developed in the flush cycle is captured and used to assist the subsequent flush. It usually costs from $225 to $300.
- Vacuum-assisted toilets: Employing a vacuum to pull the waste water from the toilets. Price range: $225 to $300.

There are two types of efficient urinals available:

- 1.0 gallon/flush urinals: Its cost ranges from $120 to about $500
- Waterless urinals: it costs about $500

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141 (Kibert, 2005)  
142 (ATG Store)  
143 (Keidel)  
144 (GuideBuy)  
145 (GuideBuy)
The second component of the water fixtures in the building is the showerhead and faucets. The EPAct requires all U.S. plumbing manufactures and importers to meet the water efficiency for showerheads and faucets. High efficiency showerhead and faucet products can save many gallons of water. These new showerheads incorporate a narrower spray area and a greater mix of air and water than older showerheads. Showerheads products have a price vary from $3 to $95 for each.146

Low-flow faucets employ sensor and aeration technology to achieve water saving and comfort levels. Using low flow faucets can cut water usage by as much as 40%. It usually cost $50-$100 for each.147 All the campus buildings are recommended to apply the high efficiency equipment listed above. Depends on the budget and type of buildings, the institution can choose the right equipments.

Case study: Blackstone- Harvard


Outdoor

Most of the outdoor water usage is for irrigation. Therefore, in order to reduce the outdoor water usage, rainwater harvesting and water recycling technologies are the most effective way for campus to implement. If the outdoor water for irrigation is recycled water, per capita consumption or potable water would drop to 50 gallons per day.149

Rainwater is a crucial source of water for human survival. This technology can be applied to regions that have abundant rainfall. Figure 18 is the map that could help campus identify if they are in those regions or not. The rain will be collected through roofing systems due to the large area of the roof and stored in a cistern, a water storage tank. Because of the unique of individual buildings, rainwater harvesting systems are required appropriate design for specific building (sustainable construction). Moreover, by using this system, collected rainwater can be also used to supply toilet flushing and also helps to prevent storm water runoff. This technology can save the potable water usage up to 50%.150 The installed cost of storage tank typically ranges from $250 to $500 per cubic meter.151

146 (Bourg, 2008)
147 (Toolbase Services)
148 (Harvard University, 2008)
149 (Kibert, 2005)
150 (Roth Global Platics, Inc.)
151 (Capital Regional District, 2007)
Besides rainwater harvesting, the campus can apply the water recycling technologies. There are two types of recycled water that can be used for irrigation on campus. They are graywater and reclaimed water. Graywater is the water from shower, bathtubs, bathroom sinks, washing machines, and drinking fountains can be reused for certain landscape applications. Graywater can be immediately directed to the landscape or stored in the tank for later irrigation usage. Controlling the amount of graywater that is pumped to the site is important for landscaping. However, graywater shouldn’t be stored for extended periods of time before use. About 60 to 65 percent of water applied to interior uses can be recycled as graywater. There is controversial issue about the public health officials but no case of illness has ever been traced for reusing graywater. It’s recommended to consult the local building codes, health officials, sanitation engineers and pollution control officials for the legal status of graywater in the community.  

The cost of constructing water treatment plant is very expensive. One of the methods to save potable water is using reclaimed water. Reclaimed water is the water from a wastewater treatment plant that has been treated and can be used for irrigation. Campuses can buy reclaimed water from wastewater treatment plant to reduce the potable water usage for irrigation. Although water prices vary around the country, reclaimed water cost significantly less than potable water.

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152 (Kibert, 2005)
This method can be use when the high quality effluent from a wastewater treatment plant is available.\(^{153}\)

It’s easier to construct rainwater harvesting systems and recycling systems for the new buildings than existing buildings. Therefore, plans for these technologies during designing process are important. It’s recommend for campuses purchased reclaimed water for irrigation if it’s applicable first. If it’s not applicable, rainwater harvesting systems and recycling systems would be the next possible solutions. These technologies when implemented to existing building would not be effective as to new buildings.

**Case study: Winrock international Global Headquarters, Little Rock, Arkansas**

Annually, Winrock’s roof will send approximately 647,238 gallons to the adjacent marina. Approximately 175,000 gallons of this captured rainwater will be used for irrigate the building’s landscape.\(^{154}\)

![Figure 23: Rain harvesting systems of Winrock International Global Headquarter](image)

**Case study: The Solaire Apartment Building in Battery Park, New York**

This building is certified LEED Gold. It recycles 100% of its wastewater on site. The recycled water is used for toilet flushing, make-up water for the cooling towers, and the extra 5,000 gallon per day for neighboring park landscape.\(^{155}\)

**4) Waste**

Reducing the amount of waste produced is a fairly simple theory with three elements, but may require creativity to make it work. The basic three elements of waste reduction are reduced, reuse, and recycle. Reducing the amount of resource you use, such as paper, will directly reduce the amount of waste the campus has to deal with in the end. If a reduction in usage cannot be obtained, then the items may be reused somewhere else, such as old furniture from an

\(^{153}\) (Kibert, 2005)

\(^{154}\) (Mendler, Odell, & Lazarus, 2006)

\(^{155}\) (University of California, Berkeley)
administration office might be needed in a student lounge. If these two options fail, then recycling is a third alternative before resorting to the final choice of sending it to a landfill.\(^\text{156}\)

What kind of program or policy should a campus create to better manage their waste has no definite answer. Each campus is unique in how they operate and are structured and so each program would be developed differently. Recycling programs will also depend on the recycling facilities locally available to the campus and the policies that they operated under. This chapter will present the basic ideas for waste management and some case studies of how various colleges have implemented these basic ideas.

**Reduce**

Reducing the amount of materials used on a daily basis is the first step in reducing waste. With less material used, then less waste can be produced. To reduce the amount of resources used will involve more of a social marketing program, which is mention in the Community-Based Social Marketing chapter, but some of the investment based solutions are presented in the next few sections.

**Paper Consumption**

*Relevant inventory question WS-19*

One of the main contributors to waste is paper, and reducing paper is typically the first step a campus will take in order to reduce waste. When purchasing new printers or copiers, departments should purchases equipment that allows duplex printing. Then the department should be trained on how to use this feature. With duplex printing, paper usage could be reduced by half.\(^\text{157}\) Having a system that allows for easy scanning of documents into PDF format encourages electronic file management. Providing books, brochures, manuals, and other documents in electronic form is another great way to reduce waste.

**Case Study: University of British Columbia**

By implementing various programs such as encouraging people to bring in their own mugs and print drafts on re-used paper helped the University of British Columbia to decrease their waste production by 763 tones in two years.\(^\text{158}\) January 2007, their bookstore began selling e-textbooks, books that can be downloaded from the internet.\(^\text{159}\)

In 2006-2007 year, the university was able to declare their Faculty of Land & Food System Academic Office to be the first paperless office on campus. A computer system was created that was reliable and secure. Paper forms were replaced by laminated forms, which are reusable. Instead of making copies, all copied paperwork is created into a PDF document. With a computer database of files now available and secure, the office began to get rid of filing cabinets, making more room. By becoming paperless, the office has saved $4,000 on paper costs, and also allows the staff to work with students more since they do not have to “push paper around.”\(^\text{160}\)

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\(^{156}\) (EPA - Waste, 2008)  
\(^{157}\) (Beringer & Students, 2005, p. 167)  
\(^{158}\) (UBC Sustainability Office, 2008, p. 40)  
\(^{159}\) (UBC Sustainability Office, 2008, p. 42)  
\(^{160}\) (Waugh, 2008)
Web-Based Sharing

Relevant inventory question WS-19

Another simple way of reducing paper consumption is to provide a convenient way to share files and campus event information through the web or the campus intranet. Many organizations on campuses use paper to advertise their events or just to share information. In classrooms, professors print homework assignments on paper and distribute to the assignment to their students. If an easy accessible web site can be created by each organization and each professor for their classroom, then all documents and communications can be shared online, avoiding paper distribution all together. Many campuses already have the infrastructure for producing and hosting websites. If not already done so, this service should be expanded to include various campus organization and also professors.

More sophisticated web based programs are available for purchase in assisting the campus to provide information on the web. Blackboard is one company that provides various web based programs for education, social, and other purposes. For education purposes, these programs allow a professor to create a course online where they can upload homework assignments, notes, and reading supplements. The Blackboard system will also allow students to upload their completed homework assignments for grading, avoiding paper usage completely. Social events can also be posted on the Blackboard service avoiding paper advertisements. The service is hosted by Blackboard and therefore there is no investment required in upgrading current campus technology. The cost of the program varies depending on the size, services desired, and other factors. The price may range from $25,000 to $75,000 for a full suite for a college. Another program that is a competitor to Blackboard is Moodle, which is an open source program that is free, but may require investments in computers, networks, and hiring professionals for installation. More information about these programs can be obtained at [www.blackboard.com](http://www.blackboard.com) and [www.moodle.org](http://www.moodle.org).\(^{161}\)

Case Studies:

Many campuses have implemented the sophisticated web based programs, such as Blackboard. Some colleges that currently are using blackboard are, Worcester Polytechnic Institute\(^{162}\), Central Michigan University, Clark College\(^{163}\), and Boston University\(^{164}\). These programs are not advertised for paper reduction, but as an education tool. So very little data is available on how much paper is actually reduced when investing in these programs.

Reusable Food Containers and Utensils

Relevant inventory question WS-18.

Many offices and dining facilities provide some sort of disposable cup, utensils, and container, which just encourage waste production. To reduce or eliminate the use of disposable

\(^{161}\)(Trotter, 2008)
\(^{162}\)(WPI)
\(^{163}\)(Clark College)
\(^{164}\)(Boston University)
food containers then it should be encouraged for the campus community to use reusable mugs and reusable food containers. These containers and mugs can be purchased by the campus and resold for a reasonable price to the campus community. As an incentive to use them, an agreement should be made with the dining facilities that would provide a discount for customers that provide their own reusable containers for the food they purchased.

**Case Study: Illinois of Bloomington**

University of Illinois of Bloomington had created a “Go Green Challenge” program where green water bottles are sold at residential halls for five dollars. These bottles can be refilled at participating local restaurants and anywhere on campus for fifty cents.\(^{165}\)

**Reuse**

The second way of reducing waste production is by diverting the waste somewhere where it is needed, such collecting furniture, clothing, office supplies, and donating them to charity, or selling these items at a yard sale. By diverting the waste, it directly reduces the amount of waste sent to a landfill. Various types of programs have been implemented by campuses in order to reuse unwanted items.

One of the main problems with starting a reuse program is storage. Certain items may not be needed at the time, but has great potential for future need. These items may need to be stored for a period of time. Having space for these items is important for the program to have success. Campuses need to allocate sufficient space for items and have the flexibility to expand in the future, as the program expands its services.

**Surplus Redistribution**

*Relevant analyzes question AWS-6, AWS-8, and AWS-9*

The main reason items are thrown away is because they are no longer needed by a person, but sometimes these items are needed by someone else, and therefore can be saved from the waste stream. When a department, on campus, gets a renovation of their office, many of the electronics, office furniture, and other items is sent into the waste stream. Although these items are useless for the department, a student organization may need office furniture or some electronics for their offices. If a network is set up where items, that are no longer needed, are matched with departments or organizations that have the need for the items, this will reduce waste and also reduce the overall expenses of purchasing new items.

**Case Study: University of Indiana Bloomington**

University of Indiana Bloomington had created a Resource Redistribution listserv as one method of distributing unwanted items to those who actually need them. It is an e-mail based program that circulates a list of unwanted items available. It also allows departments to post items needed allowing the program to work in both directions. If items cannot be relocated via the Resource Redistribution list, then the items can go to the University Surplus Stores.

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\(^{165}\) (Indiana University Task Force on Campus Sustainability, 2008, p. 56)
Surplus stores sell the unwanted items, such as electronics, furniture, and other various items to the general public. The profits made from these sales allow the store to be self-sufficient financially. If items such as electronic are unable to be sold, then they are sold to Heritage Environmental on a per pound value, whom recycle the electronics back into the market.\textsuperscript{166} Due to lack of space, University of Indiana Bloomington Surplus Store occasionally sells items by the pallet, at lower value.\textsuperscript{167}

**End of Academic Year Collection**

**Case Studies:**

**Penn State and Indiana University**

Penn State and Indiana University had recognized that there was an increase in waste produced at the end of an academic year. The result of this increase was from unwanted items the students had thrown away prior to moving out. Recognizing this problem, the campus established a “Trash to Treasure” program, where a huge yard sale is held at the end of the year. All unwanted student items are collected and sold to the public. In 2002, University of Indiana Bloomington began a similar program called “End of Year Collection,” but instead of selling the items, these items were donated to local charity groups and food banks. They collected clothes, furniture, books, and food. In 2008, twenty truck loads of unwanted student items were donated.\textsuperscript{168}

**Michigan State University**

<table>
<thead>
<tr>
<th>Table 15: Michigan State University Materials Collected, 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>Clothing/Shoes</td>
</tr>
<tr>
<td>Loft Lumber</td>
</tr>
<tr>
<td>Non-perishable food</td>
</tr>
<tr>
<td>Student Room Carpet</td>
</tr>
<tr>
<td>Refuse</td>
</tr>
<tr>
<td>Furniture</td>
</tr>
<tr>
<td>Metal</td>
</tr>
<tr>
<td>Electronics/Appliances</td>
</tr>
</tbody>
</table>

Michigan State University also has a similar program which is known as “Pack up. Pitch In. Help Out.” In 2008 they collected clothing/shoes, loft lumber, non-perishable food, carpet, furniture, household goods, electronics, bicycles, low-grade mixed paper, cardboard, plastic, metal, and refuse. The lumber was donated to organizations such as Teen Challenge, Boy Scouts, Turf Grass, and Rockbuilt. Teen Challenge used the wood to build chairs and tables and

\begin{footnotes}
\begin{itemize}
\item[\textsuperscript{166}] (Indiana University Task Force on Campus Sustainability, 2008, pp. 56-57)
\item[\textsuperscript{167}] (Indiana University Task Force on Campus Sustainability, 2008, p. 60)
\item[\textsuperscript{168}] (Indiana University Task Force on Campus Sustainability, 2008, p. 59)
\end{itemize}
\end{footnotes}
sold them for their non-profit organization. Table 15 shows the amount of each material that was collected at the end of the 2008 academic year.\textsuperscript{169}

**Recycle**

*Relevant inventory question WS-15 and WS-16.*

Recycling material is the third and last well known method for reducing materials in the waste stream. Many organizations and campuses contain a recycling program because local regulations have or starting to ban all recyclable goods in the waste stream. Based on the 2007 Municipal Solid Waste generation data, gathered by EPA, for the United States, 32.2\% of the waste was paper, 5.3\% glass, 8.2\% metals, and 12.1\% plastic, which are all items that can be recycled.\textsuperscript{170} The following section describes the basic idea of starting a recycling program on campus and organic recycling, and what things should be considered when creating these programs.

In order to establish any recycling program, the campus needs to identify recycling facilities that are within their local area. Some campuses maybe limited on what items they can recycle if facilities do not exist and other innovative ideas maybe required. Recycling facilities may also have policies that require certain size loads before they will accept the material or may only accept certain types of plastic. This may require campuses to establish a larger storage area for recycled material, so that enough material can be gathered for a facility to accept.

Once a recycling facility is identified and the policies understood, a storage area needs to be established. The size of the storage area will depend on the campus availability and the amount of expected recycled material to be gathered. This same location may also serve as a central drop off point for the whole campus.

To further encourage recycling, recycling bins that are clearly labeled should be placed at convenient locations where large volumes of waste are generated. Many colleges have placed paper and co-mingled recycling bins on every floor of their residential buildings. With a basic infrastructure established, the social marketing of recycling can be incorporated to encourage the campus community to recycle.

**Case Studies:**

*University Recycling Programs*

Indian University Bloomington piloted a program where small recycling bins where placed in each of the residential rooms. The results of this pilot program were successful and now Indiana University is providing recycling bins to any residential students that want them.\textsuperscript{171}

Many colleges have various bins for various types of recyclable material, such as paper, glass, plastics, and newspaper. Ohio State University attempted tried a new concept of providing one bin for all recyclable material. This program proved to be very successful and has made the recycling more convenient and more predictable for the campus community.\textsuperscript{172}

\textsuperscript{169} (Michigan State University, 2008, pp. 1-5)
\textsuperscript{170} (EPA - Waste, 2008)
\textsuperscript{171} (Indiana University Task Force on Campus Sustainability, 2008, p. 56)
\textsuperscript{172} (Indiana University Task Force on Campus Sustainability, 2008, p. 58)
University of British Columbia had established a special items recycling station in the basement of the Student Union Building. This station collects various items batteries, plastic bags, and small e-waste. Styrofoam egg cartons are collected and given to the university’s farm, which are reused for their purposes. There is also a Surplus Equipment Recycling Facility that collects low-end value equipment, such as office furniture. They store the items and re-distribute them to those groups that need them. In 2008 they had generated 5,941.6 tons of waste, of which 46% was recycled.

Cost Benefits

Auburn University, in Alabama, had set a goal of 50% waste reduction by 2010. So far they have achieved 16%. They estimated that the collection of valuable paper, plastic, aluminum, and cardboard materials waste produced on campus can be sold for annual amount of $50,000.

Bowling Green State University, in Bowling Green, Ohio, has placed recycling bins on every floor in every building. A total of about 900 bins have been distributed. Faculty, student, or staff workers from each building collect the materials from the bins and put them all in a central location for collection. These items are then placed into 30 yard roll-off containers. Since the start of the program in 1994, the campus has sold over $390,000 of recyclable material and received over $400,000 is savings from the waste service bills.

Contamination Issue

Contamination is a challenge that any recycling program may need to deal with. McGill College reported that on average contamination of the paper and cardboard bins was 12%. Some buildings had 100% contamination in their recycling bins because of bags of waste had ripped open and spilled over into the other compartments. 18 of the total 57 bins were found to contain no contaminants. McGill suggests, this is just the role of ignorance, and more awareness programs need to be conducted to educate the community about recycling.

Using Waste for BioFuel

Some campuses are research other ways to recycle material, such as organic waste. University of British Columbia (UBC) is experimenting and developing the technology which will take cooking oil from dining facilities and convert it into bio-diesel fuel that will help run the university’s maintenance fleet.

Composting

Relevant inventory question WS-17

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173 (University of British Columbia, 2007)
174 (UBC Sustainability Office, 2008, p. 40)
175 (University of Auburn, 2008)
176 (BGSU Recycling Center)
177 (The Sustainable McGill Project, 2005, pp. 32-33)
178 (UBC Sustainability Office, 2006, p. 12)
Composting is another form of recycling which converts organic material into nutrient rich soil that can be used for landscaping. The organic material is put in a favorable condition that allows the material to breakdown into a very rich soil substance. The organic materials that can be composted are split into two categories, carbons and nitrogens. Carbons consist of dried material such as wood, dried leaves, grass, and other plants. Nitrogens are considered moist items such as grass cuttings and food scraps.\textsuperscript{179}

Composting is a fairly simple concept that requires little attention if done properly. The first challenge for a campus is to find a location to conduct composting. A campus in a rural area may have plenty of room to spare for an open air composting. But for campuses located in an urban area, space may be very limited, but composting can still be done. Composting bins can be placed near buildings to store the compost material and provide a neat, efficient, and easy to manage compost pile. The bins can also be brought inside and worms can be placed in the bins to help digest the organics, known as Vermicomposting.

When choosing the location of the compost pile, moisture and aeration are very important factors to consider. The pile should be located where it will be moist at all times but not drenched with water. The location should also not be in direct sunlight to make it very dry, unless if it is located in a poor drained area. The location should also provide ventilation for fresh air, in order to allow for organism to complete the reaction process of a compost pile.

The rate at which the decomposition process takes place is determined by many variables. Warmer climates will see a faster reaction process compared to a cooler climate. A ratio of 30:1 of carbons versus nitrogen materials is recommended to satisfy the microbes that are digesting the material. If an ammonia odor is given off by the pile, indicates high nitrogen content. To resolve the issue, more carbon type material should be added to balance the ratio. Campuses in cooler climates will experience a slower decomposition process. During a winter period, the decomposing process will come to a complete halt, but will return after the first thaw.

Once a compost pile is created, patience is required. Occasionally the pile should be turned over for complete decomposition of the material. Depending on the various variables, the compost pile can be ready for use in a matter of weeks, or it can take several months. Problems such as foul odors, animal intrusions, and flies are of major concern for some people, but if maintained properly, as advised above and by other resources, these problems become of little concern.\textsuperscript{180}

There are three different types of composting, Windrow, Backyard, and Vermicomposting. Windrow composting contains organic materials that are placed in long rows that have a triangular cross section. Every two to three months the compost is turned over. Backyard composting uses composting bins to store the compost material and allows for a neat, efficient, and manageable way of composting. Vermicomposting also uses bins but also contains worms to decompose the material and convert it into rich soil. Vermicomposting is typically used indoors or to just speed up the composting process.\textsuperscript{181}

\textbf{Case Studies:}

\textit{Composting Sites}

\textsuperscript{179} (UW Waste Management)
\textsuperscript{180} (The Regional Municipality of Waterloo, 2002, pp. 1-16)
\textsuperscript{181} (UW Waste Management)
University of Waterloo, Ontario, utilizes all three types of composting. The compost contains leaves, yard waste, and flowers from various garden beds on campus. The soil produced is used for greenhouse potting, fill for tree holes, and topsoil. It is estimated that 120 tones of materials are composted each year. Waterloo does vermin-composting in some of their campus offices. University of British Columbia utilizes an in-vessel composter, which was installed in 2004. An in-vessel composter is a mechanized vessel used for large scale composting sites. The composter decomposes over 300 tons of waste, which is collected from 46 different sites on campus. The soil produced is used by the landscape team as topsoil.

Cost Benefits
A composting program may not show a rate of return right away, but a rate of return is possible. McGill University conducted a one year pilot study for composting using donated money by various organizations. In-vessel composting was done at Macdonald Campus and central storage area was created Downtown. One ton of composted material was used each week. The operations costs were $32,000 per year with a start up cost of $53,000. They sold the soil for total of $6,000 per year and had saved $8,000 in disposal savings per year. After all the investments in bins and payment of salaries for all the pickups, the operation was $550 in debt. For the project to continue a technician and a manager had to be hired. It was estimated that McGill University would have to contribute two-thirds of the cost to operate the system.

Middlebury College, of Vermont with 2,310 students, began composting in 1993, and had great success. It initially would collect its compost material in 26 cubic yard roll off containers and then ship them to Agricycle. There, they were mixed with chicken manure, grocery store residuals, and paper mill sludge to begin the composting process. There was an initial investment of $30,000 to purchase the containers, but that was paid back within 30 months. They were required to invest in ozone generators to control the maggot population and the odors that came from the containers. Eventually an on-site windrow composting program was started. Since 1993, $102,000 in savings has been achieved. Comparing the costs of composting ceresus landfill services, the composting process was about $39 per ton while landfill costs were $135 per ton. The technology used is considered low tech by Middlebury College, and most of the materials required were already owned by the campus.

5) Community-Based Social Marking (CBSM)

When it comes to the theme of sustainability, we always have this kind of thought that after people are educated about the importance of sustainability, and informed that it is for their own financial benefits, people will “rationally” start altering their behaviors to be sustainable. However, in the reality, studies document that the relationship between environmental awareness and behavior is very weak. Education alone usually will not have any impact on people’s sustainable behavior. For example, an authority in the field of CBSM mentioned two of his anecdotes in his book to explain why a knowledgeable person like him doesn’t keep sustainable

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182 (UW Waste Management)
183 (UBC Sustainability Office, 2008, p. 41)
184 (Spitzberg & Gell, 2005)
185 (Seif, 2005)
behaviors. He ever diligently composted in his backyard for nine month, but when winter came, the one meter deep snow drift and minus 20 degree Celsius weather kept him from “trampling down the snow with a pair of boots that reach nearly to his knees” to feed his composer. Also, in the winters he started taking taxi to work instead of taking buses or walking, although he knew the automobile carbon dioxide emission is the principle cause of global warming and he did concern with about environmental problem. This was because it would take 40 minutes for him to walk to work and there was no direct bus route from his house to his working place and he found the taxi fare costs only a little bit more than bus. These two cases showed the human-sided challenges we have to face to promote the sustainable behaviors, such as the inconvenience caused by sustainable actions in winter.\footnote{(Doug McKenzie-Mohr, 1996, p. 2)}

To address this human component problem, a new area called “community-based social marking (CBSM)” emerged as sustainability progressed with time. The goal of community-based social marking is to uncover the internal and external barriers to human’s sustainable behaviors and then utilize different strategies to overcome these barriers and foster people’s environmentally friendly behaviors. Typically, six tools or strategies are applied in the CBSM:

1. Commitment to engage in sustainable activities,
2. Using prompts to reminder people to engage in sustainable behaviors,
3. Using perceived norms on the promotion of sustainable behaviors,
4. Effective communication,
5. External barrier removal and

In this section of master plan, we will only introduce the first four strategies, which are very effective to overcome people’s internal barriers to sustainable behaviors. We will detail the concept of each of the four strategies, the effects these tools can make to alter people’s behaviors and then ways to apply them into different sustainable activities, such as waste reduction, energy conservation and water conservation.

For information about the last two strategies, external barrier removal and methods of barrier revelation, and more discussion on CBSM, please refer to the work “Promoting a Sustainable Future: An Introduction to Community-Based Social Marketing” written by Doug McKenzie-Mohr, PhD

**Commitment to Engage in Sustainable Activities**

If people can commit themselves to sustainability, it will be more likely that they will turn their good intentions into actions. This is because people like to behave consistently. When they commit to start sustainable behaviors, the chance that they will actually do the behaviors is greatly increased. On study conducted on the New York City beach showed the need in all of us to behave consistently. In this study, one researcher posed as a sunbather relaxing on a blanket and listening to his radio and another research posed as a thief. When the “sunbather” left his radio and took a walk somewhere else, the “thief” would steal his radio. Under this circumstance, the “thief” was pursued 4 times out of 20 stagings, but when the “sunbather” asked the person...
besides him to watch his stuff before he took the walk, 19 out of 20 stagings, the “thief” was pursued. 187

Gaining written commitment was found to have more efficacy than gaining verbal commitment. For example, in a recycling promotion study, households were randomly assigned into one of three groups. The first group received pamphlets emphasizing the importance of recycling. The second group of homes was asked to make a verbal pledge to recycle newspaper and the third group was asked to sign a commitment statement. The result revealed that both the second and third groups recycled more than the first group and in the follow-up examination, it was found that the effects endured only for the group who made written commitment. 188

Further testimony of the power of commitment came from an energy conservation research. Randomly selected homes were asked to take part in a home energy conservation assessment. After the assessment, half of the households were asked for the permission of publicizing their names. Even though the names were never publicized, 15% reduction in natural gas consumption and 20% in electricity consumption were found in those households who permitted to be publicized. 189

**Guidelines to Use Commitment Tool**

- Don’t force people to make commitment. The commitment should be sought only if people have interest in a certain behavior. Research indicates that when people feel pressure to make a commitment, the commitment will not work.
- If possible, ask people sign a commitment rather than ask them commit verbally, as studies document that a written commitment is more effective.
- If possible, ask for a public commitment rather than a private one. Research shows that when people’s names are published on school’s newspaper, it is more likely to have an enduring effect. 190

**Using Prompts to Remind People to Carry Out the Behaviors They Have Already Decided to Do**

People like me, we sometimes forgot to bring the homework to class and forgot to call someone we need to contact. Similarly, people easily forget to turn off the lights when leaving a room or forget to purchase products with recycled content. A “Prompt” is an effective visual or auditory reminder that helps us to remember to engage in sustainable behaviors. Unlike the strategy effective communication, it is not a tool used to change people’s attitude, but simply help us to carry out the behaviors we have decided to do. 191

In one department of Florida State University, prompts indicating types of recyclable paper were put on the top of all the recycling containers. Simultaneously, all the trash containers in this

187 (Doug McKenzie-Mohr, 1996, pp. 4-7)
188 (Doug McKenzie-Mohr, 1996, pp. 4-7)
189 (Doug McKenzie-Mohr, 1996, pp. 4-7)
190 (Doug McKenzie-Mohr, 1996, pp. 4-7)
191 (Doug McKenzie-Mohr, 1996, pp. 8-11)
department got prompts which read “No paper”. As a result, this small change increased the amount of recycled paper by 54%.\(^{192}\)

**Guidelines to Use Prompts**

- Prompts should be made noticeable and easy to understand
- Prompts should be delivered close in space and time to the targeted behaviors. For example, put a prompt directly on the light switch to remind people to turn off the lights upon leaving
- Prompts should be used to encourage positive sustainable behaviors, instead of to prevent people from doing environmentally harmful behaviors. For example, utilize prompts to promote the purchase of recycling content-contained products, rather than discourage people to buy environmentally harmful products.\(^{193}\)

**Using Perceived Norms on the Promotion of Sustainable Behaviors**

In a research conducted by Solomon E. Asch, a world-renowned American Gestalt psychologist and pioneer in social psychology, it was found that people prefer to keep their behavior the same as others’ around them. What someone chooses to do is easily influenced by how people around him behave, even their behaviors are incorrect.\(^{194}\)

Studies have demonstrated the influence perceived norms have upon promoting people’s sustainable behaviors. One study was conducted at University of California, Santa Cruz. A sign, which encourages users to turn off showers when soaping up, was put in a male shower room. The sign was found to be ineffective on behavior alteration and only 6% of users complied with the sign. However, when one accomplice came to this shower room and followed the sign’s suggestion, a dramatic change appeared: 49% of students started doing the same thing. When two accomplices was arranged to model the water conservation behavior, the percent of students turning off shower to soap up increased to 67%. In this case, a community norm has formed within the shower room and users in this room began doing conservation behaviors together. Also evidenced by other studies, it was discovered that creating a community norm results in substantial effect on altering people’s behaviors to be sustainable. As what Dr Doug McKenzie-Mohr said, “The change in behavior occurs not because the person believes that the behavior in which they are engaging is the ‘right thing to do’, but rather because there is tangible consequence for not engaging in the behavior”.\(^{195}\)

Further, studies document that behavior changes due to the conformity with others can be long-lasting. Therefore, creating and maintaining a community norm is a very successful psychological tool to enhance sustainable behaviors.\(^{196}\)

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\(^{192}\) (Doug McKenzie-Mohr, 1996, pp. 8-11)
\(^{193}\) (Doug McKenzie-Mohr, 1996, pp. 8-11)
\(^{194}\) (Doug McKenzie-Mohr, 1996, pp. 12-15)
\(^{195}\) (Doug McKenzie-Mohr, 1996, pp. 12-15)
\(^{196}\) (Doug McKenzie-Mohr, 1996, pp. 12-15)
Guidelines to Apply Perceived/Community Norm

- Like prompts, norm should be perceptible
- Like prompts, norm should be used to encourage positive sustainable behaviors, instead of to prevent people from doing environmentally harmful behaviors.  

Now we give an example to utilize perceived norm. To encourage shoppers to purchase environmentally friendly products, a noticeable display can be set in supermarket and shows the percent of purchasers who have selected environmentally beneficial products.  

Effective Communication

The purpose of trying to effectively communicate with others is usually to persuade others and to influence their attitude. In the process of our society’s transition to a sustainable society, being able to successfully persuade most people to alter their attitude and behaviors is the most important and urgent task. Now we will talk about four ways to make one’s persuasion more effective.  

Present Vivid, Concrete and Personal Information

First, an effective persuasion requires people’s attention. To successfully capture attention, information presented to people should be made vivid, concrete and personalized. For example, to persuade a household to retrofit its house, a home assessor can use this household’s utility bill to explain the money can be saved by retrofitting the house. Also he can provide a vivid example to tell how much energy consumption has been reduced in a similar household due to the conservation equipment installation in their community.

Another example of making information vivid is in one residence complex in Harvard University. All the trash produced in this residence in one week was piled up and put in front of the residence, so that all the students passing by were able to realize and actually “see” how large amount of trash they can make in only one week. In this way, it is easier for students to understand why their behavior needs to be changed.

Use a Credible Source

A more credible source makes better effect on the audience. In a study, one group of homes received energy conservation pamphlets enclosed in envelops from the State Regulatory Agency, whereas the other group of homes received the same pamphlets but enclosed in envelops from the local utility. As a result, the first group who got pamphlets from a more credible organization showed much more advocated changes than the second group.

197 (Doug McKenzie-Mohr, 1996, pp. 12-15)
198 (Doug McKenzie-Mohr, 1996, pp. 12-15)
199 (Doug McKenzie-Mohr, 1996, pp. 16-21)
200 (Doug McKenzie-Mohr, 1996, pp. 16-21)
201 (Doug McKenzie-Mohr, 1996, pp. 16-21)
Carefully Use Fear Appeals

Fear appeal strategy means someone uses negative or threatening facts in order to convince people change their behavior. For example, some environment protection organization dispensed flyers to drivers on which the drivers were informed that when they are driving, they are actually “chronically killing” their children. Here, the organization is using fear appeal to promote sustainable behaviors.

However, research shows that if the audience feels they are able to control the situation, they are willing to change and act, but if they feel there is little they can do, they will act emotionally, such as in last example, most of the drivers who received flyers just threw the flyers away and didn’t want to see them anymore. For these reasons, social marketing experts recommend that when fear appeals are utilized, they should be coupled with constructive suggestions. 202

Exploit Social Diffusion

Similar as perceived norms, studies document that people change their attitude and behaviors through contact with others. When someone adopts a new lifestyle, such as saving energy and recycling, it is usually because friends or colleagues around him/her have started doing these things. This process is called social diffusion. 203

Guidelines to Effectively Communicate

- Information should be made vivid, concrete and personalized
- Information is better to be delivered by credible sources/organizations/people

When fear appeals are exploited, audience should be also advised what they can do. Social diffusion can have a great influence upon people’s attitude and behavior changes. 204

202 (Doug McKenzie-Mohr, 1996, pp. 16-21)
203 (Doug McKenzie-Mohr, 1996, pp. 16-21)
204 (Doug McKenzie-Mohr, 1996, pp. 16-21)
Appendix B – Communication Log Example

This is an excerpt from the Clean Air Cool Planet Campus Carbon Calculator User’s Guide (Appendix I – Clean Air – Cool Planet Campus Carbon Calculator User’s Guide). This shows what communication log could look like.

Sample Data Collection Experience: A true record of a search for University Fleet Fuel Consumption

12/14/00 - Contacted the Director of Transportation - was told the supervisor of garage maintenance would have the information. Contacted the supervisor of garage maintenance - was told that he forwards all of that information to the facilities business office.

12/20/00 - Contacted the facilities business office - was told that they could prepare the data in a few days.

1/11/01 - Was contacted by the facilities business office - was told they did not have that information and that the State Department of Transportation handles the fuel distribution and should have the data. Contacted the DOT - was told they keep no historical records but University Dep. of Transportation should.

1/18/01 - Contacted the University Controllers Office, was told they didn’t have the information and forwarded my message to the Director of Facilities. Did not hear back.

1/25/01 - Contacted the Director of Facilities and was told he would get back to me. Did not hear back.

1/31/01 - Contacted the Dir. of Facilities; was told my message had been forwarded to the Dir. of Transportation.

2/7/01 - Received email from Dir. of Transportation suggesting I contact a specific person at the State DOT. Contacted the State DOT and was sent a file containing data from each vehicle fueling event (about 400 pages long) for the year 2000. Also learned that there used to be a University position that was charged with summarizing the vehicle data and reporting it to the state, but that this position had been eliminated in 1998.

2/21/01 - Contacted the supervisor of garage maintenance; was told he would look around for the old reports.

3/1/01 - Received a message from the supervisor of garage maintenance that he had found the reports in an old file cabinet. Photocopied reports. Discovered that they estimated fuel use at about half the amount estimated by the annual report received from the State DOT. The Dir. of Transportation was unable to explain
the discrepancy. Used these reports, as they were relatively steady over the four years recorded (i.e. there would not have been a doubling of fuel use over 2 years).

4/18/01 - Dir. of Transportation called me to ask if I had found out the annual fuel consumption, average fuel efficiency, or up-to-date fleet size. He needed them for a report he was working on. I gave him what I had.

(Cool Air Clean Planet, 2008, p. 14)
Appendix C – Sample Campus Inventory Worksheet

This Sample Campus Inventory Worksheet was created by our student team based on the STARS and CSAF inventories, which can be found in Appendix F and Appendix G. Some aspects in STARS and CSAF inventories were chosen and developed to be more suitable for campuses.

G - Basic Information

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-1</td>
<td>Institution Name</td>
<td></td>
</tr>
<tr>
<td>G-2</td>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>G-3</td>
<td>Community Type (urban, suburban, or rural)</td>
<td></td>
</tr>
<tr>
<td>G-4</td>
<td>Sustainability Website</td>
<td></td>
</tr>
<tr>
<td>G-5</td>
<td>Contact Information for the Primary Contact Person</td>
<td></td>
</tr>
<tr>
<td>G-6</td>
<td>Source of Data</td>
<td></td>
</tr>
<tr>
<td>G-7</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
</tr>
<tr>
<td>G-8</td>
<td>Format of data</td>
<td></td>
</tr>
<tr>
<td>G-9</td>
<td>The boundaries of the data</td>
<td></td>
</tr>
<tr>
<td>G-10</td>
<td>Process of getting data</td>
<td></td>
</tr>
<tr>
<td>G-11</td>
<td>Repeatability</td>
<td></td>
</tr>
<tr>
<td>G-12</td>
<td>Other comments or issues</td>
<td></td>
</tr>
</tbody>
</table>

Common Timeframes for Reporting Data

- 12-month Academic Year
- 12-month Fiscal Year

P - Population Information

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-1</td>
<td>Total Enrollment</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>P-2</td>
<td>Residential Students</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>P-3</td>
<td>Full-time Non-resident Students</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>P-4</td>
<td>Part-time Non-resident</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Question</td>
<td>Metric</td>
<td>Response</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------</td>
<td>-------------</td>
<td>----------</td>
</tr>
<tr>
<td>P-5</td>
<td>Non-credit Students</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>P-6</td>
<td>Full-time Faculty</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>P-7</td>
<td>Part-time Faculty</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>P-8</td>
<td>Full-time Staff</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>P-9</td>
<td>Part-time Staff</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>P-10</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-11</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-12</td>
<td>Format of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-13</td>
<td>The boundaries of the data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-14</td>
<td>Process of getting data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-15</td>
<td>Repeatability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-16</td>
<td>Other comments or issues</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CS - Campus Space**

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS-1</td>
<td>Total number of buildings</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>CS-2</td>
<td>Total gross square feet of floor space of all buildings</td>
<td>ft²</td>
<td></td>
</tr>
<tr>
<td>CS-3</td>
<td>Area of Campus Lawns, Outdoor Athletic Fields, and Garden</td>
<td>acres</td>
<td></td>
</tr>
<tr>
<td>CS-4</td>
<td>Area of Undeveloped Land and/or Natural Areas</td>
<td>acres</td>
<td></td>
</tr>
<tr>
<td>CS-5</td>
<td>Area of Campus that is paved or Build</td>
<td>acres</td>
<td></td>
</tr>
<tr>
<td>CS-6</td>
<td>Research Lab Space</td>
<td>ft²</td>
<td></td>
</tr>
<tr>
<td>CS-7</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS-8</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS-9</td>
<td>Format of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS-10</td>
<td>The boundaries of the data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS-11</td>
<td>Process of getting data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS-12</td>
<td>Repeatability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS-13</td>
<td>Other comments or issues</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FI - Financial Information**

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>FI-1</td>
<td>Operating Budget</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>FI-2</td>
<td>Research Budget</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>FI-3</td>
<td>Administration-allocated Funding for Sustainability Officer, Office, or</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Question</td>
<td>Metric</td>
<td>Response</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>FI-4</td>
<td>Discretionary Funding for Sustainability Officer, Office, or Committee, if applicable</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>FI-5</td>
<td>Student Fees Allocated to Sustainability Officer Office, or Committee, if applicable</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>FI-6</td>
<td>Sustainability Revolving Loan Fund Value, if applicable</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>FI-7</td>
<td>Energy Budget</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>FI-8</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI-9</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI-10</td>
<td>Format of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI-11</td>
<td>The boundaries of the data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI-12</td>
<td>Process of getting data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI-13</td>
<td>Repeatability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI-14</td>
<td>Other comments or issues</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Energy**

**HC - HVAC**

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC-1</td>
<td>Does the campus use boilers as a source of heat? If no, skip to question HC-6.</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>HC-2</td>
<td>Are the Boilers 20 years old or more?</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>HC-3</td>
<td>What percentage of boilers is high efficiency?</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>HC-4</td>
<td>Do the boilers have a control system that allows them to operate through a wide range of loads?</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>HC-5</td>
<td>Do boilers have automatic vent dampers?</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>HC-6</td>
<td>What percentage of chillers is high efficiency?</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>HC-7</td>
<td>Does the campus use geothermal energy?</td>
<td></td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
HC-8 Does the institute have a centralized energy management system? Yes/No

HC-9 Source of Data

HC-10 Rate the reliability of data, 1-5. Explain.

HC-11 Format of data

HC-12 The boundaries of the data

HC-13 Process of getting data

HC-14 Repeatability

HC-15 Other comments or issues

S1 - Scope 1

Cogeneration

Answer the following questions if heat or electricity is produced on campus. Otherwise go to the next section, “Other On Campus Stationary Sources.”

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1-1</td>
<td>Residual Oil</td>
<td>Gallons</td>
<td></td>
</tr>
<tr>
<td>S1-2</td>
<td>Distillate Oil</td>
<td>Gallons</td>
<td></td>
</tr>
<tr>
<td>S1-3</td>
<td>Natural Gas</td>
<td>MMBtu</td>
<td></td>
</tr>
<tr>
<td>S1-4</td>
<td>LPG (Propane)</td>
<td>Gallons</td>
<td></td>
</tr>
<tr>
<td>S1-5</td>
<td>Coal (Steam Coal)</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>S1-6</td>
<td>Incinerated Waste</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>S1-7</td>
<td>Wood Chips</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>S1-8</td>
<td>Wood Pellets</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>S1-9</td>
<td>Grass Pellets</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>S1-10</td>
<td>Residual BioHeat</td>
<td>Gallons</td>
<td></td>
</tr>
<tr>
<td>S1-11</td>
<td>Distillate BioHeat</td>
<td>Gallons</td>
<td></td>
</tr>
<tr>
<td>S1-12</td>
<td>Other</td>
<td>MMBtu</td>
<td></td>
</tr>
<tr>
<td>S1-13</td>
<td>Electric Output</td>
<td>kWh</td>
<td></td>
</tr>
<tr>
<td>S1-14</td>
<td>Steam Output</td>
<td>MMBtu</td>
<td></td>
</tr>
<tr>
<td>S1-15</td>
<td>Electric Efficiency</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>S1-16</td>
<td>Steam Efficiency</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>S1-17</td>
<td>Renewable Electricity Output</td>
<td>kWh</td>
<td></td>
</tr>
<tr>
<td>S1-18</td>
<td>Total Electricity Output (Renewable and Conventional)</td>
<td>kWh</td>
<td></td>
</tr>
<tr>
<td>S1-19</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1-20</td>
<td>Rate the reliability of data,</td>
<td></td>
<td></td>
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</tbody>
</table>
1-5. Explain.

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
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</thead>
<tbody>
<tr>
<td>S1-21</td>
<td>Format of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1-22</td>
<td>The boundaries of the data</td>
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<td></td>
</tr>
<tr>
<td>S1-23</td>
<td>Process of getting data</td>
<td></td>
<td></td>
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**Other On Campus Stationary Sources**

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**Transportation**

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**S3 - Scope 3**

**Commuting**

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**Solid Waste**

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<td>Repeatability</td>
<td></td>
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</tr>
<tr>
<td>S3-98</td>
<td>Other comments or issues</td>
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**Paper – Uncoated Freesheet**

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
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<th>Response</th>
</tr>
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<tbody>
<tr>
<td>S3-99</td>
<td>0% recycled</td>
<td>lbs</td>
<td></td>
</tr>
<tr>
<td>S3-100</td>
<td>25% recycled</td>
<td>lbs</td>
<td></td>
</tr>
<tr>
<td>S3-101</td>
<td>50% recycled</td>
<td>lbs</td>
<td></td>
</tr>
<tr>
<td>S3-102</td>
<td>75% recycled</td>
<td>lbs</td>
<td></td>
</tr>
<tr>
<td>S3-103</td>
<td>100%</td>
<td>lbs</td>
<td></td>
</tr>
<tr>
<td>S3-104</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3-105</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3-106</td>
<td>Format of data</td>
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<td></td>
</tr>
<tr>
<td>S3-107</td>
<td>The boundaries of the data</td>
<td></td>
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</tr>
<tr>
<td>S3-108</td>
<td>Process of getting data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3-109</td>
<td>Repeatability</td>
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### Offsets

<table>
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<tbody>
<tr>
<td>S3-111</td>
<td>Offsets with Additionality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3-112</td>
<td>On-campus Composting</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>S3-113</td>
<td>Forest Preservation</td>
<td>MT eCO2</td>
<td></td>
</tr>
<tr>
<td>S3-114</td>
<td>Retail Offsets (High End)</td>
<td>MT eCO2</td>
<td></td>
</tr>
<tr>
<td>S3-115</td>
<td>Retail Offsets (Low End)</td>
<td>MT eCO2</td>
<td></td>
</tr>
<tr>
<td>S3-116</td>
<td>Other</td>
<td>MT eCO2</td>
<td></td>
</tr>
<tr>
<td>S3-117</td>
<td>Non-Additional Renewable Energy Certificates (RECs)</td>
<td></td>
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<tr>
<td>S3-118</td>
<td>Green Power Certificates</td>
<td>kWh</td>
<td></td>
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<td>S3-119</td>
<td>Retail Offsets (High End)</td>
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<tr>
<td>S3-120</td>
<td>Retail Offsets (Low End)</td>
<td>MT eCO2</td>
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<td>S3-121</td>
<td>Other</td>
<td>MT eCO2</td>
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</tr>
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<td>S3-122</td>
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<td>S3-123</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
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</tr>
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<td>S3-124</td>
<td>Format of data</td>
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<td>S3-125</td>
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<td>S3-126</td>
<td>Process of getting data</td>
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<tr>
<td>S3-127</td>
<td>Repeatability</td>
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<tr>
<td>S3-128</td>
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### Water

#### Irrigation

<table>
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<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-1</td>
<td>Rainwater</td>
<td>gallons/ ft²</td>
<td></td>
</tr>
<tr>
<td>W-2</td>
<td>Gray water</td>
<td>gallons/ ft²</td>
<td></td>
</tr>
<tr>
<td>W-3</td>
<td>Total potable water used for irrigation?</td>
<td>gallons/ft²</td>
<td></td>
</tr>
<tr>
<td>W-4</td>
<td>Is water consumption being monitored?</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>W-5</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W-6</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
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<td>W-7</td>
<td>The boundaries of the data</td>
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<td></td>
</tr>
<tr>
<td>W-8</td>
<td>Process of getting data</td>
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<td></td>
</tr>
<tr>
<td>W-9</td>
<td>Repeatability</td>
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**WS – Waste**

**Overview**

<table>
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<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight of materials:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-1</td>
<td>Recycled</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>WS-2</td>
<td>Composted</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>WS-3</td>
<td>Reused</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>WS-4</td>
<td>Re-sold</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>WS-5</td>
<td>Donated</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>WS-6</td>
<td>Diverted</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>WS-7</td>
<td>Sent to Landfill</td>
<td>Tons</td>
<td></td>
</tr>
<tr>
<td>WS-8</td>
<td>Source of Data:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-9</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-10</td>
<td>Format of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-11</td>
<td>The boundaries of the data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-12</td>
<td>Process of getting data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-13</td>
<td>Repeatability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-14</td>
<td>Other comments or issues</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Recycling**

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS-15</td>
<td>Is there a recycling program that incorporates the recycling of office paper, newspaper, cardboard, bottles, plastic and cans?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>WS-16</td>
<td>Are there collection points for sorting paper, glass, metal and plastic in the areas where waste is generated?</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

**Composting**

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS-17</td>
<td>Does the campus have a composting program for organic waste?</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
### Reduce

<table>
<thead>
<tr>
<th>WS-18</th>
<th>Campus dining operations offer discounts for reusable mugs?</th>
<th>Yes/no</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS-19</td>
<td>Replaced paper materials, such as course catalogs, registration, and directories, with online alternatives?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>WS-20</td>
<td>Limit of free printing in computer labs and libraries?</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WS-21</th>
<th>Source of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS-22</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
</tr>
<tr>
<td>WS-23</td>
<td>The boundaries of the data</td>
</tr>
<tr>
<td>WS-24</td>
<td>Process of getting data</td>
</tr>
<tr>
<td>WS-25</td>
<td>Repeatability</td>
</tr>
<tr>
<td>WS-26</td>
<td>Other comments or issues</td>
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</table>

### A - Administration

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Environmental Management System (EMS) Documentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-2</td>
<td>Does the campus have a written environmental policy?</td>
<td>Yes/No</td>
<td></td>
</tr>
</tbody>
</table>

**Are there stated goals and targets documents in the policy manual with respect to each of the following:**

<p>| A-3  | - Energy Conservation | Yes/No |
| A-4  | - Water Conservation | Yes/No |
| A-5  | - Waste reduction and recycling | Yes/No |
| A-6  | - Environmental purchasing | Yes/No |
| A-7  | Environmental Purchasing | |
| A-8  | Does the building management have a written environmental-purchasing policy? | Yes/No |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A-9</td>
<td>Does the purchasing policy include the requirement for purchasing energy efficient building equipment?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>A-10</td>
<td>Policy of purchasing environmentally preferable furniture</td>
<td>Yes/No</td>
</tr>
<tr>
<td>A-11</td>
<td>Source of Data</td>
<td></td>
</tr>
<tr>
<td>A-12</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
</tr>
<tr>
<td>A-13</td>
<td>Format of data</td>
<td></td>
</tr>
<tr>
<td>A-14</td>
<td>The boundaries of the data</td>
<td></td>
</tr>
<tr>
<td>A-15</td>
<td>Process of getting data</td>
<td></td>
</tr>
<tr>
<td>A-16</td>
<td>Repeatability</td>
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</tr>
<tr>
<td>A-17</td>
<td>Other comments or issues</td>
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</tr>
</tbody>
</table>
Appendix D – Sample Building Inventory Worksheet

This Sample Building Inventory Worksheet was a work of our team, but is based on the BOMA Best Go Green Plus Assessment Questionnaire, which can be found in Appendix HH.

BG - Basic Information

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG-1</td>
<td>Name of Building</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG-2</td>
<td>Function of building</td>
<td>Residential dormitory, classroom, etc.</td>
<td></td>
</tr>
<tr>
<td>BG-3</td>
<td>Gross floor area of building?</td>
<td>ft²</td>
<td></td>
</tr>
<tr>
<td>BG-4</td>
<td>Does the building have a sustainable roof? (Green roof, cool roof, renewable energy integrated roof)</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BG-5</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG-6</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG-7</td>
<td>Format of data</td>
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<td></td>
</tr>
<tr>
<td>BG-8</td>
<td>The boundaries of the data</td>
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<tr>
<td>BG-9</td>
<td>Process of getting data</td>
<td></td>
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<tr>
<td>BG-10</td>
<td>Repeatability</td>
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<tr>
<td>BG-11</td>
<td>Other comments or issues</td>
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BE - Energy

General Energy Consumption

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE-1</td>
<td>Total Energy bill</td>
<td>Dollars</td>
<td></td>
</tr>
<tr>
<td>BE-2</td>
<td>Total Energy Consumption</td>
<td>kWh</td>
<td></td>
</tr>
<tr>
<td>BE-3</td>
<td>Total Heating Bill</td>
<td>Dollars</td>
<td></td>
</tr>
<tr>
<td>BE-4</td>
<td>Total BTU</td>
<td>MMBtu</td>
<td></td>
</tr>
<tr>
<td>BE-5</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE-6</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE-7</td>
<td>Format of data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE-8</td>
<td>The boundaries of the data</td>
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<td></td>
</tr>
<tr>
<td>Code</td>
<td>Question</td>
<td>Metric</td>
<td>Response</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------------------------------</td>
<td>--------</td>
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</tr>
<tr>
<td>BE-9</td>
<td>Process of getting data</td>
<td></td>
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<tr>
<td>BE-10</td>
<td>Repeatability</td>
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<tr>
<td>BE-11</td>
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## HVAC

<table>
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<th>Question</th>
<th>Metric</th>
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</tr>
</thead>
<tbody>
<tr>
<td>BE-12</td>
<td>Does HVAC system have energy recovery system?</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BE-13</td>
<td>Source of Data</td>
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<tr>
<td>BE-14</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
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<tr>
<td>BE-15</td>
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<tr>
<td>BE-16</td>
<td>The boundaries of the data</td>
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<tr>
<td>BE-17</td>
<td>Process of getting data</td>
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<tr>
<td>BE-18</td>
<td>Repeatability</td>
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</tr>
<tr>
<td>BE-19</td>
<td>Other comments or issues</td>
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## Lighting

<table>
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<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE-20</td>
<td>What percentage of the lighting are the following types?</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>BE-21</td>
<td>Compact fluorescent</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>BE-22</td>
<td>LED lighting</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>BE-23</td>
<td>What percentage of all lighting in the facility is “high efficiency lighting”?</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>BE-24</td>
<td>Does the building use more efficient fume hoods?</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BE-25</td>
<td>Does the building use motion, infrared, and/or light sensors to reduce energy use for lighting?</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BE-26</td>
<td>Source of Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE-27</td>
<td>Rate the reliability of data, 1-5. Explain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE-28</td>
<td>Format of data</td>
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<tr>
<td>BE-29</td>
<td>The boundaries of the data</td>
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<tr>
<td>BE-30</td>
<td>Process of getting data</td>
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<tr>
<td>BE-31</td>
<td>Repeatability</td>
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</tr>
<tr>
<td>BE-32</td>
<td>Other comments or issues</td>
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</table>
## Renewable Energy

<table>
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<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the building utilize any of the following renewable on-site energy sources?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BE-32</td>
<td>Active Solar</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BE-33</td>
<td>Wind</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BE-34</td>
<td>Photo Voltaic</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BE-35</td>
<td>Ground Source “Heat Pump”</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BE-36</td>
<td>Bio-Mass</td>
<td>Yes/No</td>
<td></td>
</tr>
<tr>
<td>BE-37</td>
<td>What is the percentage of building’s total energy use supplied by renewable sources?</td>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>

## BW - Water

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
<th>Metric</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW-1</td>
<td>Total water bill</td>
<td>Dollars</td>
<td></td>
</tr>
<tr>
<td>BW-2</td>
<td>Total water consumption</td>
<td>Gallons</td>
<td></td>
</tr>
<tr>
<td>BW-3</td>
<td>Water Conserving Features</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW-4</td>
<td>Low flow toilets that use less than or equal to 1.6 gallons per flush?</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>BW-5</td>
<td>Ultra low flush urinals that use less than 0.8 gallons per flush?</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>BW-6</td>
<td>Automatic valve controls and/or proximity detectors on toilets and urinals?</td>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>

191
<table>
<thead>
<tr>
<th>BW-9</th>
<th>Format of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW-10</td>
<td>The boundaries of the data</td>
</tr>
<tr>
<td>BW-11</td>
<td>Process of getting data</td>
</tr>
<tr>
<td>BW-12</td>
<td>Repeatability</td>
</tr>
<tr>
<td>BW-13</td>
<td>Other comments or issues</td>
</tr>
</tbody>
</table>

**Other**

Describe any other energy saving technologies used that were not mentioned above.
Appendix E – Sample Analysis Worksheet

This sample analysis worksheet was developed by the team. It shows in which way an analysis worksheet could be made.

**EU - Energy Used**

The following values are obtained from the Cool Air Clean Planet Greenhouse Gas Calculator.

<table>
<thead>
<tr>
<th>Code</th>
<th>Category</th>
<th>Source</th>
<th>Energy Used (MMBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU-1</td>
<td></td>
<td>Residual Oil</td>
<td></td>
</tr>
<tr>
<td>EU-2</td>
<td></td>
<td>Distilled Oil</td>
<td></td>
</tr>
<tr>
<td>EU-3</td>
<td></td>
<td>Natural Gas</td>
<td></td>
</tr>
<tr>
<td>EU-4</td>
<td></td>
<td>LPG (Propane)</td>
<td></td>
</tr>
<tr>
<td>EU-5</td>
<td>On Campus Co-generation Plants</td>
<td>Coal (Steam Coal)</td>
<td></td>
</tr>
<tr>
<td>EU-6</td>
<td>On Campus Co-generation Plants</td>
<td>Incinerated Waste</td>
<td></td>
</tr>
<tr>
<td>EU-7</td>
<td>On Campus Co-generation Plants</td>
<td>Wood Chips</td>
<td></td>
</tr>
<tr>
<td>EU-8</td>
<td>On Campus Co-generation Plants</td>
<td>Wood Pellets</td>
<td></td>
</tr>
<tr>
<td>EU-9</td>
<td>On Campus Co-generation Plants</td>
<td>Grass Pellets</td>
<td></td>
</tr>
<tr>
<td>EU-10</td>
<td>On Campus Co-generation Plants</td>
<td>Residual BioHeat</td>
<td></td>
</tr>
<tr>
<td>EU-11</td>
<td>On Campus Co-generation Plants</td>
<td>Distilled BioHeat</td>
<td></td>
</tr>
<tr>
<td>EU-12</td>
<td>On Campus Co-generation Plants</td>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>EU-13</td>
<td>Direct Transportation University Fleet</td>
<td>Gasoline Fleet</td>
<td></td>
</tr>
<tr>
<td>EU-14</td>
<td>Direct Transportation University Fleet</td>
<td>Diesel Fleet</td>
<td></td>
</tr>
<tr>
<td>EU-15</td>
<td>Direct Transportation University Fleet</td>
<td>Natural Gas Fleet</td>
<td></td>
</tr>
<tr>
<td>EU-16</td>
<td>Direct Transportation University Fleet</td>
<td>E85 Fleet</td>
<td></td>
</tr>
<tr>
<td>EU-17</td>
<td>Direct Transportation University Fleet</td>
<td>B5 Fleet</td>
<td></td>
</tr>
<tr>
<td>EU-18</td>
<td>Direct Transportation University Fleet</td>
<td>B20 Fleet</td>
<td></td>
</tr>
<tr>
<td>EU-19</td>
<td>Direct Transportation University Fleet</td>
<td>B100 Fleet</td>
<td></td>
</tr>
<tr>
<td>EU-20</td>
<td>Direct Transportation University Fleet</td>
<td>Hydrogen</td>
<td></td>
</tr>
<tr>
<td>EU-21</td>
<td>Direct Transportation University Fleet</td>
<td>Other Fleet Fuel</td>
<td></td>
</tr>
<tr>
<td>EU-22</td>
<td>Direct Transportation University Fleet</td>
<td>Electric Fleet</td>
<td></td>
</tr>
</tbody>
</table>

The Codes in the Calculation column represent the location of the values in the Sample Campus Inventory Worksheet (Appendix C – Sample Campus Inventory Worksheet) or the Sample Building Analysis Worksheet (Appendix D – Sample Building Inventory Worksheet).

**AWS - Waste**

<table>
<thead>
<tr>
<th>Code</th>
<th>Request</th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS-1</td>
<td>Total Waste</td>
<td>Add the values of Questions WS-1 through</td>
<td>Short Tons</td>
</tr>
<tr>
<td>AWS-2</td>
<td>Total Waste Land filled/ Incinerated</td>
<td>Add the values of Questions S3-86 through S3-90</td>
<td>Short Tons</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>AWS-3</td>
<td>Waste produced per capita</td>
<td>$\frac{\text{Tons of Waste Produced (AWS1)}}{\text{Population of campus (P1)}}$</td>
<td>Tons/capita</td>
</tr>
<tr>
<td>AWS-4</td>
<td>% Recycled</td>
<td>$\frac{\text{tons of material recycled (WS1)}}{\text{tons of waste produced (AWS1)}} \times 100$</td>
<td>%</td>
</tr>
<tr>
<td>AWS-5</td>
<td>% Composted</td>
<td>$\frac{\text{tons of material composted (WS2)}}{\text{tons of waste produced (AWS1)}} \times 100$</td>
<td>%</td>
</tr>
<tr>
<td>AWS-6</td>
<td>% Reused</td>
<td>$\frac{\text{tons of material reused (WS3)}}{\text{tons of waste produced (AWS1)}} \times 100$</td>
<td>%</td>
</tr>
<tr>
<td>AWS-7</td>
<td>% re-sold</td>
<td>$\frac{\text{tons of material resold (WS4)}}{\text{tons of waste produced (AWS1)}} \times 100$</td>
<td>%</td>
</tr>
<tr>
<td>AWS-8</td>
<td>% donated</td>
<td>$\frac{\text{tons of material donated (WS5)}}{\text{tons of waste produced (AWS1)}} \times 100$</td>
<td>%</td>
</tr>
<tr>
<td>AWS-9</td>
<td>% diverted</td>
<td>$\frac{\text{tons of material diverted (WS6)}}{\text{tons of waste produced (AWS1)}} \times 100$</td>
<td>%</td>
</tr>
<tr>
<td>AWS-10</td>
<td>% Land filled/ Incinerated</td>
<td>$\frac{\text{material landfilled (AWS2)}}{\text{tons of waste produced (AWS1)}} \times 100$</td>
<td>%</td>
</tr>
<tr>
<td>AWS-11</td>
<td>Total Weight of Paper Purchased</td>
<td>Add the values of questions S3-99 through S3-103</td>
<td>Pounds</td>
</tr>
<tr>
<td>AWS-12</td>
<td>Weight of paper purchased per capita</td>
<td>$\frac{\text{Total Weight of Paper (AWS11)}}{\text{Campus Population (P1)}}$</td>
<td>Pounds/capita</td>
</tr>
</tbody>
</table>

**AE - Energy**

<table>
<thead>
<tr>
<th>Code</th>
<th>Requested</th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE-1</td>
<td>% of renewable electricity output</td>
<td>$\frac{\text{Total Renewable Output (S117)}}{\text{Total Output (S118)}} \times 100$</td>
<td>%</td>
</tr>
<tr>
<td>AE-2</td>
<td>Total MMBtu Transportation fleet fuels purchased</td>
<td>Add all the values from analyzes questions EU-13 through EU-22.</td>
<td>MMBtu</td>
</tr>
<tr>
<td>AE-3</td>
<td>Total MMBtu transportation fleet renewable fuels purchased</td>
<td>Add the value from analyzes questions EU-16 through EU-22.</td>
<td>MMBtu</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>AE-4</td>
<td>% of MMBtu consumed by renewable energy fueled vehicles</td>
<td>( \frac{\text{Total MMBtu renewable fuel (AE2)}}{\text{Total MMBtu fuel (AE1)}} \times 100 ) %</td>
<td></td>
</tr>
<tr>
<td>AE-5</td>
<td>Total MMBtu for Cogeneration</td>
<td>Add the values from EU-1 to EU-12.</td>
<td>MMBtu</td>
</tr>
<tr>
<td>AE-6</td>
<td>Total MMBtu for renewable fuels in cogeneration</td>
<td>Add the values from EU-7 through EU-12.</td>
<td>MMBtu</td>
</tr>
<tr>
<td>AE-7</td>
<td>% used of renewable fuel in cogeneration</td>
<td>( \frac{\text{Total MMBtu renewable fuel (AE6)}}{\text{Total MMBtu fuel (AE5)}} \times 100 ) %</td>
<td></td>
</tr>
</tbody>
</table>

**B-Buildings**

Calculation Electricity Usage

\[
\frac{\text{Total Electricity Consumed (BE2)}}{\text{Gross Floor Area (BG3)}} = \text{consumption kWh/ft}^2
\]

Calculation Heating/Cooling Usage

\[
\frac{\text{Total BTU Consumed (BE4)}}{\text{Gross Floor Area (BG3)}} = \text{consumption BTU/ft}^2
\]

Calculating Water Usage

\[
\frac{\text{Total Water Consumed (BW2)}}{\text{Gross Floor Area (BG3)}} = \text{consumption Gallons/ft}^2
\]
Campus Buildings Comparison

<table>
<thead>
<tr>
<th>Name of Building</th>
<th>Electricity (kWh/ft²)</th>
<th>Heating/Cooling (BTU/ft²)</th>
<th>Water (gallons/ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Water

<table>
<thead>
<tr>
<th>Code</th>
<th>Request</th>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW-1</td>
<td>Outdoor Water Usage per ft²</td>
<td>$\frac{Total Outdoor Water Usage (W3)}{\text{Acres of unbuilt land (CS4)}} \times (2.29 \times 10^{-5} \text{ Acres})$</td>
<td>gallons/ft²</td>
</tr>
<tr>
<td>AW-2</td>
<td>Total Indoor Usage</td>
<td>$\frac{Total Water usage by all Buildings (gallons)}{Total Area of all Buildings (ft²)}$</td>
<td>gallons/ft²</td>
</tr>
</tbody>
</table>

BC- Costs

Cost Per Unit Calculation for Individual Buildings

$$\frac{Total Cost}{Consumption \text{ for Year}} = Cost \text{ Per Unit}$$

<table>
<thead>
<tr>
<th></th>
<th>Total Cost</th>
<th>Consumption for Year</th>
<th>Cost per Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>$</td>
<td>kWh</td>
<td>$/kWh</td>
</tr>
<tr>
<td>Water</td>
<td>$</td>
<td>Gallons</td>
<td>$/gallon</td>
</tr>
<tr>
<td>Heating/Cooling</td>
<td>$</td>
<td>BTU</td>
<td>$/BTU</td>
</tr>
<tr>
<td>Waste</td>
<td>$</td>
<td>Tons</td>
<td>$/Ton</td>
</tr>
</tbody>
</table>
Appendix F – STARS Inventory

This Appendix is the STARS Inventory is taken from the AASHE website for reference. The institution can modify this inventory to suit their sustainability purposes.
Sustainability Tracking, Assessment & Rating System (STARS)

for Colleges and Universities

Version 0.5

April 2008
AASHE is an association of colleges and universities in the U.S. and Canada working to create a sustainable future. It was founded in 2006 with a mission to promote sustainability in all sectors of higher education - from governance and operations to curriculum and outreach - through education, communication, research, and professional development. AASHE defines sustainability in an inclusive way, encompassing human and ecological health, social responsibility, secure livelihoods, and a better world for all generations.

This document was written by Laura Matson with assistance from Julian Dautremont-Smith, Dave Newport, and Judy Walton.

213 ½ N. Limestone, Lexington, KY 40507 • Phone: 859-402-9272 • www.aashe.org
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<td>Applicability for Ratings</td>
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<td>9</td>
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<tr>
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<td>10</td>
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<tr>
<td>How STARS Calculates ‘Per Capita’</td>
<td>10</td>
</tr>
<tr>
<td>How STARS Calculates Trends</td>
<td>10</td>
</tr>
<tr>
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<td>Introductory Institutional Information</td>
<td>12</td>
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<td>STARS Summary Scorecard</td>
<td>15</td>
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<td>23</td>
</tr>
<tr>
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</tr>
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<td>38</td>
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April 9, 2008

Dear Reader,

Thank you for your interest in AASHE’s Sustainability Tracking, Assessment & Rating System (STARS) for higher education!

Reaching this stage in the development of STARS would not be possible without the tremendous contributions we have received from throughout the campus sustainability community. A hearty thanks to the Strategic and Technical Advisory Committees, independent reviewers, institutions participating in the pilot project, and the many others who participated in phone calls and conference sessions, asked questions, and sent resources.

While STARS 0.5 includes many improvements over the previous version released last fall, it is still a work in progress. Your suggestions and feedback will be critically important in further improving the system. Please send comments and suggestions to stars@aashe.org. The comment period on this draft will last until May 9, 2008. Further instructions for reviewers are found on the following page. We look forward to hearing from you.

Toward Sustainability,

The STARS Steering Committee

Judy Walton, Acting Executive Director, AASHE

Julian Dautremont-Smith, Associate Director, AASHE

Dave Newport, Member, Board of Directors, AASHE &
Director, Environmental Center, University of Colorado at Boulder
Instructions for Reviewers

AASHE welcomes feedback on STARS from campus sustainability practitioners, experts, and all other interested parties. The comment period on this document will last until May 9, 2008.

To facilitate the review process and foster the most useful feedback possible, AASHE prepared the following guidelines for commenting on this document.

- AASHE understands that many of the credits included in this document are imperfect. Specific suggestions for how to improve individual credits, sections, or the system overall are more helpful than criticisms of the current credits without proposed solutions.
- Reviewers are encouraged to focus their feedback on the sections or topics in which they have expertise and/or experience. While AASHE welcomes feedback on the whole system, reviewing the entire document is not required or expected.
- At this point, AASHE is focusing primarily on developing strong credits. The number of points associated with each credit and section will be determined after the criteria for each credit have been finalized. Therefore, feedback about point allocation may be more useful at a later stage.

The credits included in the Guide to STARS Pilot Phase One have been incorporated into this document without significant changes; only minor clarifying edits have been made. As a reminder, phase one of the STARS pilot project includes all of the Operations category and the following sections in the Administration and Finance category: Investment, Planning, and Sustainability Infrastructure. The one exception to this is the addition of AF Credit 12: Inter-Campus Collaboration on Sustainability, which is part of the Sustainability Infrastructure section.

Please send comments and suggestions to stars@aashe.org. AASHE will consider all input received. Following the comment period, AASHE will compile a document that includes all feedback and will make the document publicly available on its website (names will be removed to protect reviewers’ confidentiality).
Major Changes Made since the Previous Version of STARS

Since the release of STARS 0.4 in September 2007, AASHE has received widespread, constructive feedback from the campus sustainability community. As part of its response to this feedback, AASHE has made the following major changes to this version of STARS.

1) The four major categories included in STARS 0.4 (Governance and Finance, Social Responsibility and Community Engagement, Education and Research, and Operations), have been narrowed to three: Education and Research, Operations, and Administration and Finance. Each category is of roughly equal point value.

2) Many trend-based credits have been changed to recognize institutions that have met an absolute level of achievement to avoid putting schools that have already made significant progress toward sustainability at a disadvantage.

3) Each Tier One credit now includes a Criteria, Guidance, and Documentation section.

4) An institution’s overall sustainability score is based on the percentage of applicable points it achieves rather than the absolute number of points earned, as in the previous version.

Responses to other reviewer feedback and many additional changes are described throughout this document in discussion sections, which are in blue serif text. Discussion of changes and potential changes included in these sections should not be considered exhaustive or final. AASHE has received feedback that is still under consideration and was not incorporated into this document due to space and time limitations.

To view additional feedback received, please see documents posted on the STARS website (www.aashe.org/stars), including Responses to STARS 0.4 Survey, Comments on STARS 0.4, notes from conference calls about STARS 0.4, notes from sessions at campus sustainability conferences, and notes from the pilot project conference calls.
STARS Overview

Goals of STARS
AASHE’s Sustainability Tracking, Assessment & Rating System (STARS) is a voluntary, self-reporting framework for recognizing and gauging relative progress toward sustainability by colleges and universities. It is designed to:

- Provide a guide for advancing sustainability in all sectors of higher education, from education and research to operations and administration.
- Enable meaningful comparisons over time and across institutions by establishing a common standard of measurement for sustainability in higher education.
- Create incentives for continual improvement toward sustainability.
- Facilitate collaboration and information sharing about higher education sustainability practices and performance.
- Recognize sustainability achievements for all institutions, including leaders and beginners.
- Build a stronger, more diverse campus sustainability community.

In addition, schools may be able to receive marketing benefits from using STARS, and prospective students will be able to use STARS ratings in deciding which school to attend. AASHE hopes that all of this will help accelerate and enhance higher education’s move toward sustainability.

Why STARS is Needed
There is currently no standard, comprehensive way to compare the sustainability performance of higher education institutions and to benchmark a single institution’s performance over time. This makes it difficult for schools to reap the marketing, recruitment, and fundraising benefits of sustainability leadership.

While there are several other campus sustainability rankings and rating systems that serve valuable purposes, they don’t fully meet the goals of STARS outlined above and differ from STARS in the following ways:

- STARS has a fully transparent process for its ratings – it’s clear to users and observers what an institution needs to do to achieve a high rating.
- All colleges and universities have an opportunity to participate in STARS.
- STARS is being developed with widespread participation and input from higher education and sustainability communities.
- Most of the information that institutions submit to earn a STARS rating will be shared publicly, thereby enabling opportunities for learning and collaboration.
- Consistent with the original and long-standing meaning of sustainability, STARS includes credits related to an institution’s social, economic, and environmental performance. Other systems tend to focus exclusively or primarily on environmental performance.
- STARS is a rating system not a ranking. In other words, institutions are not competing against each other to earn a high score. Each school is evaluated based on its own performance and not relative to other schools.

In addition, AASHE expects that STARS will help create a central source for standardized information about campus sustainability performance and will facilitate information-sharing among institutions. Since institutions will be reporting about their sustainability programs and accomplishments, the STARS reporting system will be able to generate helpful resources for schools looking to benchmark against peer institutions and learn from experiences of other schools.
Audience

STARS is intended to engage and recognize the full spectrum of colleges and universities – from community colleges to research universities, and from institutions just starting their sustainability programs to long-time campus sustainability leaders. AASHE has attempted to encompass long-term sustainability goals for already high-achieving institutions as well as entry points of positive recognition for institutions that are taking first steps toward sustainability.

Since the upper levels of points were selected to represent, to the extent possible, what a fully sustainable campus would look like, there are some points that few, if any, institutions would achieve currently. Feedback from the campus sustainability community and data and insights provided by institutions participating in the pilot version of STARS will be used to determine what changes are necessary to ensure that STARS is relevant and useful for all campuses.

Understanding Sustainability

The concept of sustainability has shaped the development of STARS and is fundamental to the rating system. While sustainability has become increasingly popular, both on campuses and within society at large, its history and meaning are sometimes misunderstood.

The most popular definition of sustainability is from Our Common Future: The Report of the World Commission on Environment and Development, commonly known as the Brundtland Commission report:

1. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
   - the concept of ‘needs’, in particular the essential needs of the world’s poor, to which overriding priority should be given; and
   - the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs.

2. Thus the goals of economic and social development must be defined in terms of sustainability in all countries [...]  

3. [...] Physical sustainability cannot be secured unless development policies pay attention to such considerations as changes in access to resources and in the distribution of costs and benefits. Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation.

The interconnectedness and interdependence of the social, environmental, and economic components of sustainability are included throughout Our Common Future. The Brundtland Commission writes, “Our inability to promote the common interest in sustainable development is often a product of the relative neglect of economic and social justice.” The report continues, “[a] world in which poverty and inequity are endemic will always be prone to ecological and other crises. Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life.”

To further advance the principles of sustainability, the Brundtland Commission called for a “universal declaration” of norms to promote sustainable development. This goal was realized with the Earth Charter, a “global consensus statement on ethics and values for a sustainable future.” Developed over a period of ten years with
extensive global consultation, the Earth Charter has been formally endorsed by many organizations, including the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the World Conservation Union. The Earth Charter continues the Brundtland Commission’s understanding of the connections between social justice, environmental welfare, and economic security.

Today, most uses of and references to sustainability emphasize the concept’s economic, environmental, and social dimensions. For example, businesses talk about the triple bottom line: people, planet and profits (or, alternately, human capital, natural capital, and financial capital). Likewise, sustainability educators commonly refer to the Three Es of sustainability: economy, ecology, and equity.

Popular representations of sustainability also underscore the concept’s three dimensions. Sustainability experts often use a three-legged stool as a symbol for sustainability. The social, economic, and environmental components of sustainability each represent one of the stool’s legs. If one of the legs is missing, the stool can’t balance or function. Another common illustration of sustainability is a diagram depicting three overlapping circles, representing environmental needs, economic needs, and social needs. The area where the circles overlap and all three needs are met is the area of sustainability.

This understanding of the three interdependent dimensions of sustainability is consistent with best practices in sustainability reporting from the business community and sustainability rating systems for businesses, including the Dow Jones Sustainability Index and S-BAR (Sustainable Business Achievement Rating System).

STARS represents an attempt to translate this broad and inclusive view of sustainability to measurable objectives at the campus level. Thus, it includes credits related to an institution’s environmental, social, and economic performance.

**STARS History and Future Plans**

In August 2006, the Higher Education Associations Sustainability Consortium (HEASC), an informal network of higher education associations with a commitment to sustainability, issued a call for a campus sustainability rating system. HEASC said the system “would of necessity address all the dimensions of sustainability (health, social, economic and ecological) and all the sectors and functions of campus, including curriculum, facilities, operations, and collaboration with communities.” The statement called for “AASHE to convene all relevant stakeholders in a collaborative process to develop such a system.”

Over the next year and a half, AASHE gathered feedback and input from workshop participants at several campus sustainability conferences, including the AASHE 2006 Conference, the 2007 Rocky Mountain Sustainability Summit, the 2007 Smart and Sustainable Campuses Conference, and the 2007 Greening of the Campus Conference.

In September 2007 AASHE released STARS 0.4, a draft version of the rating system that included potential credits. AASHE enlisted the assistance of experts from throughout the sustainability and higher education communities to provide feedback on the draft system. The draft document generated widespread feedback. Around the same time, AASHE conducted a survey of STARS Technical and Strategic Advisory Committee members to gather input on the structure, credits, and organization of STARS. To further revise STARS, AASHE conducted a series of focused conference calls with experts and interested parties. The calls helped identify and resolve outstanding issues about particular areas covered by STARS.
AASHE spent several months processing all of the feedback to develop phase one of the STARS pilot project, which was released in early February 2008. Throughout 2008, over 90 colleges and universities are pilot testing STARS. This document, STARS 0.5, includes the same version of the Operations and Administration and Finance credits that were included in Phase One of the Pilot Project. In addition, STARS 0.5 includes the Education and Research category and the other half of the Administration and Finance category.

This version of STARS is still a work in progress. Feedback received about this document will shape future versions of STARS significantly. AASHE will conduct focused outreach to solicit feedback about STARS 0.5, and will compile feedback received. Feedback from all campus sustainability stakeholders is welcome, and should be sent to stars@aaehe.org.

AASHE plans to launch STARS 1.0 in 2009. It will be the first version to allow campuses to achieve a sustainability rating.

How Credits Were Selected

STARS is comprised of two main types of credits: performance and strategy. Performance credits are based on quantitative measurements of sustainability performance, such as the percentage of new buildings that are built to LEED standards. Strategy credits focus on approaches or processes that can help improve an institution’s performance, such as adopting a green building policy.

While both types of credits provide useful information, STARS strives to prioritize performance credits over strategy credits when possible. The primary goal of the system is to catalyze tangible improvements in sustainability achievement, not simply to encourage adoption of more strategies. In addition, there are often different strategies or approaches an institution can take to achieve the same outcome.

In many instances, however, AASHE has been unable to identify measurable, meaningful, and fairly comparable performance indicators. Likewise, strategy indicators sometimes tell a richer story about an institution’s sustainability initiatives and provide valuable information worth collecting and sharing. Therefore, both strategy and performance credits have a place in the system, but AASHE welcomes feedback on how to further prioritize performance credits.

In general, credits were selected and informed by reviewing campus sustainability assessments, sustainability reports from businesses, and other sustainability rating and ranking systems. As mentioned previously, credits were revised, eliminated, or added based on feedback from the campus sustainability community. AASHE will continue to make changes in response to further feedback.
STARS Ratings, Logistics, and Participation Guidelines

STARS Credits
STARS is comprised of two types of credits.

- **Tier One** credits are worth one or more points and, where possible, are based on sustainability outcomes.
- **Tier Two** credits are worth less than one point and, in general, recognize strategies institutions can adopt to move toward sustainability.

STARS also includes **prerequisites**, which establish a minimum baseline for using the program. Prerequisites are intended to represent the minimum requirements for demonstrating institutional commitment to sustainability. Prerequisite status is reserved for practices and/or policies that are believed to be so fundamental to campus sustainability that it would be inappropriate to recognize an institution under STARS that had not implemented those practices.

The credits and prerequisites are arranged into three categories: 1) Education and Research, 2) Operations, and 3) Administration and Finance. These categories were selected to align with the three main sectors or organizational groups at higher education institutions.

AASHE is committed to ensuring that STARS encourages and recognizes innovation in sustainability. Towards this end, STARS 1.0 will include a process for rewarding innovative sustainability practices not covered by existing credits. The exact form or point value of **innovation credits** has not been determined yet.

Eligibility
STARS is intended for institutions that are in compliance with local, state, and federal regulations that pertain to sustainability, including environmental, health, and safety regulations. AASHE plans to reserve the right to withdraw an institution’s rating if it is found to be in egregious non-compliance.

Verification and Certification
STARS users may choose to seek third party certification or verification, but it is not required. Institutions that choose to pursue certification may be rewarded with additional points or other special recognition under STARS.

STARS incorporates several strategies to ensure that the information institutions submit is accurate in absence of third-party certification. The required documentation for each credit includes a statement from a responsible party indicating that the information submitted is accurate to the best of his or her knowledge. Similarly, a letter from the institution’s president or chancellor stating that all of the information submitted through STARS is true to the best of his or her knowledge must accompany each submission. Additionally, most information that institutions submit in order to achieve a rating will be made publicly available through the AASHE website.

If there is sufficient interest, AASHE may create system for peer review of STARS submissions.
Applicability and Ratings

Some credits do not apply to all institutions. For example, the Dining Services credits do not apply to institutions that do not have in-house or contracted catering services or residential dining halls. Institutions will earn a score based on the percentage of applicable points they earn. In other words, credits that do not apply to an institution will not be counted against that institution’s overall score.

Only positive ratings will be available through STARS. Participating in STARS, which includes gathering extensive data and sharing it publicly, represents a significant commitment to sustainability and will be applauded.

AASHE has not determined the number of points required to earn different rating levels or what the different ratings will be called. Since earning any rating under STARS is a positive achievement that should be celebrated, AASHE does not plan to use different numbers of stars to signify different rating levels. AASHE welcomes suggestions on how to signify different levels of achievement.

It is possible that the thresholds required to earn certain ratings will be different for different types of institutions. Feedback and information gathered during the pilot period will inform this decision.

Timeframe for Ratings

AASHE envisions that a STARS rating will be good for three years. Institutions will be able to update information in their profile and submit additional information as often as they wish, and they will be able to apply for a new rating once per year.

Once an institution has earned a credit, it must make a good faith effort to maintain the status that made them eligible for the credit for the duration of the STARS rating. While year-to-year fluctuations in some credits are to be expected, an institution would not qualify for a credit if it dissolved the practice or policy upon earning the credit and then resumed the practice or policy when it was time to re-submit information. For example, if an institution offered incentives for faculty to integrate sustainability into their courses to achieve ER Credit 17: Incentives for Developing Sustainability Courses, dissolved the incentives upon earning the credit, and then re-created them when it was time to re-submit data, the institution would not earn the credit when data was resubmitted. The institution would become eligible for earning that credit again for its next submission.

Participation Fee

AASHE expects that institutions will be required to pay a fee in order to submit data to earn a STARS rating. The fee will help support the online reporting tool, STARS program staff, promotional collateral, and the general maintenance and further development of STARS. The exact cost has not been determined, but AASHE is committed to keeping the cost as low as possible in order to make participation accessible to all institutions.
STARS Reporting Guidelines

Letter from Leadership
Each time an institution submits its rating materials, the president or chancellor will submit a letter that establishes the credibility of the report and demonstrates institutional commitment. The letter must state that the information included in the submission is accurate to the best of the president or chancellor's knowledge. The letter may include a description of the institution's commitment to sustainability goals and how these goals relate to the institution's mission, as well as the targets for future STARS performance.

Institutional Boundaries
When gathering data, each institution is expected to include its entire main campus. Institutions may choose to include any other land holdings, facilities, and satellite campuses, as long as the selected boundary is the same for each credit. All institutions will specify the boundary for included data in the introductory institutional information section.

If an institution finds it necessary to exclude a particular unit from its submittal, the reason for excluding it must be provided in the report accompanying the submitted data.

How STARS Calculates ‘Per Capita’
Several STARS credits are based on a per capita figure. STARS determines campus population according to the following formula:

\[
\text{Campus Population} = 1 \times \text{Number of On-campus Residents} + 0.75 \times \text{Number of Full-time Students, Faculty, and Staff Members} + 0.5 \times \text{Number of Part-time Students, Faculty, and Staff Members} + 0.2 \times \text{Number of Non-credit Students}
\]

STARS takes this approach in order to avoid unfairly penalizing institutions with a large percentage of students who live on campus. The adjustment accounts for the fact that on-campus residents use more of the institution’s water and energy and will generate more waste, for example, than students who live off campus. Likewise, part-time students and employees will likely have a smaller impact than their full-time counterparts.

How STARS Calculates Trends
Some STARS credits are based on three-year trends, with points awarded for trends in the direction of sustainability. For purposes of STARS, a downward trend occurs when the least-squares regression line has a negative slope and an upward trend occurs when the least-squares regression line has a positive slope. Least-squares regression can be calculated using Microsoft Excel and many other statistics software programs.

For trend credits, institutions will submit values for each of the previous three years. The online submittal form will then calculate whether or not the data constitutes a desirable trend.
Timeframe for Reporting

Some STARS credits can be earned immediately upon taking an action. For example, as soon as an institution hires a sustainability officer, it is eligible for AF Credit 10: Sustainability Officer.

Other STARS credits use data from the past year or a baseline year to determine if an institution earns a credit. For example, OP Credit 11: Greenhouse Gas Emissions Reduction is based on reducing greenhouse gas emissions by a certain percentage from a baseline year. For credits that use data from the previous year, institutions should use the most recent 12-month consecutive period for which data are readily available. This flexibility is in recognition of the fact that some data used for STARS will be organized by fiscal year and other data will be organized by academic year.
Introductory Institutional Information

Introductory institutional information will be included in the STARS submission. This background information can help foster collaboration and enable benchmarking with similar institutions. In addition, the information provided in this section will help AASHE and campus sustainability practitioners better understand how certain institutional characteristics, such as age of campus buildings and sustainability budget, influence sustainability performance.

Furthermore, some of the background data supplied in this section will be used in the calculations for certain credits. For example, the student population figures provided in this section will be applied to AF Credit 15: Student Hours Contributed in Community Service, which is based on a calculation of total student community service hours divided by student population.

### Basic Information

<table>
<thead>
<tr>
<th>Institution Name</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>Carnegie Classification</td>
<td></td>
</tr>
<tr>
<td>Control (public, private not-for-profit, or private for-profit)</td>
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</tr>
<tr>
<td>Community Type (urban, suburban, or rural)</td>
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</tr>
<tr>
<td>Athletic Conference, if applicable</td>
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</tr>
<tr>
<td>Other Affiliations</td>
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</tr>
<tr>
<td>Sustainability Website</td>
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</tr>
<tr>
<td>Contact Information for the Primary Contact Person</td>
<td></td>
</tr>
<tr>
<td>Description of property boundaries covered by the STARS submission. If any institution-owned, leased, or operated buildings are omitted, briefly explain why.</td>
<td></td>
</tr>
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</table>

### Common Timeframes for Reported Data

<table>
<thead>
<tr>
<th>Start Date</th>
<th>End Date</th>
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</thead>
<tbody>
<tr>
<td>12-month Academic Year</td>
<td></td>
</tr>
<tr>
<td>12-month Fiscal Year</td>
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</table>
### Population Information

<table>
<thead>
<tr>
<th>Institution Population</th>
<th>This Reporting Period</th>
<th>One Year Prior</th>
<th>Two Years Prior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Enrollment</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Residential Students</td>
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<td></td>
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</tr>
<tr>
<td>Full-time Non-resident Students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-time Non-resident Students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-credit Students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time Faculty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-time Faculty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full-time Staff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-time Staff</td>
<td></td>
<td></td>
<td></td>
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</table>

### Facilities Infrastructure

<table>
<thead>
<tr>
<th>Year Institution was Founded</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Buildings that Have Received Historical Designation</td>
<td></td>
</tr>
<tr>
<td>Percentage of Buildings Constructed before 1900</td>
<td></td>
</tr>
<tr>
<td>Percentage of Buildings Constructed between 1901 and 1950</td>
<td></td>
</tr>
<tr>
<td>Percentage of Buildings Constructed between 1951 and 2000</td>
<td></td>
</tr>
<tr>
<td>Percentage of Buildings Constructed after 2000</td>
<td></td>
</tr>
</tbody>
</table>

Please describe any circumstances related to the age of campus buildings that may influence STARS performance, if applicable.

### Campus Space

<table>
<thead>
<tr>
<th>This Reporting Period</th>
<th>One Year Prior</th>
<th>Two Years Prior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area Included in STARS Boundary (acres)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area of Campus Lawns, Outdoor Athletic Fields, and Gardens (acres)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area of Undeveloped Land and/or Natural Areas (acres)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area of Campus that is Paved or Built (acres)</td>
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<td></td>
</tr>
<tr>
<td>Total Campus Conditioned Building Area (gross square feet)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching and Research Lab Space (gross square feet)</td>
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<td></td>
</tr>
<tr>
<td>Medical/Clinical Space (gross square feet)</td>
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<td></td>
</tr>
</tbody>
</table>
## Financial Information

<table>
<thead>
<tr>
<th></th>
<th>US Dollars</th>
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<tbody>
<tr>
<td>Operating Budget</td>
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<tr>
<td>Endowment</td>
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</tr>
<tr>
<td>Total Research Expenditures</td>
<td></td>
</tr>
<tr>
<td>Administration-allocated Funding for Sustainability Officer, Office, or Committee, if applicable</td>
<td></td>
</tr>
<tr>
<td>Discretionary Funding for Sustainability Officer, Office, or Committee, if applicable</td>
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<tr>
<td>Student Fees Allocated to Sustainability Officer, Office, or Committee, if applicable</td>
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<tr>
<td>Sustainability Revolving Loan Fund Value, if applicable</td>
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## STARS Summary Scorecard

### Category 1: Education and Research (ER)

<table>
<thead>
<tr>
<th>Credit Number</th>
<th>Credit Title</th>
<th>Possible Points</th>
<th>Y</th>
<th>?</th>
<th>N</th>
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<tbody>
<tr>
<td>ER Credit 1</td>
<td>Student Sustainability Outreach Program</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>ER Credit 2</td>
<td>Sustainability-Related Competition</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>ER Credit 3</td>
<td>Sustainability in New Student Orientation</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Co-Curricular Education</strong></td>
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<td></td>
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<tr>
<td>ER Credit 4</td>
<td>Sustainability Course Identification</td>
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<td></td>
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<tr>
<td>ER Credit 5</td>
<td>Sustainability-Focused Academic Courses</td>
<td>6</td>
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<tr>
<td>ER Credit 6</td>
<td>Sustainability-Related Academic Courses</td>
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<tr>
<td>ER Credit 7</td>
<td>Sustainability Courses by Academic Department</td>
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<tr>
<td>ER Credit 8</td>
<td>Academic Sustainability Courses by Student Credit Hours</td>
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<td>ER Credit 9</td>
<td>Sustainability-Focused Undergraduate Academic Program</td>
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<td>ER Credit 10</td>
<td>Sustainability Graduation Requirement</td>
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<td>ER Credit 11</td>
<td>Sustainability-Focused Graduate Academic Program*</td>
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<td>ER Credit 12</td>
<td>Sustainability Study Abroad Program*</td>
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<td>ER Credit 13</td>
<td>Non-Credit Sustainability Courses*</td>
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<td>ER Credit 14</td>
<td>Sustainability-Focused Non-Academic Certificate Program*</td>
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<td>ER Credit 15</td>
<td>Curricular Engagement</td>
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<td>ER Credit 16</td>
<td>Sustainability Literacy Assessment</td>
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<td></td>
<td><strong>Faculty and Staff Development and Training</strong></td>
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<td>ER Credit 17</td>
<td>Incentives for Developing Sustainability Courses</td>
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<td>ER Credit 18</td>
<td>Sustainability in New Employee Orientation</td>
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<td>ER Credit 19</td>
<td>Employee Sustainability Outreach Program</td>
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<td><strong>Research</strong></td>
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<td>ER Credit 20</td>
<td>Research Inventory*</td>
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<td>ER Credit 21</td>
<td>Research Incentives*</td>
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<td>ER Credit 22</td>
<td>Faculty Involved in Sustainability Research*</td>
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<td>ER Credit 23</td>
<td>Departments Involved in Sustainability Research*</td>
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<td>ER Credit 24</td>
<td>Internal Research Expenditures*</td>
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<td>ER Credit 25</td>
<td>External Research Expenditures*</td>
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<td>ER Credit 26</td>
<td>Interdisciplinary Research*</td>
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<td><strong>Total Possible</strong></td>
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* Credit includes an applicability standard
## Category 2: Operations (OP)

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<thead>
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<th>Credit Number</th>
<th>Credit Title</th>
<th>Possible Points</th>
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<th>?</th>
<th>N</th>
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<tr>
<td>Prerequisite 1</td>
<td>Recycling Program</td>
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<tr>
<td><strong>Buildings</strong></td>
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<tr>
<td>OP Credit 1</td>
<td>New Construction, Renovations, and Commercial Interiors*</td>
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<tr>
<td>OP Credit 2</td>
<td>Building Operations and Maintenance</td>
<td>5</td>
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<tr>
<td>OP Credit 3</td>
<td>Potable Non-Irrigation Water Consumption Reduction</td>
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<td></td>
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<tr>
<td>OP Credit 4</td>
<td>Green Cleaning Service</td>
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<td></td>
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<tr>
<td><strong>Dining Services</strong></td>
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<tr>
<td>OP Credit 5</td>
<td>Local Food*</td>
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<tr>
<td>OP Credit 6</td>
<td>Food Alliance and Organic Certified Food*</td>
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<td>OP Credit 7</td>
<td>Fair Trade Coffee*</td>
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<td>OP Credit 15</td>
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<td>Purchasing Green Cleaning Products</td>
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<td>Fleet Greenhouse Gas Emissions</td>
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<td>OP Credit 27</td>
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*Credit includes an applicability standard

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<td>AF Credit 2</td>
<td>Committee on Investor Responsibility*</td>
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<td>AF Credit 5</td>
<td>Shareholder Engagement*</td>
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<td><strong>Planning</strong></td>
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<td>AF Credit 6</td>
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<td>AF Credit 7</td>
<td>Master Plan</td>
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<td>AF Credit 8</td>
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<td><strong>Sustainability Infrastructure</strong></td>
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<td>AF Credit 10</td>
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<td>Sustainability Recognition Program</td>
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<td>Inter-Campus Collaboration on Sustainability</td>
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<td><strong>Community Relations and Partnerships</strong></td>
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<td>AF Credit 13</td>
<td>Community Service Infrastructure</td>
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<td>Student Participation in Community Service</td>
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<td>Student Hours Contributed in Community Service</td>
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<td>AF Credit 16</td>
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<td>AF Credit 17</td>
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<td>AF Credit 18</td>
<td>Public Policy Engagement</td>
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<td><strong>Diversity, Access, and Affordability</strong></td>
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<td>AF Credit 19</td>
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<td>Diversity Plan</td>
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<td>AF Credit 23</td>
<td>Recruiting for Student Diversity</td>
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<td>AF Credit 24</td>
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<td>AF Credit 26</td>
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### Human Resources

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<tr>
<td>27</td>
<td>Sustainable Compensation for Faculty and Staff</td>
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<tr>
<td>28</td>
<td>Faculty and Staff Benefits*</td>
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<td>29</td>
<td>Graduate Student Employee Benefits*</td>
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<tr>
<td>30</td>
<td>Parental Leave*</td>
<td>1</td>
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<tr>
<td>31</td>
<td>Domestic Partner Benefits*</td>
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<tr>
<td>32</td>
<td>Employee Satisfaction Survey</td>
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### Trademark Licensing

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<th>AF Credit</th>
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<tr>
<td>33</td>
<td>Independent Monitoring of Logo Apparel*</td>
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<tr>
<td>34</td>
<td>Designated Suppliers Program*</td>
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*Credit includes an applicability standard

### Summary Table

<table>
<thead>
<tr>
<th>Category</th>
<th>Possible Points</th>
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<tr>
<td>Education and Research</td>
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<tr>
<td>Operations</td>
<td>61</td>
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<tr>
<td>Administration and Finance</td>
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**Total Possible** 177


Education and Research Credits

Discussion
The Education and Research category has changed significantly since STARS 0.4. In the previous draft, this category was worth significantly fewer points than the other categories. Several reviewers said that educating students and conducting research are the primary functions of higher education and that schools can make the largest contributions to sustainability through these activities. These reviewers suggested that the Education and Research category should be worth as many, if not more, points than the other categories. To address this issue, AASHE added several new credits and points to this category. While the point distribution is not final, AASHE expects to maintain a roughly equal balance of points between the three major categories (Education and Research, Operations, and Administration and Finance) included in STARS.

For many STARS credits, institutions can earn multiple points. In general, institutions are recognized with higher levels of points for achieving progressively higher thresholds. The highest point level is intended to recognize a truly sustainable institution's performance on that indicator. For some of the credits in the Curriculum and Research sections, however, the achievement thresholds were selected somewhat arbitrarily since it is not clear what level of performance would be necessary to be considered truly sustainable. For instance, it’s unclear what percentage of courses would be sustainability-focused at a truly sustainable institution. AASHE expects that data gathered during the pilot period will help inform these issues and welcomes additional feedback and guidance on establishing thresholds.
Co-Curricular Education

This section seeks to recognize institutions that provide their students with sustainability learning experiences outside the formal curriculum. Engaging in sustainability issues through co-curricular activities allows students to deepen and apply their understandings of sustainability principles. Institution-sponsored co-curricular sustainability offerings help integrate sustainability into the campus culture and set a positive tone for the institution.

Discussion

In the previous version of STARS, several of the credits in this section were part of a section called ‘Informal Education,’ which reviewers suggested renaming Co-Curricular Education.

The Informal Education section in STARS 0.4 included a credit for having a sustainability-focused student group. In general, reviewers felt that the presence of a student group is not necessarily indicative of significant student engagement in sustainability issues, so it is now a Tier Two credit.

ER Credit 1: Student Sustainability Outreach Program

Criteria

Institution coordinates or oversees a peer-to-peer sustainability outreach and education program for students. The program conducts at least one event per semester or term.

Documentation

Complete the online STARS submittal form for this credit. The form requests:

- Program name
- Date program started
- A brief description of the program
- The name, title, and department of the staff member who supervises the program
- A copy of outreach materials the program produces
- A copy of an application form, training manual, and other materials used to select and train students conducting the outreach program
- The URL for the peer-to-peer outreach program's website
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance

This credit recognizes institutions that have programs that engage students to serve as educators in peer-to-peer sustainability outreach programs. Serving as an educator provides a valuable learning experience for students and can help deepen their understanding of sustainability. Likewise, having students serve as teachers helps disseminate sustainability concepts and a sustainability ethic throughout the campus community.

Discussion

STARS 0.4 included a similar credit that recognized schools with Eco-Reps or similar programs, which focus on residence halls. Some reviewers said the credit was too prescriptive. This version allows for broader programs to count, but stipulates that the institution must be contributing formally to the program.
**ER Credit 2: Sustainability-Related Competition**

**Criteria**
Institution coordinates or oversees a sustainability-related competition at least annually. The competition may take place among the entire institution, between different residence halls, academic departments, classes, or other divisions appropriate to the institution.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- Name of the competition
- Year competition started
- A brief description of the competition’s history or appropriate URL
- A brief description of the competition’s rules or appropriate URL
- A brief description of how the competition has advanced sustainability and results from the competition
- URL for the competition’s website
- Copies of outreach materials related to the competition
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that sponsor or coordinate sustainability competitions. Competitions can be important tools in engaging the student body in sustainability issues and can help raise student awareness about sustainability. In addition, competitions encourage students to adopt sustainable practices or try environmentally and socially preferable lifestyle choices.

**Discussion**
This credit was added to STARS 0.5 based on feedback suggesting that competitions provide valuable ways to engage students in sustainability learning and activities.

**ER Credit 3: Sustainability in New Student Orientation**

**Criteria**
Institution includes sustainability prominently in new student orientation activities and/or materials distributed to new students.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of how sustainability is incorporated into new student orientation
- A copy of sustainability-related outreach materials distributed to new students
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that include sustainability in orientation activities and outreach materials for new students. Orientation sets the tone for the campus experience. Including sustainability in student orientation demonstrates that sustainability is an institutional goal and helps encourage students to adopt sustainable habits in their new school environments.
Discussion
This credit was previously a Tier Two credit. It was changed to Tier One based on suggestions that orientation is a particularly beneficial time to expose students to sustainability concepts.

Co-Curricular Education: Tier Two Credits
1. Institution has an outdoor program that follows Leave No Trace principles.
2. Institution has student groups focused on or dedicated to sustainability.
3. Institution has sustainability-themed housing (residential hall, floor, or theme house).
4. Institution has an on-campus, organic garden for students.
5. Institution has a model dorm room that demonstrates sustainable living principles.
6. Institution produces outreach materials about on-campus sustainability efforts, such as information kiosks and sustainability maps.
7. Institution has a student-run café that serves environmentally or socially preferable foods.
8. Institution has a student publication focused on sustainability.
9. Institution has space dedicated to sustainability in a student newspaper.
10. Institution holds major events related to sustainability, such as conferences or symposia.
Curriculum
This section seeks to recognize institutions that have formal education programs and courses that address sustainability. A primary function of colleges and universities is to educate students. By training and educating future leaders, scholars, workers, and professionals, higher education institutions are positioned uniquely to prepare students to understand and address sustainability challenges. Institutions that hold courses relevant to sustainability issues help equip their students to lead society to a sustainable future.

Discussion
This section has changed significantly since STAR 0.4. Several new credits have been added to this section and many preexisting credits have changed form or scope since the previous draft.

STARS 0.4 contained a prerequisite for formally adopting a definition of sustainability. Many reviewers felt that getting an institution to develop and formally adopt a definition of sustainability would be challenging and time-consuming. In addition, several comments suggested that AASHE should provide the definition in order to ensure that the data gathered using that definition would be comparable between institutions. Rough definitions for sustainability-related and focused courses are included in the credits below. AASHE understands that classifying courses according to these standards may be a challenging process and welcomes suggestions on how to strengthen the definitions.

The previous draft version of STARS only included credits based on sustainability-focused courses. Several reviewers felt that STARS should distinguish between courses that focus on sustainability and those that include sustainability but not as a core focus, and that the system should recognize both. Under this classification system, a sustainable agriculture course that addresses the economic, social, and environmental dimensions of food production using sustainability as a lens would be recognized as a sustainability-focused course. Sustainability-related courses would include a creative writing course that includes sustainability as a module, an engineering course that focuses on renewable energy, and a sociology course that concentrates on the sustainability principle of intergenerational equity.

STARS 0.4 included a credit for a three-year upward trend in student exposure to sustainability. AASHE received feedback suggesting that such trends would be difficult to measure and that using a trend unfairly disadvantages schools that have already achieved significant levels of student exposure to sustainability. Several new credits are included in this document that address student exposure to sustainability, including credits on student enrollment in sustainability-related and focused courses, as well as credits in the Co-Curricular Education section.
ER Credit 4: Sustainability Course Identification

Criteria
Institution has identified all of its sustainability-focused and sustainability-related courses. The identification system can take any form, including official recognition in the course catalog or a list compiled and published by the sustainability committee or officer, as long as the information is publicly available to the campus community.

For this credit, sustainability-focused courses concentrate on sustainability, including its social, economic, and environmental dimensions, or examine an issue or topic using sustainability as a lens. Sustainability-related courses include sustainability as a course component or module, or concentrate on a key sustainability principle or issue.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A copy of a document and/or the URL where sustainability courses are listed
- A brief description of how the list of sustainability courses is shared with the campus community
- A brief description of the methodology used to identify sustainability courses
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have identified their sustainability course and program offerings and share that information with their campus communities. Conducting an inventory of academic offerings provides an important foundation for advancing sustainability curriculum. It offers a sense of where the institution is now and can help identify strengths and opportunities for growth. In addition, a list helps current and prospective students find and understand sustainability course offerings, which can help them organize their academic studies.

Discussion
STARS 0.4 included a similar credit, but the previous version only recognized institutions that labeled sustainability courses in the course catalog. Some reviewers suggested making the credit more flexible to recognize schools that have created independent lists of sustainability courses; this version of the credit incorporates that flexibility.

Some feedback that AASHE received suggested that course identification was not impressive or meaningful enough to constitute a credit. Other reviewers, in contrast, felt that identifying courses is a significant undertaking for many schools and is necessary to measure performance for several of the other credits in this section. Since STARS strives to include points that recognize first steps toward sustainability and conducting an inventory of sustainability course offerings is an important first step in strengthening sustainability in the curriculum, the credit is still included in this version of STARS. AASHE welcomes suggestions on how to strengthen the credit for future versions.
ER Credit 5: Sustainability-Focused Academic Courses

Criteria
Institution conducts a specified percentage of sustainability-focused academic courses, as measured by courses held during the past academic year.
- 1 pt: Between 0 and 0.1 percent of the institution’s courses are sustainability-focused.
- 2 pts: 0.1 to one percent of the institution’s courses are sustainability-focused.
- 3 pts: Between 1 and 2 percent of the institution’s courses are sustainability-focused.
- 4 pts: 2 to 3 percent of the institution’s courses are sustainability-focused.
- 5 pts: Between 3 and 4 percent of the institution’s courses are sustainability-focused.
- 6 pts: 4 percent or more of the institution’s courses are sustainability-focused.

For this credit, sustainability-focused courses concentrate on sustainability, including its social, economic, and environmental dimensions, or examine an issue or topic using sustainability as a lens.

Courses that are cross-listed in multiple departments do not count as separate courses. In determining percentages, institutions should count each time a course was held. For example, a course that is held twice (including two sections) in the fall term and once in the spring term shall be counted as three courses.

This credit does not include continuing education and non-credit courses, which are covered by ER Credit 13: Non-Credit Sustainability Courses.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A list of all sustainability-focused, for-credit academic courses and the number of times each course was held during the previous academic year
- Total number of sustainability-focused courses and total number of for-credit academic courses held during the previous academic year
- URL where course descriptions and/or catalog are posted
- Course syllabi (optional)
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that hold academic courses focused on sustainability. Sustainability-focused courses provide valuable grounding in the concepts and principles of sustainability. These courses educate students about how different dimensions of sustainability relate to and support each other. In addition, these course help equip students with the skills to weave together disparate components of sustainability.

Discussion
The previous version of STARS included a credit that was based on a three-year upward trend in sustainability-focused course offerings. Since trend-based credits can disadvantage schools that have already integrated sustainability into their curricula, the credit was changed to be based on having a specified percentage of total courses be sustainability-focused.

There has been some discussion about how to count courses for this credit and for ER Credit 6: Sustainability-Related Academic Courses. Some reviewers felt it would be unduly burdensome to gather data on how many times a course was conducted; the institution would have to exclude courses that were canceled and determine how many sections were held for each course. Other reviewers felt that
counting the number of times courses were held, and not just listed in the course catalog, provides a more accurate picture of the level of sustainability courses an institution makes available to students.

Likewise, since some courses are not held every year, there has been discussion about whether to include courses from the previous academic year or the previous two or three academic years. While using a longer time frame would provide a more accurate picture of course offerings, it could pose an unreasonable data collection challenge.

The current version of this credit and ER Credit 6 are based on the number of times the course was held during the previous year. AASHE welcomes feedback on whether and how this should be changed.

**ER Credit 6: Sustainability-Related Academic Courses**

**Criteria**
Institution conducts a specified percentage of sustainability-related academic courses, as measured by courses held during the previous academic year.

- **1 pts:** Between 1 and 5 percent of the institution's courses are sustainability-related.
- **2 pts:** 5 to 10 percent of the institution's courses are sustainability-related.
- **3 pts:** Between 10 and 15 percent of the institution's courses are sustainability-related.
- **4 pts:** 15 to 20 percent of the institution's courses are sustainability-related.
- **5 pts:** Between 20 and 25 percent of the institution's courses are sustainability-related.
- **6 pts:** 25 percent or more of the institution's courses are sustainability-related.

For this credit, sustainability-related courses include sustainability as a course component or module, or concentrate on a key sustainability principle or issue.

Courses that are cross-listed in multiple departments do not count as separate courses. In determining percentages, institutions shall count each time a course is offered. For example, a course that is offered twice (including two sections) in the fall term and once in the spring term shall be counted as three courses.

This credit does not include continuing education and non-credit courses, which are covered by ER Credit 13: Non-Credit Sustainability Courses.

**Documenta**
Complete the online STARS submittal form for this credit. The form requests:

- A list of all sustainability-related, for-credit academic courses and the number of times each course was held during the previous academic year
- The total number of sustainability-related, for-credit academic courses, and the total number of for-credit academic courses held during the previous academic year
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that offer courses related to sustainability. Sustainability-related courses help build knowledge about a component of sustainability or briefly introduce students to sustainability concepts. They may complement sustainability-focused courses by producing graduates with in-depth knowledge of an aspect of sustainability and helping provide focus to students’ sustainability studies, or they may broaden understanding of sustainability from within different disciplines.
Discussion
This credit was added to STARS since the previous version. Please see the discussion under the Curriculum section and ER Credit 5 for more information about data collection questions for this credit.

ER Credit 7: Sustainability Courses by Academic Department

Criteria
A specified percentage of the academic departments or programs that offer courses within an institution offer at least one course related to or focused on sustainability.

- 1 pt: More than 5 and up to 10 percent of the institution's academic departments offer a sustainability-related or focused course.
- 2 pts: 10 to 30 percent of the institution's academic departments offer a sustainability-related or focused course.
- 3 pts: More than 30 percent of the institution's academic departments offer a sustainability-related or focused course.

For this credit, sustainability-focused courses concentrate on sustainability, including its social, economic, and environmental dimensions, or examine an issue or topic using sustainability as a lens. Sustainability-related courses include sustainability as a course component or module, or concentrate on a key sustainability principle or issue.

Sustainability-related or focused courses that are cross-listed in multiple departments count for each department though which the course is listed. Courses that are held at least once every three years are sufficient for this credit.

This credit does not include continuing education and non-credit courses, which are covered by ER Credit 13: Non-Credit Sustainability Courses.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A list of all academic departments that offer at least one course related to or focused on sustainability
- A list of sustainability course offerings by department
- The total number of academic departments that offer courses and the number of departments that offer a sustainability-related or focused course
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions whose academic departments offer sustainability courses. Most, if not all, academic departments have a critical role to play in building a sustainable society. Having sustainability courses offered by numerous departments helps ensure that the institution's approach to sustainability education is broad and includes many topics. This will help students to have a broad understanding of the field. Likewise, offering sustainability courses in numerous departments can help increase student exposure to sustainability topics and themes.
Discussion
This credit was added to STARS as a way to gauge how broadly sustainability is included in the institution's curriculum.

ER Credit 8: Academic Sustainability Courses by Student Credit Hours

Criteria
A specified percentage of student credit hours is earned through sustainability-related or focused courses.

- 1 pt: More than 0.1 and up to 1 percent of student credit hours are earned in sustainability-related or focused courses.
- 2 pts: 1 to 2 percent of student credit hours are earned in sustainability-related or focused courses.
- 3 pts: Between 2 and 3 percent of student credit hours are earned in sustainability-related or focused courses.
- 4 pts: 3 to 4 percent of student credit hours are earned in sustainability-related or focused courses.
- 5 pts: Between 4 and 5 percent of student credit hours are earned in sustainability-related or focused courses.
- 6 pts: 5 or more percent of student credit hours are earned in sustainability-related or focused courses.

For this credit, sustainability-focused courses concentrate on sustainability, including its social, economic, and environmental dimensions, or examine an issue or topic using sustainability as a lens. Sustainability-related courses include sustainability as a course component or module, or concentrate on a key sustainability principle or issue.

Student credit hours are calculated by multiplying the number of students that complete each course in each class by the number of credit hours the course is worth.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The total number of student credit hours during the previous academic year
- The total number of student credit hours earned in sustainability related and focused courses during the previous academic year
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions where students are engaged in sustainability coursework. Looking at sustainability courses based on the number of students taking such courses measures student exposure to sustainability. By providing more sustainability education, institutions are preparing their students to lead the transition to a sustainable future.
Discussion
The previous version of STARS included a credit that was based on a three-year upward trend in the percentage of students enrolled in one or more sustainability-focused course. In addition to the concerns associated with trend-based indicators, AASHE received feedback that determining which students are enrolled in sustainability courses would be burdensome or, in some cases, impossible. At the same time, several reviewers felt that it is important to recognize schools where students are taking sustainability courses. This credit strives to measure student exposure to sustainability through academic courses.

ER Credit 9: Sustainability-Focused Undergraduate Academic Program

Criteria
Institution offers a sustainability-focused undergraduate academic program.
- 1 pt: Institution offers a sustainability-focused major, academic concentration, academic certificate, or minor program for its undergraduate students.
- 2 pts: At least one percent of undergraduate students graduate with a sustainability-focused major, academic concentration, academic certificate, or minor.

For this credit, sustainability-focused academic programs concentrate on sustainability, including its social, economic, and environmental dimensions.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of each sustainability-focused academic program for undergraduate students, including the program’s name, degree or accreditation awarded, and the URL for the program’s website.
- The number of graduates from each sustainability-focused academic program from the previous academic year.
- The total number of graduates from the previous academic year.
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party.

Guidance
This credit recognizes institutions that have formal academic programs focused on sustainability. Developing such programs signals an institution’s commitment to sustainability. Formal academic programs focused on sustainability provide a path for students to study sustainability topics in depth, thus better preparing them to address sustainability challenges. Formal academic programs also provide a home for sustainability scholars within the institution.

Discussion
The previous version of this credit was based on having “sustainable” or “sustainability” in the program name. Several reviewers suggested that the name is not as important as the program’s content. The revised credit reflects that feedback. In addition, the previous version of this credit didn’t distinguish between graduate and undergraduate programs, which are included as separated credits in this document.
**ER Credit 10: Sustainability Graduation Requirement**

**Criteria**
A specified percentage of the institution's departments require undergraduate students to take a sustainability-focused or sustainability-related course as a graduation prerequisite.

- **1 pt:** More than 0 and less than 25 percent of the institution's departments have a sustainability graduation requirement.
- **2 pts:** 25 to 50 percent of the institution's departments have a sustainability graduation requirement.
- **3 pts:** Between 50 and 75 percent of the institution's departments have a sustainability graduation requirement.
- **4 pts:** 75 to less than 100 percent of the institution's departments have a sustainability graduation requirement.
- **5 pts:** 100 percent of the institution's departments have a sustainability graduation requirement, or there is an institution-wide sustainability graduation requirement that applies to all undergraduate students. The institution-wide requirement may take the form of the institution requiring students to take a common sustainability-related or focused course or allowing students to select from a menu of sustainability-related or focused courses.

For this credit, sustainability-focused courses concentrate on sustainability, including its social, economic, and environmental dimensions, or examine an issue or topic using sustainability as a lens. Sustainability-related courses include sustainability as a course component or module, or concentrate on a key sustainability principle or issue.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A list of all academic departments and departments that have a sustainability graduation requirement
- A brief description of the sustainability graduation requirements for each department above, including a list of courses that fulfill the requirement
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that have adopted a sustainability graduation requirement. Adopting a graduation requirement ensures that students are exposed to formal sustainability training and that they will graduate with a basic knowledge about sustainability.

**Discussion**
STARS 0.4 included a one-point credit for having a sustainability graduation requirement. Several reviewers suggested making the credit worth more than one point. Having the credit based on the percentage of departments that have a sustainability graduation requirement allows for additional levels of recognition for schools with graduation requirements that only apply to certain schools, majors, or programs.

There were differences of opinion about recognizing sustainability graduation requirements. While some reviewers supported the idea as the best way to guarantee student exposure to sustainability, others raised concerns that graduation requirements are often unpopular among students and can arouse backlash and negative associations for sustainability courses. AASHE is interested in continuing this conversation and welcomes suggestions on how to best address this issue.
ER Credit 11: Sustainability-Focused Graduate Academic Program

**Criteria**
Institution offers a sustainability-focused academic program for graduate students.

- 1 pt: Institution offers a sustainability-focused major, academic concentration, academic certificate, or minor program for graduate students.
- 2 pts: At least one percent of graduate students graduate with a sustainability-focused major, academic concentration, academic certificate, or minor.

For this credit, sustainability-focused academic programs concentrate on sustainability, including its social, economic, and environmental dimensions.

*This credit does not apply to institutions that offer fewer than 25 different master's degrees.*

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of each sustainability-focused academic program for graduate students, including the program's name, degree or accreditation awarded, and the URL for the program's website
- The number of graduates from each sustainability-focused graduate-level academic program from the previous academic year
- The total number of graduate-level graduates from the previous academic year.
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that have formal, graduate-level academic programs focused on sustainability. Developing such programs signals an institution's commitment to sustainability. Formal academic programs focused on sustainability provide a path for students to study sustainability topics in depth, thus better preparing them to address sustainability challenges. Formal academic programs also provide a home for sustainability scholars within the institution.

**Discussion**
STARS 0.4 included a credit for having a sustainability academic program or department that did not distinguish between graduate and undergraduate programs. Some reviewers suggested they be treated separately and so this version of STARS includes two separate credits that recognize undergraduate and graduate programs separately.

ER Credit 12: Sustainability Study Abroad Program

**Criteria**
Institution offers a sustainability-related or focused study abroad program. In other words, the study abroad program meets one or more of the following criteria: it concentrates on sustainability, including its social, economic, and environmental dimensions; it examines an issue or topic using sustainability as a lens; it includes sustainability as a component or module; it concentrates on a key sustainability principle; or, it focuses on addressing a sustainability challenge.

Study abroad programs offered by outside entities do not count for this credit.

*This credit does not apply to institutions that do not offer study abroad programs.*
**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of the study abroad program, including destination or location, dates of the most recent time the program was held, and the number of students participating in the program
- A brief description of how the study abroad program content addresses sustainability
- A brief description of the policies, programs, and other practices in place to mitigate the negative social and environmental impacts of study abroad programs, including air travel
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that offer sustainability-related or focused study abroad programs. Study abroad programs give students the opportunity to witness and learn about the sustainability challenges and solutions occurring elsewhere. Study abroad programs provide a memorable way for students to deepen and expand their knowledge of sustainability.

**Discussion**
This credit was added to STARS based on a suggestion from a reviewer.

**ER Credit 13: Non-Credit Sustainability Courses**

**Criteria**
Institution conducts a specified percentage of non-credit courses that are sustainability-related or focused.
- 1 pt: Any portion of the institution's non-credit courses are sustainability-related or focused.
- 2 pts: 1 to 5 percent of the institution's non-credit courses are sustainability-related or focused.
- 3 pts: More than 5 percent of the institution's non-credit courses are sustainability-related or focused.

For this credit, sustainability-focused courses concentrate on sustainability, including its social, economic, and environmental dimensions, or examine an issue or topic using sustainability as a lens. Sustainability-related courses include sustainability as a course component or module, or concentrate on a key sustainability principle or issue.

Courses that are cross-listed in multiple departments do not count as separate courses. Non-credit courses refer to courses that cannot be taken for academic credit. It may include courses for which continuing education units are awarded, as long as academic credit cannot be earned.

This credit does not apply to institutions that don't offer courses for which academic credit cannot be earned.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The total number of non-credit courses the institution held during the previous academic year
- The number of non-credit sustainability-related or focused courses held during the previous academic year, and the title and catalogue description of each
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party
Guidance
This credit recognizes institutions that offer non-credit courses related to or focused on sustainability. Such courses train community members and many students in sustainability topics and help build knowledge about the subject. They can also provide the training people need to obtain and perform green jobs.

Discussion
This credit was added to STARS based on a suggestion from a reviewer.

ER Credit 14: Sustainability-Focused, Non-Academic Certificate Program

Criteria
Institution offers a non-academic, sustainability-focused certificate or training program.
- 1 pt: Institution offers a non-academic sustainability-focused certificate or training program.
- 2 pts: At least 1 percent of students participating in institution’s non-academic certificate or training programs participate in those that are sustainability-focused.

For this credit, sustainability-focused programs are programs that concentrate on sustainability, including its social, economic, and environmental dimensions.

This credit does not apply to institutions that do not offer non-academic certificate or training programs.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
☐ A brief description of all non-academic, sustainability-focused certificate or training programs
☐ The number of students participating in such programs
☐ The total number of students participating in non-academic certificate or training programs
☐ A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have non-academic training or certificate programs focused on sustainability. Certificate programs offer professional recognition for sustainability training, and are important tools in helping students obtain, perform, and advance their position in green jobs.

Discussion
This credit was added to STARS based on a suggestion from a reviewer.
**ER Credit 15: Curricular Engagement**

**Criteria**
Institution meets the criteria of the Carnegie Foundation for the Advancement of Teaching’s “Curricular Engagement” Elective Classification.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:

- A brief description of how the institution meets the criteria for the Curricular Engagement designation
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that meet the criteria for earning the Curricular Engagement Designation from the Carnegie Foundation for the Advancement of Teaching.

The Carnegie Foundation was chartered by an act of the United States Congress in 1906. Its charge is “to do and perform all things necessary to encourage, uphold, and dignify the profession of the teacher and the cause of higher education.”

In contrast to some of the designations the Carnegie Foundation assigns to schools based on their enrollment or other characteristics, Curricular Engagement is an optional designation for which institutions must apply. According to the Carnegie Foundation, the Curricular Engagement designation is given to “institutions where teaching, learning and scholarship engage faculty, students, and community in mutually beneficial and respectful collaboration. Their interactions address community-identified needs, deepen students’ civic and academic learning, enhance community well-being, and enrich the scholarship of the institution.”

To earn the Curricular Engagement designation, institutions must document how many service learning courses they offer and how widespread and integrated into the entire curriculum service learning is. In addition, they must document institutional commitments to and faculty scholarship in service learning.

More information about the Curricular Engagement classification is available at:
http://www.carnegiefoundation.org/classifications/index.asp?key=1213

**Discussion**
This credit was added to STARS based on a suggestion from a reviewer.
ER Credit 16: Sustainability Literacy Assessment

Criteria
- 1 pt: Institution conducts an assessment of its students’ sustainability literacy.
- 2 pts: Institution conducts an assessment of its incoming students’ sustainability literacy and then conducts an assessment of the same cohort’s sustainability literacy upon graduation.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A copy of the questions included in the sustainability literacy assessment
- A brief description of how the assessment was developed
- A brief description of how the assessment was administered
- Results from the assessment
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that are assessing the sustainability literacy of their students. Such an assessment helps institutions evaluate the success of their sustainability education initiatives.

Discussion
STARS 0.4 included a separate section devoted to sustainability literacy. Several reviewers felt that the Sustainability Literacy credits were too controversial, worth too many points, and offered limited information about student exposure to and understanding of sustainability. Since there are other metrics that gauge student sustainability learning and exposure, the section was deleted. In the interest of collecting data, gathering best practices, and recognizing institutions that are conducting sustainability literacy surveys, this credit is included. AASHE welcomes suggestions on how to best strengthen and supplement this credit.
Faculty and Staff Development and Training

This section seeks to recognize institutions that have incorporated sustainability into their faculty and staff training and development programs. Faculty and staff members' daily decisions impact an institution's sustainability performance. Equipping faculty and staff with the tools, knowledge, and motivation to adopt behavior changes that promote sustainability is an essential activity of a sustainable campus.

Discussion

This is a new section that was added to STARS for this version. Both the previous and current versions of STARS include several credits about student outreach and education. Several reviewers suggested that programs for outreach and education to faculty and staff should be recognized as well. The new section includes one credit that used to be in the Curriculum section (Incentives for Developing Sustainability Courses) and two new credits (Sustainability in New Employee Orientation and Employee Sustainability Outreach Program).

ER Credit 17: Incentives for Developing Sustainability Courses

Criteria

Institution offers incentives for faculty to develop sustainability-related or focused courses and/or incorporate sustainability into their courses or departments. Incentives may include release time, curriculum workshops, and funding. This credit applies to incentives for academic, non-credit, and/or continuing education courses.

Documentation

Complete the online STARS submittal form for this credit. The form requests:

- A brief description of incentives offered to faculty to develop sustainability courses and/or incorporate sustainability into their courses or departments
- A brief description of the outcomes or results of offering such incentives
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance

This credit recognizes institutions that offer incentives to help faculty expand sustainability course offerings. Providing release time, workshops, funding, and/or other incentives can help faculty broaden and deepen sustainability curriculum. Faculty often need time, support, and training to determine how best to make sustainability a focus or topic of their courses, and offering such incentives lends institutional support to expanding sustainability course offerings on campus.

Discussion

The previous version of this credit was based on encouraging “faculty to make sustainability a focus of their courses.” AASHE received feedback suggesting that the credit should recognize programs that support faculty efforts to introduce sustainability as a course module, examples during classes, and otherwise integrate sustainability into the curriculum short of making it a focus of the course. The revised credit reflects that suggestion.
**ER Credit 18: Sustainability in New Employee Orientation**

**Criteria**
Institution covers sustainability topics in new employee orientation and/or in outreach and guidance materials distributed to new employees.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of how sustainability is covered in orientations and trainings for new employees
- A copy of outreach materials distributed to new employees that address sustainability
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that address sustainability issues during new employee orientation. Including sustainability in new employee orientation helps establish sustainability as an institutional priority and part of the campus culture. Providing information and tools about the institution's sustainability programs and options at the time when an employee is getting acquainted with his or her new employer and developing new work routines and habits can help encourage the adoption of environmentally and socially preferable habits, routines, and choices.

**ER Credit 19: Employee Peer-to-Peer Sustainability Outreach Program**

**Criteria**
Institution administers or oversees a faculty/staff peer-to-peer sustainability outreach program that holds an event or campaign at least once per semester or term.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The name, title, and department of the person who coordinates the program
- The name of the program and a brief description of its activities during the previous year
- A brief description of how the outreach program is organized, including how representatives are selected
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that coordinate programs in which faculty and staff members educate and mobilize their peers around sustainability initiatives and programs. Engaging faculty and staff in educator roles can help disseminate sustainability messages more widely and encourage broader participation in sustainability initiatives.
Research
This section seeks to recognize institutions that are conducting research related to or focused on sustainability. Conducting research is a major function of many colleges and universities. By researching sustainability issues, higher education institutions can continue to help the world understand sustainability challenges and develop new technologies and strategies to address those challenges.

Discussion
This section has changed in a couple of ways since the previous version. First, there are several new credits and the section overall is worth more points. Second, all of the credits included in this version include an applicability provision. That is, the credits do not apply to institutions where research is not a core component of the institution’s activities. This way the credits will not penalize community colleges and other schools that do not conduct research. Third, this section no longer includes a credit for having a sustainability research center. Reviewers suggested that most small schools do not have research centers and this credit unfairly penalized them and that the credit was unnecessarily prescriptive about how institutions organize their research.

ER Credit 20: Research Inventory
Criteria
Institution has identified all of its sustainability research initiatives. The Inventory should include all research centers, laboratories, and individual professors’ activities that focus on or are related to sustainability.

For this credit, sustainability research includes research that focuses on a key principle of sustainability, addresses a sustainability challenge, or addresses the social, economic, and environmental components of sustainability.

This credit does not apply to institutions where research is not a core component of the institution's activities.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A copy of a the research inventory or the URL where the information is posted
- A brief description of the methodology the institution used to conduct the inventory
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have identified their sustainability research activities. Conducting an inventory of an institution’s sustainability research can serve as a valuable first step in identifying strengths and areas for development. Likewise, since sustainability requires collaboration that transcends traditional disciplines, conducting an inventory can help connect individuals, laboratories, research centers, and other campus community members with a shared interest in sustainability. Conducting an Inventory also establishes a baseline for measuring future progress.
Discussion
This credit was added to STARS based on feedback that conducting an inventory of sustainability research is a significant undertaking, provides an accessible point of entry for earning points in this section, and is necessary for determining whether an institution qualifies for several of the other credits.

Some reviewers suggested that AASHE prescribe a common methodology for identifying sustainability research so that results are comparable between institutions. AASHE welcomes suggestions on what methodology to suggest or require. Likewise, AASHE welcomes suggestions for how to strengthen the definition of sustainability research.

ER Credit 21: Research Incentives

Criteria
Institution offers incentives or programs to encourage faculty to conduct sustainability related or focused research. Incentives may include, but are not limited to, fellowships, financial support, and faculty development workshops.

This credit does not apply to institutions where research is not a core component of the institution’s activities.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of the programs, incentives, and policies in place to encourage faculty members to research sustainability
- A brief description of the results or outcomes of those programs and incentives
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have programs in place to encourage faculty members to research sustainability. Providing incentives demonstrates that sustainability is an institutional priority and can help attract new researchers to the field. In addition, it helps faculty members explore new areas and encourages broader research on the topic. Having faculty broadly engaged in sustainability research can help increase student exposure to and participation in sustainability research as well.
**ER Credit 22: Faculty Involved in Sustainability Research**

**Criteria**
A specified percentage of the institution's faculty members are engaged in sustainability research.

- 1 pt: Up to 0.1 percent of the institution's faculty members are engaged in sustainability research.
- 2 pts: 0.1 to 1 percent of the institution's faculty members are engaged in sustainability research.
- 3 pts: More than 1 percent of the institution's faculty members are engaged in sustainability research.

For this credit, sustainability research includes research that focuses on a key principle of sustainability, addresses a sustainability challenge, or addresses the social, economic, and environmental components of sustainability.

*This credit does not apply to institutions where research is not a core component of the institution's activities.*

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The total number of faculty members
- The total number and names of faculty members engaged in sustainability research, including their departmental affiliations, and a brief description of the sustainability research conducted by each.
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions where a specified percentage of research faculty members are researching sustainability. The percentage of faculty members engaged in sustainability research is a measure of the spread of sustainability research.

**Discussion**
This credit was added to STARS for this version based on suggestions from reviewers.

**ER Credit 23: Departments Involved in Sustainability Research**

**Criteria**
A specified percentage of the institution's academic departments are engaged in sustainability research.

- 1 pt: Up to 5 percent of the institution's academic departments are engaged in sustainability research.
- 2 pts: 5 to 15 percent of the institution's academic departments are engaged in sustainability research.
- 3 pts: Between 15 and 25 percent of the institution's academic departments are engaged in sustainability research.
- 4 pts: 25 to 35 percent of the institution's academic departments are engaged in sustainability research.
- 5 pts: More than 35 percent of the institution's academic departments are engaged in sustainability research.

For this credit, sustainability research includes research that focuses on a key principle of sustainability, addresses a sustainability challenge, or addresses the social, economic, and environmental components of sustainability.

*This credit does not apply to institutions where research is not a core component of the institution's activities.*
**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A list of all academic departments
- A list of academic departments in which at least one faculty member engages in sustainability research, including a brief statement about the focus of such research
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions where sustainability research is being conducted in many departments. Most, if not all, academic departments can make significant contributions to deepening society’s understanding of sustainability issues and developing solutions to sustainability challenges. Since sustainability transcends traditional academic divisions, having multiple departments involved in research indicates that the institution has a broad perspective on sustainability and can help ensure that multiple perspectives are considered.

**Discussion**
This credit was added to STARS for this version based on suggestions from reviewers.

**ER Credit 24: Internal Funding for Research**

**Criteria**
This credit includes two components.

1) Institution demonstrates a three-year upward trend in sustainability research funding from internal sources. **(1 point possible)**

2) Institution dedicates a specified percentage of its internal research funds to sustainability research. **(4 points possible)**
   - 1 pt: 0.1 to 1 percent of the institution’s internal research funds are devoted to sustainability research.
   - 2 pts: Between 1 and 5 percent of the institution’s internal research funds are devoted to sustainability research.
   - 3 pts: 5 to 10 percent of the institution’s internal research funds are devoted to sustainability research.
   - 4 pts: More than 10 percent of the institution’s internal research funds are devoted to sustainability research.

For this credit, sustainability research includes research that focuses on a key principle of sustainability, addresses a sustainability challenge, or addresses the social, economic, and environmental components of sustainability.

This credit does not apply to institutions where research is not a core component of the institution’s activities.
Documentation
Complete the online STARS submittal form for this credit. The form requests:

- Total internal research funds for each of the past three years
- Internal research funds devoted to sustainability research for each of the past three years
- A brief description of how internal research funds are apportioned
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that are devoting internal research funds to sustainability research. Funding sustainability research indicates an institution’s support for sustainability research and helps encourage growth in the field.

Discussion
STARS 0.4 included a credit based on a three-year upward trend in internal funding for sustainability research. AASHE received feedback that STARS should include absolute dollars devoted to sustainability research as well as upward trends. The revised credit includes a component based on devoting a specified percentage of internal research funding to sustainability research. AASHE welcomes suggestions on what percentages should be required to earn each point.

ER Credit 25: External Funds for Research

Criteria
This credit includes two components

1) Institution demonstrates a three-year upward trend in sustainability research funding from external sources. (1 point possible)

2) A specified percentage of the research grant money an institution receives goes towards funding sustainability research. (3 points possible)
   - 1 pt: Up to 0.1 percent of the institution’s external research funds are devoted to sustainability research.
   - 2 pts: 0.1 to 1 percent of the institution’s external research funds are devoted to sustainability research.
   - 3 pts: More than 1 percent of the institution’s external research funds are devoted to sustainability research.

For this credit, sustainability research includes research that focuses on a key principle of sustainability, addresses a sustainability challenge, or addresses the social, economic, and environmental components of sustainability.

This credit does not apply to institutions where research is not a core component of the institution’s activities.
**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- Total external research funds
- External research funds devoted to sustainability research
- A brief description of strategies or best practices institution can share to increase external funding for sustainability research
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that have attracted external funding, such as grants, for sustainability research. Much of the research conducted by colleges and universities is funded from outside sources. Outside funding can be an important tool in advancing sustainability research.

**Discussion**
STARS 0.4 included a credit based on a three-year upward trend in external funding for sustainability research. AASHE received feedback that STARS should consider absolute value of research dollars devoted to sustainability research in addition to trends. The revised credit includes a component based on achieving a specified percentage of external research funding for sustainability research. AASHE welcomes suggestions on what percentages should be required to earn each point.

**ER Credit 26: Interdisciplinary Research**

**Criteria**
Institution treats interdisciplinary research the same as discipline-specific research during faculty promotion and tenure decisions.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief summary of how the institution treats interdisciplinary research in faculty promotion and tenure decisions and how this is communicated to all academic departments and faculty review committees
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that treat interdisciplinary research the same as research conducted in a single discipline during faculty promotion and tenure decision. Addressing sustainability challenges requires solutions and understandings that often cover multiple academic disciplines. Treating interdisciplinary research the same as research from one academic discipline is an important step in enabling faculty to pursue sustainability related research.

**Discussion**
STARS 0.4 included a credit that recognized schools that reward faculty sustainability research during the tenure and promotion process. Several reviewers suggested the credit could be controversial and suggested developing a credit that allowed interdisciplinary research, which sustainability research often is, to be treated fairly and equally during faculty evaluations.
Operations Credits

Discussion
The Operations category includes three new sections. First, the Buildings section includes credits similar to those included in the ‘Planning and Development’ and ‘Water and Landscape Management’ sections in the previous draft (the old sections are not included in this draft; credits about planning are in the ‘Planning’ section, which is part of the Administration and Finance category). Second, the Grounds section covers the other credits that were included in the ‘Water and Landscape Management’ section. Third, the Dining Services section includes credits related to food procurement that were previously included in the Purchasing section.

The previous draft of STARS included a prerequisite stipulating that schools must comply with environmental, health, and safety regulations. AASHE received feedback that this prerequisite may end up prohibiting schools from participating due to a minor infraction and that such a requirement would have disproportionate impacts on certain types of institutions. Based on this feedback, AASHE plans to take an approach similar to LEED and stipulate in the front matter that STARS is intended for institutions that are in compliance with sustainability-related regulations. In cases of egregious non-compliance with such regulations, AASHE reserves the right to withdraw the offending institution’s STARS rating. In addition, AASHE has added a new credit about hazardous waste management.

OP Prerequisite 1: Recycling Program

Criteria
Institution provides a means for recycling bottles, cans, paper, and cardboard. There are designated and clearly labeled recycling receptacles for all occupied buildings or building clusters.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of institution’s recycling program, including a list of materials collected.
- The URL for the institution’s recycling program, if applicable
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This prerequisite ensures that all institutions recognized under the STARS rating system have a basic recycling program in place. Recycling is generally one of the first campus sustainability programs that an institution undertakes, and it often provides an important foundation for further campus sustainability efforts.

Discussion
Based on feedback, this prerequisite was changed in two ways. First, instead of requiring institutions to collect the materials accepted by their local jurisdictions, schools are required to collect all of the most common materials for recycling. Second, the revised prerequisite allows for materials to be collected outdoors and for collection areas to cover a group of buildings to allow for flexibility in complying with fire codes.
Buildings
This section seeks to recognize institutions that are taking steps to improve the sustainability performance of their buildings. Buildings are generally the largest user of energy and the largest source of greenhouse gas emissions on campuses. Buildings also use significant amounts of potable water. Institutions can design, build, and maintain buildings in ways that provide a safe and healthy indoor environment for inhabitants while simultaneously mitigating the building's impact on the outdoor environment.

Discussion
AASHE is interested in adding a credit about Indoor Environmental Quality to this section and welcomes feedback on the form such a credit may take.

OP Credit 1: New Construction, Renovations, and Commercial Interiors

Criteria
Institution's new buildings, major renovations, and interior improvements meet Leadership in Energy and Environmental Design (LEED) standards for New Construction, Core & Shell, or Commercial Interiors.

- 1 pt: All new buildings, major renovations, and interior improvements meet LEED certification criteria (at any level).
- 2 pts: All new buildings, major renovations, and interior improvements meet LEED Silver or higher certification criteria and at least 25 percent of new building square footage is certified LEED Silver or higher.
- 3 pts: All new buildings, major renovations, and interior improvements meet LEED Gold or higher certification criteria and at least 25 percent of new building square footage is certified LEED Gold or higher.
- 4 pts: All new buildings, major renovations, and interior improvements meet LEED Platinum certification criteria, and at least 25 percent of new building square footage is certified LEED Platinum.

For this credit, buildings completed during the past three years are considered 'new.' Institutions may use the version of LEED-NC, LEED-CS, or LEED-CI that was available at the time of the building construction, significant renovation, or interior improvement.

Institutions in the United States should use the versions of LEED put forth by the U.S. Green Building Council. Canadian institutions may use the versions of LEED-Canada put forth by the Canada Green Building Council.

This credit does not apply to institutions that have not constructed any buildings during the past three years.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The URL where the Institution's green building policy is posted, if applicable
- The date the policy was adopted, if applicable
- A brief description (including gross square footage and budget) for each new building, renovation, and interior improvement that was completed during the last three years
- The date and level (Certified, Silver, Gold, or Platinum) of LEED certification for each applicable project
- LEED scorecards for certified projects and documentation demonstrating the achievement of LEED criteria for projects that are not certified
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party
**Guidance**
This credit recognizes institutions that have incorporated environmental features into the design and construction of new buildings, major renovations, and interior improvements. The LEED certification system, which was developed by the U.S. Green Building Council (USGBC), is the premier green building standard in the United States. In partnership with the USGBC, the Canada Green Building Council administers the LEED Canada certification system in Canada. LEED has transparent technical criteria that are evaluated and approved by the USGBC's membership. The certification process involves rigorous documentation, which helps to ensure accurate, fair, and meaningful standards. LEED certification includes criteria grouped into the following categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design.

Certification ensures third-party verification of a building's green features, increases an institution's familiarity with the LEED certification criteria, and tends to improve building performance. However, in recognition of the additional expense and time that certification requires, this credit requires only that a specified percentage of new buildings receive certification.

More information about LEED is available at www.usgbc.org.

**Discussion**
STARS 0.4 included a credit for having a green building policy that required new buildings to be built to LEED silver standards. AASHE received feedback that instead of prescribing a policy, the credit should be based on the actual outcomes of buildings constructed; the revised credit reflects that change.

Some comments suggested that LEED Silver was not rigorous enough and the credit should focus on higher levels of certification (i.e., LEED Gold and Platinum). In keeping with the spirit that STARS should encompass both entry points for institutions beginning campus sustainability efforts as well as ambitious end goals, the credit was revised to offer multiple levels of recognition based on the level of LEED certification or equivalence.

There were also differences of opinion about the merits of certification. While some felt certification was necessary to achieve high-performing green buildings, others felt the certification process was too onerous and expensive to be required. As a compromise, the revised credit stipulates that a portion of the new buildings must be certified in order to qualify for more than one point. Institutions that have gone through the certification process for some of their buildings will be able to gauge more accurately what equivalent means.

Institutions participating in the pilot version of STARS suggested changing this credit so that new construction projects are addressed separately from major renovations and commercial interior spaces. AASHE is considering this suggestion for future versions of STARS.
OP Credit 2: Building Operations and Maintenance

Criteria
A specified percentage of the institution's eligible buildings meet the certification criteria outlined in the LEED for Existing Buildings (LEED-EB) certification system and/or are certified under the LEED-EB system.

- 1 pt: Any portion of the institution's buildings are LEED-EB certified (at any level).
- 2 pts: At least 10 percent of the institution's building square footage is LEED-EB certified (at any level) and at least another 40 percent of the institution's building square footage meets the criteria for LEED-EB certification (at any level).
- 3 pts: At least 15 percent of the institution's building square footage is certified LEED-EB Silver or higher and at least another 60 percent of the institution's building square footage meets the criteria for LEED-EB Silver or higher certification.
- 4 pts: At least 20 percent of the institution's building square footage is certified LEED-EB at the Gold level or higher and at least another 70 percent of the institution's building square footage meets the criteria for LEED-EB Gold or higher certification.
- 5 pts: At least 20 percent of the institution's building square footage is LEED-EB Platinum certified, and at least another 75 percent of the institution's building square footage meets the criteria for LEED-EB Platinum certification.

This credit applies to all buildings eligible for LEED-EB certification. Institutions should use the most recent version of LEED-EB to determine if non-certified buildings meet LEED-EB certification criteria.

Institutions in the United States should use the versions of LEED put forth by the U.S. Green Building Council. Canadian institutions may use the versions of LEED Canada put forth by the Canada Green Building Council.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of each building that is LEED-EB certified or meets the standards for LEED-EB certification including the following:
  - The name and primary function of the building (e.g., residential dormitory, classrooms, laboratories)
  - Square footage of the building
  - Date and level of LEED-EB certification, if applicable
  - LEED-EB scorecards for certified buildings and documentation demonstrating the achievement of LEED-EB criteria for buildings that were not certified
- A brief description of the tools, strategies, and policies in place to encourage the adoption and maintenance of LEED-EB criteria
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that operate and maintain their buildings in ways that protect the human health of building occupants and the environment. The LEED certification system, which was developed by the U.S. Green Building Council (USGBC), is the premier green building standard in the U.S. In partnership with the USGBC, the Canada Green Building Council administers the LEED Canada certification system in Canada. LEED has transparent technical criteria that are evaluated and approved by the USGBC's membership. The certification process involves rigorous documentation, which helps to ensure accurate, fair, and meaningful standards. LEED-EB certification includes criteria grouped into the following categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design.
Certification ensures third-party verification of a building’s green features, increases an institution’s familiarity with the LEED certification criteria, and tends to improve building performance. However, in recognition of the additional expense and time that certification requires, this credit does not require that all new buildings receive certification.

More information about LEED is available at www.usgbc.org.

Discussion
In response to feedback suggesting that trends can penalize already high-achieving institutions and do not provide the appropriate metrics for comparison between schools, this credit is no longer based on a three-year upward trend in LEED-EB certification. In addition, this credit incorporates two changes that also were made to OP Credit 1. First, higher levels of LEED certification and equivalence (e.g., Gold and Platinum) are worth more points. Second, certification is required for a portion of buildings in order to earn higher levels of points.

OP Credit 3: Potable Non-Irrigation Water Consumption Reduction

Criteria
Institution achieves a specified reduction in potable, non-irrigation water consumption per gross square footage of building space. The reduction is measured against a baseline year of AY 2000-01.

- 1 pt: Institution reduces potable, non-irrigation water consumption per square foot of building space by at least 10 percent.
- 2 pts: Institution reduces potable, non-irrigation water consumption per square foot of building space by at least 25 percent.
- 3 pts: Institution reduces potable, non-irrigation water consumption per square foot of building space by at least 50 percent.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- The amount of potable non-irrigation water that the institution consumed in 2000-01, in gallons
- The amount of potable non-irrigation water that the institution consumed in the previous year, in gallons
- The total floor area in gross square feet in 2000-01
- A brief description of policies, practices, and programs that the institution has implemented to reduce potable, non-irrigation water consumption
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have become more efficient water users. Conserving water helps protect wildlife habitat and conserve energy, as delivering and treating water require considerable amounts of energy.

The credit uses gallons of water per gross conditioned square foot of floor space to avoid penalizing institutions for physical growth. The credit is measured against a baseline specific to an institution in recognition of the fact that there are several institutional characteristics that may contribute to higher water consumption, including climate variations and building function.
Discussion
The previous draft version of STARS included a credit based on a three-year downward trend in potable water consumption. In response to feedback suggesting that a trend penalizes already high-achieving institutions, the credit was changed so that it is based on achieving an absolute reduction compared to a baseline year. In addition, this version of STARS separates irrigation water, which is covered in the Grounds section, from non-irrigation water, which is covered by this credit. This separation was based on comments suggesting that conserving irrigation water and conserving water in buildings entail different strategies and often involve different staff or campus departments.

OP Credit 4: Green Cleaning Service

Criteria
Institution’s in-house or contracted cleaning service is Green Seal certified or meets the certification criteria for the Green Seal Environmental Standard for Cleaning Services (GS-42).

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- Date of Green Seal certification, if applicable
- Documentation indicating that the cleaning service meets the Green Seal criteria
- A brief description of how the institution ensures compliance with Green Seal’s standards
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have safe and effective cleaning practices that protect human health and the environment. Green Seal certification is administered by an independent, non-profit organization that develops science-based certification criteria specific to several product categories and services. The certification system recognizes services that improve health and wellbeing, reduce toxic pollution and waste, conserve resources and habitats, and minimize global warming and ozone depletion. In addition to requiring the use of non-toxic cleaning products, the cleaning service certification system details several best practices for cleaning services, which covers topics such as cleaning equipment, staff communications, worker safety, and reducing solid waste.

More information about the Green Seal Environmental Standard for Cleaning Services (GS-42) is available at www.greenseal.org/certification/cleaning_services_gs-42.pdf.

Discussion
Both the previous and current version of STARS include a credit for purchasing environmentally preferable cleaning products (OP Credit 21). This credit was added in response to feedback noting that green cleaning involves more than just the products used.
**Buildings: Tier Two Credits**

1. Institution uses vegetated/green and/or reflective/high albedo roofs.
2. Institution uses water conservation devices, such as waterless urinals, dual flush toilets, low-flow showerheads, and faucet aerators.
3. Institution has systems in place to detect and repair water leaks.
4. Institution implements strategies to reduce light pollution.
5. Institution uses front-loading washing machines.
Dining Services

This section seeks to recognize institutions that are helping build a sustainable food system by supporting local, Food Alliance-certified, organic, and Fair Trade-certified products. Food production often has deleterious environmental impacts. Pesticides and fertilizers used in agriculture can contaminate ground and surface water, which has potentially dangerous impacts on wildlife and human health. Furthermore, the often long-distance transportation of food to institutions produces greenhouse gas emissions and other pollution. Additionally, farm workers are often paid sub-standard wages, subjected to harsh working conditions, and exposed to dangerous pesticides. Institutions can use their food purchases to support their local economies, encourage safe, environmentally-friendly farming methods, and help alleviate poverty for farmers.

Discussion

STARS 0.4 included food procurement credits in the Purchasing section. The Dining Services section was created for this version of STARS based on feedback that typically dining services departments, and not purchasing departments, purchase food for colleges and universities.

The credits included in this document were developed for the STARS pilot project and, therefore, emphasize gathering data to help establish reasonable point thresholds for future versions of STARS.

The food purchasing credit in STARS 0.4 grouped organic, Fair Trade, local, and other certified or otherwise preferable food in the same credit. Several reviewers commented that different certifications or attributes should not be grouped together in one category but should be treated separately. Since there are many potential food certifications or attributes to include, AASHE selected four commonly found in college and university dining operations: local, organic, Food Alliance, and Fair Trade. During the pilot period, however, schools are asked to report on alternate certifications and standards used to help determine what will be most appropriate to include for future versions of STARS.

The upper level threshold for the previous version of the food purchasing credit was 100 percent. Reviewers suggested lowering the threshold required to earn certain points since 100 percent was not realistic.

STARS 0.4 also included a credit based on offering vegan and vegetarian food options. AASHE received strong feedback indicating that doing so was standard practice undeserving of Tier One level recognition under STARS; the credit was moved to Tier Two.

Participants in the STARS pilot project noted that supporting small and mid-size family farms is an important benefit of buying local food that the current version of the local food credit does not address. AASHE welcomes suggestions on how to develop a credit around this issue or incorporate it into the local food credit. STARS pilot participants also suggested adding a credit for seafood (perhaps based on Marine Stewardship Council standards). AASHE is considering this for future versions. In addition, AASHE is working with the Real Food Challenge in an effort to link the STARS standard with other standards that are or are likely to be used by higher education institutions.
OP Credit 5: Local Food

Criteria
Institution’s dining service purchases a specified percentage of local food*.
- 1 pt: Five percent of food expenditures go toward local food*.
- 2 pts: Twenty percent of food expenditures go toward local food*.
- 3 pts: Fifty percent of food expenditures go toward local food*.

For this credit, institutions should include food purchases for the institution’s residential dining halls and on-site catered events provided by the institution’s dining services provider and for which the institution is the client. On-site franchises, convenience stores, vending machines, or concessions are not included in this credit.

*Local food is defined as food that is grown and processed within 150 miles of the institution, for this credit.

This credit does not apply to institutions without residential dining halls or an on-site, institution-affiliated catering service.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The name of the contracted dining services provider, if applicable
- The USDA Plant Hardiness Zone where the institution is located
- Total food expenditures for the following product categories: meat and seafood, fresh and frozen produce, milk and other dairy products, bakery goods, beverages, grocery items, and other
- Total expenditures on local* food for the following product categories: meat and seafood, fresh and frozen produce, milk and other dairy products, bakery goods, beverages, grocery items, and other
- Total expenditures on local food that is also certified organic
- Total expenditures on local food that is also Food Alliance certified
- A brief description of policies and programs institution has implemented to increase local food procurement
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that are buying local food. Purchasing local food helps mitigate the impacts of food transportation, supports local farmers and processors, helps strengthen local economies, and helps build a local food system while enhancing food security.
OP Credit 6: Food Alliance and Organic Certified Food

Criteria
Institution's dining service purchases a specified percentage of Food Alliance and/or organic certified food.

- 1 pt: Five percent of food expenditures go toward Food Alliance and/or organic certified food products.
- 2 pts: Twenty percent of food expenditures go toward Food Alliance and/or organic certified products.
- 3 pts: Fifty percent of food expenditures go toward Food Alliance and/or organic certified products.

For this credit, institutions should include food purchases for the institution's residential dining halls and on-site catered events provided by the institution's dining services provider and for which the institution is the client. On-site franchises, convenience stores, vending machines, or concessions are not included in this credit.

Food items that are made with at least 70 percent organic ingredients are considered organic for this credit. According to USDA organic labeling requirements, products labeled 'made with organic' must contain at least 70 percent organically produced ingredients.

This credit does not apply to institutions without residential dining halls or an on-site, institution-affiliated catering service.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- Expenditures on certified organic food for the following product categories: meat and seafood, fresh and frozen produce, milk and other dairy products, bakery goods, beverages, grocery items, and other
- Expenditures on Food Alliance certified food for the following product categories: meat and seafood, fresh and frozen produce, milk and other dairy products, bakery goods, beverages, grocery items, and other
- Total expenditures on food that is both organic and Food Alliance certified
- Total expenditures on certified organic food that is also Fair Trade Certified
- Total expenditures on certified organic food that meets another (not including Fair Trade Certified or local) criteria that makes it preferable, and please specify which criteria
- Total expenditures on Food Alliance certified food that meets another (not including Fair Trade Certified or local) criteria that makes it preferable, and please specify which criteria
- A brief description of policies and programs institution has implemented to increase organic food procurement
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that are buying certified organic food. The U.S. Department of Agriculture (USDA) and the Canadian Food Inspection Agency oversee organic certification in the U.S. and Canada respectively. These government agencies ensure that products labeled as organic meet environmental and consumer protection standards, including restrictions on the types of seeds, pesticides, fertilizers, and livestock practices that are allowed. In addition, organic agriculture operations must implement practices to conserve soil, manage manure and rotate crops to preserve the value of agricultural lands.

Food Alliance certification is overseen by a nonprofit organization. The certification requirements include providing just working conditions, treating animals humanely, raising livestock without added hormones or antibiotics, reducing pesticide usage and toxicity, and conserving soil and water.
OP Credit 7: Fair Trade Certified Coffee

Criteria
All of the institution's coffee purchases are Fair Trade Certified.

For this credit, institutions should include coffee purchases for the institution's residential dining halls and on-site catered events provided by the institution's dining services provider and for which the institution is the client. On-site franchises, convenience stores, vending machines, or concessions are not included in this credit.

This credit does not apply to institutions without residential dining halls or an on-site, institution-affiliated catering service.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- Expenditures on Fair Trade Certified coffee
- Total expenditures on coffee
- Expenditures on Fair Trade Certified products for the following categories: tea, sugar, cocoa, rice, vanilla, bananas, and other
- Total expenditures on products in the following categories: tea, sugar, cocoa, rice, vanilla, bananas, and other products eligible for Fair Trade Certification
- Total expenditures on Fair Trade Certified food that meets another criteria that makes it preferable (not including organic certified), and please specify which criteria
- A brief description of policies and programs institution has implemented to increase Fair Trade Certified food purchasing
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that are buying Fair Trade Certified coffee. Fair Trade Certification, which is conducted by third-party organizations, is based on fair prices and working conditions for farmers. Fair Trade Certification encourages community development, democratic and transparent collaborations among farmers, and direct trade between producer groups. By purchasing Fair Trade Certified products, Institutions can support economic development and help alleviate poverty in less-developed countries.

This credit focuses on Fair Trade Certified coffee because it was one of the first products to be covered by the certification and is widely available. Institutions are asked to report expenditures on other products in recognition of the growth in Fair Trade Certification for other product categories. Future versions of STARS may include these additional products.

Dining Services: Tier Two Credits
1. Institution does not use trays in its dining service operations.
2. Institution has vegan and vegetarian dining options available for every meal.
3. Institution does not use trans fats or ingredients that include trans fats in its dining operations.
Energy and Climate

This section seeks to recognize institutions that are reducing their energy consumption through conservation and efficiency, and switching to cleaner and renewable sources of energy such as solar, wind, geothermal, and low-impact hydropower. For most institutions, energy consumption is the largest source of greenhouse gas emissions, the cause of global warming. Global warming is expected to have myriad impacts throughout the world, including increased frequency and potency of extreme weather events, sea level rise, species extinction, water shortages, declining agricultural production, and spread of diseases. The impacts are expected to be particularly pronounced for poor communities and countries. In addition to global warming, energy generation from fossil fuels, especially coal, produces air pollutants such as sulfur dioxide, nitrogen oxides, mercury, dioxins, arsenic, cadmium and lead. These pollutants contribute to acid rain as well as health problems such as heart and respiratory diseases and cancer. Coal mining and oil/gas drilling can also damage environmentally and/or culturally significant ecosystems. Nuclear power creates highly toxic and long-lasting radioactive waste. Large-scale hydropower floods habitat and disrupts fish migration.

Implementing conservation measures and switching to renewable sources of energy can help institutions save money and protect them from utility rate volatility. Renewable energy may be generated locally and allow campuses to support local economic development. Furthermore, institutions can help shape markets by creating demand for cleaner, renewable sources of energy.

OP Credit 8: Reduction in Energy Intensity

Criteria

Institution has achieved a three-year downward trend in energy intensity, normalized for heating or cooling degree days. For this credit, energy intensity is calculated by dividing total energy consumption (electricity plus temperature control) by the amount of conditioned floor space.

- 1 pt: Institution reduced energy intensity up to two percent.
- 2 pts: Institution reduced energy intensity by more than two percent.
- 3 pts: Institution reduced energy intensity by more than four percent.

Documentation

Complete the online STARS submittal form for this credit. The form requests:

- Total electricity consumed in each of the past 3 years
- Total BTU used for temperature in each of the past 3 years
- Gross square feet of conditioned floor space
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance

This credit recognizes institutions that have reduced their energy usage per gross square foot of conditioned floor space. The credit is measured as a trend to allow for tracking improvements over time without penalizing institutions in particular climates or with significant energy-intensive activities, such as laboratories. Energy consumption is normalized by conditioned floor space in order to enable fairer comparisons and avoid penalizing institutions for growth in their physical plants.
Discussion
The previous version of this credit did not account for annual temperature variations that may
influence energy requirements; based on feedback, this adjustment was added to the credit.

Several comments suggested changing this credit so it is not based on a trend. AASHE is interested in
using established energy efficiency standards based on building type instead of a downward trend.
The U.S. EPA's Portfolio Manager program could provide standards for some buildings, but doesn't
cover many building types found on campuses.

**OP Credit 9: Renewable Electricity**

**Criteria**
Institution derives a specified percentage of its total electricity consumed from institution-catalyzed renewable
sources, or purchases the environmental attributes of electricity generated off-site from renewable sources in
the form of Renewable Energy Certificates (RECs) and other similar renewable energy products.

- 1 pt: More than 5 percent of electricity consumed is from institution-catalyzed* renewable energy
  sources, or the environmental attributes of more than 15 percent was purchased in the form of
  RECs and other similar renewable energy products.
- 2 pts: More than 15 percent of electricity consumed is from institution-catalyzed* renewable energy
  sources, or 100 percent was purchased in the form of RECs and other similar renewable energy
  products.
- 3 pts: More than 35 percent of electricity consumed is from institution-catalyzed* renewable energy
  sources.
- 4 pts: More than 65 percent of electricity consumed is from institution-catalyzed* renewable energy
  sources.
- 5 pts: 100 percent of electricity consumed is from institution-catalyzed* renewable energy sources.

For this credit, the following sources of renewable electricity count: wind, concentrated solar power, solar
photovoltaics, geothermal, low-impact hydropower, clean biomass, and B100 biodiesel. Renewable energy
technologies that are not used to generate electricity do not count for this credit.

RECs and other similar renewable energy products used to achieve this credit must be Green-e certified or meet
the Green-e standard's technical requirements.

**"Institution-catalyzed renewable energy sources" refers to on-site sources as well as off-site renewable energy
sources developed for the institution and for which the institution holds the rights to the associated emissions
reductions. An institution may not apply electricity generated toward this credit if it sold RECs for the same
electricity. Likewise, if the on-site renewable energy generating devices are owned and maintained by another
party, the institution must have contractual rights to the associated emissions reductions for the electricity to
count towards achieving this credit.**
**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The total electricity in kilowatt-hours (kWh) institution consumed in each of previous three years
- The total electricity (in kWh) generated from on-site renewable sources in each of previous three years
- A brief description of the on-site renewable energy generating devices
- The total electricity (in kWh) generated from institution-catalyzed renewable energy sources in each of previous three years
- A brief description of the institution-catalyzed renewable energy sources
- The total amount (in kWh) of Green-e certified or equivalent electricity purchased in each of previous three years
- A brief description of electricity purchased from off-site renewable sources
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that are using renewable energy sources for electricity. The credit is intended to enable fairer comparisons between large and small institutions, reward conservation, and allow institutions to track progress over time in relation to physical plant growth.

The credit includes a preference for institution-catalyzed renewable energy sources (see definition above) to reward institutions that directly contribute to the development of new renewable sources of electricity.

There are three options for earning this credit with electricity from off-site renewable sources. First, Renewable Energy Certificates (RECs), which are available from a variety of nationwide retailers, are created when a new renewable energy facility generates electricity and the environmental benefits of that electricity are sold to the REC buyer. Each REC represents all of the environmental benefits associated with a specific quantity of renewable electricity generation. Second, some electric utilities have green power programs that offer customers the opportunity to purchase some or all of their electricity from certified renewable energy sources. Third, in areas where electricity markets have been deregulated, customers may be able to choose an electricity provider that effectively offers a direct connection to renewable energy as an option.

The Green-e Renewable Energy Certification Program is the leading voluntary certification and verification program in the United States for renewable energy products. Green-e certification intends to make sure that these products meet environmental and consumer protection standards.

**Discussion**
The previous version of this credit did not distinguish between on-site renewably derived electricity and RECs. Among reviewers, there was disagreement on whether or not RECs should count. As a compromise, the revised credit allows RECs to help earn up to two of the five points.
OP Credit 10: On-Site Combustion with Renewable Fuel

Criteria
A specified percentage of the institution’s on-site energy combustion for heating and cooling is from renewable sources, such as biomass and renewably derived hydrogen.

- 1 pt: Institution derives 15 percent or more of its on-site combustion for heating and cooling from renewable sources.
- 2 pts: Institution derives 50 percent or more of its on-site combustion for heating and cooling from renewable sources.
- 3 pts: Institution derives 100 percent or more of its on-site combustion for heating and cooling from renewable sources.

For this credit, renewable energy technologies that are used to generate electricity and renewable fuels used for transportation do not count, as those benefits are captured in OP Credit 9 and OP Credit 25 respectively.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- Total BTUs of energy for heating and cooling from on-site combustion from all sources
- Total BTUs of energy generated for heating and cooling from on-site renewable sources
- A brief description of renewable energy sources used for on-site combustion for heating and cooling
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that are using fuel from renewable sources for on-campus combustion. Using renewable fuel sources, such as biomass, instead of fossil fuels reduces greenhouse gas emissions and several other pollutants. Renewable fuel sources can be grown or obtained locally, which mitigates emissions and other impacts of transporting other fuels longer distances and can help strengthen local economies. Harvesting methane from landfills and wastewater treatment plants similarly decreases emissions and transforms a waste product to a source of energy.

Discussion
The previous version of this credit was based on the percentage of heating and cooling load that was met with renewable sources. AASHE received feedback indicating that it would be difficult to accurately measure the impact of certain techniques and technologies (such as passive solar design, geothermal, and solar thermal) on heating and cooling. On-site combustion, on the other hand, can be measured more accurately, and it thus forms the basis for the revised credit. AASHE is interested in feedback on how to measure the impacts of technologies and techniques not covered by the current version of this credit.
OP Credit 11: Greenhouse Gas Emissions Reduction

Criteria
Institution achieved specified net reductions in its Scope 1 and Scope 2 greenhouse gas (GHG) emissions from a 2005-06 academic year baseline. For this credit, purchasing carbon offsets that have been verified by a third party may count towards a portion of the reduction.

- 1 pt: Institution reduced GHG emissions by at least 5 percent, or purchased carbon offsets to achieve a net reduction of at least 50 percent.
- 2 pts: Institution reduced GHG emissions by at least 20 percent, or purchased carbon offsets to achieve a net reduction of 100 percent.
- 3 pts: Institution reduced GHG emissions by at least 40 percent.
- 4 pts: Institution reduced GHG emissions by at least 65 percent.
- 5 pts: Institution reduced GHG emissions by 100 percent (carbon neutrality), with carbon offsets comprising no more than 15 percent of the reduction.

To conduct a GHG emissions inventory, campuses may use any methodology and/or calculator that is consistent with the Greenhouse Gas Protocol's Corporate Accounting and Reporting Standards.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- The total GHG emissions during the 2005-06 academic year (the baseline)
- The total GHG emissions during the previous academic year
- The total amount of carbon offsets purchased during the performance period and a brief narrative description of the purchased carbon offsets
- A brief description of actions the institution has taken to reduce its greenhouse gas emissions
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have reduced their net GHG emissions. Using a baseline of AY 2005-06 allows all campuses the same reference point for measuring progress and provides a metric that is comparable between campuses of different sizes.

The GHG Protocol, developed by the World Resources Institute and the World Business Council for Sustainable Development, is the most widely-used international accounting tool for quantifying GHG emissions. It provides the accounting framework for nearly every GHG program and standard in the world, including the Chicago Climate Exchange and the California Climate Action Registry. Clean Air-Cool Planet's Campus Carbon Calculator is consistent with GHG Protocol standards.

Scope 1 refers to an institution's direct GHG emissions, such as the emissions from on-site fuel combustion. Scope 2 refers to emissions generated off-site in the production of energy that the institution purchases. This primarily means electricity but can also include steam and chilled water.

Green-e Climate, the Voluntary Climate Standard, and the Gold Standard are three organizations that provide third-party certification for carbon offsets. These standards provide assurance that offsets are real, measured, permanent, verified, and beyond business-as-usual GHG emission reductions.
Discussion
The version of this credit included in STARS 0.4 did not distinguish between on-site reductions and offset purchases. While some people supported the inclusion of offsets, others argued they should not be included at all. The current version of the credit includes standards that the offsets must meet in order to count. In addition, in this version of the credit, offsets can only be used to earn up to two out of five points.

Some reviewers and pilot participants suggested adding a point for conducting a greenhouse gas emissions inventory. AASHE is considering this suggestion.

More than any other credit, many people suggested that this credit should be worth more points. While AASHE is receptive to the suggestion, at this point, the focus is on developing credits. When the form and range of credits has been decided, AASHE will turn its focus to point allocation.

Energy and Climate: Tier Two Credits
1. Institution uses timers to regulate temperatures based on occupancy hours.
2. Institution uses motion, infrared, and/or light sensors to reduce energy use for lighting.
3. Institution uses LED lighting.
4. Institution has installed vending machine motion sensors.
5. Institution has engaged in energy-related performance contracting.
6. Institution uses more efficient fume hoods.
7. Institution has a centralized energy management system.
8. Institution uses geothermal energy.
Grounds
This section seeks to recognize institutions that plan and maintain their grounds with sustainability in mind. Beautiful and welcoming campus grounds can be planned, planted, and maintained in all regions while using water wisely and without the use of harmful chemicals.

Discussion
The name and purview of this section has changed since STARS 0.4. The section was titled ‘Water and Landscape Management’ previously and covered both grounds and overall water usage. Based on feedback, the water usage credit was separated into building water usage, which is covered in the Buildings section, and irrigation water usage, which is covered in this section.

The previous draft of STARS included a credit that recognized institutions that mitigate 50% of stormwater falling on campus. Feedback indicated that the percentage of stormwater mitigated could be measured for one building but not for an entire campus. Since many schools take an institution-wide approach to managing stormwater, having a building-by-building standard would not be reasonable or applicable.

AASHE is interested in developing one or more credits that address stormwater, and such a credit may take the form of recognizing institutions that follow a set of best management practices. In this case, it is possible that some of the Tier Two credits related to stormwater management could be combined to form one or two Tier One credits.

Several comments also recommended developing credits that recognize landscaping with native plants, promoting biodiversity, and preserving undeveloped land on campus. AASHE is interested in addressing these issues and welcomes suggestions on the form such credits should take.

OP Credit 12: Organic Campus
Criteria
Institution applies to its grounds only pesticides and fertilizers that are allowable under the U.S. Department of Agriculture’s standards for organic crop production. For this credit, campus grounds do not include on-campus farms.

This credit does not apply to institutions with cultivated grounds comprising less than one percent of the institution’s total area.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The size of maintained grounds, in acres
- The URL where the organic campus policy is posted, if applicable
- A brief description of landscaping and pest-management strategies
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party
Guidance
This credit recognizes institutions that are maintaining their grounds in accordance with organic standards. The U.S. Department of Agriculture has established a list of harmful and potentially harmful materials that cannot be used in organic operations. Many of these chemicals have been linked to human health problems, such as cancer. Exposure risks are especially pronounced for grounds staff and people with chemical sensitivities. In addition, chemicals applied to grounds can harm wildlife and contaminate ground and surface water supplies.

Discussion
In STARS 0.4 this credit was based on the Organic Materials Review Institute’s (OMRI’s) list of permissible fertilizers and pesticides. OMRI is an organization that tests materials to determine if products qualify for the USDA’s organic standards. The credit was changed to be based on the USDA’s organic standards list because it is more comprehensive and widely recognized.

Some institutions participating in the pilot period recommended changing this credit to allow for flexibility for pests that cannot be treated with organic approved pesticides. Other pilot participants suggested basing the credit on integrated pest management practices. AASHE is considering these suggestions and welcomes feedback on them.

OP Credit 13: Non-potable Water Usage for Irrigation

Criteria
Institution meets a specified percentage of its irrigation water needs with non-potable water.
- 1 pt: Institution meets 50 percent of its irrigation water needs with non-potable water.
- 2 pts: Institution meets 100 percent of its irrigation water needs with non-potable water.

This credit does not apply to institutions with cultivated grounds comprising less than one percent of the institution’s total area.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The volume of potable water used for irrigation, in acre feet
- The volume of non-potable water used for irrigation, in acre feet, by source (e.g., reclaimed water, harvested rainwater, gray water)
- A brief description of policies, strategies, and technologies in place to reduce potable water usage for irrigation
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that use non-potable water for irrigation. Irrigation is often the largest user of potable water on campuses. Institutions can substitute reclaimed water, gray water, and captured rainwater to supply their irrigation needs. Delivering and treating potable water requires a significant amount of energy. In addition, groundwater supplies are being depleted faster than they are being replenished in some places. Investing in water conservation and water re-use is also a prudent risk management strategy, as global warming is expected to increase strains on water supplies.
Discussion
The previous draft of STARS included a credit based on a three-year downward trend in irrigation water use OR meeting 100 percent of irrigation water needs from reclaimed water. The credit was changed to avoid penalizing schools that already have strong irrigation water conservation programs.

While it would be easier to achieve this credit if an institution reduces its potable water usage, a weakness of the current version of this credit is that it does not recognize such reductions in the absence of using non-potable water. AASHE is interested in finding standards for landscaping water usage that incorporate regional/climatic variations that could be used instead of this credit.

Grounds Tier Two Credits
1. Institution uses integrated pest management.
2. Institution landscapes with native plant species.
3. Institution protects, restores, and/or creates habitat on campus.
4. Institution inventories and maps all campus trees and other landscape assets.
5. Institution uses pervious paving.
6. Institution has bioswales, rain gardens, or other vegetated areas designed to filter stormwater runoff.
7. Institution follows best management practices for snow and ice removal.
Materials, Recycling, and Waste Minimization

This section seeks to recognize institutions that are moving toward zero waste by reducing, reusing, recycling, and composting. These actions mitigate the need to extract virgin materials, such as trees and metals. It generally takes less energy to make a product with recycled material than with virgin resources. Reducing waste generation also reduces the flow of waste to incinerators and landfills, which produce greenhouse gas emissions, can contaminate air and groundwater supplies, and tend to have disproportionate negative impacts on low-income communities. In addition, waste reduction campaigns can engage the entire campus community in contributing to a sustainability goal.

Discussion

This section no longer includes a credit about paper consumption; information about paper consumption is captured in the waste minimization credit. There are new credits for Electronics Recycling, Construction and Demolition Waste Diversion, and Hazardous Waste Minimization, as well as several new Tier Two Credits.

OP Credit 14: Waste Minimization

Criteria

Institution demonstrates a three-year downward trend in waste generated per capita. Total waste generation is measured by weight, and includes all materials recycled, composted, and disposed of as trash except construction, demolition, hazardous, universal and non-regulated chemical waste. Volume measurements may be converted to weight using the conversion factors provided by the U.S. Environmental Protection Agency and the College and University Recycling Council that are used for the RecycleMania competition.

Documentation

Complete the online STARS submittal form for this credit. The form requests:

- The weight in pounds of materials recycled, composted, and disposed of as garbage for each year
- A brief description of programs, policies, infrastructure investments, outreach efforts, and/or other factors that contribute to waste minimization
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance

This credit recognizes institutions that have reduced waste generation over time. While other credits recognize the benefits of recycling, this credit acknowledges that reducing the use of materials in the first place and lessening the total amount of materials discarded offers significant environmental benefits.

Using a trend rewards institutions for improving their performances without unfairly penalizing institutions with characteristics that may lead to higher levels of waste generation per capita, such as a high percentage of students living on campus.
Discussion
Based on feedback, this credit excludes special types of waste, such as hazardous and construction waste, which are included in separate credits. Despite concerns with trend-based indicators, this credit is based on a trend in response to feedback suggesting that waste generation is influenced strongly by several factors (including research laboratories and percentage of students living on campus) for which STARS is, at this point, unable to control. AASHE welcomes suggestions on whether and how to change this credit so it is not based on a trend.

OP Credit 15: Waste Diversion
Criteria
Institution achieves a specified landfill diversion rate.
- 1 pt: Institution achieves a 13 percent diversion rate.
- 2 pts: Institution achieves a 35 percent diversion rate.
- 3 pts: Institution achieves a 50 percent diversion rate.

Landfill diversion rate is calculated by dividing the weight of materials diverted from the landfill or incinerator by the sum of the weight of materials sent to a landfill or incinerator and the weight of the materials diverted from the landfill or incinerator.

For this credit, calculations do not include construction, demolition, hazardous, universal, and non-regulated chemical wastes. Volume measurements may be converted to weight using the conversion factors provided by the U.S. Environmental Protection Agency and the College and University Recycling Council that are used for the RecycleMania competition.

‘Materials diverted from the landfill or incinerator’ includes any solid waste that was destined for disposal in a municipal waste landfill or incinerator but was diverted by recycling, composting, donating, re-selling, or reusing.
‘Materials sent to landfill or incinerator’ includes any solid waste that was sent for disposal in a municipal waste landfill or incinerator.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The weight in pounds of materials recycled, composted, reused, donated, re-sold, or otherwise diverted
- The weight in pounds of materials disposed in a solid waste landfill or incinerator
- A brief description of programs, policies, infrastructure investments, outreach efforts, and/or other factors that contributed to the diversion rate
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and information for the responsible party

Guidance
This credit recognizes institutions that have achieved significant diversion rates. Diversion rate is a common measurement used to evaluate the success of waste reduction efforts.

Discussion
This credit is no longer based on a three-year downward trend, but is instead based on achieving an absolute diversion rate, which is informed by years of data collected by campuses and thus provides a more comparable metric about an institution’s performance.
OP Credit 16: Construction and Demolition Waste Diversion

Criteria
Institution diverts at least 75 percent of its non-hazardous construction and demolition waste from the landfill and/or incinerator. Soil and organic debris from excavating or clearing the site do not count for this credit. The diversion rate is calculated by dividing the weight or volume of materials recycled, donated, or otherwise recovered by the sum of the weight or volume of materials landfilled or incinerated and the weight of materials recycled, donated, or otherwise recovered.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The weight in pounds or volume in cubic yards of construction and demolition materials recycled, donated, or otherwise recovered
- The weight in pounds or volume in cubic yards of construction and demolition materials landfilled or incinerated
- A brief description of programs, policies, infrastructure investments, outreach efforts, and/or other factors that contribute to the diversion rate
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have diverted at least 75 percent of their construction and demolition wastes. Construction and demolition is a significant source of waste that falls outside of an institution's standard waste stream and may be handled by a separate contractor or waste hauler. This credit is similar to the Materials and Recycling Credit 2.2: Construction Waste Management in the Leadership in Energy and Environmental Design (LEED) for New Construction rating system.

Discussion
This credit was added based on feedback suggesting construction and demolition is a significant source of waste that should be addressed separately from the standard waste stream.

OP Credit 17: Electronic Waste Recycling Program

Criteria
Institution has a comprehensive electronic waste (e-waste) recycling and/or reuse program. The program includes collecting all institution-owned electronic products and, at least annually, electronic materials from students. All of the e-waste collected is refurbished, donated, or recycled domestically.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The weight in pounds, volume in cubic yards, or number of electronic materials collected for reuse or recycling
- The destination(s) for collected materials
- A brief description of programs, policies, infrastructure investments, outreach efforts, and/or other components of institution’s e-waste program
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party
**Guidance**
This credit recognizes institutions that have e-waste recycling and/or reuse programs. E-waste typically contains toxic components, such as lead and mercury, that can contaminate soil and groundwater, and have detrimental human health impacts if handled improperly. At the same time, e-waste contains components that can be recycled. Likewise, computers, cellular phones, and other electronic materials can be donated or re-sold at reduced cost to non-profit organizations and community groups. Domestic recycling helps to make sure workers' basic safety is protected and environmental standards are met.

**Discussion**
This credit was added based on feedback suggesting electronic materials are a significant source of waste that should be addressed separately from the standard waste stream.

Several institutions participating in the STARS pilot project suggested separating institution-generated electronics from student-generated electronics. AASHE is considering making that change.

**OP Credit 18: Hazardous Waste Minimization**

**Criteria**
Institution tracks and safely disposes of all hazardous, universal, and non-regulated chemical waste.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The total pounds of chemical waste shipped to outside vendors, and whether or not the weight includes containers and packaging
- The total pounds of radioactive waste removed from institution
- The total pounds of biological/medical waste shipped to outside vendors
- A brief description of institution’s hazardous waste disposal policies and activities
- The number of regulatory visits or audits from EPA, NRC, DOT, OSHA, and other federal regulatory agencies during the previous year
- The total number and cost of federal violations
- The number of regulatory visits or audits from state and local agencies during the previous academic year
- The total number and cost of state and local violations
- A brief description of policies, programs, and other initiatives institution has taken to reduce hazardous, universal, and unregulated chemical waste, and the impact of those initiatives
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that track and safely dispose of all hazardous, universal, and non-regulated chemical waste. These waste streams can be particularly dangerous to human health and wildlife.
Discussion
This credit was developed in response to a strong desire to address safe handling and disposal of hazardous materials. However, the credit at this point is focused on data gathering. AASHE is considering developing a credit that is based on best management practices for reducing the use of and safely handling hazardous, universal, and un-regulated waste, and welcomes suggestions on how to best accomplish this.

Materials, Recycling, and Waste Minimization: Tier Two Credits
1. Institution has a pre-consumer food waste composting program.
2. Institution has a post-consumer food waste composting.
3. Institution composts yard waste.
4. Institution has a surplus department or office supplies exchange that facilitates reuse of materials.
5. Campus dining operations offer discounts for reusable mugs.
6. Institution has replaced paper materials, such as course catalogs, registration, and directories, with online alternatives.
7. Institution limits free printing in computer labs and libraries.
8. Campus dining operations use bulk condiment dispensers and decreased packaging for to-go food service purchases.
9. Institution has a program to reuse chemicals.
Purchasing
This section seeks to recognize institutions that are using their purchasing power to help build a sustainable economy. Collectively, colleges and universities spend many billions of dollars on goods and services annually. Each purchasing decision represents an opportunity for institutions to choose environmentally and socially preferable products and services and support companies with strong commitments to sustainability.

Discussion
The Purchasing section no longer includes a credit based on having an environmentally preferable purchasing policy. Feedback suggested that STARS should measure purchasing decisions rather than policies.

STARS 0.4 also included a credit that was based on a three-year upward trend in environmentally preferable purchasing. In addition to the concerns associated with using trend-based data, several people suggested that environmentally preferable purchasing was too difficult to measure and broad. Based on this suggestion, the current draft of STARS focuses on key areas where clear socially or environmentally preferable alternatives exist.

This section also no longer contains credits for food procurement, as those topics are now covered by the Dining Services section.

Reviewers have had different opinions on how to fairly request data, given the decentralized nature of purchasing that is common among colleges and universities. In this draft of STARS, credits only apply to purchases for which the institution has a central mechanism for tracking. AASHE has received feedback suggesting that limiting the purview of the credits to centrally tracked purchases may render the credits meaningless if, for example, an institution meets the criteria for the five percent of its total purchases that are centrally tracked and doesn’t meet the criteria for the other 95 percent of its purchases.

AASHE is considering establishing an applicability or eligibility threshold as a strategy to overcome this shortcoming. If the credit included an applicability threshold, credits would only apply to schools that have a mechanism for tracking at least 75 percent (or another level) of their total purchases. Alternately, the applicability thresholds could be credit-specific, so that if a school has an institution-wide paper procurement contract, for example, and tracks more than a specified percentage of its paper purchases, the paper purchasing credit would apply.

Under an applicability threshold approach, however, two schools with identical purchasing behavior would be treated differently depending on whether or not they track purchases. If both institutions’ purchases would qualify for the credit, the school with a tracking mechanism would be recognized while the school without a central tracking mechanism would not. If neither school’s purchases would qualify for the credit, the school with the tracking mechanism would not earn the points, which would decrease its overall sustainability score. The credit would not apply to a school without a central tracking mechanism, so its overall sustainability score would benefit from excluding these credits.
An eligibility threshold, on the other hand, would require that schools track a certain percentage of their purchases in order to be recognized by the credit, and the credit would apply to all institutions. However, given the decentralized nature of purchasing for many colleges and universities, this standard may be unrealistic. AASHE welcomes feedback on how to address this issue.

**OP Credit 19: ENERGY STAR Purchasing**

**Criteria**
Institution purchases ENERGY STAR qualified products, or the equivalent, for all product categories covered by the program. This credit applies to all purchases that the institution has a central mechanism for tracking.

For this credit, non-certified products that are equally or more efficient than similar ENERGY STAR qualified products are considered "equivalent."

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The URL where the ENERGY STAR policy, or equivalent, is posted, if applicable
- A copy of a Request for Proposals (RFP) that includes the ENERGY STAR requirement, if available
- A brief description of steps institution has taken to ensure that it purchases only ENERGY STAR qualified or equivalent products when applicable
- The number of ENERGY STAR products institution purchased and dollars spent on ENERGY STAR products
- The institution's total expenditures
- The value of expenditures institution has a central mechanism for tracking
- The percentage of expenditures on products covered by ENERGY STAR that institution has a central mechanism for tracking, if known
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that are making environmentally preferable purchasing decisions by exclusively purchasing ENERGY STAR qualified products or the equivalent, when available. The ENERGY STAR program, which is administered by the U.S. Environmental Protection Agency and U.S. Department of Energy, is a leading standard for energy efficiency for more than fifty product categories, including appliances, heating and cooling, electronics, lighting, food service, and office equipment. Relative to non-qualified products, ENERGY STAR products use 25 to 50 percent less energy, have extended product lives and decreased maintenance costs, and do not compromise quality or performance.

More information about ENERGY STAR is available at [www.energystar.gov](http://www.energystar.gov).

**OP Credit 20: EPEAT Purchasing**

**Criteria**
Institution purchases Electronic Product Environmental Assessment Tool (EPEAT) Silver registered products, or the equivalent, for all products covered by the standard. This credit applies to all purchases that the institution has a central mechanism for tracking.

For this credit, non-registered products that meet EPEAT Silver criteria are considered "equivalent."
**Documentation**

Complete the online STARS submittal form for this credit. The form requests:

- The URL where the EPEAT policy, or equivalent, is posted, if applicable
- A copy of a Request for Proposals (RFP) that includes the EPEAT requirement, if available
- A brief description of steps institution has taken to ensure that it purchases only EPEAT Silver or equivalent products when applicable
- The number of EPEAT products institution purchased and dollars spent on EPEAT Silver (or higher) products
- The percentage of expenditures on products covered by EPEAT that the institution has a central mechanism for tracking, if known
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**

This credit recognizes institutions that are making environmentally preferable purchasing decisions by exclusively purchasing EPEAT Silver products or the equivalent, when applicable. EPEAT, which was developed by the Zero Waste Alliance with a grant from the U.S. Environmental Protection Agency, incorporates energy efficiency, the reduction and elimination of environmentally sensitive materials, materials selection, design for end-of-life, product longevity and life cycle extension, end-of-life management, corporate performance, and packaging characteristics of products into its evaluation criteria.

More information about EPEAT is available at [www.epeat.net](http://www.epeat.net).

**Discussion**

Based on feedback suggesting that Bronze standards are not rigorous enough, the credit has changed to require Silver registered products.
OP Credit 21: Purchasing Green Cleaning Products

Criteria
Institution purchases environmentally preferable cleaning products, as outlined below. This credit applies to all purchases that the institution has a central mechanism for tracking.

All cleaning products are certified by, or meet the criteria required for certification, for the appropriate product categories as outlined below.

For cleaning products
- Green Seal GS-37 Environmental Standard for General-Purpose, Bathroom, Glass, and Carpet Cleaners Used for Industrial and Institutional Purposes
- Environmental Choice CCD-110 for Cleaning and De-greasing Compounds
- Environmental Choice CCD-146 for Hard Surface Cleaners
- Environmental Choice CCD-148 for Carpet and Upholstery Cleaners

For disinfectants, metal polish, floor finishes, strippers, and other products not covered by the standards outlined above
- Green Seal GS-40 Environmental Standard for Industrial and Institutional Floor-Care
- Environmental Choice CCD-112 for Biological Digestion Additives for Cleaning and Odor Control
- Environmental Choice CCD-113 for Drain and/or Grease Trap Additives
- Environmental Choice CCD-115 for Odor Control Additives
- Environmental Choice CCD-147 for Floor Care Products

Institutions with contracted cleaning and/or painting services qualify for this credit if the use of only the products specified above is specified in their contracts and their contractors use only these products.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The URL where the Green Seal, Environmental Choice, or equivalent policy is posted, if applicable
- A copy of a Request for Proposals (RFP) that includes the green cleaning product requirement, if available
- A copy or relevant sections of the cleaning and/or painting services contract(s), if applicable
- A brief description of steps institution has taken to ensure that it purchases only Green Seal, Environmental Choice, or equivalent cleaners and floor care products
- The percentage of expenditures on cleaning products that institution has a central mechanism for tracking, if known
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party
Guidance
This credit recognizes institutions that are purchasing green cleaning products. Many traditional cleaning products contain toxins that harm human health and the environment. Exposure impacts are pronounced for cleaning staff and individuals with chemical sensitivities. To maintain consistency between rating systems, this credit is similar to the LEED for Existing Buildings’ Environmental Quality Credits 3.4-3.6: Green Cleaning: Purchase of Sustainable Cleaning Products and Materials.

Green Seal certification is administered by an independent non-profit organization that develops science-based certification criteria specific to several product categories and services. The certification system recognizes products that improve health and well-being, reduce toxic pollution and waste, conserve resources and habitats, and minimize global warming and ozone depletion. More information about Green Seal is available at www.greenseal.org.

Environmental Choice is administered by EcoLogo, North America’s oldest environmental standard and certification organization. The certification system was launched by the Canadian federal government in 1988. Environmental Choice meets ISO 14024 standard for Type I (third-party certified, multi-attribute) environmental labels. More information about Environmental Choice is available at www.ecologo.org.

Discussion
The previous version of STARS included a credit that recognized schools that purchased Green Seal certified products for all product categories that are covered by the certification. AASHE received feedback suggesting that requiring Green Seal certification for some product categories may not be appropriate given the limited availability of certified products for some product categories. In addition, there are alternate third-party certifications that cover similar products that should be considered. For consistency with LEED EB standards, this credit includes both Green Seal and Environmental Choice certification.

OP Credit 22: Environmentally Preferable Paper Purchasing
Criteria
Institution purchases or has a policy to purchase only environmentally preferable copy paper and bathroom paper products. For this credit, environmentally preferable paper meets one of the following criteria.
- 100 percent post-consumer recycled content and processed chlorine free or
- Certified by the Forest Stewardship Council (FSC) and total chlorine free or
- 100 percent tree-free material or
- Any combination of the above such that 100 percent of the paper is comprised of environmentally preferable materials.

This credit applies to all purchases that the institution has a central mechanism for tracking. The environmentally preferable paper purchasing requirement may be a stand-alone policy or part of a broader policy.
Documentation

Complete the online STARS submittal form for this credit. The form requests:
- The URL where the environmentally preferable paper policy is posted, if available
- Product information for centrally-tracked paper purchases
- A brief description of steps institution has taken to ensure that only environmentally preferable paper is being purchased
- The percentage of expenditures on paper that institution has a central mechanism for tracking, if known
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance

This credit recognizes institutions that are purchasing environmentally preferable paper products. The use of environmentally preferable paper helps conserve forests, water, and energy; prevents pollution; and helps to protect biodiversity. FSC certification is the most widely used social and environmental standard for pulp and paper products made from virgin fibers. More information about FSC is available at www.fsc.org. Tree-free paper is made of alternative fibers that tend to grow rapidly, so harvesting these materials tends to have a smaller environmental impact than harvesting trees.

Discussion

This previous version of this credit stipulated that paper be made with at least 50 percent post-consumer waste. Feedback suggested raising the threshold to 100 percent post-consumer waste. The revised credit incorporates this change.

Participants in the STARS pilot project have suggested separating this credit into multiple credits or points to distinguish between different types of paper (office/copy paper, bathroom tissue, paper napkins and towels, and specialty paper).

OP Credit 23: Environmentally Preferable Furniture Purchasing

Criteria

At least 50 percent of institution's furniture expenditures go towards products that meet at least one of the following criteria.
- Product contains at least 10 percent post-consumer or 20 percent post-industrial material, or
- Product contains at least 70 percent of salvaged materials, or
- Product contains at least 50 percent rapidly renewable material, or
- Product contains at least 50 percent Forest Stewardship Council (FSC)-certified wood, or
- Product contains at least 50 percent material harvested/extracted and processed within 500 miles of the institution

This credit applies to purchases that the institution has a central mechanism for tracking.

A single piece of furniture can be counted more than once if it meets multiple criteria. For example, a $100 chair made with 50 percent FSC-certified wood that was harvested and manufactured within 500 miles of the institution would count for $200 in environmentally preferable furniture purchases.
Documentation
Complete the online STARS submittal form for this credit. The form requests:

- Total expenditures on environmentally preferable furniture, and the criterion or criteria the furniture meets
- Total furniture expenditures
- A brief description of categories of furniture purchased
- A brief description of programs, policies, or strategies to purchase environmentally preferable furniture
- The percentage of total furniture expenditures that are centrally tracked, if known
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that purchase environmentally preferable furniture. From beds and picnic tables to lab benches and desks, higher education institutions spend a significant amount of money on furniture. For consistency across rating systems, this credit is similar to the LEED for Existing Buildings Materials and Resources Credit 2.2 Sustainable Purchasing – Durable Goods, furniture.

There are several options or environmental attributes that make furniture environmentally preferable. Making furniture with post-consumer or post-industrial waste or salvaged materials conserves energy, reduces waste, and mitigates the need to extract virgin materials, such as trees and metal. Using rapidly renewable materials tends to have a smaller environmental impact than using materials that take longer to renew, such as petroleum and old growth wood. FSC-certification is a rigorous third-party certification system that rewards sustainably managed forests. Locally grown and manufactured products have smaller transportation-related environmental impacts and help support local economies.

Discussion
This credit was not included in STARS 0.4 and was added based on suggestions that furniture constitutes a notable portion of purchases for institutions, and that environmentally preferable furniture options exist.

OP Credit 24: Vendor Code of Conduct

Criteria
Institution has and acts on a vendor code of conduct that sets expectations about the social and environmental responsibility of vendors with whom the institution does business.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- The URL where the vendor code of conduct is posted or a copy of the code
- The date the vendor code of conduct was adopted
- A brief description of programs and strategies institution has implemented to ensure the code is followed
- A brief description of instances when vendor code of conduct has changed purchasing behavior within the last five years
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party
Guidance
This credit recognizes institutions that have taken proactive steps to ensure that their vendors meet minimum standards of environmental and social responsibility.

Discussion
This credit was included as a Tier Two credit in the previous draft version of STARS. AASHE has upgraded it to a Tier One credit in light of its significance in ensuring that an institution’s vendors meet the values of the institution.

In addition, STARS 0.4 included a credit that recognized schools that have a policy requiring contractors to pay employees who work on campus a living wage, which is not included in this document. A vendor code of conduct allows institutions to use broader criteria to screen vendors.
Transportation

This section seeks to recognize institutions that are moving toward sustainable transportation systems. Transportation is a major source of greenhouse gas emissions and other pollutants that contribute to health problems, including heart and respiratory diseases and cancer. Due to disproportionate exposure, these health impacts are frequently more pronounced in low-income communities proximate to major transportation corridors. In addition, the extraction, production, and global distribution of fuels for transportation can damage environmentally and/or culturally significant ecosystems. Furthermore, at times these activities are accompanied by human rights abuses and the profits from fossil fuel purchases may support hostile and/or repressive governments. At the same time, campuses can reap benefits from implementing sustainable changes to their transportation systems. Bicycling and walking provide human health benefits and mitigate the need for large paved surfaces, which can help campuses better manage storm water. Also, institutions may realize cost savings and help support local economies by reducing their dependency on petroleum-based fuels for transportation.

OP Credit 25: Fleet Greenhouse Gas Emissions

Criteria
Institution’s motorized fleet emits specified levels of greenhouse gases per passenger mile traveled.
- 1 pt: 0.5 or fewer pounds of carbon dioxide equivalent (CO₂e) per passenger mile traveled.
- 2 pts: Zero pounds of CO₂e per passenger mile traveled (carbon neutral fleet).

For this credit, the institution’s motorized fleet includes all institution-owned and operated vehicles. Fleet emissions should be calculated in a way that is consistent with the Greenhouse Gas Protocol’s Corporate Accounting and Reporting Standards. Only emissions generated directly by vehicle operation are counted in this credit, and carbon offsets may not be applied to this credit.

To calculate passenger miles traveled by each vehicle, multiply the number of miles each vehicle traveled by that vehicle’s average occupancy. Fleet passenger miles are calculated by taking the sum of the passenger miles traveled by each vehicle in the fleet. If regular vehicle occupancy data are unavailable, data may be gathered by a survey conducted during regular school session, as long as the survey incorporates seasonal, weekend, and out-of-session variability.

This credit does not apply to institutions without a motorized fleet.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The total number of passenger miles traveled by vehicles in the institution’s fleet
- The greenhouse gas emissions from institution’s fleet in pounds of CO₂e
- A brief description of institution’s methodology for gathering data and calculating emissions
- A brief description of steps the institution has taken to reduce its fleet emissions
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party
**Guidance**

This credit recognizes institutions that use cleaner fuels, fuel efficient vehicles, and/or multi-passerger vehicles. Institutions can help shape markets by creating demand for more efficient vehicles and cleaner fuels. In addition, institutions can realize efficiencies by increasing the number of passengers per vehicle.

The credit measures fleet greenhouse gas emissions in terms of passenger miles traveled to prevent penalizing institutions that operate shuttles. For context, 0.5 pounds of CO₂E per passenger mile is roughly twice as efficient as the average single occupancy vehicle.

The GHG Protocol, administered by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI), is the most widely-used international accounting tool for quantifying greenhouse gas emissions and it provides the accounting framework for nearly every greenhouse gas standard and program in the world.

**Discussion**

STARS 0.4 included a credit based on a three-year downward trend in fleet greenhouse gas emissions. In order to avoid disadvantaging already high achieving schools and schools that recently began shuttles or van services with multiple passengers, this credit was changed to be based on achieving a specified level of greenhouse gas emissions and is normalized per passenger mile.

Several institutions participating in the pilot project suggested separating campus fleet into transit vehicles and single-passenger vehicles. AASHE is considering this suggestion and welcomes feedback on what form the revised credits should take.

**OP Credit 26: Commute Modal Split**

**Criteria**

A specified percentage of the institution’s faculty, staff, and students get to and from campus by a means other than single occupancy vehicle for the majority of their daily trips. Alternatives to single-occupancy vehicle transportation include walking, bicycling, van or carpooling, taking public transportation, or riding a campus shuttle.

- 1 pt: More than 25 percent of institution’s population primarily uses preferable modes of transportation.
- 2 pts: More than 50 percent of institution’s population primarily uses preferable modes of transportation.
- 3 pts: More than 95 percent of institution’s population primarily uses preferable modes of transportation.

Commute modal split data may be gathered anytime within the last five years. If data for faculty, staff, and students were collected separately, they may be aggregated based on full-time equivalent populations.
**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The percentage of institution's population walking, bicycling, or using other non-motorized means as their primary method of transportation
- The percentage of institution's population van or car pooling as their primary method of transportation
- The percentage of institution's population riding campus shuttle as their primary method of transportation
- The percentage of institution's population driving alone as their primary method of transportation
- The URL for institution's transportation sustainability website, if applicable
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions where a significant portion of the campus community uses preferable modes of transportation to travel to and from the institution. Commute modal split is a common measure used to evaluate the sustainability performance of a transportation system.

**OP Credit 27: Commuter Options**

**Criteria**
Institution meets the criteria for being recognized by the Best Workplaces for Commuters program.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief list of incentives for preferable modes of transportation that demonstrate how the institution meets the Best Workplaces for Commuters guidelines
- If not designated as a Best Workplace for Commuters, an explanation of why not.
- The date of Best Workplaces for Commuters designation, if applicable
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions with strong programs in place to encourage employees to use preferable modes of transportation. The National Standard of Excellence in commuter benefits, developed by the U.S. Environmental Protection Agency, is used to determine whether employers qualify for designation under the Best Workplaces for Commuters program. To encourage their employees to bike, walk, carpool, or use mass transit to and from campus, institutions can implement a variety of programs, incentives, and facilities. Examples of such tools include transit subsidies, bicycle facilities, awards programs, and parking incentives for carpoolers.

More information about the Best Workplaces for Commuters Program is available at [www.bestworkplaces.org](http://www.bestworkplaces.org).

**OP Credit 28: Air Travel**

**Criteria**
Institution calculates greenhouse gas emissions from institution-funded air travel.
**Documentation**

Complete the online STARS submittal form for this credit. The form requests:
- The greenhouse gas emissions from air travel in pounds of CO₂ equivalent
- A brief description of institution’s methodology for gathering data and calculating emissions
- A brief description of steps the institution has taken to reduce emissions from air travel
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**

This credit recognizes institutions that are measuring greenhouse gas emissions from institution-funded air travel. Air travel is a significant contributor to global climate change but often is excluded from emissions inventories due to data collection and emissions calculation challenges. In addition, while there are viable alternatives for many other greenhouse gas emissions sources, there are fewer comparable alternatives for air travel. This credit aims to foster creative solutions to reducing air travel emissions.

This credit was added to STARS since the previous draft in response to suggestions that air travel should be included since it has large impacts that are not included in greenhouse gas emissions covered by STARS. While the credit is based only on measuring emissions, the documentation section requests information about steps the institution has taken to reduce air travel emissions in order to gather information, identify best practices, and facilitate information sharing.
Administration and Finance Credits

Discussion
This category combines many of the sections and credits included in the Governance and Finance category and the Social Responsibility and Community Engagement category of the previous draft version of STARS.

STARS 0.4 included a section called ‘Institutional Commitment’ that is not included in this version; the credits from that section are now part of the Sustainability Infrastructure or Planning sections. STARS 0.4 also included sections called ‘Affordability and Social Mobility’ and ‘Fair Labor Practices.’ Some of these credits have been eliminated from STARS and others have been incorporated into three new categories: Human Resources, Trademark Licensing, and Diversity, Access, and Affordability.

The previous draft of STARS included a section for ‘Sustainability Funding.’ In this version, funding information is requested in the Introductory Institutional Information section to help better understand an institution’s sustainability performance, but sustainability funding alone does not qualify an institution for any credits. Despite its importance and desirability, funding is more a process than an outcome. Schools could have great outcomes with little funding and small outcomes with great funding. Also, AASHE found it difficult to design a strong credit around sustainability funding.

AASHE received mixed feedback about the inclusion of credits that focus on the social dimensions of sustainability. While several people felt STARS should focus exclusively on environmental metrics, other reviewers welcomed the inclusion of social credits. In response to this mixed feedback, AASHE has revised many of the social credits to better align with corporate sustainability reporting standards. For additional background on AASHE’s understanding of sustainability and the inclusion of social credits, please see the ‘Understanding Sustainability’ section on page 5 of this document.

AF Prerequisite 1: Sustainability Committee

Criteria
Institution has a standing sustainability committee or other entity that meets at least once per semester or term. The committee advises on and/or implements policies and programs related to sustainability. The committee has multi-stakeholder representation, which means its membership includes students, faculty, and staff, and may include other interested parties. The committee may be an informal group or officially appointed by the institution’s administration.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The charter or mission statement of the committee or a brief description of the committee’s purview and activities
- The committee membership, including affiliations
- The committee meeting schedule
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

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Guidance
This prerequisite ensures that schools have a committee or other body in place to advise and/or implement policies and programs related to sustainability. Having an organized group of people working on the issue is fundamental in making progress towards sustainability.

Having a sustainability committee signals an institution’s commitment to sustainability. A sustainability committee may help share the workload related to sustainability, promote sustainability efforts and achievements, and develop innovative solutions to address environmental and social concerns.

The committee should have student, staff, and faculty representation in accordance with the sustainability principle of shared governance. In addition, multi-stakeholder involvement provides educational opportunities for all sectors of the campus community and may help foster broader community engagement.

Discussion
The sustainability committee prerequisite included in the previous version of STARS stipulated that the committee be formally appointed. Several reviewers suggested that informal committees can be very effective. In addition, mandating that schools have a formal committee may create a significant barrier to participating in STARS. The revised credit included in this draft allows for informal committees.

Some reviewers suggested that requiring a committee was too prescriptive and that schools could achieve the same outcomes as a committee through other mechanisms. Most reviewers, however, felt that having a committee, whether formal or informal, with representation from across the institution was crucial to making progress and having a collaborative effort. AASHE welcomes suggestions for how to modify this prerequisite to allow for greater flexibility while still ensuring that representatives from throughout the campus are involved in helping to shape sustainability policies or programs.
Investment
This section seeks to recognize institutions that make investment decisions that promote sustainability. Most institutions invest some of their assets in order to generate income. Together, colleges and universities invest hundreds of billions of dollars. Schools with transparent and democratic investment processes promote accountability and community engagement. Furthermore, institutions can support the development of sustainable products and services by investing in these industries. Likewise, they can support sustainability by investing in companies and funds that, in addition to providing a strong rate of return, are committed to social and environmental responsibility. Finally, campuses can engage with the businesses in which they are invested in order to promote sustainable practices.

Discussion
AASHE received feedback indicating that the credits in this section wouldn’t apply to all institutions. The credits now include an applicability standard so schools without an investment pool will not be penalized.

AF Credit 1: Investment Transparency

Criteria
Institution makes a snapshot of its investment pool and proxy voting records (including abstentions) publicly available on the internet. The snapshot and voting records are updated at least annually. The snapshot includes a listing of all direct investments and a summary of amount held in all other asset classes, including names of all funds held.

STARS uses the definition of “investment pool” used by the National Association of College and University Business Officers (NACUBO) in their annual endowment survey: “the predominant asset pool or grouping of assets that is organized primarily to support the institution and reflect its investment policies.” This may include funds managed by a foundation associated with the institution.

This credit does not apply to schools that do not have an investment pool.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The URL of the website where the information is available
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that make information about their investments publicly available. Investment transparency contributes to an open exchange of information, which is consistent with the mission of higher education. Making the information available publicly enables discussion about whether the institution’s investment decisions reflect a commitment to sustainability.
AF Credit 2: Committee on Investor Responsibility

Criteria
Institution has a formally established and active body that makes recommendations to the Board of Trustees, or sub-committee thereof, on responsible investment opportunities across asset classes, including proxy voting. The body has multi-stakeholder representation, which means its membership includes faculty, staff, and students and may include alumni, trustees, and other interested parties.

This credit does not apply to schools that do not have an investment pool.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- The charter or mission statement of the committee or a brief description of its purview and activities
- The membership of the committee, including affiliations
- The meeting schedule of the committee
- A summary of committee's activities or annual report
- The URL of committee's website, if applicable
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions with an established and active committee on investor responsibility (CIR) with multi-stakeholder representation. Establishing a CIR provides a structure for fostering dialogue on investment decisions, and can help campuses make responsible investment decisions that promote sustainability. Drawing CIR membership from multiple sectors of the campus community provides educational experiences for involved students, faculty, alumni, and staff. In addition, a multi-stakeholder CIR is consistent with the sustainability principle of shared governance.

AF Credit 3: Screening for Negative Investments

Criteria
Institution has conducted a negative screening of its entire investment pool within the last three years. This could take the form of prohibiting investment in an industry (e.g., tobacco or weapons manufacturing) or participating in a divestment effort (e.g., companies operating in South Africa during apartheid). The negative screen includes selling all affected direct holdings and writing a letter to all fund managers encouraging them to remove affected holdings as well.

This credit does not apply to schools that do not have an investment pool.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- The date of the most recent screening
- The industry or industries excluded from investments
- The divestment efforts in which school participated in the past three years
- A copy of letters sent to fund managers encouraging divestment or negative screening
- The value of holdings identified and sold due to the screen (Optional)
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party
Guidance
This credit recognizes schools that withhold investments from companies or industries that are particularly unsustainable. Divestment can be an important tool in safeguarding human rights, protecting the environment, and promoting social responsibility. Similarly, screening enables institutions to align their investments with their values. In addition, screening may protect institutions from the financial consequences of fines, lawsuits, customer boycotts and damages to a company’s reputation that may result from unsustainable corporate behavior.

Discussion
The version of this credit included in STARS 0.4 did not include a provision for funds in which the institution holds assets. AASHE received feedback suggesting that because many institutions hold a significant portion of their assets in funds and not direct holdings, the screen should address funds as well as direct holdings. The revised credit stipulates that in addition to selling affected direct holdings, institutions must write a letter to fund managers requesting that they do the same.

AF Credit 4: Positive Sustainability Investments

Criteria
Institution invests in any of the following: sustainable industries, such as renewable energy or sustainable forestry; businesses with exemplary sustainability performances; a sustainability investment fund, such as a community development financial institution (CDFI) or a renewable energy investment fund; and/or a socially responsible mutual fund with positive screens. A positive screen means that the fund managers select businesses based on positive social and environmental performance. Investment in a socially responsible mutual fund with only negative screens (i.e., excluding egregious offenders or certain industries, such as tobacco or weapons manufacturing) does not count for this credit.

- 1 pt: Up to 5 percent of the institution’s investment pool is invested positively to advance sustainability.
- 2 pts: Between 5 and 15 percent of the investment pool is invested positively to advance sustainability.
- 3 pts: 15 to 30 percent of the investment pool is invested positively to advance sustainability.
- 4 pts: More than 30 percent of the investment pool is invested positively to advance sustainability.

This credit does not apply to schools that do not have an investment pool.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The investment pool’s total value
- The amount invested directly in sustainable industries and the names of the corresponding companies
- The amount invested in sustainability investment funds, including CDFIs, and the names of the funds
- The amount invested in positively screened mutual funds and names of the funds
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party
**Guidance**
This credit recognizes institutions that seek positive investments that promote sustainability. Positive investing supports socially and environmentally responsible practices and the development of sustainable products and services.

Investing in CDFIs promotes the sustainability principle of helping provide credit to individuals and communities who are under-served by conventional lending institutions. In addition, CDFIs provide an opportunity for institutions to invest in their local communities.

This credit uses percentage of total investment pool to provide a metric that is comparable between campuses, without penalizing smaller investors. In addition, using a percentage allows institutions to track their progress over time.

**Discussion**
Based on feedback suggesting higher levels of investment in positive funds should be rewarded with additional points, this credit is now worth multiple points.

**AF Credit 5: Shareholder Engagement**

**Criteria**
Institution filed or co-filed one or more shareholder resolutions that address sustainability, or submitted one or more letters about social or environmental responsibility to a company in which it holds investments, during the previous three years.

*This credit does not apply to schools that do not have an investment pool.*

**Documentation**
Complete the online STARS submittal form for this credit. The form requests
- A copy of correspondence with the companies that was sent during the previous three academic years
- A copy of the relevant shareholder resolutions that were filed or co-filed during the previous three academic years
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that engage with companies in which they hold investments to address social and environmental responsibility. Filing and co-filing shareholder resolutions and directly communicating with the companies in which the school is invested can be important tools in improving the sustainability performance of those businesses.

**Discussion**
This credit was added in response to a suggestion that shareholder engagement can be a powerful tool for advancing sustainability.

**Investment: Tier Two Credits**
1. Institution has a responsible investment policy.
Planning

This section seeks to recognize institutions that have incorporated sustainability into their primary campus plans and those that have developed plans to move towards sustainability. Strategic and master plans guide an institution and its physical campus. These important documents establish an institution’s priorities and influence budgeting and decision-making for the institution. Incorporating sustainability into these plans is an important step in making sustainability a campus priority and may help advocates implement sustainable changes. Sustainability plans and climate plans provide a road map for how to achieve sustainability goals.

AF Credit 6: Strategic Plan

Criteria

Institution’s current formally adopted strategic plan or equivalent guiding document includes sustainability at a high level. The strategic plan covers the entire institution.

An amendment to the strategic plan may count for this credit, as long as the institution always presents the amendment with the original plan.

Neither a master plan (which is covered in AF Credit 7) nor an independent sustainability plan (which is covered in AF Credit 8) counts for this credit.

Documentation

Complete the online STARS submittal form for this credit. The form requests:

- The URL where the strategic plan (and amendment, if applicable) is posted
- The date the strategic plan or amendment was adopted
- A brief description of how the strategic plan or amendment addresses the environmental, social, and economic dimensions of sustainability
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance

This credit recognizes institutions that have made a formal, substantive commitment to sustainability by including it in their strategic plans. The strategic plan is the premier guiding document for an institution; it shapes the institution’s priorities and guides budgeting and policy making. Including sustainability at a high level in the plan signals an institution’s commitment to sustainability and may help infuse an ethic of environmental and social responsibility throughout the campus community.

Discussion

The previous version of this credit did not include a provision for allowing sustainability to be included in an amendment to the strategic plan. Based on feedback noting that strategic plans are updated infrequently and recognizing amendments would offer valuable flexibility to the credit, AASHE added a provision about amendments to the credit.
AF Credit 7: Master Plan

Criteria
Institution’s current master plan or equivalent guiding document includes sustainability at a high level. The master plan covers the institution’s entire physical campus.

An amendment to the master plan may count for this credit, as long as the institution always presents the amendment with the original plan.

Neither a strategic plan (which is covered in AF Credit 6) nor an independent sustainability plan (which is covered in AF Credit 8) counts for this credit.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The URL where the master plan (and amendment if applicable) is posted
- The date the master plan or amendment was adopted
- A brief description of how the master plan or amendment includes sustainability
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have made a formal commitment to developing and maintaining their physical campuses with sustainability in mind by including the principle at a high level in their master plans. An institution’s master plan shapes the development and maintenance of its physical campus. Incorporating sustainability into the campus master plan may help an institution realize sustainability objectives when making decisions about its facilities.

Discussion
Similar to AF Credit 6: Strategic Plan, the previous version of this credit did not include a provision for allowing sustainability to be included in an amendment to the master plan. Based on feedback noting that strategic plans are updated infrequently and recognizing amendments would offer valuable flexibility to the credit, AASHE added a provision about amendments to the credit.

AF Credit 8: Sustainability Plan

Criteria
Institution has a sustainability plan that was developed with input from faculty, staff, and students. The plan includes measurable goals with corresponding strategies and timeframes to achieve the goals. The plan need not be formally adopted.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The URL where the sustainability plan is posted
- The date the sustainability plan was adopted, if applicable
- A brief description of the sustainability plan and a summary of progress toward achieving plan objectives.
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party
Guidance
This credit recognizes institutions that have developed a comprehensive plan to move towards sustainability. Developing a sustainability plan provides an exceptional learning opportunity for an institution’s stakeholders to learn what it takes to become sustainable, using the campus as a laboratory. A sustainability plan provides a road map for achieving sustainability and may help guide decision-making. Having measurable goals with corresponding timeframes may help motivate institutions to maintain their commitments to sustainability and implement sustainable practices.

There are benefits from formal and informal plans. A formal plan signals institutional commitment to sustainability. An informal plan provides an avenue for sustainability advocates to articulate a bold sustainability vision and provides a framework for the institution to discuss its sustainability performance and goals.

Discussion
The previous version of STARS included a Tier Two credit for having a sustainability plan. Several reviewers suggested moving the credit to Tier One due to its value in helping to develop goals and a plan for achieving those goals.

AF Credit 9: Climate Plan
Criteria
Institution has a formal plan to mitigate its greenhouse gas emissions. The plan includes a measurable, numerical goal or goals and a corresponding date or dates by which the institution aims to achieve its goal(s). A formal sustainability plan that includes climate change goals, strategies, and timeframes counts for this credit.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- The URL where the climate plan is posted
- The date the climate plan was adopted
- A statement of the climate plan’s overall and short-term goals
- A brief description of progress toward achieving plan goals
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have developed a formal strategy to reduce their greenhouse gas emissions. Adopting a formal plan indicates the institution’s commitment to reducing its global warming impact. A climate action plan is a major component of the American College & University Presidents’ Climate Commitment. Since multiple facets of an institution’s operations can help reduce emissions, developing a climate action strategy can help an institution realize its sustainability goals as well as climate targets.

Discussion
STARS 0.4 included a credit that recognized schools that have signed the American College & University Presidents’ Climate Commitment (ACUPCC). Several reviewers noted that this could be viewed as a conflict of interest since AASHE is a co-coordinator of the ACUPCC. In addition, institutions that have developed climate plans and emissions reduction strategies outside of the ACUPCC should be recognized. The revised credit reflects those suggestions.
Sustainability Infrastructure
This section seeks to recognize institutions that have dedicated staff and other resources to sustainability. Staff and other resources help an institution organize, implement, and publicize sustainability initiatives. These resources provide the infrastructure that fosters sustainable changes within an institution.

AF Credit 10: Sustainability Officer
Criteria
Institution has a paid sustainability officer who addresses multiple issues. An employee who focuses on just one issue, such as a diversity officer or alternative transportation coordinator, would not count toward this credit.

- 1 pt: Any percentage of a paid staff member's time is dedicated to coordinating sustainability initiatives and this responsibility is included in the individual's job description.
- 2 pts: Institution has a full-time paid sustainability officer.
- 3 pts: Institution has a full-time paid sustainability officer with both academic and operational purview who reports directly to the institution's president, a vice president, or equivalent.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The name, title, and brief job description of the sustainability officer.
- The office or department where the sustainability officer is housed and the position to whom the sustainability officer reports
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have devoted staffing resources to coordinating sustainability efforts. A sustainability officer may help an institution organize its sustainability efforts and realize its sustainability goals. Designating staff resources for sustainability coordination signals an institution's commitment to sustainability. Making this task a full-time position signifies a stronger commitment. Likewise, having the officer report directly to a president or vice president and granting him or her academic and operational purview indicates the officer has a good deal of influence within the institution and that the institution prioritizes sustainability.

Discussion
The previous draft of STARS included a similar credit. Some reviewers suggested that sustainability staff levels required to earn this credit should be adjusted based on student population. AASHE is considering this suggestion and welcomes suggestions on optimal staffing levels.

AF Credit 11: Sustainability Recognition Program
Criteria
Institution has an awards program that recognizes sustainability achievements. Awards and recognition may be granted to individuals, buildings, departments, colleges, or other organizations within the campus community. Awards and recognition are publicized throughout the institution and are granted at least annually.
**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The URL of the sustainability recognition program’s website
- A brief description of the sustainability recognition program
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that have a sustainability recognition program. Awards and recognition programs help advertise sustainability achievements and reward the people and/or entities that have spearheaded or supported sustainable changes. In addition, awards and recognition programs create an incentive for further improvement.

**Discussion**
This is a new credit that was not included in STARS 0.4. It was created in response to feedback suggesting that award programs are an important way to encourage participation in sustainability programs.

**AF Credit 12: Inter-Campus Collaboration on Sustainability**

**Criteria**
Institution partners with other colleges and universities to support and help build the campus sustainability community.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief summary of papers, guides, presentations, and other resources the institution has developed to share their sustainability experience with other institutions.
- The names of local, state, regional, national, and other campus sustainability organizations or consortia in which the institution participates and/or is a member.
- A brief summary of additional ways the institution collaborates with other campuses to advance sustainability.
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party.

**Guidance**
This credit recognizes institutions that collaborate with other schools to help build campus sustainability broadly. Institutions can make significant contributions to sustainability by sharing their experiences and expertise with other colleges and universities. Sharing best practices and lessons learned can help other institutions realize efficiencies that accelerate the movement to sustainability.

**Discussion**
This credit was added to STARS for this version based on feedback suggesting that an important way that many schools contribute to sustainability is by sharing their best practices or experiences with other schools. Since there are many different forms collaboration can take, the current version of this credit recognizes many possible means of collaboration under one credit. AASHE welcomes feedback on how make the standards for earning this credit more rigorous, if appropriate.
Sustainability Infrastructure: Tier Two Credits
1. Institution has a sustainability communications, outreach, or education coordinator.
2. Institution has a recycling manager.
3. Institution has an energy manager.
4. Institution has an alternative transportation coordinator.
5. Institution has a sustainable food procurement coordinator.
6. Institution has a social responsibility and/or environmental justice coordinator.
7. Institution has an alumni sustainability fund.
8. Institution has an alumni sustainability network.
9. Institution has a student government position focused on sustainability (e.g., an environmental affairs commissioner).
10. Institution has a payroll deduction option for campus sustainability projects.
11. Institution is a signatory to Talloires Declaration.
12. Institution has a website describing its practices and efforts.
Community Relations and Partnerships
This section seeks to recognize institutions that give back to their communities through community service, engagement, and partnerships. Volunteerism and the sense of compassion that community service helps develop are fundamental to achieving sustainability. From tutoring children to removing invasive species to feeding the homeless, students can make tangible contributions that address sustainability challenges through community service. In addition, community engagement can help students develop leadership skills while deepening their understandings of practical, real-world problems. Institutions can contribute to their communities by harnessing their financial and academic resources to address community needs. For example, faculty research and courses can focus on how to address community problems. In addition, colleges and universities can offer incentives for their graduates to pursue careers that fill community needs, and schools can use their prominence to advocate for sustainability outside of their institutions.

Discussion
This section includes several significant changes since the previous version. First, three new credits were added: Financial Incentives for Public Service Careers, Outreach & Partnerships Carnegie Designation, and Public Policy Engagement. Second, the previous version included a credit based on community service in job descriptions. The credit was eliminated due to feedback suggesting it was not necessarily meaningful and could be controversial. Finally, credits about the percentage of Federal Work Study funds that were spent on community service jobs have been deleted from this version of STARS. Feedback on these credits suggested that they may not be a meaningful way to measure an institution’s commitment to community service. In addition, an institution’s ability to spend Work Study funds on community service jobs is often dependent on the institution’s location.

AF Credit 13: Community Service Infrastructure

Criteria
Institution has a permanent community service coordinator, office, or other mechanism in place to facilitate and promote community service participation.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of the community service coordinator, including name, job title, job description, and the date the position was created, if applicable
- A brief description of the community service office including its mission, a brief summary of its activities, and the date it was founded, if applicable
- A brief description of other programs, policies, or systems in place to foster community service
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that have devoted resources to encourage community service. Having a community service coordinator or office indicates institutional support for community service and helps facilitate participation.
Discussion
The previous version of this credit only recognized schools that have a community service coordinator. Reviewers noted that having a mechanism in place to facilitate community service participation is more important than having a coordinator specifically. The revised credit recognizes multiple approaches.

**AF Credit 14: Student Participation in Community Service**

**Criteria**
Institution engages a specified percentage of its student body in institution-organized or coordinated, unpaid community service activities, including, but not limited to, service that earns academic credit.
- 1 pt: Between 25 and 50 percent of the student body participates in community service.
- 2 pts: 50 to 90 percent of the student body participates in community service.
- 3 pts: Over 90 percent of the student body participates in community service.

For this credit, the student body does not include non-credit students.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of the institution’s system for tracking community service participation
- The number of students participating in community service during the previous year
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that have engaged a significant portion of their student body in community service, as measured by how widespread participation is at the institution. The credit focuses on institution-sponsored or coordinated community service activities because data on community service that is not institution-sponsored or coordinated is often unavailable.

**AF Credit 15: Student Hours Contributed in Community Service**

**Criteria**
Institution engages students in a specified number of hours of institution-organized or coordinated, unpaid community service per full-time equivalent student per year.
- 1 pt: Institution engages students in at least 1 and less than 5 hours of community service per full-time equivalent student per year.
- 2 pts: Institution engages students in 5 to 10 hours of community service per full-time equivalent student per year.
- 3 pts: Institution engages students in more than 10 hours of community service per full-time equivalent student per year.

For this credit, the student body does not include non-credit students.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- The total number of hours students contributed to community service during the previous year
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party
Guidance
This credit recognizes institutions whose students devote a significant amount of time to community service, as measured by the average amount of time students devote to community service per year. While AF Credit 14 measures the number of students participating in community service, this credit measures the amount of time students devote to community service. The credit focuses on institution-sponsored or facilitated community service activities because data on community service that is not institution-sponsored or coordinated is often unavailable.

Discussion
The previous version of STARS had a credit similar to AF Credit 14 that was based on the percentage of students engaged in community service. This credit was created in response to feedback suggesting that a credit based on hours spent conducting community service would be a meaningful supplement to that credit, as together they would provide a better picture of the institution's community service activities.

AF Credit 16: Financial Incentives for Public Service Careers

Criteria
Institution has financial incentives programs for graduates of JD and/or MBA programs who enter public service careers.

This credit does not apply to institutions that do not have a JD or MBA program.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of each of the institution's loan repayment assistance or other financial incentive programs for MBA and JD programs
- The date the programs began
- A brief summary of the impact of the programs, including the number and percentage of graduates participating in the programs
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that offer incentives for their graduates to enter public service careers. The burden of paying off student loans can dissuade qualified graduates from seeking careers in public service, as these jobs tend to be lower paid. Offering financial incentives helps attract people to public service careers and can be a useful strategy in fulfilling shortages in high-need vocations.

Discussion
This credit was created for this version of STARS based on suggestions from reviewers.

AF Credit 17: Outreach & Partnerships Carnegie Designation

Criteria
Institution meets the criteria of the Carnegie Foundation for the Advancement of Teaching's "Outreach & Partnerships" Elective Classification.
**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of how the institution meets the criteria for the Outreach & Partnerships designation (a Community Engagement Elective Classification).
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party.

**Guidance**
This credit recognizes institutions that meet the criteria for earning the Outreach & Partnerships Designation from the Carnegie Foundation for the Advancement of Teaching. This designation is given to "Institutions that provided compelling evidence of one or both of two approaches to community engagement. Outreach focuses on the application and provision of institutional resources for community use with benefits to both campus and community. Partnerships focuses on collaborative interactions with community and related scholarship for the mutually beneficial exchange, exploration, and application of knowledge, information, and resources (research, capacity building, economic development, etc.)."

To earn the Outreach & Partnerships designation, institutions must describe their community outreach programs, institutional resources provided to meet community needs, and examples of faculty scholarship associated with community partnerships.

**Discussion**
This credit was created for this version of STARS based on suggestions from reviewers.

**AF Credit 18: Public Policy Engagement**

**Criteria**
Institution advocates for federal, state, or local public policies that support campus sustainability or that otherwise advance sustainability.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of how the institution engages in public policy advocacy for sustainability, including the issues, bills, ordinances, for or against which the institution has advocated.
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party.

**Guidance**
This credit recognizes institutions that have promoted sustainability through public policy advocacy. There are myriad public policies that address sustainability, including several specific to higher education, for which institutions can advocate. Given the prominence and importance of colleges and universities in their communities, institutions can be powerful voices in advancing sustainability legislation.

**Discussion**
This credit was created for this version of STARS based on suggestions from reviewers.
Diversity, Access, and Affordability

This section seeks to recognize institutions that are working to advance diversity, access, and affordability both on campus and in society at large. In order to build a sustainable society, diverse groups will need to be able to come together and work collaboratively to address sustainability challenges. People of color and low-income communities tend to suffer disproportionate exposure to environmental problems. This environmental injustice happens as a result of unequal and segregated communities. To achieve environmental justice, society must work to address discrimination and promote equality. Higher education opens doors to opportunities that can help create a more equitable world. The historical legacy and persistence of discrimination based on racial, gender, religious, and other differences makes a proactive approach to addressing diversity and promoting a culture of inclusiveness important components of creating an equitable society. In addition, a diverse student body, faculty, and staff provides a rich resource for learning and collaboration.

Discussion

This section has changed significantly since STARS 0.4, and includes credits and issues from the ‘Diversity’ and ‘Affordability and Social Mobility’ sections of the previous draft.

STARS 0.4 included credits that recognized schools with three-year upward trends in the following: faculty racial and ethnic diversity, under-represented group graduation rate, faculty gender diversity, administrator racial and ethnic diversity, and administrator gender diversity. AASHE received feedback that these credits create an unfair disadvantage for schools that have already made progress in creating a diverse campus community. In addition, several reviewers noted that diversity means different things to different schools, depending on their locations, histories, institution-types, and other factors. In this spirit, many reviewers felt that setting numerical targets for diversity was not appropriate. This section contains several new credits that recognize institutions that have programs and mechanisms in place to promote and celebrate diversity.

AASHE is interested in developing additional credits that are based on comparable metrics of having a campus culture of inclusiveness and welcomes feedback on what form those credits should take.

AF Credit 19: Diversity Committee

Criteria

Institution has a diversity committee or other body with broad stakeholder representation, including students and administrators, that meets at least once per semester or term, and is charged by the administration or board of trustees to advise on and implement policies and programs related to diversity on campus.

Documentation

Complete the online STARS submittal form for this credit. The form requests:

- The charter or mission statement of the committee or a brief description of the committee’s purview and activities
- The committee membership, including affiliations
- The committee meeting schedule
- The URL for the committee’s website, if applicable
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party
**Guidance**

This credit recognizes institutions with active diversity committees charged by the administration or board of trustees. Having a diversity committee is an important first step in fostering dialogue about diversity issues on campus. An active diversity committee helps institutions develop, implement, and evaluate diversity policies. Drawing committee membership from students, faculty, staff, and other campus stakeholders helps foster broader participation in the conversation and helps ensure that the committee addresses diversity for all levels of the campus. In addition, serving on a diversity committee provides a valuable learning opportunity for involved students, faculty, staff, and others. Having an organized group of people working on the issue is fundamental in creating a campus culture that welcomes and respects diversity.

**Discussion**

While most reviewers supported maintaining this credit, which was included in STARS 0.4 as well, some reviewers said that institutions could have other mechanisms that achieve the same thing as a diversity committee. AASHE is open to considering other mechanisms and would be interested to hear more about what campuses are or could be doing to achieve the same things as a diversity committee.

**AF Credit 20: Diversity Officer**

**Criteria**

Institution has a diversity officer who reports to the president or provost, and has responsibility for directing or coordinating diversity initiatives. For institutions with 5,000 or fewer students, the diversity officer is at least 0.5 full-time equivalent. For institutions with more than 5,000 students, the diversity officer is full-time.

**Documentation**

Complete the online STARS submittal form for this credit. The form requests:
- The name and title of the diversity officer
- The job description of the diversity officer
- The date the diversity officer position was created
- The title of the position to whom the diversity officer reports
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

**Guidance**

This credit recognizes institutions that have a dedicated diversity officer. Dedicating staff time to diversity and inclusiveness and having the diversity officer report to a high-ranking administrator indicates institutional commitment to diversity. Having a dedicated diversity officer is a valuable way to support, address, and implement diversity policies and programs and create a culture of inclusiveness.

**Discussion**

STARS 0.4 included a credit that only recognized schools with a full-time diversity officer. Based on feedback suggesting that a full-time position may not make sense for all sizes and types of schools, the current version of the credit allows for part-time diversity officers to earn credit for schools with 5,000 or fewer students.
**AF Credit 21: Non-Discrimination Policy**

**Criteria**
Institution has a comprehensive non-discrimination statement that prohibits discrimination on the basis of race, ethnicity, culture, religion, national origin, sex, age, disability, sexual orientation, medical condition, gender identity, pregnancy, parental status, marital status, and veteran status.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A copy of the institution's non-discrimination policy
- The date the policy was adopted
- A brief description of how the policy is implemented and/or upheld
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions with comprehensive policies that prohibit discrimination. A non-discrimination policy sets the tone for the institution about its commitment to respecting differences and not tolerating discrimination. A non-discrimination policy is an important foundation for ensuring equal treatment and respect for all within the campus community.

**Discussion**
A similar credit was included in the previous version of STARS. Some reviewers felt it should be a prerequisite instead of a credit. Others felt that it should remain a credit since the statement includes some classes or groups that are not always included in non-discrimination statements. In addition, since STARS strives to include points that recognize schools beginning their sustainability programs, this credit provides a valuable point of entry for many schools.

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**AF Credit 22: Diversity Plan**

**Criteria**
Institution has a diversity plan or plans that cover the entire institution. The diversity plan may be a stand-alone document, part of the strategic plan, or a set of separate plans at the school or department level, as long as all areas of the institution are covered by a plan.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A copy of the diversity plan(s)
- The date(s) the plan(s) were adopted
- A brief description of the goals and strategies outlined in the plan(s) and progress made in achieving those goals
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party


**Guidance**
This credit recognizes institutions that have developed plans to foster diversity on campus. Having a plan allows institutions to articulate their diversity vision and goals, and provides a roadmap for achieving those goals. Due to widespread differences between institutions, each college or university will have a unique approach to diversity. This credit allows institutions to pursue their own approaches to diversity and develop plans that are most appropriate for their circumstances.

**Discussion**
A similar credit that focused on department-level diversity plans was included in STARS 0.4. The current version of the credit allows for institution-wide plans to count in response to feedback suggesting that alternate approaches should be recognized.

**AF Credit 23: Recruiting for Student Diversity**

**Criteria**
Institution has programs and policies in place to recruit a diverse student body.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of policies and programs in place to attract a diverse student body, including the dates those programs were enacted
- A brief summary of the results of those policies and programs, including the composition of the student body according to the diversity breakdowns the institution uses
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that are working to attract a diverse student body. In acknowledgement of the various strategies that are appropriate to different institutions, this credit does not prescribe a specific strategy, but recognizes schools that have a proactive approach to recruiting a diverse student body.

**Discussion**
The previous version of this credit was more prescriptive about what an institution must do in its recruitment efforts in order to promote diversity. The current version of the credit allows for each school to determine an approach that is appropriate for itself.

**AF Credit 24: Support Programs for Under-represented Groups**

**Criteria**
Institution has mentoring, counseling, or other programs in place to support under-represented groups on campus.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of the programs institution has to support under-represented groups on campus, including the dates those programs were implemented
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

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Guidance
This credit recognizes institutions that have programs in place to support under-represented groups on campus. Certain challenges accompany being a minority on campus. Schools can help maintain a diverse student body by offering support programs to help individuals in under-represented groups thrive.

Discussion
This credit was added to STARS in an attempt to recognize schools that are taking initiative to help create a culture of inclusiveness by supporting students from under-represented groups.

AF Credit 25: Support Programs for Under-represented Ph.D. Candidates
Criteria
Institution has or participates in a mentoring or other program that supports doctoral candidates from under-represented groups.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of the programs and policies in place to support doctoral candidates from under-represented groups
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that are taking steps to help build a more diverse faculty throughout higher education by supporting Ph.D. candidates from under-represented groups. Having a diverse faculty helps provide a rich learning experience for all students. Mentoring and other support programs help foster the participation of under-represented groups in higher education.

Discussion
STARS 0.4 included credits based on the racial and ethnic diversity of faculty and on the gender diversity of faculty. As explained above, developing fair credits based on the diversity of faculty proved challenging. In addition, some reviewers noted that colleges and universities can do much to support diversity in higher education by fostering the participation of Ph.D. candidates from under-represented groups. This credit seeks to recognize schools that are working to build a more diverse pool of potential faculty members throughout higher education.

AF Credit 26: Affordability and Access Programs
Criteria
Institution has policies and programs in place to make the institution accessible and affordable to low-income students.
**Documentation**
Complete the online STARS submittal form for this credit. The form requests:

- A brief description of the policies and programs the institution uses to improve its access and affordability
- A brief summary of the impact of such programs within the past three to five years
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that are implementing strategies to improve their access and affordability. Achieving a higher education degree is a valuable tool in addressing inequity, but in order for higher education to help society move toward greater equity, schools must be accessible to low-income populations.

**Discussion**
STARS 0.4 included a separate section called ‘Affordability and Social Mobility.’ The section was comprised of two credits. The first credit, Social Mobility – Trend, was based on a three-year upward trend in the percentage of students from low-income families or from families in which neither parent has a college degree. In addition to concerns with using trend-based credits, several reviewers suggested that gathering data for this credit would be unduly burdensome or impossible. The second credit, Affordability – Trend, was based on having faster growth in financial aid than in tuition over a three year period. This credit was unpopular with reviewers as it could reward institutions that are offering more loans and leaving their graduates with large debts.

Further research revealed that there are widespread differences in opinion about best practices for rewarding financial aid, measuring affordability, and improving access to higher education. The credit included in this document is based on the suggestion that it is best not to prescribe strategies, but to focus on learning what schools are doing to help share information and identify best practices.

**Diversity, Access, and Affordability: Tier Two Credits**
1. Institution offers gender neutral housing options.
Human Resources
This section seeks to recognize institutions that treat and remunerate their workers responsibly and fairly. Just as businesses addressing sustainability include human capital as part of the triple bottom line, colleges and universities can contribute to an equitable and sustainable society by offering benefits, wages, and other policies that respect and ethically compensate their human capital.

Discussion
This is a new section that was not included in STARS 04. Some of the credits in this section are similar to those in the ‘Fair Labor Practices’ section of 04. Other credits from that section were eliminated, moved to the purchasing section, or added to a new section that addresses trademark licensing.

AF Credit 27: Sustainable Compensation

Criteria
Institution periodically evaluates, and updates as appropriate, its wages and benefits policies to ensure that total compensation (wages plus benefits) for the lowest-paid employees is sufficient to enable these employees to meet their basic needs. Student workers are not covered by this credit.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of how the institution evaluates its compensation policies, including the methodology used to calculate the appropriate compensation and how often compensation policies are reviewed.
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party.

Guidance
This credit recognizes institutions that take proactive steps to ensure that their lowest paid workers earn a sustainable compensation.

Discussion
This credit replaces a credit from STARS 04 that was based on paying employees a “living wage.” AASHE received feedback that the term ‘living wage’ can be interpreted differently and carries connotations that are inappropriate for STARS. The new credit looks at total compensation rather than wages alone, and lets the institution determine what constitutes sustainable compensation. The intent of the new credit is to ensure that the institution regularly reviews its compensation policies with an eye towards enabling the lowest paid workers to meet their basic needs.

In revising this credit, AASHE examined how wage issues are addressed in corporate sustainability standards, such as the Global Reporting Initiative (GRI), the Dow Jones Sustainability Indexes, and the B Corporation Rating Systems. Each of these standards includes questions related to wages and compensation for business’ lowest paid workers. The B Corporation Rating Systems ask if a living wage is paid to all full-time and part-time employees. GRI asks for the “Range of ratios of standard entry level wage compared to local minimum wage at significant locations of operation.” The Dow Jones Sustainability Indexes ask if the company has endorsed the Universal Declaration of Human Rights, which says, “Everyone who works has the right to just and favourable remuneration ensuring for himself and his family an existence worthy of human dignity.” While existing corporate
sustainability standards don't provide a clear consensus for what form a STARS credit should take, they affirm that considering compensation for lowest paid employees is a recognized component of sustainability.

**AF Credit 28: Faculty and Staff Benefits**

**Criteria**
Institution provides healthcare benefits to employees.
- 1 pt: All full-time employees receive full health care coverage.
- 2 pts: All employees with at least 0.75 full-time equivalence receive full health care coverage.
- 3 pts: All employees with at least 0.5 full-time equivalence receive full health care coverage.

*This credit does not apply to Canadian institutions.*

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A copy of the institution’s most recent health care policy for employees, or a brief summary of the policy
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that provide health care coverage to employees. Human health is an important component of sustainability. Institutions can help build a healthy and productive workforce by providing healthcare benefits to their employees.

**Discussion**
This credit is similar to a credit included in STARS 0.4, but the new credit includes three points to allow for gradual improvement and different levels of recognition.

**AF Credit 29: Graduate Student Employee Benefits**

**Criteria**
Institution provides graduate student employees (e.g., GRAs and TAs) health insurance benefits.
- 1 pt: Institution covers 75 percent of graduate student employees’ health care premiums.
- 2 pts: Institution covers 100 percent of graduate student employees’ health care premiums.

*This credit does not apply to Canadian institutions.*

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A copy of the graduate student employee health care policy, or a brief summary of the policy
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that provide health insurance coverage to graduate student employees.
Discussion
This credit is similar to a credit included in STARS 0.4, but the new credit includes two points to allow for gradual improvement and different levels of recognition.

AF Credit 30: Parental Leave
Criteria
Institution grants parental leave to all employees, including graduate students.

This credit does not apply to Canadian institutions.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of the institution's parental leave policy
- The date the institution adopted the policy
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that grant parental leave to their employees. Parental leave recognizes unpaid family work of raising children, and is an important tool to promote gender equality in the workplace.

Discussion
This credit was added to STARS for this version.

AF Credit 31: Domestic Partner Benefits
Criteria
Institution provides equal benefits to employees' same-sex domestic partners as to employees' spouses.

This credit does not apply to Canadian institutions or to institutions located in states that prohibit the provision of equivalent domestic partner benefits.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- A brief description of the institution's equal benefits policy or program and the date it was implemented
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that provide equal benefits to domestic partners.
**AF Credit 32: Employee Satisfaction Survey**

**Criteria**
Institution conducts a survey at least once every three years to measure employee satisfaction. The survey may be conducted institution-wide or may be done by individual departments as long as all departments are covered by a survey.

**Documentation**
Complete the online STARS submittal form for this credit. The form requests:
- A copy of the survey used to measure employee satisfaction
- The date the survey was last administered
- A brief summary or a copy of a report summarizing the results from the survey
- A brief description of policies or programs implemented to address issues raised by the survey
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

**Guidance**
This credit recognizes institutions that take an active interest in the satisfaction of their employees by conducting a regular survey of employee satisfaction. Surveying employees about job satisfaction helps institutions gauge their performance as an employer and can help identify strengths and areas for development.

**Discussion**
This credit was added to STARS for this version.

**Human Resources: Tier Two Credits**
1. Institution has an on-site child care facility or partners with a local facility to meet the child care needs of students, faculty, and staff.
2. Institution has a whistle-blower policy and established method to raise complaints and concerns without fear of reprisal.
3. Institution offers part-time schedules and job share arrangements.
Trademark Licensing
This section seeks to recognize institutions that take steps to ensure that apparel and other products bearing the institution's name are made in environmentally and socially responsible ways. Colleges and universities can promote fair, just, and sustainable labor and manufacturing practices by proactively screening, selecting, and monitoring the factories that produce apparel that bears their logo.

Discussion
This is a new section that was created for STARS version 0.5. Credits similar to those included in this section were part of the ‘Fair Labor Practices’ section in STARS 0.4. The new section was created in response to feedback noting that trademark licensing typically is not handled by human resources departments, which oversee or coordinate the topics covered by other credits that were included in the ‘Fair Labor Practices’ section.

AF Credit 33: Independent Monitoring of Logo Apparel

Criteria
Institution is a member of an organization that conducts monitoring and verification to ensure that products bearing the institution’s name or logo are produced under fair conditions (e.g., the Worker Rights Consortium or the Fair Labor Association).

This credit does not apply to schools that do not have their logo on apparel.

Documentation
Complete the online STARS submittal form for this credit. The form requests:

- The monitoring and verification organization of which the institution is a member
- The date the institution joined the organization
- A statement that the submitted information is accurate to the best of a responsible party's knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that join a monitoring and verification organization to help ensure that apparel bearing the institution’s name is produced under fair conditions. The Worker Rights Consortium is an independent monitoring organization focused on protecting the rights of workers who sew and make products to be sold in the United States. Its membership is comprised of colleges and universities. The Fair Labor Association is comprised of apparel businesses, higher education institutions, and non-governmental organizations. Its mission is to promote compliance with international labor laws and standards.

Discussion
The previous version of this credit did not allow participation in the Fair Labor Association to count. AASHE received feedback the credit should be more inclusive and changed the credit to reflect that input.
AF Credit 34: Designated Suppliers Program

Criteria
Institution participates in the Worker Rights Consortium’s Designated Suppliers Program.

This credit does not apply to schools that do not have their logo on apparel.

Documentation
Complete the online STARS submittal form for this credit. The form requests:
- The date the institution joined the Designated Suppliers Program
- A brief description of the institution’s involvement in the Designated Suppliers Program
- A brief description of the institution’s efforts to add factories to be included under the program
- A statement that the submitted information is accurate to the best of a responsible party’s knowledge and contact information for the responsible party

Guidance
This credit recognizes institutions that join the Designated Suppliers Program to help ensure that apparel bearing the institution’s name is produced under fair conditions. The Designated Suppliers Program, administered by the Worker Rights Consortium, conducts independent screening and verification to proactively select factories that respect and honor workers’ rights, including the right to sustainable compensation.
Appendix A: Institutions Participating in the STARS Pilot Project

Acadia University  
Appalachian State University  
American University  
Arizona State University  
Ball State University  
Boise State University  
British Columbia Institute of Technology  
California State University, Chico  
California State University, Sacramento  
Case Western Reserve University  
College of St. Benedict  
Colorado State University  
Concordia University  
Dallas County Community College District  
De Anza Community College  
Delta College  
Dickinson College  
Earlham College  
Eastern Iowa Community College District  
Eastern Kentucky University  
Emory University  
Florida Gulf Coast University  
Grand Rapids Community College  
Grand Valley State University  
Green Mountain College  
Gustavus Adolphus College  
Hennepin Technical College  
Illinois State University  
Iowa State University  
Ithaca College  
Jackson Community College  
Lane Community College  
Lewis & Clark College  
Lipscomb University  
McGill University  
Middlebury College  
Monroe Community College  
Monterey Institute of International Studies  
Mount Union College  
Mt. Hood Community College  
New York University  
Northland College  
Northwest State Community College  
Pacific Lutheran University  
Portland State University  
Randolph College  
Richland College  
Richland Community College  
Rochester Community and Technical College  
Rose-Hulman Institute of Technology  
Rowan University  
Rutgers, The State University of New Jersey  
Saint Xavier University  
San Diego City College  
Santa Barbara City College  
Santa Clara University  
Santa Fe Community College  
Seattle Pacific University  
Spokane Falls Community College  
St. John’s University  
State University of New York, College of  
Environmental Science & Forestry  
Syracuse University  
The Evergreen State College  
University of Arizona  
University of British Columbia  
University of Calgary  
University of California, San Diego  
University of California, Santa Barbara  
University of Central Florida  
University of Colorado at Boulder  
University of Colorado at Colorado Springs  
University of Florida  
University of Illinois at Chicago  
University of Kansas  
University of Kentucky  
University of Maine  
University of Minnesota, Morris
University of Nebraska at Omaha
University of New Hampshire
University of Northern British Columbia
University of Puget Sound
University of Southern Maine
University of Texas at Austin
University of Washington, Tacoma
University of Wisconsin - River Falls
University of Wisconsin Oshkosh
Washington University in St. Louis
Western Carolina University
Western Illinois University
Western Iowa Tech Community College
Western Washington University
Williams College
Winona State University
Worcester Polytechnic Institution
Appendix B: Strategic Advisory Committee Members

Sarah Banas - Program Associate, American Association for the Advancement of Science
Elizabeth Beltramini - Director of Communications, Association of College Unions International (ACUI)
Bettie Ann Brigham - Vice President for Student Development, Eastern University (representing the National Association of Student Personnel Administrators)
Mary Ann Coughlin - Professor of Research and Statistics and Assistant Vice President for Academic Affairs, Springfield College (representing Association for Institutional Research)
Geri Durka-Pelok - Instructional Designer, Society for College & University Planning
Andrea George - Associate Director of Environmental Health & Safety & Sustainability Coordinator, Vanderbilt University (representing Campus Safety Health and Environmental Management Association)
John Hammang - Director of Special Projects and Development, American Association of State Colleges and Universities
Mary Jensen - Coordinator of Campus Sustainability, Keene State College (representing the College and University Recycling Council)
Julian Keniry - Senior Director, Campus & Community Leadership, National Wildlife Federation
Shannon Kenny - Deputy Director, Sector Strategies Division, U.S. Environmental Protection Agency
Michele Madia - Director, Environmental Leadership, NACUBO
Paula Martin - Assistant Provost, Juniata College (representing the National Council for Science and the Environment)
Amy G. McGlashan - Executive Director, Vermont Campus Compact
Lander Medlin - Executive Director, APPA
Susan Mendoza-Jones - Director of Integrative Learning, Grand Valley State University (representing Disciplinary Associations Network for Sustainability)
Doreen Munner - CEO, National Association of Educational Procurement (NAEP)
Mark Orlowski - Executive Director, Sustainable Endowments Institute
Cameron Schauf - Director, Dining Services & Auxiliary Operations, University of Rochester (representing National Association of College & University Food Services)
Richard A. Skinner - Senior Vice President, Programs & Research, Association of Governing Boards (AGB)
Mary Spilde - President, Lane Community College (representing American Association of Community Colleges)
Jeanne S. Steffes - Associate Vice President for Student Affairs, Syracuse University (representing ACPA - College Student Educators International)
Appendix C: Technical Advisory Committee Members

Cathy Anderson - Assistant Dean, Student Services, Northern Wyoming Community College District
Peter Ashbrook - Director, Environmental Health & Safety, University of Missouri-Columbia
Tom Balf - Director, Campus Consortium for Environmental Excellence (C2E2)
Richard Bankowski - Manager of Safety and Health, Rutgers, The State University of New Jersey
Ed Becker - Executive Director, Environmental Health & Safety, University of Southern California
Bonny Bentzin - Manager, Campus Sustainability Practices, Arizona State University
Almut Beringer - Senior Research Fellow, UNESCO Chair 'Higher Education for Sustainable Development', University of Lueneburg, Germany
Scott Berlin - Dining & Hospitality Services Director, University of California, Santa Cruz
Matthew Bette - Director, Dining Services, Middlebury College
Carol Brodie - Research Administrator, Research & Graduate Studies, University of the Pacific
Jack Byrne - Campus Sustainability Coordinator, Middlebury College
Wynn Calder - Director, University Leaders for a Sustainable Future
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Enid Cardinal - Sustainability Coordinator, Illinois State University
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Tonia Compton - President, National Association of Graduate-Professional Students
Joe Curnow - National Coordinator, United Students for Fair Trade
John Cusack - Executive Director, New Jersey Higher Education Partnership for Sustainability
Jeff Darling - Purchasing Agent, University of Colorado at Boulder
Mark Darling - Program Coordinator, Recycling Resource Management, Ithaca College
Jack DeBell - Recycling Program Development Director, University of Colorado at Boulder
Edward Delaney - President, Strategic Analyses: Organizational Planning & Research
DeeDee Delongpre - Director, Office of Sustainability, University of Florida
David Eagan - Outreach Specialist, Nelson Institute for Environmental Studies, University of Wisconsin-Madison
Jonathan Eldridge - Vice President for Student Affairs, Southern Oregon University
Jonathan Fink - Director and Chief Sustainability Officer, Global Institute of Sustainability, Arizona State University
Andy Fisher - Executive Director, Community Food Security Coalition
Tim Foster - Accounting Manager, Siemens Building Technology
Debby Freed - Alternative Transportation Manager, Office of Transportation, Virginia Tech
Jeremy Friedman - Project Administrator, NYU Sustainability Task Force, New York University
Jim Frierson - Director of Strategic Projects and Vice Chairman, Advanced Transportation Technology Institute (ATTI), University of Tennessee at Chattanooga
Tim Galanne - Food Systems Education & Research Coordinator, Center for Agroecology & Sustainable Food Systems, University of California, Santa Cruz
Harold Glasser - Associate Professor, Environmental Studies, Western Michigan University
Stephen Gnadt - Associate Director, Stamp Student Union, University of Maryland
Char Gray - Executive Director, Pennsylvania Campus Compact
Steve Guenther - Vice President of Operations, ARAMARK Education
Gail Hall - EHBS Officer, Boston College
Michele Hallahan - Environmental Specialist, University of Texas at Austin
Lauren Heising - Coordinator of Sales & Nutrition, Housing & Dining Services, University of Colorado at Boulder
Anjali Helferty - National Coordinator, Sustainable Campuses, Sierra Youth Coalition
Elaine A. Hills - PhD Candidate, Department of Epidemiology & Biostatistics, University at Albany-SUNY
Winston Huff - Sustainability Coordinator/Project Manager, Smith Seckman Reid Engineers
Mark Kelly - Manager Environmental Services, Rutgers, The State University of New Jersey
Tom Kelly - Chief Sustainability Officer, University of New Hampshire
Linda Kogan - Sustainability Officer, University of Colorado at Colorado Springs
Steve Kreidler - Executive Vice President, University of Central Oklahoma
Dominique LaRoche - Director, Space Management, Arizona State University
Nancy Levandowski - Director of ISU Dining, Iowa State University
Phil Ling - Powernomics
Terry Link - Director, Office of Campus Sustainability, Michigan State University
Larry Litten - Retired; previously Director of Institutional Research at Carleton and Dartmouth Colleges as well as the Director of Research at the Consortium on Financing Higher Education (COFHE)
Jean MacGregor - Senior Scholar and Director, "Curriculum for the Bioregion" Initiative, Washington Center for Improving the Quality of Undergraduate Education, The Evergreen State College
Matt Malton - Assistant Vice Chancellor for Campus Sustainability, Washington University in St. Louis
Jerry Mann - Director, Student Support Services/Business Analysis, UCLA
Johnette McKown - Executive Vice President, McLennan Community College
Penny Menton - Associate Director, Transportation Services, UCLA
John Mlake - National Market Sector Research Manager, Perkins Will
Gordon Nelson - Director of Property Management, University of Maine
Jane Nichols - Professor of Interior Design, Western Carolina University
Dixie Norris - Vice President Finance & Administration, Cape Cod Community College
Mark O’Gorman - Associate Professor, Environmental Studies, Maryville College
Jacob Park - Assistant Professor, Business Strategy & Sustainability Business, Green Mountain College
Christopher Payne - Associate Vice Chancellor for Student Affairs, University of North Carolina
John Petersen - Chair, Environmental Studies Program, Oberlin College
Jim Pittman - Associate Faculty, Sustainability Science & Practice, Prescott College
Jesse B. Pyles - Service-Learning & Sustainability Coordinator, Green Mountain College
Edward L. Quevedo - Senior Consultant, Strategic and Corporate Services, WSP Environmental Strategies
Lee Richardson - Professor of Marketing, University of Baltimore
Jonathan Raussew - Sustainability Development Coordinator, University of Ottawa
Kyle Rosato - Manager of Environmental Programs, Office of Environmental Health & Radiation Safety, University of Pennsylvania
Dave Rosenfeld - National Program Director, The Student PIRGs
Maureen Roskoski - Senior Project Manager, Facility Engineering Associates
Debra Rowe - Coordinator, Disciplinary Associations Network for Sustainability (DANS)
Justin Schott - Campus Field Coordinator, Campus Ecology Program, National Wildlife Federation
Sarena Seifer - Executive Director, Community-Campus Partnerships for Health
Morgan Simon - Executive Director, Responsible Endowments Coalition
Walter Simpson - Energy Officer, University at Buffalo
Brad Smith - Dean, Huxley College of the Environment, Western Washington University
Jeff Stebar - Principal, Perkins Will
Anne Stephenson - Consultant, University of Chicago
Brett M. Stevens - Manager, Business Development and Sustainability, NELSON
Joel Stout - Sustainability Specialist, Sebesta Blomberg
Tuesday A. Strong - Director of Facilities Services, Rose-Hulman Institute of Technology
Susan Sutheimer - Chair, Dept. of Natural Sciences and Math, Green Mountain College
Edward R. Terceiro Jr. - Executive Vice President, Mt. Wachusett Community College
Dawn Geronimo Terkla - Associate Provost of Institutional Research, Assessment, and Evaluation, Office of Institutional Research & Evaluation, Tufts University
Lia Wetzstein - Instructor, Environmental Science, University of Washington, Tacoma
Rick Wilke - Director, Environmental Education and Training Partnership and Distinguished Professor of Environmental Education, University of Wisconsin-Stevens Point
James Wilkins - Sustainability Coordinator, Furman University
Boyd Yarbrough - Director of University Housing, Furman University
Brian Yeoman - City Director, Houston, Clinton Climate Initiative
Michael Youdelman - Manager, Department of Recycling/Resource Management, Stony Brook University
Appendix G – CSAF Sustainability Inventory

This sustainability inventory which is created by Lindsay Cole is for reference purposes. The institution can modify this inventory to suit their sustainability purposes.
Campus Sustainability Assessment Framework (CSAF)

© Lindsay Cole, 2003. The author has created this document to assist Canadian campuses in moving forward with their sustainability objectives. The author encourages the broad use of this document for research, learning, teaching, and other non-profit uses, and hopes that users are respectful in recognizing and referencing the ideas herein. The author retains the sole right to use this research product for consulting and other potentially for-profit uses.
A BRIEF INTRODUCTION

Welcome to the Campus Sustainability Assessment Framework (CSAF). The CSAF is the product of a Masters thesis, the work of 15 co-researchers who are experts in campus sustainability, and more than 130 others who helped out with advice, input, and ideas along the way. Although this version of the CSAF is the “final version” in terms of this phase of the project, it is by no means complete. There is still a tremendous amount of work to be done. Most of this work must involve all of the budding campus sustainability activists out there who want to start a new project on their campus. This version of the CSAF needs to be used, abused, critiqued, ripped apart, and then rebuilt (hopefully in the near future) in order for it to begin to realize its full potential. This project needs all of you to take action.

I encourage you to read through the full Masters thesis by Lindsay Cole associated with this framework so as to fully understand how it was developed, who was involved in its development, why certain decisions were made, and what the remaining challenges that need to be worked out are. It is important to understand all of the bias and assumptions built in to this version of the CSAF in order for it to be most effectively tested, critiqued, and then improved. I hope that this tool helps you to work through some of your campus sustainability challenges, and helps to unite the Canadian campus sustainability movement together with one objective: to transform the way that our campuses teach, research and operate in to models of sustainability.

CAMPUS SUSTAINABILITY ASSESSMENT FRAMEWORK OVERVIEW

The CSAF began as a slightly modified version of Robert Prescott-Allen’s Wellbeing Assessment (2001). Through working with his methodological framework, trying to shape and mold it to the university campus context, and through piloting it with over 130 different sustainable campus proponents the CSAF has evolved substantially. The figure below represents our egg of sustainability, differing fundamentally from Wellbeing Assessment’s version (Prescott-Allen, 2001). This schematic shows that the people subsystem lies within the eco-subsystem, representing its supportive function, and that each subsystem needs to be healthy in order for the whole system to be healthy. Within each subsystem are five “dimensions,” representing the key campus sustainability issues identified by the co-research team. The ecosystem dimensions are air, water, land, materials, and energy. The people dimensions are knowledge, community, economy and wealth, governance, and health and wellbeing. Each dimension is then further broken down into “elements” and “subelements” until the organizational level of indicators is reached.
It is important to remember that any model of sustainability, for any context, serves only to visually represent and simplify a highly complex issue in order to aid our understanding of it. One of the greatest challenges of this research has been to model campus sustainability. Sustainability is a complex, interdependent, and long-term state that is currently ill defined, and very difficult to accurately divide into smaller parts. Humans are one part of the larger ecosystem, and the larger universe in which we live. Every living and non-living part of this earth has an essential role to play in the function of our world, and a right to continued existence. A model can only describe the complexity of these relationships in a very simplistic way. This model – our egg of sustainability – is meant to help with understanding and describing the wide range of campus sustainability issues included in the CSAF. There will be many criticisms of this model, and it is hoped that it can evolve over time as our understanding of campus sustainability grows.

Many campuses will face challenges in data and information gathering, and fully completing the CSAF. The CSAF is the largest scale tool of its kind, containing over 170 indicators. Many campuses will not be able to find information on all of the indicators contained in the CSAF, and perhaps whole sub-sections will have to be left blank due to inaccessibility or unavailability of information. This will be a great frustration, but should also be seen as a challenge and an opportunity for future improvements on your campus. People employing the CSAF should use these particularly challenging sections of the framework to describe your data collection difficulties, talk about these issues where your campus lacks important information, and make concrete suggestions on how to move forward. Inaccessible or uncollected information does not mean that the issue is not important for your campus, in fact it may be that these exact issues are the most important ones for your campus to address. The CSAF has been designed as a whole to describe overall movement of your campus towards sustainability. Application of the CSAF will be a great challenge, and an important one, requiring patience, diplomacy, strategic planning and perseverance to complete.
PEOPLE: HEALTH AND WELLBEING

There are 19 indicators in this section.

Recreation

Issue: Physical and social activity leads to improved human wellbeing through activation of the body and mind. It is important for campuses to support and encourage recreation on campus for these reasons. Recreation can include both competitive and intra-mural or club recreational activities. Need to define "recreation" a bit more clearly.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW-1</td>
<td>Recreation Space</td>
<td>Total square metres dedicated to recreation uses (both in- and outdoor to be included) divided by total campus square metres; multiply by 100.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HW-2</td>
<td>Recreation Participation</td>
<td>Total number of CCMs participating in one or more on-campus recreation programs (avoid double counting of people who participate in more than one program) divided by the total number of CCMs; multiply by 100.</td>
<td>At least 40%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: It is particularly difficult to set performance benchmarks for these indicators, as they will require some new research and testing for appropriate levels of performance. Thus all three short-term benchmarks should be seen as highly malleable, and are meant to initiate discussion on this important subject. HW-1 will have optimum performance that must be neither too high nor too low, and a careful balance must be found between the two extremes.
### Food

**Issue:** Access to healthy, nutritious, safe, and sustainable food products on campus is critical to the wellbeing of a campus community.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW-3</td>
<td>Diet Types</td>
<td>Total annual number of meal servings (i.e. breakfast, lunch and/or dinner) provided by all food service outlets on-campus that have all listed diet types provided for in the serving, divided by total number of meal servings provided by all food services each year; multiply by 100. Different diet types include: regular, vegan, vegetarian (lacto ovo), kosher, halal, diabetic, gluten free, and low calorie, cholesterol and salt.</td>
<td>At least 30%</td>
<td>100%</td>
</tr>
<tr>
<td>HW-4</td>
<td>Nutritional Information</td>
<td>Total annual number of meal servings (i.e. breakfast, lunch and/or dinner) provided by all food service outlets on-campus that provide detailed nutritional information to the consumer at point of purchase, divided by the total meals served; multiply by 100. Note: if one meal serving (i.e. breakfast) has 25% of its food products labeled with detailed nutritional information, then only 25% of that one meal should be counted towards the total.</td>
<td>At least 30%</td>
<td>100%</td>
</tr>
<tr>
<td>HW-5</td>
<td>Organic, Non-GMO, Fair Trade Food</td>
<td>Total annual dollar value of certified organic, and/or non-genetically modified, and/or fairly traded food products for all outlets selling food (prepared and unprepared) on campus, divided by the total annual food budget; multiply by 100. Note: if a food meets two or more of the categories, it should only be counted once.</td>
<td>At least 30%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Discussion: The list of meal types in indicator HW-3 is adapted from Air Canada’s list of meal options. This was selected as a source because of the national context from which their meal options were informed, and because it was quite extensive. This list will likely need to be adapted over time as better sources are found. Difficulty of quantifying a “meal.”

It would be better to measure certified organic, non-genetically modified, and fairly traded food purchases by weight rather than dollar value, because they often cost substantially more than ‘traditional’ food products. Dollar value thus skews the results, as it more heavily weights the ‘non-traditional’ foods purchased. However, because most campuses measure food purchases by dollar value and not weight, we used this measure.

The short-term benchmarks used in this section have been decided upon through a limited consensus process, and future work on setting these benchmarks must occur in order to set better targets.
Safety

**Issue:** All campuses should work to protect the personal safety of their students, staff, faculty and visitors, as this is essential for long-term social sustainability.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
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<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW-6</td>
<td>Motor Vehicle Accidents</td>
<td>Total annual number of accidents on-campus occurring on campus lands and involving at least one motor vehicle (include accidents involving cyclists, pedestrians, etc. with motor vehicles) divided by the total number of CCMs; multiply by 1000.</td>
<td></td>
<td>Zero per 1000 CCMs</td>
</tr>
<tr>
<td>HW-7</td>
<td>Workplace Incidents</td>
<td>Total annual number of workplace incidents divided by total number of staff and faculty CCMs (do not include FTE students); multiply by 1000.</td>
<td></td>
<td>Zero per 1000 CCMs</td>
</tr>
<tr>
<td>HW-8</td>
<td>Incidents of Assault</td>
<td>Total annual number of reported incidents of rape, sexual assault, racism, physical assault, homophobia, and other similar events divided by the total number of CCMs; multiply by 1000.</td>
<td></td>
<td>Zero per 1000 CCMs</td>
</tr>
</tbody>
</table>

**Discussion:**

Many workplace incidents go unreported, as well as many incidents of assault, so indicators HW-7 and HW-8 are only as good as the systems in place to report and track them.

Perhaps the reporting scale for all of these indicators is too small, and many campuses may have resulting numbers in the very low decimals even though we are using a number per 1000 CCMs. Over time, a better scale might be found that makes the resulting numbers more reasonable.

The long-term goals for all of these indicators are quite easy and obvious, but the shorter-term benchmarks are much less so. It was a struggle to set short-term benchmarks for these very serious issues that were something less than zero.
Health Services: Physical

**Issue:** The provision of on-campus services to promote and protect the physical wellbeing of the campus community is an important aspect of campus sustainability.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>Short-Term Benchmark</th>
<th>Long-Term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW-9</td>
<td>Physical Health Care Practitioners</td>
<td>Total number of CCMs divided by the total number of certified FTE physical health care professionals on-campus in assessment year (doctors, nurses, naturopaths, physiotherapists, etc.).</td>
<td>X CCMs/ FTE professional</td>
<td>X CCMs/ FTE professional</td>
</tr>
<tr>
<td>HW-10</td>
<td>Sick Days</td>
<td>Total annual number of sick days taken by FTE staff and faculty, divided by the total FTE staff and faculty members.</td>
<td></td>
<td>Zero</td>
</tr>
<tr>
<td>HW-11</td>
<td>Smoking</td>
<td>Total number of CCMs who smoke daily in assessment year, divided by the total number of CCMs.</td>
<td>14.5% or less</td>
<td>Zero</td>
</tr>
</tbody>
</table>

**Discussion:** Measuring the quality of on-campus physical health care services is difficult in a primarily quantitative indicator framework. It is assumed that one reason for a low number of visits might be poor quality of the service. Of course there are likely to be other reasons for a low number of visits, but a qualitative indicator to measure quality is not likely currently measured by most campuses.

Indicator HW-10 can be interpreted in several ways, as sick days are taken for different reasons including some that are outside the control of the campus. Many of these reasons likely relate to less than optimum working conditions, including actual sickness, stress, fatigue, workplace dissatisfaction, etc.
Health Services: Mental

**Issue:** The provision of high-quality on-campus mental health care services is a vitally important sustainability issue in the high stress, complex world of a campus.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW-12</td>
<td>Mental Health Care Practitioner</td>
<td>Total number of CCMs divided by the total number of certified FTE mental health care professionals on-campus in assessment year (psychiatrists, psychologists, counselors, etc.)</td>
<td>X CCMs/ FTE professional</td>
<td>X CCMs/ FTE professional</td>
</tr>
<tr>
<td>HW-13</td>
<td>Retention Rate</td>
<td>Measure annual retention rates of staff, students and faculty and average them based on the total FTE populations of each group.</td>
<td>At least 85%</td>
<td>100%</td>
</tr>
<tr>
<td>HW-14</td>
<td>Spiritual Services</td>
<td>Total number of CCMs practicing a spiritual discipline who are serviced by spirituality outlets available on-campus (with care taken not to double count individuals using more than one service) divided by the total number of CCMs; multiply by 100.</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>HW-15</td>
<td>Mental Illness</td>
<td>Total annual number of people reporting depression, alcohol/drug abuse, etc., divided by the total campus headcount; multiply by 100.</td>
<td>Zero</td>
<td></td>
</tr>
<tr>
<td>HW-16</td>
<td>Student Suicide Rate</td>
<td>Total annual number of student suicides, divided by the total headcount of students; multiply by 1000.</td>
<td>Zero per 1000 students.</td>
<td></td>
</tr>
</tbody>
</table>

**Discussion:** Indicator HW-12 has the same challenges as its counterpart in the physical health services section. It is difficult to determine what good short- and long-term performance is, and also what low or high levels actually mean in terms of sustainability and quality of the service. This indicator needs further work.

Indicators HW-15 and 16 are also difficult in many ways. It is emotionally difficult to set any short-term benchmark above zero due to the nature of these issues. Also, these issues are not entirely within the control or responsibility of the campus as there are often many other confounding factors in these cases. A campus can have a contribution to mental stresses, and has some responsibility to its community to help...
deal with them. That is why these two measures have been included, even though they are difficult.
Environment

Issue: These indicators link environmental issues specifically with human wellbeing issues as a vital convergence in sustainability work on campus. They address measurable issues that have potential impacts on both humans and the ecosystem together.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW-17</td>
<td>Accessible Greenspace</td>
<td>Total hectares of greenspace accessible to CCMs within 1 kilometre of campus (both on- and off-campus) in assessment year divided by the total number of CCMs; multiply by 1000.</td>
<td>X hectares per 1000 CCMs</td>
<td>X hectares per 1000 CCMs</td>
</tr>
<tr>
<td>HW-18</td>
<td>Noise Pollution</td>
<td>Number of unoccupied classrooms and offices with noise levels of 35 decibels or less, divided by the total number of classrooms in assessment year; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>HW-19</td>
<td>Light Pollution</td>
<td>Subtract average upright level above built campus space (in footcandles) from ambient upright levels (i.e. levels with all campus lights turned off). Divide the difference by the built campus upright levels; multiply by 100.</td>
<td>25% or less contribution of campus lighting to upright levels</td>
<td>Zero</td>
</tr>
</tbody>
</table>

Discussion: HW-17 was deemed important by the co-research team and others. It is important for wellbeing in terms of recreation and respite from day-to-day campus stresses. By linking this issue to off-campus accessible greenspace, we have moved in to the realm of things outside of the control of the campus. We didn’t want to limit this indicator to only on-campus greenspace, however, so as to give urban campuses the opportunity to perform well on this measure.

Light pollution is an important environment and health issue, for humans and other animals. The measurement of upright pollution is a new and emerging field, and there is currently no consensus-based method of measurement, or indicator of good performance. We urge those interested in this indicator to watch the literature carefully on this topic to ensure that the latest and most innovative ideas are used when assessing this indicator. The short-term benchmark used here is based on upright of 25% greater than that arising from a full moon in a completely dark environment.
**PEOPLE: COMMUNITY**

This section has 25 indicators.

![Diagram of PEOPLE node with branches for Community, Involvement & Cohesion, Diversity, Services, Disabilities, Ethnicity, Gender, Indigenous Peoples]

**Involvement & Cohesion**

**Issue:** A community with involved and engaged citizens has a much better chance of making coordinated and cooperative progress towards sustainability. Community cohesion is the on-going process of developing a community of shared values, shared challenges, and equal opportunity, based on a sense of trust, hope, and reciprocity. This section measures the strength of the campus community, as well as the strength of the relationship between on- and off-campus communities.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Measurement Units</th>
<th>Short-Term Benchmark</th>
<th>Long-Term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-1</td>
<td>Volunteerism</td>
<td>Total annual number of CCMs who volunteer at least 2 hours per week divided by the total number of CCMs, and multiplied by 100. Volunteering can be with one, or several different groups working on any issue but must be based on-campus. Organizations actively working against the concepts of sustainability (i.e. racial discrimination, waste of resources, etc.) shall not be included, and double counting of people should be avoided.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>C-2</td>
<td>Financing Volunteer Groups</td>
<td>Total annual amount of money university gives to each on-campus volunteer driven organization (excluding those working against sustainability), divided by the total number of organizations (excluding those working against sustainability). Money from both university and student government administrations should be included.</td>
<td>At least $250 per group each year.</td>
<td>At least $500 per group each year.</td>
</tr>
<tr>
<td>C-3</td>
<td>Alumni Volunteerism</td>
<td>Total annual hours of volunteer work done by university alumni for university specific tasks, divided by the total number of living alumni.</td>
<td>At least 12 hours per year.</td>
<td>At least 24 hours per year.</td>
</tr>
<tr>
<td>C-4</td>
<td>Graduates in the Community</td>
<td>Total annual number of incoming students from the local community, subtract total number of those local students who graduate and are still living in the community 1 year after graduation. Divide the difference by the total number of incoming students from the local community; multiply by 100. “Local” is defined as the local or regional government management area, as this is most likely how statistics will be kept.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>C-5</td>
<td>Sense of Community</td>
<td>Total annual number of CCNs who feel a very strong sense of belonging, attachment to, confidence in, and engagement in their campus community according to survey results, divided by total number of survey respondents; multiply by 100.</td>
<td>At least 75%</td>
<td>100%</td>
</tr>
<tr>
<td>C-6</td>
<td>Voter Turnout</td>
<td>Number of student voters in most recent student election (of any type), divided by total number of eligible voters; multiply by 100. If more than one election was held in the previous year, average the voter turnout results.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: It is difficult to determine where to draw the line in terms of community engagement in volunteer driven organizations. Do we pick only those that focus specifically on sustainability issues, or do we choose all organizations – as they all promote community involvement in one way or another? We chose the latter, and the problem then became how we exclude groups that are actively working against the concepts of sustainability (i.e. car racing clubs, racial discrimination groups, etc.). This indicator forms our best first attempt at measuring this issue.

Indicators C-2 through 4 are all challenging in terms of setting benchmarks, as they will all have undesirable extremes on the low and high ends of the scale, and the optimum level will be found somewhere in between. It is also difficult to determine what reasonable targets might be for long-term goals. The benchmarks should be reviewed and improved through use, and the determination of best practice examples. The measurement unit of ‘local’ in indicator C-4 is also sub-optimal, and does not correspond to other uses of the word, but was selected because it is the most reasonable in terms of data collection.

Indicator C-5 is one of very few examples of a qualitative measure used in this framework. We strove to use quantitative measures as much as possible not because we view them as stronger measures, but because in many cases they are easier to use, and more consistent when used for comparisons across different campuses. The important elements of community cohesion described in the indicator were deemed a vital part of this section, and thus a qualitative measure was included. As the implementation of the framework is designed following the completion of this tool, guidelines should be developed for determining performance on this indicator so as to standardize results as much as possible.
Diversity: Disabilities

Issues: Active promotion of employment equity for faculty and staff, and for recruitment and accessibility equity for students for people living with disabilities is a vital component of social sustainability on the campus. Each of these indicators measures the gap between the provincial population average of people of working age with physical and/or mental disabilities, and the campus community group in question.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-7</td>
<td>Faculty with Disabilities</td>
<td>Percent of FTE faculty with physical and/or mental disabilities from each of three faculty groups (in FTE's): tenured faculty; nontenured faculty; and sessional instructors. Subtract the provincial population average of people of working age with disabilities from the percent for each of the three faculty groups.</td>
<td>Gap of 10% or less above or below zero for all three faculty groupings.</td>
<td>Zero difference between campus and provincial populations for all three faculty groupings.</td>
</tr>
<tr>
<td>C-8</td>
<td>Staff with Disabilities</td>
<td>Percent of FTE staff with physical and/or mental disabilities from each of the three staff groups (in FTE's): staff from the top 33% of salary; the middle 33%; and the bottom 34%. Subtract the provincial population average of people of working age with disabilities from the percent for each of the three staff groups.</td>
<td>Gap of 10% or less above or below zero for all three staff groupings.</td>
<td>Zero difference between campus and provincial populations for all three staff groupings.</td>
</tr>
<tr>
<td>C-9</td>
<td>Students with Disabilities</td>
<td>Percent of FTE students with physical and/or mental disabilities from each department on campus, by number of FTE students. Note: each campus will have different department listings, according to their unique academic structures. Subtract the provincial population average of people of working age with disabilities from the percent for each of the departments.</td>
<td>Gap of 10% or less above or below zero for all departments.</td>
<td>Zero difference between campus and provincial populations for all departments.</td>
</tr>
</tbody>
</table>
**Discussion:** It is difficult to determine acceptable short- and long-term benchmarks for these diversity issues. Is it ideal to have campus averages of people with disabilities match the provincial averages, or should a campus strive to exceed the provincial population average? If that is a goal, then by how much should those averages be exceeded? Should a campus strive to exceed these averages in all categories, or only the higher income/stability job types? These indicators have taken fairly conservative long-term measures at this point, but these may change over time. A further complication is that not all people who live with disabilities declare it, for a variety of reasons, thus potentially skewing results.

These measures are relatively complex, but this was deemed necessary in order to paint an appropriate picture of a campus’ performance. High numbers of people with disabilities in low wage, part-time, impermanent positions is not as desirable as high numbers in higher wage, permanent positions. This indicator hopes to capture the appropriate resolution necessary to assess this variation.
Diversity: Ethnicity

**Issues:**
Canada is an increasingly ethnically diverse country, and the hiring and recruitment policies and practices of universities should be designed to fully include this diversity in the campus community to promote equity, and the cross-cultural sharing of ideas and knowledge for enhanced learning. Please note that Indigenous Peoples have a separate diversity category, and thus should not be included in the 'ethnic minority' measures in this section. Each of these indicators measures the gap between the provincial population average of people that self-identify as an ethnic minority, and the campus community group in question.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Measurement Units</th>
<th>Short-Term Benchmark</th>
<th>Long-Term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-10</td>
<td>Faculty of Ethnic Minorities</td>
<td>Percent of FTE faculty that self-identify as a member of an ethnic minority from each of the three faculty groups (in FTE's): tenured faculty; non-tenured faculty; and sessional instructors. Subtract the provincial population average of people of working age who self-identify as members of ethnic minorities from the percent from all three faculty groups.</td>
<td>Gap of 10% or less above or below zero for all three faculty groupings.</td>
<td>Zero difference between campus and provincial populations for all three faculty groupings.</td>
</tr>
<tr>
<td>C-11</td>
<td>Staff of Ethnic Minorities</td>
<td>Percent of FTE staff that self-identify as a member of an ethnic minority from each of the three staff groups (in FTE's): staff from the top 33% of salary; the middle 33%; and the bottom 34%. Subtract the provincial population average of people of working age that self-identify as members of ethnic minorities from the percent from each of the three staff groups.</td>
<td>Gap of 10% or less above or below zero for all three staff groupings.</td>
<td>Zero difference between campus and provincial populations for all three staff groupings.</td>
</tr>
<tr>
<td>C-12</td>
<td>Students of Ethnic Minorities</td>
<td>Percent of FTE students that self-identify as a member of an ethnic minority from each department on campus, by number of FTE students. Note: each campus will have different department listings, according to their unique academic structures. Subtract the provincial</td>
<td>Gap of 10% or less above or below zero for all departments.</td>
<td>Zero difference between campus and provincial populations</td>
</tr>
<tr>
<td>Population average of people of working age that self-identify as members of ethnic minorities from the percent from all departments.</td>
<td>for all departments.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Discussion:** These indicators are relatively coarse measures of ethnic diversity, as they do not accurately take representation from different ethnic groups into account. Setting benchmarks and goals face the same challenges as the ‘disabilities’ section above. It is difficult to determine what acceptable benchmarks and targets of performance are for promoting ethnic diversity in the campus community.

These measures are relatively complex, but this was deemed necessary in order to paint an appropriate picture of a campus’ performance. High numbers of people from ethnic minority groups in low wage, part-time, impermanent positions is not as desirable as high numbers in higher wage, permanent positions. This indicator hopes to capture the appropriate resolution necessary to assess this variation.
Diversity: Gender

**Issues:** Promotion of gender equity in hiring and recruitment processes has long been a sustainability issue in Canada and beyond. These indicators help to assess a campus' gender diversity, thus helping to promote more vibrant and equitable learning, teaching, and working environments. Each of these indicators measures the gap between the provincial population average of women of working age, and the campus community group in question.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
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<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-13</td>
<td>Faculty Gender</td>
<td>Percent of FTE women in each of the three faculty groups (in FTE's): non-tenured full-time faculty, and sessionals. Subtract the provincial population average of women of working age from the percent from each of the three faculty groups.</td>
<td>Gap of 10% or less above or below zero for all three faculty groupings.</td>
<td>Zero difference between campus and provincial populations for all three faculty groupings.</td>
</tr>
<tr>
<td>C-14</td>
<td>Staff Gender</td>
<td>Percent of FTE women in each of the three staff groups (in FTE's): staff from the top 33% of salary; the middle 33%; and the bottom 34%. Subtract the provincial population average of working age women from the percent for each of the three staff groups.</td>
<td>Gap of 10% or less above or below zero for all three staff groupings.</td>
<td>Zero difference between campus and provincial populations for all three staff groupings.</td>
</tr>
<tr>
<td>C-15</td>
<td>Student Gender</td>
<td>Percent of FTE women students in each department on campus (in student FTE's). Note: each campus will have different department listings, according to their unique academic structures. Subtract the provincial population average of working age women from the percentage of all departments.</td>
<td>Gap of 10% or less above or below zero for all departments.</td>
<td>Zero difference between campus and provincial populations for all departments.</td>
</tr>
</tbody>
</table>
**Discussion:** Benchmarks for these indicators were difficult to set, and whether or not a campus should strive to meet provincial averages, or exceed them in certain circumstances is difficult to determine.

These measures are relatively complex, but this was deemed necessary in order to paint an appropriate picture of a campus' performance. High numbers of women in low wage, part-time, impermanent positions is not as desirable as high numbers in higher wage, permanent positions. This indicator hopes to capture the appropriate resolution necessary to assess this variation.
Diversity: Indigenous Peoples

**Issues:** Indigenous Peoples who live in Canada are a integral part of a healthy, sustainable community. Promotion of fully including Indigenous Peoples in our campus communities through focused hiring and recruitment is an important aspect of campus sustainability, and these indicators measure a campuses ability to perform on these issues. Each of these indicators measures the gap between the provincial population average of people who self-identify as Indigenous Peoples of working age, and the campus community group in question.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-16</td>
<td>Equity of Indigenous Peoples: Faculty</td>
<td>Percent of faculty that self-identify as Indigenous Peoples in each of the three faculty groups (in FTE's): tenured faculty; non-tenured full-time faculty; and sessionals. Subtract the national population average of people of working age that self-identify as Indigenous Peoples from the percent from each faculty group.</td>
<td>Gap of 10% above or below zero for all three faculty groupings.</td>
<td>Zero between campus and national populations for all three faculty groupings.</td>
</tr>
<tr>
<td>C-17</td>
<td>Equity of Indigenous Peoples: Staff</td>
<td>Percent of staff that self-identify as Indigenous Peoples in each of the three staff groups (in FTE's): staff in the top 33% salary range; the middle 33%; and the bottom 34%. Subtract the national population average of people of working age that self-identify as Indigenous Peoples from the percent for each staff group.</td>
<td>Gap of 10% above or below zero for all three staff groupings.</td>
<td>Zero difference between campus and national populations for all three staff groupings.</td>
</tr>
<tr>
<td>C-18</td>
<td>Equity of Indigenous Peoples: Students</td>
<td>Percent of students that self-identify as Indigenous Peoples from each department on campus (in FTE's). Note: each campus will have different department listings, according to their academic structures. Subtract the national population average of people that self-identify as Indigenous Peoples from the percent for each department.</td>
<td>Gap of 10% above or below zero for all departments.</td>
<td>Zero difference between campus and national populations for all departments.</td>
</tr>
</tbody>
</table>
Discussion: It was a challenge to define both short- and long-term benchmarks for this indicator, like its counterparts in the ‘diversity’ section. It is also difficult to find an appropriate boundary to assess the percent population of Indigenous Peoples, as their sense of boundaries is different than the politicized Canadian boundary. We used national statistics, for ease of data collection, but perhaps in the future a better measure can be found.

These measures are relatively complex, but this was deemed necessary in order to paint an appropriate picture of a campus’ performance. High numbers of Indigenous Peoples in low wage, part-time, impermanent positions is not as desirable as high numbers in higher wage, permanent positions. This indicator hopes to capture the appropriate resolution necessary to assess this variation.
## Services

**Issues:** Provision of accessible services that are available on campus promote campus community, well-being, and thus sustainability.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Measurement Units</th>
<th>Short-Term Benchmark</th>
<th>Long-Term Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-19</td>
<td>Indoor Community Space</td>
<td>Square metres of designated indoor community gathering space, divided by the total indoor square metres; multiply by 100. Indoor community gathering space includes lounges, food service outlets, designated meeting rooms, computer laboratories (accessible to whole campus), etc. It excludes hallways, classrooms, offices, private study spaces, etc.</td>
<td>At least 15%</td>
<td>At least 25%</td>
</tr>
<tr>
<td>C-20</td>
<td>On-campus Housing</td>
<td>Total number of university owned and managed beds (for students, staff and faculty), both on- and off-campus, divided by the total number of CCMs; multiply by 100.</td>
<td></td>
<td>At least 75%</td>
</tr>
<tr>
<td>C-21</td>
<td>On-campus Housing Affordability</td>
<td>Average cost of university owned and managed single student housing divided by the total average expenses per single student (based on a normal months' costs while in school); multiply by 100.</td>
<td>30 - 35% (based on Student Loan allowances)</td>
<td>Less than 30%</td>
</tr>
<tr>
<td>C-22</td>
<td>On-campus Employment Services</td>
<td>Total number of full-time jobs posted annually by an on-campus student employment centre, divided by the total number of students graduating in that year (including undergraduate and graduate students).</td>
<td>At least 0.5 per student</td>
<td>At least 1 per student</td>
</tr>
<tr>
<td>C-23</td>
<td>Community Library Cards</td>
<td>Total number of “community library cards” (i.e. non-student (of any university), staff or faculty) issued or renewed annually, divided by the total number of cards issued; multiply by 100. Note: if there is an annual fee of $20 or more, these cards should not be counted in the calculation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator</td>
<td>Description</td>
<td>Calculation</td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>-------------</td>
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</tr>
<tr>
<td>C-24 On-campus Media Expenditures</td>
<td>Total annual operating budget for all on-campus media sources (of all types), subtract total annual financial contribution in dollars by both student and university administrations (in order to identify external funding sources like advertising, grants, etc.). Divide this difference by the total annual operating budget; multiply by 100.</td>
<td>At least 75%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>C-25 Affordability of Public Transit</td>
<td>Total annual cost of providing all CCMs with public transit passes for their time on campus, subtract total amount of money spent by university and student administrations on public transit subsidies each year. Divide this difference by the total annual cost of providing all CCMs with public transit passes; multiply by 100.</td>
<td>At least 25%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

**Discussion:** Indicator C-22 attempts to get at how well the employment service meets the needs of graduating students through measuring total number of jobs against the need for jobs, as determined by the number of graduating students. This is quite an indirect measure of the issue, excludes in-term students needing work and staff and faculty looking for new work, and perhaps a qualitative measure of ‘perceived quality’ would be better in the longer term.

Many of these indicators are difficult to benchmark for a variety of reasons. Some benchmarks have been left blank, and others suggested but they will all need to be refined over time with use.
PEOPLE: KNOWLEDGE

This section has 21 indicators.

Training: Orientation

Issues: Orientation of new students, staff and faculty helps to create a welcoming community, and also introduces new campus community members to local ecological and social issues of importance, thus (hopefully) making them more conscientious campus citizens.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
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<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-1</td>
<td>New Faculty Orientation</td>
<td>Total annual number of new faculty (by headcount) receiving at least 1 hour of in-person orientation to campus and local community environment/social issues divided by the total number of new faculty members arriving on-campus in that year, multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>K-2</td>
<td>New Staff Orientation</td>
<td>Total annual number of new staff (by headcount) receiving at least 1 hour of in-person orientation to campus and local community environment/social issues divided by the total number of new staff arriving on-campus in that year; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>K-3</td>
<td>New Student Orientation</td>
<td>Total annual number of new students (by headcount) receiving at least 1 hour of in-person orientation to campus and local community environment/social issues divided by the total number of new students arriving on-campus in that year; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: These indicators may be challenging for some, as often orientation programs are offered but there are no incentives or requirements in place that guarantee participation. These indicators wanted to address actual delivery of specific orientation programming.
hence the more focused, and potentially challenging measures. It is also difficult to determine performance benchmarks for these indicators.
Training: Ongoing

**Issues:** Ongoing training for campus community members on social and ecological sustainability issues is important for continued learning on these topics as new and emerging information becomes available.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>K-4</td>
<td>Faculty Sustainability Training</td>
<td>Total annual number of training hours dedicated to sustainability topics (including on- and off-campus workshops, seminars, conferences, etc.) for faculty members (by headcount) divided by the total number of faculty (headcount).</td>
<td>At least 24 hours per year per faculty member</td>
<td>At least 60 hours per year per faculty member</td>
</tr>
<tr>
<td>K-5</td>
<td>Staff Sustainability Training</td>
<td>Total annual number of training hours dedicated to sustainability topics for staff (by headcount), divided by the total number of staff (headcount).</td>
<td>At least 24 hours per year per staff person</td>
<td>At least 60 hours per year per staff person</td>
</tr>
<tr>
<td>K-6</td>
<td>On-campus Student Sustainability Jobs</td>
<td>Total annual number of on-campus student job postings (full- and part-time jobs adjusted to FTE) focused on sustainability issues, divided by total number of jobs posted; multiply by 100.</td>
<td>At least 10%</td>
<td>40%</td>
</tr>
</tbody>
</table>

**Discussion:** It is difficult to determine appropriate training indicators for faculty and students, as faculty ‘training’ is quite unique in nature and students are arguably being ‘trained’ throughout their whole university career. These indicators attempt to get at the less academic and more practical, hands-on elements of training, while still being responsive to the nature of the three on-campus communities listed. Perhaps over time better measures for ongoing training can be found. Benchmarks for both the short- and long-term are also difficult to determine in this category.
Research: Collaboration

Issues: Research collaboration is a great way for a university campus to fulfill its research mandate and to promote sustainability through the integration of and cooperation between different faculties and departments. It is also a great way to extend the research expertise of one campus into the broader communities of other educational institutions, government, community organizations, etc.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>K-7</td>
<td>Research Collaboration: On-campus</td>
<td>Total annual number of on-campus research projects involving two or more on-campus departments divided by the total number of on-campus research projects, multiply by 100. Note: collaborative projects that actively promote unsustainability should not be included as a collaborative project in this indicator.</td>
<td>At least 50%</td>
<td>Approach 100%</td>
</tr>
<tr>
<td>K-8</td>
<td>Research Collaboration: Non-Profit</td>
<td>Total number of research projects involving two or more partners (one of which is the university and the other being government, community, higher education, and/or not-for-profit organizations) divided by the total number of all research projects; multiply by 100. Note: collaborative projects that actively promote unsustainability should not be included as a partnership in this indicator.</td>
<td>At least 50%</td>
<td>Approach 100%</td>
</tr>
<tr>
<td>K-9</td>
<td>Research Collaboration: For Profit</td>
<td>Total number of research projects involving the university with one or more businesses, corporations, and/or other for-profit organizations, divided by the total number of all research projects; multiply by 100. Note: collaborative projects that actively promote sustainability should not be included as a collaborative project in this indicator.</td>
<td>25% or less</td>
<td>Approach 0%</td>
</tr>
</tbody>
</table>
Discussion: These indicators are quite challenging to assess. In indicator K-10, the influence of for-profit agencies in higher education institutions is considered. It is growing by leaps and bounds, especially as government financing in many provinces continues to drop, and enrollment demands rise. This is a controversial issue, but consensus within the sustainable campus community leans toward a discomfort with, and opposition to, for-profit investments in university campuses. We have tried to balance this out by allowing projects that actively promote and research sustainability to be discounted. Indicators K-8 and K-9 we have allowed similar discounting calculations for projects that actively promote unsustainability through research.

It is also important to recognize that intra-campus research collaboration is a desirable thing in terms of promoting inter-disciplinary and greater understanding of issues beyond a single faculty members' research interests. There are, however, certain kinds of research that would suffer from collaboration. Highly specialized scientific research might be an example of this. That is why the long-term benchmark uses the word "approaches" in order to set a direction for improvement but recognize that it is not likely to be achieved. Similarly, the other indicators in this section use the word "approach" in the long-term benchmark column to reflect a similar thought.

Add on- and off-campus cross-departmental collaboration.
Research: Funding

Issues: Research financing is a vitally important campus sustainability issue. Universities are centres of innovation and creation, and research dollars fuel these activities.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>K-10</td>
<td>Sustainability Research Expenditures</td>
<td>Total annual research dollars spent on sustainability-focused projects divided by the total annual research dollars, multiply by 100.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K-11</td>
<td>For-profit Research Contributions</td>
<td>Total research dollars from all for-profit sources (i.e., corporations, businesses, etc.), divided by the total annual research dollars; multiply by 100.</td>
<td></td>
<td>Approach 0%</td>
</tr>
</tbody>
</table>

Discussion: A definition for ‘sustainability focused research’ is offered in the definitions section at the beginning of this Appendix. It is a relatively loose definition, and will thus be open to some interpretation when a campus sustainability assessment is undertaken.

Research activities at universities are highly complex, and it is important to be aware of one major complication in most research expenditure measures. An emerging issue in this area has become contracted and non-trackable research activities of many academics. Many academics have begun taking money to support research and publishing activities that is not managed by the university. Thus whatever results come out of assessing these indicators will likely miss out on this huge source of money for research.

Indicator K-12 is another controversial and difficult one, in terms of corporate influence on campuses. There was general consensus among those reviewed in the development of this framework that research money from for-profit agencies was not inline with the not-for-profit nature of a university and thus does not promote sustainability. Hence we have set our benchmarks to correspond with this ethic. We have attempted to find some balance on this issue in the research collaboration section, where for-profit agencies who actively work to promote sustainability are seen as having a positive effect.
Research: Practice

Issues: This is a small section, but an important one as it addresses the support that a university gives to its faculty that specialize in sustainability issues. This issue addresses the issue of a campus’ responsibility to its local and global communities to find innovative solutions to our sustainability challenges.

Indicators and Benchmarks:

<table>
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<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-12</td>
<td>Faculty Sustainability Research</td>
<td>Total annual tenured and tenure-track faculty (headcount) “specialized” in sustainability-focused research divided by the total number of tenured and tenure-track faculty, multiply by 100.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion: This is a challenging issue to measure, and this indicator does not quite get to the heart of the issue of research practice in terms of sustainability. Further, this will be a challenging indicator to get information for, the definition of “sustainability focused research” is a bit foggy and open to interpretation, and performance benchmarks are difficult to determine. Finally, “sustainability focused” is an oxymoron as sustainability is inherently broad and inclusive rather than focused.
Curriculum: Internalization of Learning

Issues: This section attempts to get at the vitally important issue of education for sustainability. That being the internalization of sustainability knowledge in a way that affects the future civic, professional, and personal lives of the students (but also staff and faculty) that have moved on from the campus. This is a long-term temporally variable issue that no universities (to our knowledge) currently track. We hope that by including this topic, universities will start to take responsibility for their long-term societal influence through measurement and tracking of this indicator.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-13</td>
<td>Sustainability Pledge</td>
<td>Total number of annual graduating students (headcount) who take a sustainability pledge at convocation, divided by the total number of graduating students (who attend convocation) in that year; multiply by 100.</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>K-14</td>
<td>Sustainability Literacy Survey</td>
<td>Average percent improvement on a sustainability literacy survey between first semester and last semester of degree program. *Note: use calculator provided in Appendix.</td>
<td>40% - 48% improvement in scores.</td>
<td>50% or greater improvement in scores.</td>
</tr>
</tbody>
</table>

Discussion: These are two very unique indicators, and it is likely that most campuses will not currently measure these two issues. Indicator K-14 will be quite easy to measure once it is incorporated into campus sustainability issues, but it does not represent "internalization of learning" very well. Many people may take a sustainability pledge at convocation without it meaning anything to them, and without them really internalizing anything as it could potentially be only a symbolic act.

Indicator K-15 has much greater potential to assess this issue, but will require a substantial investment of efforts to get useful and accurate information. It will also take 4 years (for most campuses) before any results are determined.
Curriculum: Education for Sustainability: Availability

**Issues:** It is much easier to incorporate sustainability into an educational program if appropriate courses are available. These indicators measure the number of, and participation in sustainability focused courses.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-15</td>
<td>Courses with Applied Learning</td>
<td>Total number of courses with an applied research/learning element based on-campus and/or in the local community, divided by total number of courses offered; multiply by 100.</td>
<td>At least 25%</td>
<td>75%</td>
</tr>
<tr>
<td>K-16</td>
<td>Courses with Sustainability Content</td>
<td>Total number of courses that have &quot;substantial sustainability content,&quot; divided by total number of courses; multiply by 100.</td>
<td>At least 25%</td>
<td>75%</td>
</tr>
<tr>
<td>K-17</td>
<td>Students Taking Sustainability Courses</td>
<td>Total number of students (headcount) having taken at least one course with substantial sustainability content upon graduation, divided by total number of graduating students in that school year; multiply by 100.</td>
<td>At least 25%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** These indicators will all be quite challenging to measure, and most campuses will not currently have data on these measures. It will be difficult not to double count people in indicator K-18. The definition of a course with ‘substantial sustainability content’ (as described in the definitions section at the beginning of this document) is quite loose, and thus it will be difficult to determine whether some courses fit into this category or not. Determining benchmarks for these categories is also difficult, and there may be disagreement as to what ‘sustainability’ means in terms of availability of courses. Courses that benefit both the student and the campus or the local community (service learning).
Curriculum: Education for Sustainability: Quality

**Issues:**
The quality of sustainability-focused courses is equally important as their availability. Many sustainability-focused courses have non-permanent faculty teaching them, and have lower available financial resources. These indicators attempt to measure this important issue of quality.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-18</td>
<td>Faculty Teaching Sustainability Courses</td>
<td>Total number of courses with substantial sustainability content taught by tenured or tenure track faculty, divided by total number of courses with substantial sustainability content; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>K-19</td>
<td>Quality of Sustainability Courses</td>
<td>Number of courses with substantial sustainability content that received top marks (i.e. in the top ranking level or scale band) in their most recent external review, divided by total number of courses with substantial sustainability content; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** These indicators should be fairly easy to assess for most campuses. The challenge is in defining appropriate performance benchmarks, and the ones proposed here will likely need to change and adapt over time.
Curriculum: Development

**Issues:** These indicators are concerned with who has authority to develop course curriculum, and how this might affect the content and quality of curriculum being delivered.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-20</td>
<td>Collaborative Course Development</td>
<td>Total number of courses that were developed using the input of more than one person in more than one department, divided by the total number of courses; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>K-21</td>
<td>For-profit Course Development</td>
<td>Total number of courses where for-profit agencies were directly and/or indirectly involved in curriculum development, divided by the total number of courses offered; multiply by 100.</td>
<td>10% or less</td>
<td>Approach 0%</td>
</tr>
</tbody>
</table>

**Discussion:** There are some major challenges in this section. Curriculum development is a very touchy subject for most universities, as academic freedom is prized, and many members of the academic community do not want that challenged. Such a challenge may be perceived in the use of these indicators. Further, this is a difficult issue to find measures for, and the ones selected here will likely need to change over time as the framework is used.

Again in this section, the developers of the framework have taken the stance that corporate, or for-profit influence over curriculum development works against sustainability, a position that will be controversial to some. Curriculum development is often not a transparent process, thus it will likely be difficult to collect the information necessary to assess these indicators.
**People: Governance**

This section has 20 indicators.

![Flowchart showing the Governance, Policy, Implementation, Monitoring, University government, Student government levels]

**Policy: University Government**

**Issues:** Although a policy is only arguably as good as the mechanisms in place to ensure its implementation and enforcement, it does represent an important commitment by high-level university management to certain issues. This indicator measures the sustainability policy structure in which a campus government operates.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
</table>
| G-1 | University Government Policy | Total number of policies present on campus from this list divided by total number of policies in this list; multiply by 100. Only policies of the university government should be included.  
1. Energy Management (efficiency measures, greenhouse gas reduction, and use of perpetual renewable sources)  
2. Water Management (efficiency measures and reuse)  
3. Clean Air (both in- and out-door)  
4. Health and Safety  
5. Ethical and Environmentally Sound Purchasing  
6. Solid Waste Management (reduction, reuse and recycling measures)  
7. Hazardous Waste Management (reduction, reuse and recycling measures)  
8. Transportation Demand Management  
9. Community Engagement in Campus Decision-making (both on- and off-campus communities)  
10. Ethical and Environmentally Sound | At least 50% | 100% |
### Investment

11. Sustainability in Education (sustainability course content for all graduating students, strategies to meet this)
12. Sustainability in Research
13. Equity (gender, people with disabilities, and ethnic)
14. Wellness (fitness, safe work environment, spirituality, nutrition, alternative work arrangements)
15. Long-term Campus Land-use Planning (principles of smart growth, protection of green space, design for efficiency, community engagement)
16. University Mission (broad commitment to sustainability)
17. Strategic Plan (academic and administrative planning and positioning)
18. Preferential Purchase of Local Goods and Services
19. Conflict and Dispute Resolution processes (for both internal and external issues)

If a particular policy covers more than one of the issues listed in depth, all of the issues covered should be counted. For example, if a campus has one Resource Efficiency policy that addresses energy, water, and solid waste, three points towards the total should be tallied.

---

**Discussion:** Setting the policy types for this section was somewhat challenging, as each university will have its own unique suite of policies that they work within. It is hoped that this indicator gives enough flexibility to account for all the variation within this topic. Over time, this indicator may need to be reorganized to account for overlap and gaps in the policy list.
Policy: Student Government

**Issues:** Although a policy is only arguably as good as the mechanisms in place to ensure its implementation and enforcement, it does represent an important commitment by student government to certain issues. This indicator measures the sustainability policy structure in which a student government operates.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-2</td>
<td>Student Government Policy</td>
<td>Total number of policies present on campus from this list divided by total number of policies in this list; multiply by 100. Only policies of the student government(s) should be included. 1. Energy Management (efficiency measures, greenhouse gas reduction, and use of perpetual renewable sources) 2. Water Management (efficiency measures and reuse) 3. Clean Air (both in- and out-door) 4. Health and Safety 5. Ethical and Environmentally Sound Purchasing 6. Solid Waste Management (reduction, reuse and recycling measures) 7. Hazardous Waste Management (reduction, reuse and recycling measures) 8. Transportation Demand Management 9. Community Engagement in Student Government Decision-making (both on- and off-campus communities) 10. Ethical and Environmentally Sound Investment 11. Equity (gender, people with disabilities, and ethnic) 12. Wellness (fitness, safe work environment,</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
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<td>35</td>
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</tbody>
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<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>spirituality, nutrition, alternative work arrangements)</td>
<td></td>
</tr>
<tr>
<td>13. Student Government Mission (broad commitment to sustainability)</td>
<td></td>
</tr>
<tr>
<td>14. Long-term Student Government Strategic Plan (academic and administrative planning and positioning)</td>
<td></td>
</tr>
<tr>
<td>15. Preferential Purchase of Local Goods and Services</td>
<td></td>
</tr>
<tr>
<td>16. Conflict and Dispute Resolution processes (for both internal and external issues)</td>
<td></td>
</tr>
</tbody>
</table>

If a particular policy covers more than one of the issues listed in depth, all of the issues covered should be counted. For example, if a campus has one Resource Efficiency policy that addresses energy, water, and solid waste, three points towards the total should be tallied.

**Discussion:** See the discussion in the "Governance: Policy: University Government" Section.

In addition to these weaknesses, some student governments may have a less defined policy structure because they work both within and outside of the larger university system, and may thus be somewhat affected by their policies. This indicator, however, recognizes that a strong student government should have its own set of sustainability policies in order to maximize its own performance on these issues. A separate, and strong, suite of student government sustainability policies can further work to promote the autonomy of student government, and to pressure a lagging campus government on sustainability issues through leading by example.

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Appendix V: Campus Sustainability Assessment Framework ©2003 Lindsay Cole
Implementation: University Government: Committees

**Issues:** These indicators are designed to determine how well the university’s policies are working: do they have working groups, are the working groups inclusive of different interest groups, and do the working groups have the ear of a high-level campus administrator. Sustainability in terms of governance requires both a strong policy and implementation structure.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-3</td>
<td>University Government Working Groups</td>
<td>Percent of policies (from G-1) with active working groups, committees, or advisory groups that are working within the university government system divided by the total number of policies; multiply by 100.&lt;br&gt;Note: if one policy has more than one working group, this should count as only one working group. An exception to this is policies that cover more than one of the issues from the policy list and are counted for more than one in indicator G-1.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>G-4</td>
<td>Diversity of University Government Working Groups</td>
<td>Percent of total active working groups, committees, or advisory groups (tied to a policy from the list in the ‘Policy: university government’ section) that have more than five different stakeholder/interest groups represented divided by the total number of working groups; multiply by 100.&lt;br&gt;Note: stakeholder groups include: staff and faculty (divided by representing unions).</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>G-5</td>
<td>Reporting of University Government Working Groups</td>
<td>Percent of total working groups that report directly to the university president, board of governors, and/or senate divided by the total number of active working groups; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** This is another section of the framework where there is very little information to draw upon in setting benchmarks of performance. These benchmarks represent consensus opinion of a small group of campus sustainability experts only, and will need to be refined over time.
Implementation: University Government: Staff & Funding

**Issues:** Both staff and funding are required to deliver on policy objectives, and their associated implementation plans. All three must work in harmony to make progress toward sustainability.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
</table>
  Note: if one staff person is responsible for more than one of these issues, they should only be counted once. | At least 50%             | 100%            |
<table>
<thead>
<tr>
<th>G-7</th>
<th>University Financing of Sustainability</th>
<th>Total annual dollars spent on staffing and operations of sustainability focused programs and initiatives from the list in G-6, divided by the total annual university budget (including operations and research/teaching); multiply by 100.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>G-8</td>
<td>Reporting of University Sustainability Staff</td>
<td>Total number of staff (as counted in G-6) who report directly to the president, a vice-president, or a departmental director, divided by the total number of staff counted in G-6; multiply by 100.</td>
<td>At least 50%</td>
</tr>
</tbody>
</table>

**Discussion:** It is a challenge to develop an appropriate list of staff positions, and this list is based on only a small groups’ consensus. Indicator G-7 does not have an obvious short- or long-term performance benchmark, as both too little or too much money could be spent on these issues, making the optimum benchmark somewhere in between. Rather than cut this indicator (as we did with most of the others that had similar difficulties), this one was kept in the hopes that through using best practices from Canadian campuses a performance benchmark can be set.
Implementation: Student Government: Committees

**Issues:** These indicators are designed to determine how well the student governments’ policies are working: do they have working groups, are the working groups inclusive of different interest groups, and do the working groups have the ear of a high-level student government representative. Sustainability in terms of governance requires both a strong policy and implementation structure.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-9</td>
<td>Student Government Working Groups</td>
<td>Percent of policies (from the list in G-2) with active working groups, committees, or advisory groups that are working within the student government system divided by the total number of policies from G-2; multiply by 100. Note: if one policy has more than one working group, this should count as only one working group. An exception to this is policies that cover more than one of the issues from the policy list and are counted for more than one in G-2.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>G-10</td>
<td>Diversity of Student Government Working Groups</td>
<td>Percent of total active working groups, committees, or advisory groups (tied to a policy from the list in G-2) that have more than five different stakeholder/interest groups represented divided by the total number of working groups; multiply by 100. Note: see definition of stakeholders in G-4.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>G-11</td>
<td>Reporting of Student Government Working Groups</td>
<td>Total number of active working groups reporting directly to the student council president, a vice-president, or the board of directors divided by the total number of active working groups; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>
**Discussion:** This is another section of the framework where there is very little information to draw upon in setting benchmarks of performance. These benchmarks represent consensus opinion of a small group of campus sustainability experts only, and will need to be refined over time.
Implementation: Student Government: Staff & Funding

Issues: Both staff and funding are required to deliver on policy objectives, and their associated implementation plans. All three must work in harmony to make progress toward sustainability.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
</table>
| G-12| Student Government Staffing for Sustainability                            | Total number of FTE staff responsible for the management of the issues from this list, divided by the total number of issues in the list; multiply by 100.  
1. Resource Conservation/ Efficiency (including energy, water, and solid waste management)  
2. Sustainability in Facilities Management (broader definition of sustainability than #1)  
3. Equity  
4. Environmental Health and Safety  
5. Wellness  
6. Ethical and Environmentally Sound Purchasing  
7. Ethical and Environmentally Sound Investment  
8. High-level Administrator of Student Sustainability Issues.  
Note: if one staff person is responsible for more than one of these issues, they should only be counted once. | At least 50% | 100% |
<p>| G-13| Student Government                                                        | Total annual student government dollars spent on staffing and operations of sustainability                   |                       |                |</p>
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing of Sustainability</td>
<td>Focused programs and initiatives from G-12 divided by the total annual student government budget; multiply by 100.</td>
<td></td>
</tr>
<tr>
<td>G-14 Reporting of Student Government Sustainability Staff</td>
<td>Total number of staff (as counted in G-12) who report directly to the student government president, a vice-president, or the board of directors divided by the total number of staff from G-12; multiply by 100.</td>
<td>At least 50%; 100%</td>
</tr>
</tbody>
</table>

**Discussion:** It is a challenge to develop an appropriate list of staff positions, and this list is based on only a small groups’ consensus. Indicator G-13 does not have an obvious short- or long-term performance benchmark, as both too little or too much money could be spent on these issues, making the optimum benchmark somewhere in between. Rather than cut this indicator (as we did with most of the others that had similar difficulties), this one was kept in the hopes that through using best practices from Canadian campuses a performance benchmark can be set. It may also be unrealistic to expect a student government to support such a wide range of staff positions dedicated to sustainability issues, given that their operations are often a great deal smaller than a university’s. This issue may need to be dealt with in future versions of the framework if it is deemed inappropriate by the majority.
Monitoring: University Government

**Issues:** This section addresses the important issue of monitoring and reporting on the performance of campus sustainability policy. Transparency in university governance is an important sustainability issue, and both the on- and off-campus communities affected by the campus operations and functions should have access to information on performance, and ideally to influence future policy and implementation planning decisions as well.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-15</td>
<td>University Government: Implementation Planning</td>
<td>Percent of policies (from the list in G-1) that annually set new objectives for policy implementation divided by the total number of policies from the section, multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>G-16</td>
<td>University Government: Reporting</td>
<td>Percent of policies (from the list in G-1) that have annual policy implementation reports made available to the campus and surrounding communities divided by the total number of policies; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>G-17</td>
<td>University Government: Information Management</td>
<td>Percent of policies (from the list in G-1) with data collection and management systems in place divided by the total number of policies, multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** This section should be relatively straightforward, and data should be accessible for most of these issues. It is likely that performance will be quite low for many campuses, as the effects of a poor sustainability policy, implementation planning and monitoring structure will be compounded in this section. This section, along with all others in the governance section, lend themselves to supporting an environment or sustainability management system as described by the ISO 14001 standard. Thus those campuses working towards an EMS certification will likely be the only ones to score well in this section. This is not necessarily a ‘weakness’ of the section, but more of a warning and explanation for poor performance.
Monitoring: Student Government

**Issues:** This section addresses the issue of monitoring and reporting on the performance of campus sustainability policies. Transparency in student governance is an important sustainability issue, and both the on- and off-campus communities affected by student government operations should have access to information on performance, and ideally be able to influence future policy and implementation planning decisions.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-18</td>
<td>Student Government: Implementation Planning</td>
<td>Percent of policies (from the list in G-2) that annually set new objectives for policy implementation divided by the total number of policies from the section; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>G-19</td>
<td>Student Government: Reporting</td>
<td>Percent of policies (from the list in G-2) that have annual policy implementation reports made available to the campus and surrounding communities divided by the total number of policies; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>G-20</td>
<td>Student Government: Information Management</td>
<td>Percent of policies (from the list in G-2) with data collection and management systems in place divided by the total number of policies, multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** This section should be relatively straightforward, and data should be accessible for most of these issues. It is likely that performance will be quite low for many campuses, as the effects of a poor sustainability policy, implementation planning and monitoring structure will be compounded in this section. This section, along with all others in the governance section, lend themselves to supporting an environment or sustainability management system as described by the ISO 14001 standard. Thus those campuses working towards an EMS certification will likely be the only ones to score well in this section. This is not necessarily a ‘weakness’ of the section, but more of a warning and explanation for poor performance. These issues will likely be even more prevalent for student governments, as they are generally more limited in resources, expertise and time needed to dedicate to sustainability governance.
**Economy & Wealth**

This section has 18 indicators.

**PEOPLE**

- **Economy & Wealth**
  - **Individual**
  - **Institutional**
    - **Accessibility**
    - **University as employer**
    - **Income**
    - **Expenditures**
    - **Investments**
    - **Costs**
    - **Financial Support**

**Individual: Accessibility: Costs**

**Issues:** This section addresses the accessibility of post-secondary education for students. The cost of post-secondary education is on the rise across Canada. This is making post-secondary education more a privilege of the wealthy than a right for all. These indicators measure the affordability of post-secondary education, and the ability of students to self-finance their educational objectives over taking out loans.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>Indicator</th>
<th>Measurement Units</th>
<th>Short-Term Benchmark</th>
<th>Long-Term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>EW-1</td>
<td>Students With Loans</td>
<td>Total annual number of FTE graduating students with a government or bank loan, or line of credit divided by total number of FTE graduating students, measured annually; multiply by 100.</td>
<td>25% less than current annual statistic.</td>
<td>0%</td>
</tr>
<tr>
<td>EW-2</td>
<td>Student Debt Load</td>
<td>Average debt per FTE graduating student with a government or bank loan, or line of credit subtracted from the national average debt load (of students with a debt).</td>
<td>Zero to −10%</td>
<td>More than 10% below national average.</td>
</tr>
<tr>
<td>EW-3</td>
<td>Student Fees</td>
<td>Average university fees (including all tuition, recreation, student, etc. fees) calculated by totaling all fees for all departments and dividing by the total number of FTE students. Subtract from average national student fees. Do not include independent per credit fee levies charged to fund student groups.</td>
<td>Zero to −10%</td>
<td>More than 10% below national average.</td>
</tr>
</tbody>
</table>

**Discussion:** These three indicators are a very coarse assessment of the affordability of education, and other debts than those listed can be accumulated by students. Several
organizations – including the Canadian Federation of Students – have a wider ranging and more detailed assessment of affordability and should be referred to for a deeper understanding of this issue. Information for these indicators should be readily accessible, and the benchmarks should be quite robust.

**Individual: Accessibility: Financial Support**

**Issues:** This section works to understand the balance between the costs of education, and the financial support available to students to counter these costs. These two sets of indicators should be considered together when analyzing accessibility of post-secondary education.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>EW-4</td>
<td>Number of Financial Awards</td>
<td>Total annual number of bursaries, scholarships, and other awards available specifically to students on your campus divided by the number of FTE students in that year.</td>
<td>Zero difference (value of awards is equal to fees)</td>
<td>One per student</td>
</tr>
<tr>
<td>EW-5</td>
<td>Value of Financial Awards</td>
<td>Total annual dollar value of bursaries, scholarships and other financial awards available specifically to students on your campus, divided by the number of FTE students in that year. Subtract this value from the total annual fees as calculated in EW-3.</td>
<td>Less than zero (more money awarded than required)</td>
<td></td>
</tr>
<tr>
<td>EW-6</td>
<td>Allocation of Financial Awards</td>
<td>Total annual dollar value of bursaries, scholarships, and other financial awards allocated, divided by the total dollar value of awards available, multiply by 100.</td>
<td>At least 75%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Discussion: Data availability in this section should be quite high, and thus the major weakness of the section is the difficulty in setting appropriate short- and long-term performance benchmarks.
Individual: University as Employer

**Issues:** This section addresses how the university performs as an employer in terms of pay equity, wage gap, and benefits provided. These are important sustainability issues in terms of supporting and maintaining a diverse and healthy workforce that is treated equitably in terms of their wages.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Measurement Units</th>
<th>Short-Term Benchmark</th>
<th>Long-Term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>EW-7</td>
<td>Wage Gap</td>
<td>Wage gap between highest and lowest FTE staff and faculty (not including contractors) calculated by dividing highest annual salary by lowest annual salary.</td>
<td>Gap of 10 times or less.</td>
<td>Gap of 7 times or less</td>
</tr>
<tr>
<td>EW-8</td>
<td>Gender Pay Equity</td>
<td>Compare average pay for each of the employment types from the list, comparing male/female pay: tenured faculty; full-time untenured faculty; sessional instructors; high-level administrators; mid-level administrators; low-level administrators; trades workers; general (unskilled) workers and labourers. Worst performer (i.e. the most imbalanced group) should be used for reporting indicator performance. Subtract the highest pay from the lowest in the most imbalanced group and divide the difference by the highest pay rate; multiply by 100. Be sure to define which group is women and which is men.</td>
<td>Difference of 10% or less in salary for the same employment group.</td>
<td>Zero difference – i.e. men and women in the same job type to be paid the same salary</td>
</tr>
<tr>
<td>EW-9</td>
<td>Ethnic Minority/ Caucasian Pay Equity</td>
<td>Compare average pay for each of the employment types from the list, comparing ethnic minorities/Caucasian pay: tenured faculty; full-time untenured faculty; sessional instructors; high-level administrators; mid-level administrators; low-level administrators; trades workers; general workers. Worst performer (i.e.</td>
<td>Difference of 10% or less in salary for the same employment group.</td>
<td>Zero difference – i.e. ethnic minorities and Caucasians in the same</td>
</tr>
<tr>
<td>Job Type to be Paid the Same Salary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference of 10% or Less in Salary for the Same Employment Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero Difference – i.e. Indigenous Peoples and Caucasians in the Same Job Type to be Paid the Same Salary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Discussion:
These indicators are relatively messy ones – they will require a lot of data gathering, manipulation and analysis, and the results may be less than conclusive. These are vitally important sustainability issues to measure, however, and thus these indicators have been retained in the framework. The short-term benchmarks may be too ambitious; it will take some testing of these indicators to determine whether or not these are reasonable short-term targets.
Institutional: Income

Issues: Canadian campuses are showing a national trend of incomes shifting away from government sources and towards student and corporate sources. This framework wishes to promote government financed post-secondary education as the sustainability choice, and the indicators below represent this ethic.

Indicators and Benchmarks:

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<tbody>
<tr>
<td>EW-11</td>
<td>Income From Student Fees</td>
<td>Subtract percent of annual university budget received from student fees from the national average for all campuses percent of budget received from student fees. Student government budget should not be included in this calculation.</td>
</tr>
<tr>
<td>EW-12</td>
<td>Income From Government</td>
<td>Subtract percent of annual university budget received from government grants from the national average for all campuses percent of budget received from government grants. Student government budget should not be included in this calculation.</td>
</tr>
<tr>
<td>EW-13</td>
<td>Income From Private Sources</td>
<td>Subtract percent of annual university budget received from private (i.e. non-government, non-fee) sources from the national average for all campuses percent of budget received from private sources. Student government budget should not be included in this calculation.</td>
</tr>
</tbody>
</table>

Discussion: Although some people will not agree, it was the consensus of the group of sustainable campus exports that developed this framework that government sponsored university financing is the desirable and sustainable option. Thus high levels of financial input from student fees and corporate sources are not desirable and were deemed unsustainable. Many student and non-governmental advocacy groups agree with this.
analysis as well, thus leading us to take this stance that some may view as a weakness or bias of the framework.
Institutional: Expenditures

Issues: These indicators measure a range of issues related to expenditures and campus sustainability, including the efficiency of operational dollars spent, the equity of departmental expenditures, and preferential spending in the local economy. These are all important campus sustainability issues.

Indicators and Benchmarks:

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</thead>
<tbody>
<tr>
<td>EW-14</td>
<td>Departmental Expenditures per FTE Student</td>
<td>Academic (including research and teaching) dollars spent per FTE students in each department on campus. Divide the highest expenditure per FTE by the lowest expenditure per FTE, and report the factor difference between the two.</td>
<td>Difference should be no greater than 5 times.</td>
<td>All department expenditure per FTE to be equal.</td>
</tr>
<tr>
<td>EW-15</td>
<td>Locally Purchased Goods and Services</td>
<td>Total annual dollars spent on locally provided, harvested, produced and/or manufactured goods and services divided by the total annual dollars spent on goods and services; multiply by 100. &quot;Local&quot; means within a 200 kilometre radius of the campus.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>EW-16</td>
<td>Deferred Maintenance</td>
<td>Facilities Condition Index (FCI). Divide the total amount of deferred maintenance for all buildings on campus by the total replacement cost for all buildings on campus; multiply by 100. Note: if insurance replacement values are all that is available for data, mark these dollar values up by 30% to more accurately reflect replacement costs.</td>
<td>5% - 10%</td>
<td>Less than 5%</td>
</tr>
</tbody>
</table>

Discussion: Indicator EW-14 is a challenging one – what is an appropriate difference between departmental expenditures per FTE? It is true that some departments require more money per student than others, but we must examine ‘why’ this is so, and if those are valid reasons for valuing one students’ education over another’s. Research activities at universities are highly complex, and it is important to be aware of one major.
complication in most research expenditure measures when assessing indicator EW-14. An emerging issue in this area has become contracted and non-trackable research activities of many academics. Many academics have begun taking money to support research and publishing activities that is not managed by the university. Thus whatever results come out of assessing these indicators will likely miss out on this huge source of money for research.

EW-15 will likely be challenging to measure, as most campuses are not likely to be currently collecting information about locally provided/produced goods and services in a way that can be “mined” to respond to this indicator.
Institutional: Investments

Issues: The power of a campus’ investments is an often underrated or unexamined element of campus sustainability. As societal innovators, a campus has a responsibility to both the on- and off-campus communities to invest in a socially and ecologically responsible manner.

Indicators and Benchmarks:

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</tr>
</thead>
<tbody>
<tr>
<td>EW-17</td>
<td>Ethically and Environmentally Sound Investments</td>
<td>Total annual dollars invested by university and student administrations in ethical and environmentally responsible companies, divided by the total annual invested dollars. Investments held for less than one full year should be prorated according to length of investment (i.e. a $100,000 investment made for only 3 months would be worth $100,000 x 0.25 year = $25,000.)</td>
<td>At least 20%</td>
<td>100%</td>
</tr>
<tr>
<td>EW-18</td>
<td>Local Investments</td>
<td>Total annual dollars invested by university and student administrations in locally owned and operated companies, divided by the total annual invested dollars. If investments are for less than a full year, use the calculation in EW-15. &quot;Local&quot; means within a 500 kilometre radius of the campus. &quot;Locally owned and operated&quot; means that the company is at least 51% owned by local people, and 100% operated by local people.</td>
<td>At least 20%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: For most campuses these are highly challenging and controversial issues. Many different things must be juggled when making investments, including protection of a campus’ endowment, assurance of pension money for future retiree’s etc. These indicators promote the ideas of local, ecologically sound, and socially responsible investment practices as vitally important sustainability issues on the campus that must begin to take the forefront in investment activities.
WATER

This section has 12 indicators.

ECOSYSTEM

Water

Consumption

Management

Storm and Wastewater

Quantity

Quality

Consumption

Issues: Water consumption is an obvious sustainability issue for campuses. Although the cost of water in Canada is quite cheap, it is important to conserve for many other reasons, not the least of which is the current trend of very dry, drought ridden summer seasons for most regions in Canada. This section addresses the issues of potable water consumption and reuse of storm water and grey water.

Indicators and Benchmarks:

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</tr>
</thead>
<tbody>
<tr>
<td>W-1</td>
<td>Potable Water Consumed</td>
<td>Total annual volume of potable water consumed by the campus for all uses (in litres), divided by the total number of CCMs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W-2</td>
<td>Storm and Grey Water Reuse</td>
<td>Total volume of grey water and/or storm water collected annually (in litres) that is reused on-site, divided by the total volume of water consumed (in litres) annually by the campus for non-potable water requiring uses (i.e. toilets, irrigation, etc.); multiply by 100.</td>
<td>At least 25%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: Setting benchmarks for these indicators was very challenging, and the benchmarks proposed here will need to be altered after some initial data on these indicators is collected, and best practices can be determined.

There was interest by many to have an indicator that described if the university was doing its part to help the region live within the capacity of its water supply area and, secondarily, its existing infrastructure. This proved to be quite difficult, and thus this indicator was not included at this time. Calculating the capacity of the water supply area is possible, and likely already measured. The problems were around defining units of use – water use for the whole campus, or for each CCM did not take into account the fact that many people live off campus, thus severely skewing the results. Also, we found that in order to give any kind of useful results, trends in ratio of use of
the campus to the whole community over time would be necessary. Useful results would not be given until many years of measurement had been done.

**Management**

**Issues:** The active management of water infrastructure and use is important for understanding the system, operating it at maximum efficiency, and minimizing water use and waste. This section addresses leaking fixtures, leaking water distribution infrastructure, management of water use information at an appropriate scale, on-site wastewater treatment, and water efficient fixture installation.

**Indicators and Benchmarks:**

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>W-3</td>
<td>Leaking Fixtures</td>
<td>Number of hours between each leaking fixture incident report and the time that the leak is repaired. Total number of hours taken for each report and divide by the total number of reports to get the average.</td>
<td>5 working days or less</td>
<td>24 hours or less</td>
</tr>
<tr>
<td>W-4</td>
<td>Water Metering: Potable</td>
<td>Total number of buildings on campus that have a water meter for that buildings' use, divided by the total number of buildings; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>W-5</td>
<td>Water Metering: Wastewater</td>
<td>Total number of buildings on campus that have a wastewater meter for that buildings' production, divided by the total number of buildings; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>W-6</td>
<td>Pressure Testing for Leaks</td>
<td>Total amount of water distribution system pressure tested for leaks over the past three years (as measured by length of pipe tested in metres), divided by the total length of pipe in the water distribution system; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>W-7</td>
<td>Efficiency of Fixtures</td>
<td>Total number of new water fixtures installed annually that are of highest possible water efficiency rating for that year, divided by the total number of new fixtures installed in that year; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>W-8</td>
<td>Motion Detectors Installed</td>
<td>Total number of sinks (all types), toilets, and urinals with motion detector flushing/flow devices installed, divided by the total number of toilets.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>sinks, and urinals; multiply by 100.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Discussion:** The major weakness of this section is that it is likely that many campuses do not currently measure all or most of these indicators. Hopefully this suite of indicators will encourage campuses to begin collecting this information if they aren’t already doing so, as they will help to improve the management of water use and infrastructure on their campus.
Storm and Wastewater: Quantity

**Issues:** There are several effective methods of reducing the consumption and waste of potable water, and associated conveyance of wastewater into the sewage system through the reuse and treatment of wastewater.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>W-9</td>
<td>Wastewater Produced</td>
<td>Total volume of wastewater produced on campus annually in litres, divided by the total number of CCMs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W-10</td>
<td>Wastewater Treatment</td>
<td>Total volume of wastewater produced annually by the campus in litres, divided by the total volume of wastewater treated to tertiary standards either on- or off-site; multiply by 100.</td>
<td>At least 25%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** These indicators will be challenging for many campuses, in terms of both measurement and in taking action towards sustainability. It is very difficult to determine appropriate performance benchmarks for indicator W-9, and these will need to be adapted and refined over time.
Storm and Wastewater: Quality

Issues: Wastewater quality is an important sustainability issue for the campus, the surrounding community, and the receiving ecosystem. It is an ecosystem and human health issue that is often not effectively addressed by university campuses. This section addresses the quality of wastewater being sent off-campus.

Indicators and Benchmarks:

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>W-11</td>
<td>Stormwater Contaminant Separation/Collection</td>
<td>Total number of storm water drains connected to contaminant separation/collection systems, divided by the total number of drains; multiply by 100. The contaminant collection system should, at minimum, remove oil and gas and large debris.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>
MATERIALS

This section has 16 indicators.

Buildings

Issues: Buildings require an immense amount of resources in their design and use, especially when aggregated over the whole lifetime that the building is in use. This section focuses on environmentally sound and healthy building design options.

Indicators and Benchmarks:

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>M-1</td>
<td>LEED™ Certified Base Buildings</td>
<td>Total number of base buildings completed in the previous three years that have been certified to LEED™ silver, gold or platinum standard, divided by the total number of buildings completed in the previous three years; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>M-2</td>
<td>LEED™ Certified Interiors</td>
<td>Total number of new interiors (including new buildings and major renovations) completed in the previous three years that have been certified to LEED™ Commercial Interiors silver, gold, or platinum standard, divided by the total number of new interiors completed in the previous three years; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: There are several popular green building and green interior design certification programs in existence. Leadership in Energy and Environmental Design (LEED™) was chosen for these indicators because it is quite widely recognized by building professionals as a comprehensive and user friendly standard. At the time this thesis was written, a new Canadian Green Building Council was in its early stages of existence that was likely to adapt LEED™ to the Canadian context, making it a very appropriate standard for our use. We also chose to reference a specific standard, rather than re-hash all of the green building material issues that exist, for ease of framework use. Because of this, some overlap between this category and others in this framework (e.g. storm water management, indoor air quality, greenspace protection) occurs.
### Paper

**Issues:** Paper may seem like a relatively arbitrary material to focus on, but universities tend to use an extraordinary amount of paper in their day-to-day operations and functions. This material is thus a good indicator of overall management of campus materials, and represents a large environmental impact of most universities. Further, changes in the purchase and use of this material offer great potential for environmental improvements.

**Indicators and Benchmarks:**

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>M-3</td>
<td>Paper Consumption</td>
<td>Total pieces of paper (of all types) purchased by all departments in the university each year, divided by the total number of CCMs.</td>
<td></td>
<td>Approach zero</td>
</tr>
<tr>
<td>M-4</td>
<td>Post-consumer Content of Paper</td>
<td>Total percent post-consumer content of all tree-based paper used on campus each year. Post-consumer recycled paper counts as a factor of one, whereas post-industrial recycled paper counts as a factor of 0.5. <em>Note: use calculation template in Appendix.</em></td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>M-5</td>
<td>Tree-free Paper</td>
<td>Total pieces of paper purchased by all departments on campus each year that is tree-free, divided by the total pieces of paper purchased; multiply by 100. <em>Note: use calculation template in Appendix.</em></td>
<td>At least 25%</td>
<td>100%</td>
</tr>
<tr>
<td>M-6</td>
<td>Chlorine-free Paper</td>
<td>Total pieces of paper purchased annually by all departments on campus that has not been chlorine bleached, divided by the total pieces of paper purchased; multiply by 100. <em>Note: use calculation template in Appendix.</em></td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** This section should be relatively straightforward, clear, and effective. Performance benchmarks may need some revision as more campuses begin to collect data on these indicators.
Food

Issues: The ecological impact of foods consumed on most campuses is huge. One of the largest impacts is that of transportation. Much of the food consumed in Canada comes from far-away countries, thus requiring immense amounts of fossil fuels to bring our food to us. Other socio-economic impacts of eating foods produced in distant lands are also significant. By preferentially purchasing locally produced foods we are greatly reducing these negative transportation and socio-economic effects, while promoting the local economy. Other food related issues are addressed in the Health and Wellbeing: Food section.

Indicators and Benchmarks:

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<tbody>
<tr>
<td>M-7</td>
<td>Local Food Production</td>
<td>Total amount of food (in dollars) that is locally produced, divided by total annual food budget; multiply by 100. &quot;Local&quot; means within a 200 kilometre radius of the campus.</td>
<td>At least 30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: Many campuses may have difficulty collecting this data initially, and may have to put new systems in place to be able to report performance on this indicator. Over time the short-term benchmark will also need to be modified based on best practices for this issue.
Equipment

**Issues:** Equipment purchases are major investments, and purchase decisions should be based on a range of issues, not just the cheapest initial purchase price. Product durability and ease of repair are important for longevity. Energy, water, and other resource consumption over time should also be considered in product purchase. This indicator works to encourage the consideration of these issues through the use of a life-cycle assessment approach.

**Indicators and Benchmarks:**

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<tbody>
<tr>
<td>M-8</td>
<td>Life-cycle Cost Assessment of Equipment</td>
<td>Total annual equipment purchased based upon a life-cycle cost assessment (using dollars) divided by the total annual dollars spent on equipment purchase; multiply by 100. “Equipment” to include all office, communication, laboratory, kitchen, art, grounds equipment, vehicles, etc. “Life-cycle cost assessment” means that the purchase decision is made based on full life-cycle cost, rather than the purchase cost alone, and includes consideration of long-term energy, water, paper, fuel, and other material and financial input costs. Soft life-cycle analysis (see below) dollars should be multiplied by 0.5 before summing totals and assessing performance against benchmark and goal.</td>
<td>At least 30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** Life-cycle cost assessments are complex analyses, and a standard tool for performing them should be determined for use in this indicator. This will ensure consistency and comparability of results, and will also make the data collection and analysis process for this indicator more streamlined and efficient. At the time this framework was developed, an appropriate tool had not yet been found, and this should be a priority for implementation of the framework.
Waste: Solid

**Issues:** Solid waste reduction is the poster child of sustainability – it is the issue that brought many people in to the world of environmentalism. Although it is already actively being worked on at most Canadian campuses, it is important to continue efforts at reducing valuable material through-put in to landfills.

**Indicators and Benchmarks:**

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</thead>
<tbody>
<tr>
<td>M-9</td>
<td>Solid Waste and Recyclables Produced</td>
<td>Total weight of solid waste and recycling produced (in kilograms) annually, divided by the total number of CCMs.</td>
<td>Approach zero</td>
<td></td>
</tr>
<tr>
<td>M-10</td>
<td>Solid Waste Reduction</td>
<td>Percent of waste reduced per capita over previous years’ waste production. <em>Note: use calculator provided in Appendix.</em></td>
<td>0% to –5% change,</td>
<td>Positive percent change</td>
</tr>
<tr>
<td>M-11</td>
<td>Recyclables Being Landfilled</td>
<td>Total amount of recyclables (including organic wastes) by weight (in kilograms) contained in the waste destined for landfill or incineration, divided by the total weight (in kilograms) of all landfill waste; multiply by 100.</td>
<td>10% or less</td>
<td>Zero</td>
</tr>
<tr>
<td>M-12</td>
<td>Compost</td>
<td>Total volume of organic materials composted (in kilograms), divided by total volume of organic materials produced annually; multiply by 100. All organic materials (including all food and yard wastes) should be included in the calculation.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** Because waste reduction and recycling is a relatively well-known ecological issue, there are many potential ways to assess performance. We have selected these four indicators, but recognize that there are several other important ones that could have been included. One such indicator would deal directly with waste reuse and reduction issues. These are arguably more important than recycling, but it is difficult to quantify performance on waste avoided, salvaged or reused. Instead, these issues should be captured in indicator M9, although they will be somewhat buried amongst other waste production and reduction issues.
Waste: Hazardous

**Issues:** Hazardous materials – even in minute concentrations – can have devastating effects on both humans and the ecosystems. Campuses tend to use a large volume of hazardous materials, primarily for laboratory teaching and research purposes. Often they are even stockpiled for many years, creating a potential hazard for the campus community. These indicators measure the volume of hazardous materials used on campus, as well as their fate in the environment once they have been used.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDICATOR</th>
<th>MEASUREMENT UNITS</th>
<th>SHORT-TERM BENCHMARK</th>
<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-13</td>
<td>Hazardous Waste Produced</td>
<td>Total weight of solid and liquid hazardous waste produced (in kilograms) annually, divided by the total number of CCMs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-14</td>
<td>Reuse of Hazardous Waste</td>
<td>Total weight (in kilograms) of solid and liquid hazardous wastes reused (either on- or off-campus) each year, divided by the total amount of hazardous wastes produced (including reused materials); multiply by 100.</td>
<td>At least 25%</td>
<td>100%</td>
</tr>
<tr>
<td>M-15</td>
<td>Recycling of Hazardous Waste</td>
<td>Total weight (in kilograms) of solid and liquid hazardous wastes recycled each year, divided by the total amount of hazardous waste (in kilograms) produced annually (including recycled wastes); multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>M-16</td>
<td>Reduction of Hazardous Waste</td>
<td>Reduction of hazardous wastes produced by CCM over previous year.</td>
<td>0% to –5% change.</td>
<td>Positive percent change</td>
</tr>
</tbody>
</table>

*Note: use excel calculator provided in Appendix.*

**Discussion:** Although the handling and disposal of hazardous wastes is heavily regulated in most places, many campuses do not have tracking systems in place to monitor the movement and use of hazardous materials from their purchase through to use and disposal. This will offer a challenge of data collection for these indicators. It is also very difficult to determine what an appropriate level of hazardous material use is per CCM, as is requested in indicator M-12. Setting short-term benchmarks for indicators M-13 and 14 is also challenging, and they will need to be adapted over time.
AIR

This section has 15 indicators.

Indoor: Protection

Issues: Indoor air quality has emerged in recent years as a critical issue of concern, largely in terms of protecting human health. Older buildings often have poor ventilation, and may have mold, asbestos and other pollutant issues. New spaces can have materials that off-gas potentially hazardous chemicals into the air. By ensuring good quality indoor air, a healthier and more productive work force and academic community will result.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Measurement Units</th>
<th>Short-Term Benchmark</th>
<th>Long-Term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Asbestos and Mould</td>
<td>Total square metres of indoor spaces contaminated with asbestos and/or mold, divided by the total indoor square metres; multiply by 100.</td>
<td>20% or less</td>
<td>0%</td>
</tr>
<tr>
<td>A-2</td>
<td>Scent-free Indoor Spaces</td>
<td>Total square metres of scent-free indoor spaces, divided by the total indoor square metres; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>A-3</td>
<td>Opening Windows</td>
<td>Total square metres of regularly occupied interior spaces (excluding corridors, washrooms, etc.) serviced by opening windows, divided by the total square metres of regularly occupied interior spaces; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>A-4</td>
<td>Air Change Effectiveness</td>
<td>Total number of interior space zones that achieve air change effectiveness of 0.9 or greater, divided by total number of zones; multiply by 100. *Note: this is a LEED™ green building design standard based on ASHRAE 129-1997 Appendix B and more information about measurement of this indicator can be found there.</td>
<td>At least 75%</td>
<td>100%</td>
</tr>
<tr>
<td>A-5</td>
<td>Smoke-free Indoor Spaces</td>
<td>Total interior square metres of designated smoke free space, divided by the total interior square metres; multiply by 100.</td>
<td>At least 80%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>A-6</td>
<td>Living Plants Indoors</td>
<td>Total number of living plants in interior spaces, divided by the total square metres of interior space.</td>
<td>At least 0.1 plants per square metre</td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>A-7</td>
<td>Chemical Free Cleaning</td>
<td>Total square metres of indoor space always cleaned using a chemical free system, divided by the total interior square metres; multiply by 100.</td>
<td></td>
<td>At least 20%</td>
</tr>
<tr>
<td>A-8</td>
<td>Pesticides Used Indoors</td>
<td>Total amount of pesticides (including all types of plant and animal poisons) in grams used indoors each year, divided by the total square metres of interior space; multiply by 1000.</td>
<td></td>
<td>0 grams per 1000 square metres</td>
</tr>
<tr>
<td>A-9</td>
<td>Cleaning of Air Handling Units</td>
<td>Total number of air handling units cleaned over the last year, divided by total number of air handling units; multiply by 100.</td>
<td></td>
<td>At least 50%</td>
</tr>
</tbody>
</table>

**Discussion:** As with many indicators in this framework, it was difficult to establish short-term performance benchmarks, and the ones used here will likely need to change and adapt over time. It may also be difficult to find information on these indicators, as many campuses are not likely to track this information. It is hoped that these indicators will encourage campuses to pay more attention to critical indoor air quality issues.
Indoor: Quality and Monitoring

Issues: Indoor air quality monitoring is a challenging subject, and a difficult one to assess for many campuses due to a lack of consensus on what 'good' performance is, and a lack of consistency in measurement and analysis practices. That being said, we felt it important to include these measures as important sustainability issues, while recognizing the inherent difficulties with the section.

Indicators and Benchmarks:

<table>
<thead>
<tr>
<th>NO.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>A-10</td>
<td>Carbon Dioxide Monitoring Indoors</td>
<td>Total number of interior zones (as defined by ASHRAE 62-2001 Appendix D) that have CO2 monitoring systems installed, divided by total number of interior zones; multiply by 100. *Note: this indicator comes from LEED™ 2.1 green building standard.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>A-11</td>
<td>Indoor Air Quality Complaints</td>
<td>Total number of complaints (verbal, written etc.) regarding poor indoor air quality concerns received by all departments annually, divided by the total number of CCMs; multiply by 5000.</td>
<td>No more than 1 per 5000 CCMs.</td>
<td>Zero per 5000 CCMs.</td>
</tr>
</tbody>
</table>

Discussion: This section has only two indicators, both of which are challenging in their own ways. Indicator A-10 will be a challenge to measure for most campuses with older buildings. The standard that is referenced has likely not been considered in the design and development of most buildings, and it will likely be a challenge to analyze different zones according to the standard, and then determine the appropriate number of CO2 sensors.

Indicator A-11 is one of very few qualitative measures included in the framework, and is used because there were very few reasonable options available for indicators in this section. Data may be available for this indicator, but there will likely be questions as to its quality and comparability.

The major weakness in this section is that there are huge gaps in information. There was initially an indicator included that measured “the number of sensors per square metre of interior space for indoor air quality monitoring of non-CO2 compounds.”
also wanted to include some kind of indoor air quality performance standards for specific substances monitored. Upon discussion with an expert in this field, we decided to eliminate these indicators at this point in the development of the framework. There is currently too much variability, and even manipulation, of data collection and sampling methods, compounds to sample for, and data analysis techniques in this field to come up with meaningful results. Also, for most campuses, the cost of such monitoring is cost-prohibitive. Thus this area is one that should be explored in the future, and new indicators should be sought out for this section. Perhaps indicators could be developed to focus on potential high-risk areas like laboratories, and chemical mixing and storage areas. We would also encourage campuses particularly interested in this issue, to employ an individual with expertise in this field to assist in additional indoor air quality monitoring activities.
Outdoor: Protection

**Issues:** These indicators are concerned with outdoor air quality issues, including both negative impacts, and potential improvements that campuses can make to enhance outdoor air quality. Although many campuses will be affected by outdoor air quality impacts that are not directly caused by the campus community, this is still an important issue to understand and take action on.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>A-12</td>
<td>Smoke-free Outdoor Spaces</td>
<td>Total square metres of designated smoke-free outdoor common spaces, divided by the total square metres of outdoor common spaces (include all managed outdoor spaces as calculated in L-1); multiply by 100.</td>
<td>At least 75%</td>
<td>Approach 100%</td>
</tr>
<tr>
<td>A-13</td>
<td>Living Trees Outdoors</td>
<td>Total number of living trees on campus (including all natural and managed spaces), divided by the total area of the campus (in square metres).</td>
<td>At least 0.05 trees per square metre</td>
<td>At least 0.25 trees per square metre</td>
</tr>
</tbody>
</table>

**Discussion:** Benchmarks are also challenging in this section. Sustainable amounts of designated smoke free outdoor spaces has been set, but is likely to never be reached. It was deemed important to indicate where campuses should be heading in their efforts to become more sustainable, thus these very challenging long-term goals were retained. An acceptable number of trees per hectare is also a challenging benchmark to determine, and the ones proposed here will likely need to change over time.

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Appendix V: Campus Sustainability Assessment Framework ©2003 Lindsay Cole
Outdoor: Quality and Monitoring

Issues: This section deals with greenhouse gases, and other emissions produced by campus energy consumption, and also the quality of air being vented to the exterior environment from specific high-risk locations.

Indicators and Benchmarks:

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>A-14</td>
<td>Monitoring of Exterior Vents</td>
<td>Total number of exterior vents with CO2, other GHG, and particulate monitors, divided by the total number of exterior HVAC&amp;R vents; multiply by 100. A vent should be counted only if it has all three monitors in place.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: The major weakness in this section is similar to the indoor air quality section; that of missing indicators. This section initially had an indicator measuring the "percent of total exterior vents for laboratories, fine arts studios, chemical mixing spaces, swimming pools, and other areas where chemicals are used in high concentrations with monitors for...." We found very similar challenges in this section as the indoor air quality measurement challenges mentioned in the previous section. What substances should be monitored? At what resolution should sensors be placed? What sampling protocol and data analysis process should be used? The variation and potential manipulation of results in this section at this point in time lead us to omit this measure. Hopefully over time better measures can be found to more fully assess the issue of outdoor air quality monitoring.
ENERGY

This section has 12 indicators.

Sources

Issues: These indicators examine the sources of energy that fuel your educational institution, and how far they must travel before reaching your campus. There are many energy source options available today, and some are much more ecologically and socially responsible than others. These indicators assess these important sustainability issues.

Indicators and Benchmarks:

<table>
<thead>
<tr>
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<th>Indicator</th>
<th>Measurement Units</th>
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<th>Long-Term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1</td>
<td>Renewable Energy: Buildings</td>
<td>Total GJ of energy consumed annually by buildings for heating, ventilation, air conditioning, refrigeration and electrical systems from renewable sources, divided by the total GJ of energy consumed annually for the uses listed in the indicator; multiply by 100. Building energy should include energy used for exterior lighting and signage. “Renewable sources” means clean, non-nuclear, and perpetual renewable energy. Large-scale hydroelectricity is not considered renewable, although small-scale or micro-hydro is.</td>
<td>At least 20%</td>
<td>100%</td>
</tr>
<tr>
<td>E-2</td>
<td>Renewable Energy: Fleet and Grounds Vehicles</td>
<td>Total GJ of energy consumed annually for fleet and grounds vehicles and equipment from renewable sources, divided by the total energy consumed annually by those listed uses; multiply by 100. Definition of “renewable sources” is the same as E-1.</td>
<td>At least 20%</td>
<td>100%</td>
</tr>
<tr>
<td>E-3</td>
<td>Local Energy Sources</td>
<td>Total GJ of energy (for all uses as E-1 and E-2) consumed annually by the campus produced within 500 kilometres of the campus, divided by the total energy (for same uses) in GJ consumed annually; multiply by 100.</td>
<td>At least 20%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: The definition of ‘renewable’ energy is still evolving over time, thus our definition may be altered as new, clean, renewable energy sources come on-line. These indicators may
be challenging for many campuses to measure, especially E-3. It is difficult to determine the ultimate source of energy used on the campus, as many supply infrastructures do not track their energy sources in that way. This is also an issue that is somewhat out of the control of the university, making changes difficult.

Intensity of Use

Issues: These indicators measure how efficiently and intensely energy is used on a campus. It measures energy consumed for different uses relative to campus floor space, and relative to the number of campus community members. It also examines intensity of pollutants relative to the amount used, and also the type of fuel used through greenhouse gas equivalent emissions.

Indicators and Benchmarks:

<table>
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<tr>
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<th>Long-term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-4</td>
<td>Greenhouse Gas Emissions: Buildings</td>
<td>Total energy (of all types) consumed (in GJ) each year for heating, cooling, ventilation, and electrical systems, converted into GHG equivalent (tonnes), and divided by total square metres of interior built space. Note: energy used for outdoor uses (lighting, signage, etc.) should be included in the energy use calculation, but will still be assessed relative to square metres of interior space.</td>
<td>Tonnes GHG/square metre</td>
<td>Tonnes GHG/square metre</td>
</tr>
<tr>
<td>E-5</td>
<td>Greenhouse Gas Emissions: Commuting Transport</td>
<td>Total energy (of all types) consumed in GJ each year for commuting transportation, converted into GHG equivalent (tonnes), and divided by total number of CCMs in that year.</td>
<td>Tonnes GHG/CCM</td>
<td>Tonnes GHG/CCM</td>
</tr>
<tr>
<td>E-6</td>
<td>Greenhouse Gas Emissions: Fleet and Grounds Vehicles</td>
<td>Total energy (of all types) consumed in GJ for all fleet and grounds vehicle/equipment use, converted into GHG equivalent (tonnes), and divided by total number of CCMs in that year.</td>
<td>Tonnes GHG/CCM</td>
<td>Tonnes GHG/CCM</td>
</tr>
<tr>
<td>E-7</td>
<td>Greenhouse Gas Emissions: Campus Travel</td>
<td>Total energy (of all types) consumed in GJ for all work related travel (air, land, water, excluding fleet vehicle use) for FTE staff and faculty, converted into GHG equivalent (tonnes), and divided by total number of FTE staff and faculty in</td>
<td>Tonnes GHG/CCM</td>
<td>Tonnes GHG/CCM</td>
</tr>
</tbody>
</table>
### E-8 Reduction in Energy Consumption

<table>
<thead>
<tr>
<th>Reduction in Energy Consumption</th>
<th>Total change in energy consumption (of all types) in GJ for building, commuting and fleet/grounds vehicle uses in current year over previous year. * Note: use calculator provided in Appendix.</th>
<th>0% to −5% change. (i.e. no more than 5% increase)</th>
<th>Positive percent change (i.e. reduction made)</th>
</tr>
</thead>
</table>

**Discussion:** This section requires the use of a good carbon dioxide equivalency calculator so that all campuses using this indicator are calculating their greenhouse gas emissions in the same way. This issue should be explored in the development of assessment guidelines for using this framework. It is also quite difficult to set benchmarks for this section, and the benchmarks used here will need to be adapted over time. Finally, energy consumption needs will vary somewhat across the regions of Canada, with campuses in milder climates likely having better performance than those in more extreme climates. There will also be some transportation inequities for urban versus rural campuses. These issues should be carefully considered in analyzing results of this section, and perhaps indicators that can more equitably deal with these inequities can be found in the future.
Management

Issues: There are many management options available to campuses to greatly reduce energy consumption. Energy conservation has long been a sustainability issue, especially in terms of cost-efficiency, and thus many campuses should perform well in this section.

Indicators and Benchmarks:

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>E-9</td>
<td>Energy Metering</td>
<td>Total square metres of interior space divided by the total number of energy meters</td>
<td>X square metres per energy meter.</td>
<td>X square metres per energy meter.</td>
</tr>
<tr>
<td>E-10</td>
<td>Energy Efficient Equipment</td>
<td>Total value (in dollars) of energy consuming equipment, fixtures, appliances, etc. installed over the previous year that was of highest energy efficiency ratings available, divided by the total dollars spent on all new energy consuming equipment installed over the previous year; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>E-11</td>
<td>HVAC&amp;R System Control</td>
<td>Total amount of HVAC&amp;R system (measured by the built square metres serviced) operating with direct digital control with digital hardware, divided by total amount of built square metres serviced by HVAC&amp;R systems; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>E-12</td>
<td>Automatic Lighting Sensors</td>
<td>Total floor area (in square metres) of classrooms, office spaces, laboratories, washrooms, and other non-emergency and non-critical (i.e. hallways and walkways) spaces controlled by automatic lighting occupancy sensors, divided by total lit floor area (in square metres and excluding emergency and critical areas); multiply by 100.</td>
<td>At least 25%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: Some of these energy management options may be cost prohibitive for campuses, and the payback may be too long in order to justify installation of sensors or direct digital control systems. These indicators were still deemed to be important measures of campus sustainability in terms of energy management, and were thus included.
LAND

This section has 13 indicators.

Managed Greenspace

Issues: Managed greenspace includes all permeable (i.e. not paved, and water can penetrate) surfaces on campus that are managed in some way, including lawns, landscaped beds (with both native and non-native plant species), gardens, agricultural lands, gravel walkways, etc. Any greenspace on campus that requires maintenance by university staff should be included. These areas are important contributors to campus sustainability both in terms of human and ecosystem well-being.

Indicators and Benchmarks:

<table>
<thead>
<tr>
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<th>LONG-TERM GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-1</td>
<td>Managed Greenspace</td>
<td>Total hectares of managed greenspaces, divided by the total on-campus greenspace (both managed and natural, including everything that is not built, or that is permeable); multiply by 100. Note: the percent of total on-campus greenspace that is 'natural' can also be found here by subtracting the result of this indicator from 100.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-2</td>
<td>Inorganic Fertilizers</td>
<td>Total volume of solid and liquid inorganic fertilizers used annually (in kilograms), divided by the total hectares of managed greenspace.</td>
<td></td>
<td>Zero</td>
</tr>
<tr>
<td>L-3</td>
<td>Pesticides</td>
<td>Total volume of solid and liquid pesticides (including both plant and animal poisons of all types) used annually (in litres), divided by the total hectares of managed greenspace.</td>
<td></td>
<td>Zero</td>
</tr>
<tr>
<td>L-4</td>
<td>Native Plants</td>
<td>Total number of native plants installed (number of individual plants) annually in managed greenspaces, divided by the total number of plants installed in that year; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Discussion: It is difficult to determine a benchmark of short-term performance for volumes of inorganic fertilizer and pesticide, as there is no current campus best practice documented on this topic. Thus, with the use of these indicators, the short-term
benchmarks will need to change in order to best reflect achievable, yet ambitious short-term goals.

These indicators will be challenging for the urban campus, as some of them will have no, or very little managed or natural greenspaces. This is recognized as a particular challenge for these campuses, but a lack of greenspace does represent a significant negative sustainability impact. It is hoped that through measurement of these issues, and through developing strategies of action for improvements, all campuses (especially urban ones) will be able to find innovative and creative ways to provide green spaces to their campus communities. It is also hoped that benchmarks of performance can be found through the use and testing of indicator L-1.
Natural Areas

Issues: Natural areas include all permeable spaces on campus that are in a natural or semi-natural state. Both degraded and healthy ecosystems should be included. There should be very little or no human maintenance input in to these spaces for them to be included in this area calculation. Areas that fit in to this category, but have been drastically altered from their natural state, should be considered ‘Degraded’, and calculated as such for the indicators that consider degraded landscapes. Degraded areas, even though they will likely have high levels of human maintenance, should be included as “natural areas” in calculations. Many campuses have large tracts of natural areas that they should work to maintain, protect and even enhance over time in order to protect local biodiversity and habitat.

Indicators and Benchmarks:

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>L-5</td>
<td>Healthy Natural Areas</td>
<td>Total area (in hectares) of healthy natural areas, divided by the total area (in hectares) of all natural areas (including healthy and degraded systems); multiply by 100.</td>
<td>At least 75%</td>
<td>100%</td>
</tr>
<tr>
<td>L-6</td>
<td>Restoration of Degraded Areas</td>
<td>Total area (in hectares) of degraded natural areas that have been fully restored over the previous three years, divided by the total area (in hectares) of degraded natural areas; multiply by 100. Note: if all natural areas or healthy, or there are no natural areas on campus, “n/a” should be marked.</td>
<td>At least 25%</td>
<td>100%</td>
</tr>
<tr>
<td>L-7</td>
<td>Protection of Natural Areas</td>
<td>Total area (in hectares) of natural areas protected for the long-term through policy, covenant, or other non-alterable protection strategy, divided by the total area (in hectares) of natural areas; multiply by 100.</td>
<td>At least 50%</td>
<td>100%</td>
</tr>
<tr>
<td>L-8</td>
<td>Unresolved Land Claims</td>
<td>Total hectares of campus land with historic, unresolved land claims by Indigenous Peoples, divided by the total hectares of campus land in assessment year; multiply by 100.</td>
<td>25% or less</td>
<td>Zero.</td>
</tr>
</tbody>
</table>
**Discussion:** There will be some subjectivity in regards to some of the terms used in this section, including “healthy” and “degraded” natural areas, as well as what constitutes “full restoration”. The expertise of biologists should be engaged when assessing these indicators in order to obtain the best results possible. A further challenge in this section is indicator L-8, as there will be some campuses who do not have natural areas, or perhaps do not have degraded natural areas, and will thus be forced to mark “n/a” for this indicator.

Indicator L-8 does not fit very well in to this section, but there are no other sections in which this important indicator fits better. This is a highly charged issue for many Indigenous Peoples, and in researching performance on this indicator the issue may become highly politicized. Given this, we still wanted to include this important measure in the framework.
Intensity of Use

**Issues:** The intensity of land use is becoming an increasingly important sustainability issue throughout North America and the world. These indicators attempt to address the issues of sprawling versus compact growth, built space achieved with reducing impacts of impermeable building footprints, and the compact/sprawling qualities of parking facilities.

**Indicators and Benchmarks:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Measurement Units</th>
<th>Short-Term Benchmark</th>
<th>Long-Term Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-9</td>
<td>Impermeable Surface Coverage</td>
<td>Total area of impermeable surfaces (in hectares), divided by the total campus land area (excluding natural areas as described in L-5, and if your campus has agricultural lands these should also be excluded); multiply by 100.</td>
<td>30% or less</td>
<td>10%</td>
</tr>
<tr>
<td>L-10</td>
<td>Parking Density</td>
<td>Total number of parking stalls, divided by the total footprint of parking lot areas (in hectares). Note: only measure the footprint of the parking structure. If it is four stories tall, only measure the footprint on the ground.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-11</td>
<td>Building Density</td>
<td>Total square metres of building space (all floors of all buildings) divided by the total footprint of all buildings on campus in square metres (the ground space used by all buildings).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-12</td>
<td>Occupancy Rates: On-campus Residences</td>
<td>Percent of on-campus residences (of all types) managed by the university that are at full occupancy year round. *Note: use excel spreadsheet calculator provided in Appendix.</td>
<td>At least 75%</td>
<td>100%</td>
</tr>
<tr>
<td>L-13</td>
<td>Occupancy Rates: Classrooms</td>
<td>Percent of classrooms at full occupancy year round, from 8 am – 8 pm weekdays. *Note: use excel spreadsheet calculator provided in Appendix.</td>
<td>At least 75%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Discussion:** There is no direct measure of the relative compact or sprawling nature of a campus, as one could not be directly created. Over time, and with new and emerging research on
smart growth issues, a more direct indicator of sprawl may be developed. Several indicators relate to density of space relative to the impermeable footprint on the ground; these indicators inherently favour taller buildings, and parkades as sustainable options for intensity of land use. This may challenge some suburban and rural campuses who have large tracts of land area available to them and tend to build low lying structures, but is viewed as a more sustainable intensity of land-use pattern.

The occupancy indicators will also be challenging for some campuses who tend to operate at their peak during the regular school year and over regular working hours. These indicators challenge campuses to use their built spaces to maximum efficiency, as this will reduce the need for new developments and thus reduce the need to transform greenspaces to built spaces. It is hoped that indicators L-12 and 13 will force campus managers to rethink the way that buildings are used, workdays are designed, and courses are scheduled in order to maximize efficiency of land use.
Physicians for a Smoke-free Canada. Cigarettes and the Health of Canadians. Accessed on the world wide web January 7, 2003 at http://www.smoke-free.ca/pdf_1/Background-health.pdf. The number of Canadians over the age of 15 who smoked in 1996 (most recent statistic) was 29%. This target was set at 50% below the national average of smokers in the population.


Ladouceur, Eric. Lumec, Inc. Personal communication, January 8, 2003. Advice on how to measure uplight, current available techniques for measurement, and benchmarks of performance were given, and the indicator has been based on this discussion. The benchmarks were also based on the recommendations made by the International Dark-Sky Association at http://www.darksky.org, an advocacy group. Development of measurement strategies for this indicator should be done upon future consultation with Lumec, Inc. or another lighting expert.


These statistics are collected annually by StatsCan in the same university, student and private sources categories.

Appendix H - BOMA Best Go Green Plus Assessment Questionnaire

This questionnaire is totally a work from others and not our team's work. This questionnaire is a good example of how to conduct an green assessment.
BOMA BESt
Go Green Plus Assessment Questionnaire
Office Buildings

October 2008
## BASIC INFORMATION

**What is the name of the building?**  
*Tip: Please enter the name as you would like it to appear on the certificate if the building becomes certified.*

**What is the street address?**

<table>
<thead>
<tr>
<th>City:</th>
<th>Province:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postal code:</td>
<td></td>
</tr>
</tbody>
</table>

**When was the building constructed?**  
*Tip: Specify year of construction OR choose an era.*

<table>
<thead>
<tr>
<th>(exact year)</th>
<th>prior to 1980</th>
<th>prior to 1989</th>
<th>after 1999</th>
</tr>
</thead>
</table>

**What is the gross floor area of the building (in square feet)?**  
*Tip: The gross floor area for the purposes of the assessment is the total heated floor area within the perimeter of the exterior walls of the building, including common, mechanical and structural support areas, and excludes unheated parking garage areas.*

**Is there underground parking?**  
*Yes ■ No ■

**Who are the main tenants?**

| The building has numerous tenants |
| The main tenants are:           |

**How many people work in this facility during normal operating hours?**

**How many hours per day is the facility open?**

**How many days per week is the facility open?**

**Who is the owner of the building?**

**Who is the building manager?**  
*Tip: Provide the name and the company of the manager.*

**Building description?**  
*Tip: Provide a short building description describing also any additional innovative energy and environmental measures. The Go Green Plus Online assessment is currently best suited to Large (greater than 100,000 SF), and Small (under 100,000 SF) Office Buildings. Assessment of Multi-Residential and Industrial Buildings which is not currently part of BOMA program is available at www.greendebes.com however For other building types such as schools or retail, the small office template provides for a time being a good proxy.*

**Building construction description?**  
*Tip: Provide a short description of building construction (e.g. structural system and building envelope)*

**HVAC system description?**  
*Tip: Provide a short description of building HVAC system.*

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**1.0 ENERGY**

### 1.1 Energy Consumption

Specify the ending month of the 12 month period for which energy consumption figures are being entered.

**Month** _______ **Year** _______

What was the building’s total energy bill for the 12 month period specified?

**$__________**

What was the energy consumption for each non-renewable fuel type, by month? If you do not have a breakdown of 12 months of information, please enter the building’s total energy bill for the entire specified 12 month period in Month 1.

Tip: Provide energy consumption for the specified 12 month period by inputting either total values (in any of the boxes provided), or monthly or bi-monthly amounts. This information is used to calculate the energy intensity (kWh/sqft/yr). It is then compared to a national benchmark based on NRC data.

<table>
<thead>
<tr>
<th>Gas points</th>
<th>Gas consumption</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 points</td>
<td>m^3</td>
<td>$__________</td>
</tr>
<tr>
<td>16 points</td>
<td>m^3</td>
<td>$__________</td>
</tr>
<tr>
<td>24 points</td>
<td>m^3</td>
<td>$__________</td>
</tr>
<tr>
<td>32 points</td>
<td>m^3</td>
<td>$__________</td>
</tr>
<tr>
<td>48 points</td>
<td>m^3</td>
<td>$__________</td>
</tr>
<tr>
<td>64 points</td>
<td>m^3</td>
<td>$__________</td>
</tr>
<tr>
<td>72 points</td>
<td>m^3</td>
<td>$__________</td>
</tr>
<tr>
<td>80 points</td>
<td>m^3</td>
<td>$__________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electricity points</th>
<th>Electricity consumption</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 points</td>
<td>kWh.</td>
<td>$__________</td>
</tr>
<tr>
<td>16 points</td>
<td>kWh.</td>
<td>$__________</td>
</tr>
<tr>
<td>24 points</td>
<td>kWh.</td>
<td>$__________</td>
</tr>
<tr>
<td>32 points</td>
<td>kWh.</td>
<td>$__________</td>
</tr>
<tr>
<td>48 points</td>
<td>kWh.</td>
<td>$__________</td>
</tr>
<tr>
<td>64 points</td>
<td>kWh.</td>
<td>$__________</td>
</tr>
<tr>
<td>72 points</td>
<td>kWh.</td>
<td>$__________</td>
</tr>
<tr>
<td>80 points</td>
<td>kWh.</td>
<td>$__________</td>
</tr>
</tbody>
</table>

© ECD October 2008
<p>| Electricity month 4: | kWh. | Cost $ |
| Electricity month 5: | kWh. | Cost $ |
| Electricity month 6: | kWh. | Cost $ |
| Electricity month 7: | kWh. | Cost $ |
| Electricity month 8: | kWh. | Cost $ |
| Electricity month 9: | kWh. | Cost $ |
| Electricity month 10: | kWh. | Cost $ |
| Electricity month 11: | kWh. | Cost $ |
| Electricity month 12: | kWh. | Cost $ |
| Oil month 1: | Litres | Cost $ |
| Oil month 2: | Litres | Cost $ |
| Oil month 3: | Litres | Cost $ |
| Oil month 4: | Litres | Cost $ |
| Oil month 5: | Litres | Cost $ |
| Oil month 6: | Litres | Cost $ |
| Oil month 7: | Litres | Cost $ |
| Oil month 8: | Litres | Cost $ |
| Oil month 9: | Litres | Cost $ |
| Oil month 10: | Litres | Cost $ |
| Oil month 11: | Litres | Cost $ |
| Oil month 12: | Litres | Cost $ |
| Propane month 1: | Litres | Cost $ |
| Propane month 2: | Litres | Cost $ |
| Propane month 3: | Litres | Cost $ |
| Propane month 4: | Litres | Cost $ |
| Propane month 5: | Litres | Cost $ |
| Propane month 6: | Litres | Cost $ |
| Propane month 7: | Litres | Cost $ |
| Propane month 8: | Litres | Cost $ |
| Propane month 9: | Litres | Cost $ |
| Propane month 10: | Litres | Cost $ |
| Propane month 11: | Litres | Cost $ |
| Propane month 12: | Litres | Cost $ |
| Steam month 1: | lbs. | Cost $ |
| Steam month 2: | lbs. | Cost $ |
| Steam month 3: | lbs. | Cost $ |
| Steam month 4: | lbs. | Cost $ |
| Steam month 5: | lbs. | Cost $ |
| Steam month 6: | lbs. | Cost $ |
| Steam month 7: | lbs. | Cost $ |
| Steam month 8: | lbs. | Cost $ |
| Steam month 9: | lbs. | Cost $ |
| Steam month 10: | lbs. | Cost $ |
| Steam month 11: | lbs. | Cost $ |
| Steam month 12: | lbs. | Cost $ |</p>
<table>
<thead>
<tr>
<th>Chilled water month 1:</th>
<th>GL</th>
<th>Cost $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled water month 2:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water month 3:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water month 4:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water month 5:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water 6:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water 7:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water 8:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water 9:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water 10:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water 11:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
<tr>
<td>Chilled water 12:</td>
<td>GL</td>
<td>Cost $</td>
</tr>
</tbody>
</table>

### Energy Efficiency Features

#### 1.2 Lighting

**Does the building incorporate any of the following high-efficiency lighting features:**

- **compact fluorescents? Tip: Compact fluorescents are suitable replacement for incandescent lighting, combining small size with a high level of performance.**
  - □ Yes □ No
- **T8 or T5 fluorescent lamps in building areas? Tip: T8 or T5 fluorescent lamps are suitable for general lighting, are highly efficient and produce warmer colours than traditional cool white fluorescents.**
  - □ 70%-100% □ 40%-70% □ Under 40%
- **T8 or T5 fluorescent lamps in garage areas?**
  - □ 70%-100% □ 40%-70% □ Under 40%
- **Exit signs with light-emitting diodes (LEDs)?**
  - □ 70%-100% □ 40%-70% □ Under 40%
  - **Describe:**
  - **LED other description:**
    - □ Yes □ No

- **High-intensity fluorescent fixtures?**
  - Tip: Where there are no high levels of light required over large areas, or where changing lamps is not difficult mark “not applicable”.
  - □ Yes □ No □ N/A

- **Task lighting? Tip: Task lighting (e.g. desk lamps) concentrate light in specific areas rather than brightly lighting an entire room.**
  - □ 70%-100% □ 40%-70% □ Under 40%

- **Automated lighting controls?**
  - Describe controls:
  - □ Yes □ No
What percentage of all lighting in the facility is "high efficiency lighting"? Tip: Estimate the percentage either by floor area of occupied space or by numbers of lights.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>80% - 100%</th>
<th>60% - 80%</th>
<th>40% - 60%</th>
<th>20% - 40%</th>
<th>Under 20%</th>
<th>None</th>
</tr>
</thead>
</table>

### 1.3 Major HVAC Equipment

#### Are the boilers 20 years old or more?

- Yes
- No
- N/A (no boilers)

#### What percentage of boilers in the facility are high-efficiency?

- 50–100%
- 25–49%
- < 25%
- N/A (no boilers)

#### Do the boilers have a control system that allows them to operate through a wide range of loads?

- Yes
- No
- N/A (no boilers)

#### Do the boilers have automatic vent dampers?

- Yes
- No
- N/A (no boilers)

#### What percentage of chillers in the facility are high-efficiency?

- 50% - 100%
- 25% - 49%
- < 25%
- N/A (no chiller)

### 1.4 Controls

#### Is temperature setback and weather compensation implemented?

- Yes
- No

#### Does the building have building automation systems (BAS)?

- Full
- Partial
- None

### 1.5 Hot Water

#### Does the building have high-efficiency water heating equipment?

- Yes
- No

#### What percentage of hot water faucets have water saving devices?

- 50% - 100%
- 25% - 49%
- < 25%

#### Are domestic hot water temperatures maintained between 50° and 55° Centigrade?

- Yes
- No

Tip: Measure temperatures at the taps.
### 1.6 Other Energy Efficiency Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable speed drives on the following fan and pump systems?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: Mark “not applicable, where the systems are not present.”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>main supply air systems?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>main chilled water and condenser (cooling tower) pump systems?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>heating pump systems?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>domestic water booster pumps?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cooling tower fan motors?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust air heat recovery?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiller controls that allow the units to operate at a wide range of low and high load conditions?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cogeneration (building or district scale)?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: Cogeneration is the simultaneous production of heat and electrical or mechanical power achieved by capturing and recycling the rejected heat that escapes from an electricity generation process in the building. Cogeneration can be used to reduce peak demand.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other energy-saving systems or measures?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other energy saving systems description</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: Describe any other energy-saving systems or measures used to save energy (e.g. deep lake cooling, solar absorption chillers, CO2 demand ventilation, displacement ventilation, dehumidification methods, daylight cleaning etc.).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1.7 Green Energy

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is “green electricity” purchased?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: Many energy retailers now offer energy produced from certified solar, water, wind and recovery technologies.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the building utilize any of the following renewable on-site energy sources?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: Renewable energy sources do not deplete natural resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Solar?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Active Solar description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: This is generally used to increase the temperature of large volumes of water or air in commercial and industrial buildings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wind description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: This is generally used to increase the temperature of large volumes of water or air in commercial and industrial buildings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Photo Voltaic?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Describe:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Photo voltaic description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: Photovoltaics generate electricity. They are most effective when used during the day, avoiding the need for battery or other storage systems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Ground Source “Heat Pump”?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Describe:</strong></td>
</tr>
<tr>
<td><strong>Ground source description</strong></td>
</tr>
<tr>
<td>Tip: Using the temperature differential between above ground and below ground (or ground water), fluid is circulated in an underground (or underwater) loop. The energy collected is used for air and/or water heating. The system can be reversed in summer to provide cooling instead of heating.</td>
</tr>
<tr>
<td>☐ Yes ☐ No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Bio-mass?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Describe:</strong></td>
</tr>
<tr>
<td><strong>Bio-mass description</strong></td>
</tr>
<tr>
<td>Tip: Fuel such as round wood, wood and agricultural waste, prepared wood fuels, landfill gas and digester gas are burned using high efficiency combustion to provide space and/or water heating.</td>
</tr>
<tr>
<td>☐ &gt; 10% ☐ &lt; 10% ☐ 0%</td>
</tr>
</tbody>
</table>

**What percentage of the building's total energy use is supplied by these renewable sources?**
Describe the source and enter percentage of total annual energy requirements supplied:

**Description re renewable energy percentage**
Tip: Enter percentage of total annual energy requirements supplied from above sources.

<table>
<thead>
<tr>
<th><strong>1.8 Envelope</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Has the current performance and condition of the building envelope been assessed in terms of:</strong></td>
</tr>
<tr>
<td>Tip: The condition of the building envelope is critical to the building performance. An assessment of the current performance and condition of the envelope should consider the issues of relative humidity, temperature and interior pressure.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>water infiltration and condensation?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip: Consider the differences in temperature on the inner surface of the building and the water vapour condensation on the surface of thermal bridges-the mould and mildew control points.</td>
</tr>
<tr>
<td>☐ Yes ☐ No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>moist air transfer?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip: Consider the envelope permeability and the ability of materials to withstand, without deterioration, periods of freezing and thawing.</td>
</tr>
<tr>
<td>☐ Yes ☐ No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>air flow?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip: Consider the air pressure differences and air-leakage characteristics of the envelope.</td>
</tr>
<tr>
<td>☐ Yes ☐ No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>heat transfer?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip: Assess the thermal resistance and quantity of heat transferred through of the envelope.</td>
</tr>
<tr>
<td>☐ Yes ☐ No</td>
</tr>
</tbody>
</table>
Are there energy-efficient windows and doors?  
Describe:  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Doors and windows description**  
Tip: Energy-efficient windows consist of, at minimum, double-glazed, low-e window panes with frames spacers that have high thermal integrity. High-performance weather stripping on doors and windows also increases their thermal performance.

Does the building have appropriate shading or reflective film installed to reduce the cooling load?  
Describe:  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Shading film description**  
Tip: Exterior awnings, exterior and interior solar blinds, green roofs and exterior vegetation, high-albedo (reflective) roofing materials, and low-e film reduce cooling loads and reduce glare.

Has the building envelope been air-sealed in the following areas:  
Tip: Stack effect and air leakage through the building envelope can cause significant heat loss and deterioration of the building envelope. One indication of a leaky building is when, in the winter, the occupants in the lower levels complain of draft and cold and those in upper levels complain of over-heating.

- The top part of the building?  
  Tip: Exterior openings and roof-to-wall connections of mechanical penthouse and floors in the upper part of the building.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

- The bottom part of the building?  
  Tip: Exterior openings and floor slab-to-wall connections and service core of the parking areas, entrance doors and the floors in the lower third of the building.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

- Vertical shafts and elevators?  
  Tip: Service ducts and conduit penetrations, including excessive cable holes in the elevator shafts.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Has a Building Condition Report been produced within the last 3 years?  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Were the recommendations of the Building Condition Report for the envelope carried forward into a Capital Plan?  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Were the recommendations of the Building Condition Report for the roof carried forward into a Capital Plan?  

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

### 1.9 Energy Management

#### Energy Policy

Is there an energy policy endorsed by senior management?  
Tip: This should be a public document that expresses commitments to establish energy targets, assign responsibilities, monitor performance, and undertake an annual review and report.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a formal energy management policy</td>
<td>There is no energy management policy</td>
<td>There is no formal (documented) energy management policy, but management operates with a view to avoiding excessive energy use</td>
</tr>
</tbody>
</table>

© ECD October 2008
## Energy Audit

Has the building had an energy audit within the past three years that included recommendations with costs, savings and a payback period? **Tip:** This is a minimum requirement for BOMA BEST. An energy audit identifies areas that unnecessarily consume excessive amounts energy. The energy audit report must include:

- Utility billing analysis with benchmarking observations
- Summary of major equipment and type of lighting systems in the buildings
- List of potential energy conservation opportunities based on walk-through audit of the facility
- Building owner and manager information, building name and address, date of energy study completion
- Building description

In particular situations, where the building meets criteria set out in the BOMA BESI Application Guide for an acceptable equivalent, mark “A BOMA-accepted equivalent.”

Which of the following systems were audited? **Tip:** If no audit was done, mark “no” or “n/a.”

<table>
<thead>
<tr>
<th>System</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>lighting system?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>heating plant?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cooling plant?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC fans, pumps and distribution system?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>domestic hot water system?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>major equipment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>plug load equipment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>building envelope?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>renewable energy systems (e.g., solar, wind, geothermal)?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Energy Management, Monitoring and Targeting

Is there an energy management (reduction) plan to address issues raised in the energy audit? **Tip:** If no energy audit was done, mark “no.”

Is there a regular review of energy consumption by a qualified person to identify anomalies or excessive consumption and take corrective action as needed?

Are energy usage targets set? **Tip:** Targets are best expressed as a percentage increase or decrease of energy used.

Is there evidence of movement towards these energy targets over time? **Tip:** Review energy figures for the past 3 years. If there are no energy figures or no targets, mark “no.”

Have steps been taken to analyze and reduce peak energy demand? **Tip:** This means monitoring total monthly energy use and peak demand in 15-30 minute increments using an interval meter on a week day and a weekend-day for each season. Finding measures to flatten the load profile makes the facility more attractive to power vendors.
<table>
<thead>
<tr>
<th>Energy Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a formalized training plan for building staff, including new employees, on how to implement energy and equipment monitoring and preventive maintenance, as well as energy efficiency improvements?</td>
</tr>
<tr>
<td>List the training courses or internal training taken by staff in last two years:</td>
</tr>
<tr>
<td>Energy Training description</td>
</tr>
<tr>
<td>☐Yes ☐No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Financial Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there financial resources to improve the energy efficiency of the building or is the building participating in a program for energy efficiency upgrades?</td>
</tr>
<tr>
<td>Describe:</td>
</tr>
<tr>
<td>Financial Resources description</td>
</tr>
<tr>
<td>Tip: This could be an energy efficiency improvement budget or participation in a program that provides financial assistance for energy upgrades.</td>
</tr>
<tr>
<td>☐Yes ☐No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sub-metering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have sub-meters been installed to accurately measure and record tenants' energy usage?</td>
</tr>
<tr>
<td>Describe:</td>
</tr>
<tr>
<td>Tenant sub-metering description</td>
</tr>
<tr>
<td>Tip: Have sub-meters been installed to measure major energy uses (e.g. lighting, chilled or heating water flow, specific equipment and motors etc.), or is the building automation system (BAS) used to track major energy uses?</td>
</tr>
<tr>
<td>☐Yes ☐No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a readily available operating manual covering standard control settings and operating instructions and basic trouble shooting for all services equipment that may affect the energy consumption? Tip: A user-friendly manual listing all the building services, and describing their function, with operating instructions, standard control settings, and basic trouble-shooting makes it possible to handle minor problems and make adjustments without interrupting the service or having to call in the contractor.</td>
</tr>
<tr>
<td>☐Yes ☐No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance and Commissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the regular mechanical systems maintenance schedule include:</td>
</tr>
<tr>
<td>Tip: The maintenance schedules should be documented and records maintained.</td>
</tr>
<tr>
<td>- measurement of boiler efficiency? Tip: If there are no boilers, mark “not applicable”.</td>
</tr>
<tr>
<td>☐Yes ☐No ☐N/A</td>
</tr>
<tr>
<td>- checks on the correct operation of ventilation and cooling controls? Tip: If there is no HVAC, mark “not applicable”.</td>
</tr>
<tr>
<td>☐Yes ☐No ☐N/A</td>
</tr>
<tr>
<td>- systematic checking of temperature, humidity and fresh air controls to ensure they are set correctly and are responding as intended?</td>
</tr>
<tr>
<td>☐Yes ☐No ☐N/A</td>
</tr>
<tr>
<td>- identification and investigation of all occurrences of excess energy use?</td>
</tr>
<tr>
<td>☐Yes ☐No ☐N/A</td>
</tr>
<tr>
<td>- checking of air supply grilles to ensure they are not blocked and are delivering correct air quantity?</td>
</tr>
<tr>
<td>☐Yes ☐No ☐N/A</td>
</tr>
<tr>
<td>- checks for refrigerant leaks? Tip: If there is no cooling plant, mark “not applicable”.</td>
</tr>
<tr>
<td>☐Yes ☐No ☐N/A</td>
</tr>
<tr>
<td>- checks on cooling towers? Tip: If there are no cooling towers, mark “not applicable”.</td>
</tr>
<tr>
<td>☐Yes ☐No ☐N/A</td>
</tr>
<tr>
<td>- filter replacement schedule, and filter size and type for all systems?</td>
</tr>
<tr>
<td>Tip: If there is no air handling unit, mark “not applicable”.</td>
</tr>
<tr>
<td>☐Yes ☐No ☐N/A</td>
</tr>
</tbody>
</table>
1.10 Transportation

**Public Transportation**

Does the building have access to public transport within 500 meters? Tip: Good access to public transport is defined as at least one bus or streetcar stop, or train or underground station within 500 meters of the building. □ Yes □ No

Is there service at least every 15 minutes during rush hour? Tip: Commuters expect public transport service at least every 15 minutes during rush-hour periods. □ Yes □ No

**Cycling Facilities**

Are there bicycle racks for minimum 5% of occupants? □ Yes □ No

Tip: Providing bicycle facilities for minimum 5% of occupants at destinations encourages cycling to work.

Are there bike racks, sheltered from rain? □ Yes □ No

Are there changing facilities and showers for staff? □ Yes □ No

Tip: Although cyclists and joggers can change in washrooms and store their clothes in the workplace, dedicated facilities do more to encourage use of bicycles for regular commuting. Provide changing facilities and showers for minimum 5% of permanent occupants.

**Other measures**

Are there other measures to reduce car dependency (e.g. car-pooling, purchase of transit passes, auto share services on-site)? □ Yes □ No

Describe: ____________________________________________________________________________________

Tip: By providing a database where staff and tenants can share postal code information, this enables them to make carpooling arrangements. Building wide purchase of transit passes can provide public transportation at reduced rates. Locating a rental vehicle on the premises reduces the need to take a car to work. Improving the site access for pedestrian and bikes through signage and/or landscaping can also help to decrease car dependency.
## 2.0 WATER

### 2.1 Water Consumption

Please specify the ending month of the 12 month period for which water consumption figures are being entered.  
Tip: Please select the month and year corresponding to the last month of the 12 month period for which you will be entering water consumption figures.

<table>
<thead>
<tr>
<th>Month</th>
<th>Year</th>
</tr>
</thead>
</table>

What was the building’s total water bill for the 12 month period specified?  
Tip: Include the figures for the overall water cost of the building. If detailed information is not available, please provide an estimate.

| $ |  

What was the water consumption and costs, in total or by month, for the 12 month period specified? If you do not have the breakdown by month, please enter the total consumption for the 12 month period specified?

Tip: Provide water consumption for the specified 12 month period by inputting either total values (in any of the boxes provided), or monthly or bi-monthly amounts. This will be rated automatically based on the following scale:

- 18 points: less than 2.0 m³/m²/year
- 24 points: less than 1.0 m³/m²/year
- 30 points: less than 0.5 m³/m²/year

<table>
<thead>
<tr>
<th>Water month 1:</th>
<th>m³</th>
<th>Cost $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water month 2:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 3:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 4:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 5:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 6:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 7:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 8:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 9:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 10:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 11:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
<tr>
<td>Water month 12:</td>
<td>m³</td>
<td>Cost $</td>
</tr>
</tbody>
</table>

### 2.2 Water Conserving Features

For each category of fixture, indicate what percentage of the fixtures are water efficient:

- **low flow toilets that use less than 6L/flush?**
  - □ 70% - 100%
  - □ 40% - 70%
  - □ Under 40%

- **ultra low flush urinals that use less than 3L/flush?**
  - □ 70% - 100%
  - □ 40% - 70%
  - □ Under 40%

- **automatic valve controls and/or proximity detectors on toilets and urinals?**
  - □ 70% - 100%
  - □ 40% - 70%
  - □ Under 40%

- **low flow faucets (7.5 L/min) and/or proximity detectors on faucets?**
  - □ 70% - 100%
  - □ 40% - 70%
  - □ Under 40%
- **other water-saving features?**
  
  Description: 
  
  □ Yes □ No

**Other water saving features description**

Tip: Other water-saving devices include low flow showerheads (9.0 liters/min.), waterless urinals, greywater systems etc.

- **Does the landscaping minimize the need for irrigation?**
  
  Description: 
  
  □ Yes □ No □ N/A

**Xeriscaping description**

Tip: Landscaping that requires low or no supplemental irrigation, sometimes refer to as xeriscaping involves the use of plant species that require little watering, and techniques that help reduce the amount of water needed for irrigation. If the building covers more than 80% of the site area, i.e. there is no land available for landscaping, mark “not applicable”.

- **Are the following non-potable sources of water used for irrigation?**
  
  □ Yes □ No □ N/A

  - **Rainwater?** Tip: Rainwater is a water collected specifically for irrigation in rain cisterns. If the building covers more than 80% of the site area, i.e. there is no land available for landscaping, mark “not applicable”.
  
  □ Yes □ No □ N/A

  - **Graywater?** Tip: Gray water is treated waste-water from sinks and showers (not toilets) that has had solids and undesirable bacteria removed. If the building covers more than 80% of the site area, i.e. there is no land available for landscaping, mark “not applicable”.
  
  □ Yes □ No □ N/A

- **Is the following water efficient technology used for irrigation?**
  
  □ Yes □ No □ N/A

  □ Drip irrigation?

  □ Root-fed irrigation?

  □ Other water efficient technology? Describe:

  □ Yes □ No □ N/A

**Other irrigation measures description**

Are moisture sensors used to control irrigation? □ Yes □ No □ N/A

**Does the building use once-through water-cooled units?** Tip: Some equipment is cooled by a single-pass flow of water, often from a municipal water supply. After passing through and cooling the equipment, the water is discarded.

□ Yes □ No

**2.3 Water Management**

- **Is there a written policy intended to minimize water use, and encourage water conservation?** Tip: This is a minimum requirement for BOMA BEST. A water conservation policy should express a commitment to reducing demand for water and to establish goals and strategies to reduce water consumption.

□ Yes □ No

- **Is water consumption being monitored?** Tip: Monitoring can only be done provided there is a meter. Metering and checking bills help to verify consumption and to reflag occurrences of unusual and excessive consumption, which should be investigated and corrected - resulting in savings.

□ Yes □ No
<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a water audit been done within the last three years?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip: This is a minimum requirement for BOMA BEST. The water audit report must include:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Water billing analysis with benchmarking observations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Summary of major water-consuming systems in the buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- List of potential water conservation opportunities based on walk-through audit of the facility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Building owner and manager information, building name and address, date of study completion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Building description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>An audit should provide recommendations for maintenance procedures that may need to be revised, and identify water-using equipment that should be upgraded. The water audit report may be incorporated into the energy audit report.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there water-reduction targets? Tip: Water targets should be established in litres/m², or as a percentage reduction in litres/person.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there regular procedures for checking and fixing leaks? Tip: Periodic checks for leaks can be done by recording the water-meter reading before and after any long period when there is no water use, for example late at night and again early in the morning.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3.0 WASTE REDUCTION AND SITE

#### 3.1 Waste Reduction and Recycling

<table>
<thead>
<tr>
<th>Recycling, Handling and Storing Recyclable Materials</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Is there a recycling program that incorporates the recycling of office paper, newspaper, cardboard, bottles, plastic and cans, for tenants, shoppers and operations at the site, to the extent that local infrastructure is available to accommodate these materials?**

**Tip:** This is a minimum requirement of BOMA BEST. The property must have an active recycling program.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Are there separate storage/handling facilities for used paper products, glass, metal and plastic? Tip: A separate designated area for storage will help to avoid recycled waste being inadvertently hauled away with other refuse.**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Are there collection points for sorting paper, glass, metal and plastic in the areas where waste is generated?**

**Tip:** Unless there are collection points near the areas where waste is generated, it is unlikely that occupants will recycle. All collection should separate recyclables from waste garbage as per local or hauler requirements.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Is there a recycling program for:**

- batteries?
- fluorescent lamp?
- electronic waste?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Does the building have a composting program for organic waste?**

**Tip:** Composting may be done on-site or off-site at a special centralized facility. Mark "not applicable" where there are no facilities available to divert compost.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

#### Waste Reduction Program

**Has a waste audit been done within:**

**Tip:** A waste audit can be conducted in-house, or using a waste-management firm. It should identify the types and quantities of waste generated in the building and assess which waste materials are produced in sufficient quantities to warrant recycling.

<table>
<thead>
<tr>
<th>The last year?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
</tbody>
</table>

**Is regular monitoring of waste conducted? Tip:** This is done by recording the weight or volume of garbage that is leaving the building.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**What is the current diversion rate?**

**Tip:** Diversion rate is used by commercial contractors to report the rate at which non-hazardous solid waste is diverted from entering a disposal facility.

<table>
<thead>
<tr>
<th>above 90%</th>
<th>80% - 90%</th>
<th>70% - 79%</th>
<th>60% - 69%</th>
<th>50% - 59%</th>
<th>30% - 49%</th>
<th>Under 30%</th>
<th>Unknown</th>
</tr>
</thead>
</table>

**Please specify the ending month of the 12 month period for which solid waste figures are being entered.**

<table>
<thead>
<tr>
<th>Month</th>
<th>Year</th>
</tr>
</thead>
</table>

**If you do not have monthly data, what was the building’s total waste/recycling bill for the 12 month period specified?**

<table>
<thead>
<tr>
<th>$</th>
<th></th>
</tr>
</thead>
</table>

**What was the total waste/recycling, in total or by month, for the 12 month period specified?**

**Tip:** Enter the total amount of waste in metric tonnes (aggregate garbage and recycling) for each month or as a total amount for the 12 month period specified.

<table>
<thead>
<tr>
<th>Waste/recycling month 1:</th>
<th>MT</th>
<th>Cost $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste/recycling month 2:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>------------------------</td>
<td>----</td>
<td>-------</td>
</tr>
<tr>
<td>Waste/recycling month 3:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 4:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 5:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 6:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 7:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 8:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 9:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 10:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 11:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
<tr>
<td>Waste/recycling month 12:</td>
<td>MT</td>
<td>Cost $</td>
</tr>
</tbody>
</table>

Are there waste-reduction targets? [ ] Yes [ ] No

Is there a written policy intended to minimize construction waste being sent to landfill? [ ] Yes [ ] No

### 3.2 Site Pollution

<table>
<thead>
<tr>
<th>Site Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the building site free of contamination? [ ] Yes [ ] No [ ] Unknown</td>
</tr>
</tbody>
</table>

If the site is known to be free of contamination, which of the following is this based on:

- Document Search? Tip: A document search has been conducted and there is no reason to suspect that the site is contaminated (i.e., it has never had underground storage tanks (USTs) or outside storage tanks (ASTs), it was always an office or other facility that did not use chemicals, it is not situated near gas stations or other problem industries, there have been no previous potential problem businesses on the site). [ ] Yes [ ] No

- Phase 1 Environmental Assessment? Tip: A Phase 1 Environmental Site Assessment has been conducted that proves the site to be free of contamination. [ ] Yes [ ] No

- Confirmation Phase 2 Environmental Site Assessment or Phase 3 Clean Up Report? Tip: The site was once contaminated, but has been remediated to an acceptable level, as indicated by a Phase 3 Cleanup Report. [ ] Yes [ ] No

If the site is known to be contaminated, are efforts being made to clean it up? Tip: If the site is known to be uncleanable, mark “not applicable”. [ ] Yes [ ] No[ ] N/A

### Site Enhancement

Are there indications that the site ecological value has been enhanced? [ ] Yes [ ] No

Describe measures:

**Site enhancement description**

Tip: The ecological value can be enhanced by increasing rooftop vegetation and the number of indigenous plant species, by reducing the outdoor light pollution, by participating in the FLAP program or by creating a small natural “oasis” on the site. If the building occupies over 90% of the site area, mark this “not applicable”. 

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### 4.0 EMISSIONS AND EFFLUENTS

#### 4.1 Air Emissions

<table>
<thead>
<tr>
<th>Boiler Emissions</th>
<th>None</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
<th>DIN/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>What percentage of the building's boilers have low NOx emission rates? Tip: A low-NOx emitting boiler produces less than 20 g/GJ NOx (100 mg NOx/kWh). If there are no boilers, mark &quot;not applicable&quot;.</td>
<td>□</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>□</td>
</tr>
</tbody>
</table>

| Are records kept of cleaning of burners, monitoring of controls, and analysis of flue gas? Tip: The maintenance should take place once or twice per year. If there are no boilers, mark "not applicable". | Yes | No | DIN/A |

#### 4.2 Emissions – Ozone Depletion

<table>
<thead>
<tr>
<th>Refrigerants</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>What type of refrigerant is used for most of the cooling in the building chiller system? Select applicable</td>
<td></td>
</tr>
<tr>
<td>□ R11</td>
<td>□ R12</td>
</tr>
<tr>
<td>□ HCFC123</td>
<td>□ HFC134</td>
</tr>
<tr>
<td>□ R410B</td>
<td>□ Other</td>
</tr>
<tr>
<td>Describe:</td>
<td></td>
</tr>
<tr>
<td>Other refrigerant with ODP=□</td>
<td>N/A</td>
</tr>
<tr>
<td>Tip: The ODP for a substance is the measure of its contribution to ozone depletion relative to that of CFC11 - the higher the value, the more damaging it is to the ozone layer. Another concern with regards to refrigerants is global warming potential (GWP). If there are no ODS, or if the building is using a distributed system (e.g., heat pumps) mark &quot;not applicable&quot;.</td>
<td></td>
</tr>
</tbody>
</table>

| Are there automatic refrigerant leak detectors? Tip: There should be refrigerant sensors in machinery rooms where refrigerant vapor from a leak may be concentrated. In well-ventilated areas, leak detection should consist of air-sampling lines connected to specific parts of the refrigeration system, such as the compressor housing. If there are no ODS, mark "not applicable". | Yes | No | DIN/A |

| If the building has on-site ozone-depleting substances (ODS), are there recovery facilities that comply with federal guidelines and requirements? Tip: Recovery can be to a system receiver or to a certified recycling or recovery machine. Refrigerant recovery should take place prior to opening equipment for maintenance, service, repair or disposal. It should be done according to procedures set out in the Air-Conditioning and Refrigeration Institute (ARI) Standard 740, “Refrigerant Recovery/Recycling Equipment”. If there are no ODS, mark "not applicable". | Yes | No | DIN/A |

**Management of Ozone Depleting Refrigerants**

<table>
<thead>
<tr>
<th>Is there a documented management plan for Ozone Depleting Substances (ODS) that includes: Tip: Maintenance of the refrigeration system can reduce operating costs by improving the chiller performance, avoiding costly repairs, and reducing the need for refrigerant replacement. If there are no ODS, mark &quot;not applicable&quot;.</th>
<th>Yes</th>
<th>No</th>
<th>DIN/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>inventory of refrigerants and records?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### 4.3 Emissions – Water Efluent

**Waste Water Efluent**

- Are floor drains protected in areas where chemicals are stored? Yes □  No □  N/A □
  - Tip: At a minimum, there should be containment of chemicals used in building operations, such as oils, solvents, rust inhibitors, biocides and pesticides. This can consist of plastic trays to store the materials.

- Are roof drains connected to sanitary or combined sewers? Yes □  No □
  - Tip: Disconnecting roof drains from sanitary or combined sewers avoids unnecessarily loading the community wastewater treatment facilities.

- Are storm management measures implemented to reduce water run-off from roofs and hard surfaces, such as parking areas? Yes □  No □  N/A □

- **Storm water management description**
  - Tip: Measures include allowing the water to soak into the ground or collecting and re-using it. If the building covers more than 80% of the site, mark “not applicable”.

- Are there documented procedures in place to ensure that glycol discharges from the flushing of cooling coils are minimized or eliminated? Yes □  No □  N/A □
  - Tip: Used glycol and water from cooling towers should be tested to ensure that they meet local sewer-use by-laws before being discharged into the drain system. Ethylene glycol, used as an anti-corrosion agent, and freezing point depressant in air conditioning systems, is toxic to humans and animals. Mark “not applicable” only if glycol is not being used.

### 4.4 Emissions – Hazardous Materials

**Hazardous Materials Survey**

- Has a hazardous building materials survey been completed and has an inventory of these materials been maintained? Yes □  No □
  - Tip: This is a minimum requirement for BOMA BEST. The survey should indicate if asbestos-containing materials, PCBs, lead paint or mercury are present in the building.
| **Asbestos** |  □ Yes □ No □ N/A |
|---------------------------------------------------------------|
| If the building was completed at a time when asbestos was used in construction (up to 1981), is there an up-to-date inventory based on an asbestos survey, that includes records of locations and the condition of all asbestos? Tip: If there is no asbestos in the building mark “not applicable”. |  |
| Is there any friable asbestos in the building that has not been encapsulated (i.e. is there any possibility that asbestos fibers could become air-borne)? Tip: The presence of asbestos-containing materials does not, in itself, constitute a health hazard, provided the asbestos is intact. Friable asbestos can crumble. Encapsulating it avoids the health hazards, which can occur when asbestos fibers become airborne. If the building was completed after 1961, mark “not applicable”. |  |
| Is there a documented asbestos management plan that includes training and the precautions to be taken during repairs and renovations? Tip: If the building was completed after 1961, mark “not applicable”. |  |

| **Radon** |  □ Yes □ No |
|---------------------------------------------------------------|
| Is the building located outside a high risk area or has a radon survey been done which indicates levels below 200 Bq/m²? Where applicable, describe precaution taken. |  |
| Radon measures |  |
| Tip: Radon is a colourless, odourless, naturally occurring, radioactive gas produced by radium decay that is believed to cause lung cancer. The most common source of indoor radon is the uranium in the soil or rock upon which facilities are built. Areas considered high-risk in Canada are Winnipeg, Calgary, Vancouver, Sherbrooke, Saint John and Sudbury. A Phase 1 Environmental Site Assessment will typically make reference to radon levels. |  |

| **PCBs** |  □ Yes □ No |
|---------------------------------------------------------------|
| Are there any PCBs present in the building? Tip: Until the early 1980s, PCBs were used in fluorescent lamp ballasts for interior lighting and in some high-intensity discharge (HID) ballasts for exterior lighting. There are also electrical transformers and capacitors still in operation that contain PCBs. If the building was constructed after 1980 mark “not applicable”. |  |
| Is there a PCB management plan that designates responsibilities, requires inventory of all materials containing PCBs, including transformers, as well as records showing locations of major PCB-containing equipment, stipulates storage requirements, and describes a strategy for phasing out and disposing of PCB-containing equipment? Tip: If there are no PCBs mark “not applicable”. Mark “yes” only if the plan contains all of the above elements. |  |
| Are there procedures in place to ensure that any PCB containing materials are safely stored, regular inspection of storage sites is conducted by designated persons and spill response includes training for staff? Tip: If there are no PCBs mark “not applicable”. Mark “yes” only if there are procedures for all of the above. |  |

| **Storage Tanks** |  □ Yes □ No |
|---------------------------------------------------------------|
| Are there any above-ground (AST) or under-ground (UST) storage tanks? Tip: Most tank systems are used for storing heating fuel, but they are also used to store fuel for electric generators and vehicles; solvents, lubricants and other petrochemicals; and other hazardous substances, such as corrosive or noxious chemicals. |  |
Is there a storage tank management plan, which ensures legal compliance and includes the following operation and maintenance procedures:

Tip: Choose as many procedures as apply. If there are no storage tanks mark “not applicable”.

- tank system registration and annual reporting as required under CEPA Regulations (e.g. AST greater than 4,000 L and/or all UST)?
  Tip: All underground storage tank systems and all outdoor aboveground storage tank systems that have a single or combined capacity of 4,000 litres or more should be registered. If there are no storage tanks or if the single or combined capacity of the storage tank systems is less than 4,000 litres, mark “not applicable”.

- inventory (reconciliation) control? Tip: Establishing an inventory of tank systems is the first step in preparing tank management plan. If there are no storage tanks, mark “not applicable”.

- tank upgrading and replacement schedule? Tip: The components that are subject to upgrade are leak detection, secondary containment, corrosion protection, overflow protection and spill containment. Mark “non-applicable” if there are no storage tanks. Mark “yes” if tanks were already replaced or upgraded.

- system testing? Tip: System tests include leak tests and dipping for diesel in water and for water in diesel. If there are no storage tanks, mark “not applicable”.

- filing, transferring operations and spill protection? Tip: The Technical Guidelines and Codes of Practice may require property managers to install systems for spill containment, overflow protection, secondary containment, dispenser sump and leak detection. Various systems are available for both aboveground and underground storage tank systems. If there are no storage tanks, mark “not applicable”.

- emergency preparedness? Tip: An emergency preparedness plan should identify response personnel who are to be trained, and their responsibilities in the event of a leak or spill. If there are no storage tanks, mark “not applicable”.

- record keeping? Tip: All inspections and maintenance, alterations and upgrading should be documented. If there are no storage tanks, mark “not applicable”.

- tank closure, abandonment or removal? Tip: A storage tank system must be properly decommissioned when replaced or taken out of service. If there are no storage tanks, mark “not applicable”.

4.5 Emissions – Hazardous Products and WHMIS

<table>
<thead>
<tr>
<th>WHMIS Program</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Are MSDSs spill clean-up kits, and safety equipment such as eye-wash stations located in an accessible place near the chemical storage areas? Tip: Material Safety Data Sheets (MSDS) contain information about the properties and safe handling of each hazardous product.</td>
<td>☐ Yes ☐ No</td>
<td></td>
</tr>
<tr>
<td>Are the MSDSs less than 3 years old? Tip: Data sheets should not be more than 3 years old.</td>
<td>☐ Yes ☐ No</td>
<td></td>
</tr>
<tr>
<td>Are WHMIS labels present on regulated products? Tip: Implementing the Workplace Hazardous Materials Information System (WHMIS) is a Canada-wide legal requirement designed to ensure that chemicals and other hazardous substances are handled safely and that information about them including the relevant protective measures is disseminated to workers and employers.</td>
<td>☐ Yes ☐ No</td>
<td></td>
</tr>
<tr>
<td>Health &amp; Safety and Management of Hazardous Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are chemicals and hazardous materials stored under appropriate conditions in secure locations? Tip: Chemicals used in buildings that are classified as hazardous include oils, biocides, solvents, insecticides, pesticides and herbicides. They should be stored in rooms with proper ventilation, controlled temperatures, drain protection and adequate shelf space. Containers should be capped to avoid possible spills and fumes, properly labeled and kept in securely locked areas.</td>
<td>☐ Yes ☐ No</td>
<td></td>
</tr>
<tr>
<td>Is a hazardous products (hazardous chemicals) management plan in place? Tip: This is a minimum requirement for BOMA BEST. A hazardous products management plan should indicate how controlled products are received at the facility, how they are to be used and disposed of. It should also include WHMIS sheets for all products identified in the inventory.</td>
<td>☐ Yes ☐ No</td>
<td></td>
</tr>
<tr>
<td>Are education and training provided for the person responsible for the management of chemicals and for staff who may be required to work with them? Tip: WHMIS education refers to the instruction of workers in general information such as how WHMIS works and the hazards of controlled products, whereas training refers to the instruction in site-specific information such as work and emergency procedures.</td>
<td>☐ Yes ☐ No</td>
<td></td>
</tr>
<tr>
<td>Is there a designated person responsible for managing hazardous products? Tip: The designated person should be responsible for: (1) advising workers of potential and actual hazards (2) ensuring that workers use prescribed protective equipment devices, and (3) taking every reasonable precaution for the protection of workers.</td>
<td>☐ Yes ☐ No</td>
<td></td>
</tr>
<tr>
<td>Are there inventory and records of the hazardous products/waste, including their removal and disposal? Tip: The inventory must identify the hazardous waste streams, the operations in the building that produce them, how and where the hazardous waste is handled and stored, and who is responsible for it. The records should show that the organization tracks the hazardous waste from the facility through a provincially licensed or certified carrier to a waste disposal facility that is also licensed or certified by the province to accept hazardous waste.</td>
<td>☐ Yes ☐ No</td>
<td></td>
</tr>
<tr>
<td>Is there a Health and Safety Committee that meets regularly and carries out regular inspections of the property? Tip: Inspections should cover ventilation, spill containment and clean-up provisions as well as compatibility of the hazard materials that are being stored together, and security of access. The committee should include representatives from the tenants as well as management and should meet on a regular basis to deal with health and safety issues. If a Health and Safety Committee is not required by regulation (i.e. if there are fewer than 20 people), mark as “not applicable”.</td>
<td>☐ Yes ☐ No ☐ N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pesticides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there suitable measures to ensure that food or food waste is well contained and that there are no unprotected openings, to minimize access by rodents? Tip: One way to minimize pesticides usage indoors is through the planned elimination of sources of food and pest habitats.</td>
</tr>
<tr>
<td>Question</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Do landscaping practices minimize the use of pesticides, herbicides, fertilizer and petroleum-based products? Describe the extent to which these products are used, and any alternative methods being employed on both the exterior and interior: <strong>Landscaping (pesticides) description</strong> Tip: &quot;Pesticide&quot; refers to insecticides, herbicides, fungicides, rodenticides, disinfectants, anti-foulants and plant growth regulators. Use of local, resistant plants in landscaping may lead to a minimal need for pesticides. If there is no landscaping, mark as &quot;not applicable&quot;:</td>
</tr>
<tr>
<td>Are pest-control inspections done monthly?</td>
</tr>
<tr>
<td>Do pest control contracts require that the staff be licensed and use integrated pesticide management methods?</td>
</tr>
<tr>
<td>5.0 INDOOR ENVIRONMENT</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Indoor Air Quality</td>
</tr>
<tr>
<td>5.1 Indoor Air Quality - Ventilation System</td>
</tr>
<tr>
<td>Are air intakes located far from sources of pollution such as parking areas, bus stops, cooling towers or stagnant water?</td>
</tr>
<tr>
<td>Tip: If intakes are on the roof, check for stagnant pools of water, insects and pigeon droppings, as well as proximity and wind direction with regard to the spray from cooling towers. If near the ground level, also check for sources of vehicle emissions (parking and idling), industrial or commercial pollution.</td>
</tr>
<tr>
<td>Are air intakes located at least 30 ft. away from building exhaust outlets?</td>
</tr>
<tr>
<td>Tip: Separating air intakes from exhaust avoids “re-entrainment” (short-circuiting) of exhaust air. Also consider the prevailing direction of the wind relative to the intakes and exhaust.</td>
</tr>
<tr>
<td>Are outdoor air intakes checked regularly to ensure that the openings are protected and free from obstruction? Tip: Check that the grilles on the fresh-air supply inlets are free from obstruction by leaves, snow, insects and pigeon droppings.</td>
</tr>
<tr>
<td>Is there free-standing water which cannot drain away in the condensate drip trays? Tip: Verify that there is no free-standing water in the air-conditioning ductwork, particularly in the condensate drip trays of cooling coils, downstream from humidifiers, which can result in contamination of ducts by bacteria and fungi. If there is no air-conditioning, mark “non-applicable”.</td>
</tr>
<tr>
<td>Are there signs of corrosion, loose material (such as damaged filter bags) or sound attenuation material in the air-handling unit (AHU)? Tip: Inspect the air-handling units (air-mixing chambers, coils and fan blades) and duct interiors including any crawlspaces, tunnels or other areas that are used as ducts or which may be in contact with the ventilation air stream. Investigate whether commissioning took place. If there are no air-handling units, mark “non-applicable”.</td>
</tr>
<tr>
<td>Is there permanent carbon dioxide monitoring or are there sensors to maintain pre-set levels of carbon dioxide? Tip: Monitoring should be located in areas with high occupant densities and at the ends of the longest runs of the distribution ductwork. CO₂ monitoring can be installed as an independent system or be a function of the building automation system, preferably with feedback on space ventilation performance and operation of the air intake vents.</td>
</tr>
<tr>
<td>Are the CO₂ monitors annually calibrated?</td>
</tr>
<tr>
<td>Are measured CO₂ levels less than 850 ppm (assuming outdoor levels 400 ppm)? Tip: Measure CO₂ concentration using a Draeger pump or CO₂ data logger. Be sure to take enough readings to establish a representative profile for a wide range of spaces in the building.</td>
</tr>
<tr>
<td>Do the occupants have personal control over the ventilation rates in the area in which they work, either through hybrid system (operable windows) or personalized HVAC controls? Describe: Personal ventilation controls description. Tip: Personal controls refer to 4-6 workstations or less.</td>
</tr>
</tbody>
</table>
### 5.2 Indoor Air Quality - Filtration System

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are filters able to remove particles as small as 0.3 micrometers from incoming air (Efficiency Grade between 60% and 85% Dust Spot or a Minimum Efficiency Reporting Value (MERV) of 8)? Tip: The efficiency of filters is usually indicated on filter packages.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>Are manometers or pressure sensors fitted to indicate when filters should be changed? Tip: A manometer, which measures the pressure drop across the filters, indicates when these need cleaning or replacing. Manometers connected to BAS give even better warning.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>Is there easy access for cleaning and inspecting filters? Tip: Easy access makes it easier to visually check whether air is bypassing the filters and to determine whether they are properly installed.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>Do filters fit snugly within the filter supports? Tip: Verify that there is a snug fit, that the filters are the right size and that they are installed in the correct direction.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### 5.3 Indoor Air Quality - Humidification System

<table>
<thead>
<tr>
<th>Question</th>
<th>Steam</th>
<th>Spray</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>What type of humidification system does the building use? Tip: Because of the risk of microbial contamination associated with spray humidification, a preferred method is humidification by steam. If there is no humidification, mark &quot;not applicable&quot;.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>If steam humidification is used, is clean steam rather than treated boiler water utilized? Tip: Steam humidification should be provided from an independent source, as there are some concerns with steam generated as a by-product, because of potential air contamination from boiler additives used to control scale and corrosion. If no steam humidification is used, mark &quot;not applicable&quot;.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>If spray humidification is used, is the system rigorously maintained and free of rust, algae, or loose contaminants of any kind? Tip: Verify that there are documented maintenance procedures and records. If no spray humidification is used, mark &quot;not applicable&quot;.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### 5.4 Indoor Air Quality - Cooling Towers

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are the cooling towers located away from fresh air intakes and flue outlets? Tip: Check the relative positions of ventilation intakes to cooling tower drift, and the prevailing wind direction. If there are no cooling towers, mark &quot;not applicable&quot;.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>Are there drift eliminators? Tip: Drift eliminators remove water droplets generated by the cooling tower. This saves water and reduces the risk of downdraft spray that could contain Legionella. Eliminators can be internal or external to the cooling tower. If there are no cooling towers, mark &quot;not applicable&quot;.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>Is there at least monthly inspection of cooling towers for evidence of mould or slime, which could indicate elevated levels of bacteria; regular treatment of the cooling tower water; and complete cleaning and disinfection of each cooling tower at least every six months? Tip: There should be at least monthly inspections of cooling towers that indicate checking for evidence of slime or mould (which could indicate an elevated level of bacteria), regular treatment of the cooling tower water, and complete cleaning and disinfection of each cooling tower at least every six months. If there are no cooling towers, mark &quot;not applicable&quot;.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
</tbody>
</table>
### 5.5 Indoor Air Quality - Parking and Receiving

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are enclosed parking areas mechanically ventilated? <strong>Tip:</strong> Closed garages are generally underground and require mechanical ventilation to avoid carbon monoxide, oil and gas fumes becoming concentrated in the garage and entering the building. Open or partially open garages, which are typically above-grade, may not need mechanical ventilation. If there are no enclosed parking areas, mark “not applicable”.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there measures to prevent intake of exhaust fumes from the loading dock and parking areas? <strong>Tip:</strong> Measures include posting notices to turn off vehicles; having well-sealed doors between the parking and occupied areas; ensuring that offices near parking garages and loading docks are under positive pressure; and increasing exhaust ventilation in the garage and loading docks. If there is no loading dock nor parking areas, mark “not applicable”.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a carbon monoxide detection and monitoring system:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- In enclosed parking garages?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Near gas or fuel-fired heating boilers?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 5.6 Indoor Air Quality - Control of Pollutants at Source

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have there been ongoing observations or complaints of symptoms of mould or excess moisture? <strong>Tip:</strong> Check for visual or odour clues in the following areas: crawl spaces, sub-floor cavities and service tunnels, cold surfaces such as under windows and in corners formed by exterior walls, uninsulated cold water piping, bathrooms, indoor areas in the vicinity of known roof or wall leaks, floors and ceilings under plumbing, duct interiors near humidifiers, cooling coils, outdoor air-intakes and under carpets.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Stained ceilings or walls?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Musty odours?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Damp or musty carpets?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do large printing rooms, cafeteria, kitchens, chemical storage and washrooms have effective local exhaust? <strong>Tip:</strong> Some special-use areas may require additional local exhaust to prevent air pollutants from accumulating in or spreading beyond a local area. Fans should operate continuously when the source is present, not only when the room is occupied. Test the exhaust effectiveness with chemical smoke or light tissue paper.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there documented measures to control pollutants at source in areas such as washrooms, kitchens, printing areas, chemical storage and general storage areas? Describe:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pollution control does description</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tip:</strong> Measures to reduce pollution at source should be documented and maintenance records kept, otherwise they may be implemented in a haphazard fashion. For example, in washrooms that are not frequently used, toilets should be flushed and water run in the sinks so that water does not stagnate in the supply lines; fume hoods should be installed over printing areas; cooking activities managed carefully to avoid indoor air quality problems; gas appliances vented and checked for leaks; dumpsters properly located to avoid odors and so on.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Does the contract with the building cleaning staff or contractors specifically state that they are to use environmentally friendly cleaning materials? Tip: These are cleaning materials which do not greatly sacrifice performance and which are biodegradable, do not contain phosphates, or do not fall under the Hazardous Products Act. This requirement should be documented in the cleaning contract.</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Is there a designated smoking area outside that is away from entrances and will limit the spread of smoke to the inside of the building? Tip: Banning smoking is the most effective way to avoid environmental tobacco smoke - a source of irritation and a known carcinogen.</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Is there a checklist of items connected to Indoor Air Quality that must be discussed with architects, engineers, contractors, and other professionals prior to renovations and repairs? Describe: [Renovation checklist description] Tip: Discussion is essential to avoid design features that could interfere with ventilation or thermal comfort, or which could cause condensation, or result in the selection of inappropriate materials or systems. Renovation procedures should also be discussed to avoid the release dust and hazardous materials and to avoid sealants, finishes, carpets and furnishings that emit volatile organic compounds (VOCs).</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td><strong>5.7 Indoor Air Quality Management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does building management have in place a documented means for addressing tenants/occupant concerns regarding indoor air quality (such as a complaint form and incident log)? Tip: Building management must have in place a documented means for addressing tenants/occupant concerns regarding indoor air quality.</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Has the building had an Indoor Air Quality audit in the past year? Tip: The audit should have been detailed enough for management to gain a comprehensive understanding of the current IAQ situation in the building, including all of the factors that could influence the building’s IAQ.</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Are there procedures for maintaining good Indoor Air Quality that include: Tip: Building management must have a heating, ventilation and air conditioning (HVAC) procedures and preventive maintenance program in place.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• HVAC operations? Tip: There should be daily, weekly and monthly schedules.</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>• Preventive maintenance? Tip: This should include a scheduled program for monitoring, cleaning and replacing HVAC components such as outside air intakes, outside air dampers, air filters, drain pans, heating and cooling coils, the interior of air handling units, fan motors and belts, air humidification, controls and cooling towers.</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>• Housekeeping procedures? Tip: These should identify all areas that should be cleaned, specify the products that are to be used and their appropriate application, and provide a cleaning schedule.</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>• Mould management?</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>• Procedures for unscheduled maintenance? Tip: Procedures for unscheduled maintenance should be documented in the event of equipment failures which may require the prolonged deactivation or modification of the building’s HVAC equipment.</td>
<td>☐</td>
<td>☑</td>
<td></td>
</tr>
</tbody>
</table>
### 5.8 Lighting

#### Lighting Features

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are high frequency ballasts fitted to luminaries? Tip: Electronic ballasts help prevent eyestrain and headaches which are often associated with the flicker produced by standard magnetic ballasts. In addition they can result in 10 to 15% energy reduction compared to conventional ballasts.</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Are there controllable internal or external blinds and do light fixtures prevent glare at Visual Display Terminals? Tip: Internal shading devices limit the glare resulting from solar radiation. They should be adjustable to allow occupants to regulate the amount of direct light entering their space. The cut-off angle of downward light should reduce glare on VDT screens.</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Do lighting levels meet IES (Illuminating Engineering Society of North America) guidelines of 500-800 lux (50-75 footcandles) for office space? Tip: To measure lighting levels, use an illuminance light meter. General (ambient) lighting - the most common type of office lighting - can be provided by indirect lighting from the luminaires that bounce off the ceiling or walls, direct lighting that shines directly from the luminaire to the task, or a combination of both. Lower lighting levels with no glare are often better to view the computer screens.</td>
<td>☐</td>
<td>Yes</td>
<td>Unknown</td>
</tr>
<tr>
<td>Is individually controlled task lighting provided? Tip: This is lighting which shines directly from the luminaire to the task. It includes desk and table lights.</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Does the floor plan of the building potentially allow for 80% of a typical working area to have access to daylight or are approximately 40% of workstations within 7 meters from the windows? Tip: Although tenants may erect barriers that prevent daylight from penetrating in the area, consider whether the building plan could allow easy access to daylight</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Are there good lighting controls? Tip: Each control should be for no more than four workstations, assumining 7 m² per workspace.</td>
<td>☐</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

#### Lighting Management

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a planned schedule of cleaning light fixtures? Tip: Cleaning luminaires can increase light output and quality, resulting in the need for fewer lamps and significant energy savings over the life of the facility. Recommended cleaning intervals for luminaires in offices are one or two times a year</td>
<td>☐</td>
<td>Yes</td>
</tr>
<tr>
<td>Is there a group-relamping program? Tip: Lamps that are changed before they burn out produce greater light output, resulting in better quality light, the need for fewer lamps and corresponding energy savings</td>
<td>☐</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### 5.9 Noise

<table>
<thead>
<tr>
<th>Noise</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is it easy, in open office areas, to engage in a conversation using a normal voice, understand a phone conversation, and have a private conversation using lowered voices? Tip: To measure sound levels, use an integrated sound-level meter with 'A' weighting in accordance with the CSA Standards Z 107.51 and Z 107.52. The readings should be no more than 50 dBAeq T.</td>
<td>□ Yes □ No</td>
</tr>
<tr>
<td>Is there sufficient acoustic privacy? Tip: In open offices, speech should be heard but not generally understood in adjacent work stations, and it should be possible to have a private conversation using lowered voices. In enclosed offices, it should be possible to maintain confidentiality using normal voice levels.</td>
<td>□ Yes □ No</td>
</tr>
</tbody>
</table>
### 6.0 ENVIRONMENTAL MANAGEMENT SYSTEM

#### 6.1 Environmental Management System (EMS) Documentation

<table>
<thead>
<tr>
<th>Question</th>
<th>Points</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does building management have a written environmental policy?</td>
<td>30</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Tip: The policy should be a public document that is easily accessible to staff and tenants. It should express a commitment to: comply with relevant laws or other requirements; continuous improvement; and pollution prevention. It should also be signed by senior management.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there stated goals and targets documented in the policy manual with respect to each of the following:</td>
<td>30</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Tip: Goals and specific targets to improve or maintain the facility’s environmental performance should be documented as part of the “environmental vision” for the building.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there action plans to improve the environmental and energy performance of the building? Describe:</td>
<td>30</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Tip: The action plans should outline implementation strategies, timelines, training and resources needed to achieve stated targets. They should be reviewed, revised and updated on a regular, scheduled basis.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As tenants renew their leases or where there is a tenant turnover, do the new leases contain a section on energy and environmental responsibilities (Green Lease)?</td>
<td>30</td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>

#### 6.2 Environmental Purchasing

<table>
<thead>
<tr>
<th>Question</th>
<th>Points</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does building management have a written environmental-purchasing policy?</td>
<td>25</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Tip: The environmental purchasing plan should: assign responsibilities; ensure that those who do purchasing have adequate training; refer to products used by in-house staff; stipulate requirements for cleaning contractors; and provide education to tenants.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a list of preferred products used in housekeeping and building maintenance? Identify who maintains the list:</td>
<td>25</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>Tip: Staff need a list of feasible environmentally friendly substitutes and their suppliers. Because products are frequently discontinued and new products introduced to the market, the list should be regularly reviewed and updated.</td>
<td></td>
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</tr>
</tbody>
</table>

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| Does the purchasing policy include the requirement for purchasing energy efficient building equipment? Provide examples: Energy efficient equipment purchased examples: |
|-------------------------------------------------|------------------|
| Tip: The policy should include the requirement that any purchases of appliances and HVAC should involve consulting the EnerGuide and/or purchase of Energy Star rated products. |
| □Yes □No |

<table>
<thead>
<tr>
<th>Are MSDSs reviewed by staff who purchase hazardous products?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip: Those responsible for purchasing should ensure that up-to-date Material Safety Data Sheets (MSDS) for controlled products are reviewed and are available to employees. They should not be dated more than 3 years previous to the receiving date.</td>
</tr>
<tr>
<td>□Yes □No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Does building management have a written policy for the selection of building materials that attempts to reduce any potential negative impact on the environment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□Yes □No</td>
</tr>
</tbody>
</table>

### 6.3 Emergency Response 20

| Are procedures documented and staff trained to deal with and obtain prompt assistance for emergencies such as fire, spills, power failures and illness? Tip: Procedures must be detailed for quick and effective action in the event of an emergency. They should include up-to-date contacts to obtain assistance promptly and to report the emergency. There should also be a protocol to assess the risks of re-occupying a building in the case of evacuation. |
|-------------------------------------------------|-----------------|
| □Yes □No |

| Do the emergency plans refer to all applicable legislation regarding emergency procedures, reporting and record-keeping? Tip: The emergency response plan must ensure compliance with applicable regulations. A first step is to define accountability with respect to permits, record-keeping and reporting. |
|-------------------------------------------------|-----------------|
| □Yes □No |

| Is there equipment on-site to deal with environmental emergencies? Tip: The environmental emergency response plan should require that equipment such as spill control kits, absorbents, and personal protection equipment be on-site for quick and easy access. |
|-------------------------------------------------|-----------------|
| □Yes □No |

| Are there contingency plans for both short-term and long-term power failures? Tip: Planning for power failures should address the following elements: communication to tenants; security; provision of emergency power and water; and, if necessary, evacuation. |
|-------------------------------------------------|-----------------|
| □Yes □No |

| Is there a site map showing the location of environmentally significant features such as shut-off valves, underground and above ground storage tanks etc.? Tip: Site plans should identify environmentally significant features such as hazardous waste storage rooms, PCB-containing equipment, sanitary and storm sewer lines, CFC equipment, storage tanks as well as emergency equipment. |
|-------------------------------------------------|-----------------|
| □Yes □No |

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### 6.4 Tenant Awareness

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a well understood system for communicating with tenants/occupants regarding environmental initiatives and practices in the building?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Describe the system:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenant communications system description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there communications to tenants on the environmental measures that they can implement in the building to contribute to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Energy conservation plug load reduction? Tip: An inexpensive way to reduce energy costs is by developing energy efficiency procedures and personal habits. Provide information to occupants on energy use and means of saving energy (such as information on turning off lights in unoccupied spaces, after normal office hours and the correct use of blinds).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Waste reduction and recycling? Tip: This can include promotional materials such as brochures and newsletters to keep tenants informed about how they can reduce the amount of waste being sent to landfill through such things as recycling and composting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Proper handling, storage and disposal of toxic products? Tip: The information should be of a general nature and should communicate that each toxic product has its own characteristics, which require proper handling, storage and disposal. This can include newsletters, postings on bulletin boards, signage, memos or participation in events that promote responsible environmental stewardship.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has a tenant satisfaction survey been completed in the last 3 years? Tip: Tenant satisfaction survey enables property managers to prioritise efforts and maximize the performance of their assets.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix I – Clean Air – Cool Planet Campus Carbon Calculator User’s Guide

This Carbon Calculator is developed by Clean Air – Cool Planet and is used as a reference in this document. The institution can use this calculator to estimate how much carbon they are emitting.
The complete guide to conducting a greenhouse gas emissions inventory and building a portfolio of carbon reduction projects on your campus.
Introduction: The Campus Carbon Calculator v6.0
A Four-Step Model for Campus Climate Action
Changes from Previous Versions
Using the Calculator

Building A Foundation: Understanding Key Greenhouse Gas Accounting Concepts
Organizational Boundaries
Operational Boundaries
Temporal Boundaries
GHG Accounting Concept: "De Minimus" Emissions
GHG Accounting Concept: Biogenic Carbon

Tracking your Greenhouse Gas Emissions: The Inventory Module
Collecting Data
Calculating Emissions
Viewing Summary Data and Graphs

Projection Module
Assessing the Costs and Benefits of Carbon Reduction: The Solutions Module
Getting Started: What can I do with the Calculator?
"Project" Inputs
1- Timing:
2- Cost:
3- Activity Change:
Challenging Assumptions
Emissions Assumptions:
Cost Assumptions:
Understanding Final Product
1- IRR (Internal Rate of Return):
2- NPV (Net Present Value):
3- Discounted Payback Time:
Summary Data:
RECs Offsets, and Additionality:

Next Steps: The Beginnings of a Climate Plan
Setting Goals:
Using Your Data Effectively:
Conclusion: The Power of Narrative

Supplementary Materials
Appendix 1: Data Collection Outline
Adding Custom Emissions Sources
Appendix 2: Campus Carbon Calculator FAQs
Troubleshooting
Introduction

This new, improved Clean Air-Cool Planet Campus Carbon Calculator, v6.0, is an upgrade of a tool used at over 500 schools across North America. There are three major tasks facilitated by the Calculator:

1. **Conducting a Greenhouse Gas Emissions Inventory:** Collecting, analyzing, and presenting data on the emissions of greenhouse gases attributable to the existence and operations of an institution. This first step provides an essential foundation for focused, effective collaboration on the issue of climate change at a college or university, and is the basis for institutional action.

2. **Projecting Emissions into the Future:** Projecting the university’s “business as usual” and alternative-scenario emissions trajectories will provide a context for choosing emission reduction goals and the projects needed to meet those goals.

3. **Evaluating a Portfolio of Carbon Reduction Projects:** Developing a portfolio of proposed carbon reduction projects will put you well on your way to creating an effective climate plan that will address the specific emissions identified in your inventory.

The Campus Carbon Calculator is an Excel workbook designed to facilitate these three tasks. It includes all six greenhouse gases specified by the Kyoto Protocol (CO₂, CH₄, N₂O, HFC and PFC, and SF₆). It will enable you to calculate and project emissions for the years 1990-2060 and produce charts and graphs illustrating changes and trends in your institution’s emissions over time. The spreadsheets were originally based on the workbooks provided by the Intergovernmental Panel on Climate Change (IPCC, [www.ipcc.ch](http://www.ipcc.ch)) for national-level inventories, and incorporate data from the third and fourth Assessments of the IPCC. The Calculator has adapted this IPCC data for use at institutions like a college or university, but follows virtually the same protocols.

The Campus Carbon Calculator uses standard methodologies codified by the GHG Protocol Initiative, and employed by corporations, the state of California, The Climate Registry, and other entities to account for greenhouse gas (GHG) emissions. These methodologies are currently the most accurate and widely accepted amongst policy makers. Inventories produced by the Calculator are compatible with current standards used to craft forthcoming cap-and-trade policy. The Calculator is also a preferred tool for the ACUPCC (American College and University President’s Climate Commitment).

This document — in addition to the Calculator — is meant to support real change on your campus. Once emissions sources are identified, feasible carbon reduction measures become more apparent. This Calculator will help you document and analyze project ideas such that your campus can begin to incorporate larger investments into its definition of “business as usual.” As you may imagine, a holistic

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1. Most Notably, WRI (World Resources Institute), and the CCAR (California Climate Action Registry).
2. Disclaimer: Though methodologies remain fairly constant, the emergence of markets for RECs and carbon offsets may have a profound effect on electricity emissions attributed to institutions — especially when custom fuel mixes contain high ratios of emissions-free power like nuclear and hydropower.

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incorporation of climate-conscious sustainability is a long and ever-developing process; this Calculator will give you the tools you need to get started.

**A Four-Step Model for Campus Climate Action**

As people all over the country gravitate toward taking action on climate change, more and more eyes are looking to college campuses in search of bold new solutions. Campuses are filled with young passionate minds, mentors with diverse experience, advanced research facilities—in short, many of the resources we need to address this challenge. Thus Colleges and Universities have a unique opportunity to take real action on climate change and serve as a model for the rest of the nation to follow. This section presents a general four-step plan that will help you down the road to developing and implementing a climate action plan. Thanks for taking action! And good luck!

**Bring People Together:** The easiest and most important part of gearing up to take real climate action is to make sure everyone who wants to be is included. A broad coalition of groups is the most effective mechanism to achieve the transformational change necessary for campus carbon reductions. Make sure you include academic departments, environmental clubs (all of them), the facilities department, and the sustainability office. If serious carbon reduction targets are your goal, you’ll need all the help you can get! Your dream team will be comprised of economists, activists, talkers, listeners, staff, faculty, and administrators. Every campus community has a few people who really want to get involved—they are a resource that must be tapped. Skill sets are just as important as the story you’ll tell. The headline you’re going for is something like: “Campus comes together to set bold goals for carbon reduction.” You want something with a narrative powerful enough to get people excited.

**Find Data:** The GHG inventory and climate planning processes supported by the Calculator requires a lot of information to complete. The Inventory will best be performed by a small core group of people who will communicate well with the broader group of interested community members during and after the inventory process. For a student, this is a great project for a break, a summer, an on-campus job, a service learning project or an independent study. If you’re not the energy manager on campus, you will definitely want to get friendly with him or her; she can help you come up with the right data, but also ideas for harvesting data that doesn’t exist yet—like how much electricity goes where in each building. If you’re a student (or group of students), you will need support from campus staff, professors, and administrators to gain access to purchasing and other relevant records in the facilities department.

**Get Creative:** Once you know exactly where your emissions come from, you can focus on how to reduce them. Campus communities are great places to access people with a broad range of ideas: freshmen, seniors, faculty, staff, administrators, community business leaders, etc. Tap the collective consciousness, and get people excited about pitching in—even if they’re just supporting your goals from the sidelines. Collect as much information as you can on project ideas, but also start generating campus-wide excitement about your new low-carbon future. Host carbon-neutral events, guide tours of the co-gen plant, write articles in the paper, and be sure to get words like “offsets,” and “carbon neutrality” into shared dialogue.

**Present Your Ideas:** So you’ve assembled a reasonable list of well-sourced carbon reduction projects and your coalition of interested parties has stirred up a little excitement on campus. Now it’s time to present your ideas to your stakeholders. Armed with a thorough list of credible carbon reduction projects, you can start to chart a path toward emissions reductions that ends with a
decisive target like, “carbon neutral by 2018.” Your presentation includes how carbon reduction will enrich the academic lives of students on campus because it will be integrated into existing campus programs. You can also talk about the respect you’ll win from the academic community and media attention for pursuing such an audacious goal when the rest of the country is having trouble even maintaining its current emissions GHG levels. In the end your proposal may lack many of the specifics needed to completely integrate carbon neutrality into master planning and the curriculum – but that’s OK. The most important step here is to provide a starting point, and unite the campus community around one common reduction goal that includes a growing portfolio of carbon reduction projects.

Changes from Previous Versions

- Updated constants and emissions factors
- Added emissions factors for a range of alternative fuels
- Emissions projections extended out to 2060
- Added normalization of emissions by heating or cooling degree days
- Transportation and distribution losses no longer included in Scope 2 (rather, Scope 3)
- Re-formatted Input sheet for increased compatibility with World Resources Institute / California Climate Action Registry / Climate Registry / American College and University Presidents' Climate Commitment methodology
- Allows more conservative definitions of “offsets”
- Calculation for two new emissions source categories: wastewater treatment, and paper purchasing
- Biogenic carbon emissions reported tracked
- Projection Module assists planning for future energy needs and emissions reductions projects out to 2060, allowing for four methods of projection:
  - Linear
  - Normalized by number of students
  - Normalized by square footage
  - Custom annual growth rates
- Solutions Module allows cost/benefit analysis of carbon reduction measures and includes
  - A customizable input interface by which many different carbon reduction projects can be compared on a basis of financial feasibility and potential for GHG reduction.
  - Customizable fuel price projections out to 2060
  - Projected cash and emissions flows for carbon reduction projects
  - Executive summary comparing reduction measures by cost/savings and reductions
  - Graphs comparing reduction measures and showing overall progress towards meeting reduction goals
- Expanded documentation includes
  - Explanation of new features
  - Increased user-friendliness and guidance on developing and implementing a climate action plan
  - Updated text on User's Agreement and Introduction sheets to reflect new version
  - Updated spreadsheet map
Using the Calculator

BEFORE USING THE CALCULATOR, SAVE A COPY OF THE ORIGINAL FILE FOR REFERENCE. Then, on a computer with Excel, open the file, “Calculator_v6.xls.” Enable the macros when prompted (if you disable the macros, the Calculator will not function properly.) The Calculator will open to a user’s agreement. Read the agreement, and then click “I understand and am willing to abide by these terms...” This will take you to an introductory sheet that summarizes the information below and explains the different sheets and how to use them. Fill in the name of your institution and your contact information in the box on the introduction sheet. This will automatically update all the other sheets with your information.

Updating the Campus Climate Calculator from a previous version

Previous versions of the Calculator included a macro to automatically move input data from the old version to the new. However, the changes in formatting and functionality were so great between versions 5 and 6, that the safest and simplest way to move between versions is for users to update their new file manually. Data to update:

- Institutional data - budgets: Copy data from the “Input_InflAdj” worksheet in v5 and “paste special: values only” in corresponding “Input_InflAdj” columns in v6
- Institutional data – population and square footage: Copy values from the Input worksheet in v5 and “paste special: values only” in corresponding “Input” column in v6
- On-campus stationary sources: Copy values from v5 “Input” worksheet and “paste special: values only” in corresponding “Input” column’s (N-AO) in v6.
- Direct Transportation (Fleet): Copy values from v5 “input” worksheet and “paste special: values only” in corresponding Input column’s (AP-AX) in v6.
- Agricultural inputs: Copy from “input” worksheet in v5 and “paste special: values only” in corresponding Input column’s (BF-BQ) in v6
- Refrigerants: Copy and paste v5 “input” values (lbs of refrigerant/chemical) to v6 “Input” worksheet, and then make sure the appropriate column headers have been chosen for your refrigerants in v6 (use the pick lists in cells 9AZ, 9BA, 9BB, 9BC, 9BD, and/or 9BE.)
- Electricity: Copy and paste kWh totals from v5 Input sheet to v6 Input sheet. Follow the link at the top of the column (cell 9BR) on the v6 Input sheet to choose your electricity mix – either selecting your E-Grid region pre- and post- 2006, based on the colored maps. If you used a custom fuel mix in v5, check the box at the bottom of “EF ElectricMap” in v6 to indicate this, and then follow the link to “Input_CustomFuelMix” and copy data from that sheet in v5 to the same sheet in v6.
- Purchased steam or chilled water: Copy from v5 and “paste special: values only” in corresponding Input column’s (BS-BT) in v6. Click on the links in 9BS and/or 9BT to make sure the fuel mixes in v6 are set to be the same as in v5
- Solid waste: Copy from v5 and “paste special: values only” in corresponding Input column’s (CK-CO) in v6.
- Air travel: Version 5 has to columns related to air travel on the Input worksheet, one for total miles traveled by staff and faculty, and another for students. Version 6, likewise has a faculty/staff column and a student column for air passenger miles, but it does allow users to make the distinction between directly financed outsourced travel, and student air miles associated with study abroad programs (which are generally not directly financed by the institution). If your totals in v5 combine the two different student categories of air travel, you will have to make the decision as to whether to break these out in order to enter them in their

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separate categories in the v6 Input worksheet, or whether you will keep them combined (and note that in your inventory methodology summary/data collection log). For faculty/staff air travel, you should be able to just copy and paste your values, as is, from v5 to v6.

♦ Commuter inputs: Version 6 removes summer school students as a separate category in the commuting analysis. If you believe your summer school student commuting totals are significant and want to continue including them in your analysis, you will need to add these input totals to those in the regular “Student” columns. It also shifts from tallying student, staff, and faculty trips on a daily basis to totaling them on a weekly basis. The impetus for making this change in methodology in v6 was the recognition that, at least for students and many faculty members, their schedules may vary more day to day, but be consistent week to week, which made weekly travel a potentially more relevant and accurate foundation for creating commuting data sets. This means users upgrading from v5 to v6 have two options: either they can input new and different totals in all of the Trips Per Week and Weeks Per Year columns in the Input_Commuters worksheet of v6, which were formerly Trips Per Day and Days Per Year in the corresponding worksheet columns in v5. Or, they could change the column headers back to what they were, if they want to continue analyzing commuting information using each day as a basis for analysis. (The calculation does not change.)

♦ REC's: Note there are different categorizations of RECs and offsets in v6; if you had RECs included in your v5 input sheet, you will have to make a judgment categorization in v6.

Note: You will see differences in emissions estimates between versions (for example, you may enter the same number of kWh purchased and get a different emissions estimate). This is due to improvements in methodology and emissions factors. For example, in Version 6.0 we corrected a methodological error, which counted emissions from electricity lost in transmission and distribution as part of the institution's Scope 2 emissions; in v6 those "T&D" losses are totaled in Scope 3. Purchased electricity are taken from the EPA's eGRID electric emission database which uses plant-specific emission factors for each electrical region in the United States.

Tips for Navigating the Calculator

♦ Each worksheet has a box in the upper left corner labeled "Spreadsheet Map" - click on this to navigate to the Spreadsheet Map worksheet. This worksheet contains a diagram of all the worksheets in the Calculator. To navigate to a specific worksheet simply click on its box in the Spreadsheet Map. To reach a worksheet in the Emissions Factors or Graph Modules, click on the module in the Spreadsheet Map to view a list of worksheets in that module.

♦ Enable the "Web" toolbar (click View -> Toolbars -> Web) and use the forward and back arrows. Note that clicking the back arrow does NOT undo any changes you have made.

♦ Use the worksheet tabs at the bottom of the sheets, which are color-coded on PCs using Excel 2003 or later.

Background Information

Notes: Certain Calculator cells contain a note meant to assist you in understanding the function of that particular cell of worksheet. Notes are indicated by a small red triangle in the upper right corner of the cell. To view the note, simply place the mouse over the triangle and the comment will appear.

Reference Data: At the bottom of every column is a gray row that links to the external references of the data in that column.

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http://www.epa.gov/cleanenergy/egrid.htm

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Building A Foundation:
Understanding Key Greenhouse Gas Accounting Concepts

So you want to begin to work toward reducing your carbon footprint. How do you know what to measure on campus and what not to measure? How do you differentiate between emissions the institution is responsible for versus those that are the responsibility of the individuals that make up that institution? These questions are not always easy to answer but they must be addressed in order to start setting carbon reduction goals, collecting data or formulating plans. Indeed, one of the major sticking points in evaluating claims of “carbon neutrality” is the question of how boundaries are drawn, which emissions are “neutralized,” and what energy sources count as “carbon neutral.”

Over the past decade, the World Business Council for Sustainable Development and the World Resource Institute (WBCSD/WRI) jointly established a set of accounting standards to begin to address these questions and guide entities in their emissions-reporting. These standards provide concepts and systems to ensure transparency, accuracy and standardization for carbon management. They are primarily found in the GHG Protocol’s “Corporate Accounting and Reporting Standard” and Project Protocol, available at the GHG Protocol website (www.ghgprotocol.org). These protocols, created and maintained through multi-stakeholder input and dialogue, are the foundations upon which most national and international reporting standards rest.

One of the most important topics for which these documents provide guidance is that of setting boundaries to guide your carbon management process, from your inventory to your climate action plan to implementation and institutionalization. There are three types of boundaries to consider: organizational, operational and temporal.

**Organizational Boundaries**
Organizational boundaries are generally the highest-level, most straightforward boundaries drawn. Organizational boundaries tell you where you are measuring and reporting carbon emissions – for one department or school, or the entire campus? For one state university campus, or the entire university system? What facilities or property will be included in your analysis?

The GHG Protocol suggests choosing one of two approaches to setting organizational boundaries: the control approach, or equity share approach. The control approach suggests you measure emissions for any operations over which you have practical control; whether at facilities that are owned or leased. The equity share approach suggests you measure emissions from facilities where you have some degree of ownership. The basic guidance is to choose and then consistently apply the approach that is going to be the most comprehensive. For example, Clean Air-Cool Planet operates out of four different offices across the Northeast; these offices are essentially leased suites of rooms that occupy a portion of larger office space. In order to create a comprehensive inventory, it makes the most sense for CA-CP to apply a control-based rather than ownership (equity share)-based boundaries. On the other hand, many colleges and universities own real estate associated with college operations but not under the direct control of the institution—such as student or faculty housing. When faced with the question of whether to include these facilities – owned by the college but managed by the tenants – into its inventory, the college must decide whether it will get a more comprehensive picture of its climate impact by

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applying organizational boundaries based on the control approach, or equity share approach, consistently across the institution.

Operational Boundaries
Once you've identified where you will be managing carbon emissions, you next have to decide which emissions sources to measure. Since there are greenhouse gas emissions associated at some point with nearly every action we take and every product we use, this counting could go on for ever. Selecting operational boundaries is a key aspect of carbon management because it really dictates how ambitious, and how comprehensive, your carbon management efforts will be.

One problem commonly identified when people first start considering carbon management commitments and strategies is the potential for the “double counting” of GHG sources or sinks between institutions or individuals. Given the nature of our market-driven society, it’s hard to definitively place responsibility for many types of greenhouse gas emissions solely with one entity. Carbon management initiatives typically have to balance two competing desires: the college or university’s need to be a responsible citizen, thoughtfully and thoroughly accountable for its “true” impact, and, its need to make commitments that it can keep and that make sense from a pragmatic, operational perspective.

The GHG Protocol presents a useful accounting concept, called scopes, that can help entities understand and structure decisions about operational boundaries, and can simultaneously help address the potential for “double counting.” This approach defines three levels of responsibility for emissions, and basically posits that an entity’s responsibility for emissions is directly related to its control over, or ownership of, the sources of those emissions. For example, I am more responsible for the emissions from gasoline used in my car than the emissions from diesel in a bus I ride. It was my decision to buy a gas-guzzler rather than a fuel-efficient vehicle, and only I determine how far or frequently I drive. By contrast, I have no control over the fuel efficiency of another entity’s busses, yet it was still my choice to outsource my transportation needs to them.

The scopes laid out by the GHG Protocol are as follows:

Scope 1 – Direct emissions from sources that are owned and/or controlled by your institution. This includes combustion of fossil fuels in college-owned facilities or vehicles, fugitive emissions from refrigeration, and emissions from on-campus agriculture or livestock husbandry. Your institution has complete control over these emissions, and they are no-one else’s responsibility. Examples of these generally include the following:
- On-Campus Stationary Sources
  - Emissions from all on-campus fuel combustion, excluding vehicle fuels
- Direct Transportation Sources
  - Emissions from all fuel used in the institution’s fleet (the vehicles it owns)
- Refrigeration and other Chemicals
  - Fugitive emissions from refrigerants and other sources
- Agriculture
  - N₂O emissions from fertilizer use and CH₄ emissions from animals (cattle, horses, etc.)

Scope 2 – Indirect emissions from sources that are neither owned nor operated by your institution but whose products are directly linked to on-campus energy consumption. This includes purchased energy: electricity, steam, and chilled water. Although your institution is
not directly responsible for these emissions, it is strongly implicated. These emissions come from converting energy sources that release greenhouse gas emissions when used (fossil fuels) to energy sources that do not (electricity, steam, or chilled water). Although your institution did not burn the coal to make the electricity you use, someone had to, and although the electricity producer emitted the gasses, they did not use any of the energy produced.\footnote{The electricity producer IS responsible for energy losses due to inefficiency of production (i.e. if burning 1000 MMBtu of coal only generated 300 MMBtu of electricity). And the owner of the power lines is responsible for any electricity that is lost during transmission and distribution from power plants to end users (usually about 9%).}

- **Purchased Electricity**
  - Emissions from the production of any electricity the institution purchases
- **Purchased Steam**
  - Emissions from the production of steam purchased from off-campus
- **Purchased Chilled Water**
  - Emissions from the production of chilled water purchased from off-campus

**Scope 3** – Other emissions attributed to your institution, deemed “optional” emissions by corporate inventories. This includes emissions from sources that are neither owned nor operated by your institution but are either directly financed (i.e. commercial air travel paid for by the institution) or are otherwise linked to the campus via influence or encouragement (i.e. air travel for study abroad programs, regular faculty, staff, and student commuting). Many Scope 3 emissions are considered “upstream” like the emissions associated with making and transporting plastic silverware. To prevent institutions from accounting for too many upstream emissions, most campuses define distinct financial or control boundaries to distinguish which Scope 3 emissions they are indeed responsible for.

- **Solid Waste**
  - Emissions from managing the institution’s waste (incineration, landfilling, etc.)
- **Directly Financed Outsourced Transportation**
  - Emissions from travel that is paid for by the institution, but does not occur in fleet vehicles (business trips in commercial aircraft, staff travel in personal vehicles where mileage is reimbursed, etc.)
- **Commuting**
  - Emissions from regular commuting by faculty, staff, or students (does NOT include student travel to and from home over breaks) (note – student commuting is generally considered to be under a greater degree of institutional control than staff/faculty commuting)
- **Study Abroad Air Travel**
  - Emissions from students flying to their study abroad location
- **Transportation and Distribution Losses from Purchased Energy**
  - Energy lost while transporting purchased electricity, steam, or chilled water to campus
- **Upstream Emissions from Directly Financed Purchases**
  - Emissions associated with paper production, food production, fuel extraction, etc.

**Offsets** – Your footprint is what it is, regardless of what happens outside of your campus. However, if you use your financial control over outside entities in a way that creates a net reduction in worldwide carbon emissions that otherwise would not have occurred, you can justify declare that you have “offset” another entity’s carbon. Usually, offset transactions are
managed by firms that specialize in such complex transactions, but institutions can claim their own offsets if they oversee their own off-campus carbon reduction projects.

One of the primary goals of a scoped approach is to encourage the creation of more emissions inventories. Comprehensive inventories can be costly, but cursory inventories can be useless; the scope system allows all inventories done within the scoped model to be useful. If an institution just wants to measure its most direct (yet limited) footprint, it could conduct a 1-year snapshot inventory of Scopes 1 and 2. This inventory would be comparable to the Scope 1 and 2 section of any other institution’s inventory, and none of the emissions from Scope 1 or 2 would be included in the same scope in any other institution’s inventory.

The scoped approach categorizes emissions by level of responsibility, but does not in itself dictate what boundaries an entity should adopt. This is left at the discretion of the institution. However, the GHG Protocol Initiative (www.ghgprotocol.org) has developed consensus-based protocols to help guide operational boundary decisions, as has the American College and University Presidents’ Climate Commitment (ACUPCC). To ensure consistency and compatibility across inventories, we strongly recommend that you choose one of the following institutional boundaries:

- **All Scope 1 and Scope 2:** This is the bare minimum for most inventories. The WRI Corporate Accounting and Reporting Standard requires the reporting of all Scope 1 and Scope 2 emissions, but considers all Scope 3 emissions optional. This reporting protocol is the basis of the reporting guidelines for The Climate Registry and the California Climate Action Registry, among others. The American College and University Presidents’ Climate Commitment (ACUPCC) protocol requires that signatories inventory all Scope 1 and 2 emissions and report Scope 3 emissions from commuting and directly financed air travel “to the extent that data is available.” Institutions are also encouraged to report any other Scope 3 emissions, especially those that are large or “can be meaningfully influenced.”

- **All Directly Financed Emissions, Plus Selected Directly Encouraged Emissions:** This includes all of Scopes 1 and 2, as well as any Scope 3 emissions that are directly financed by the institution such as emissions from directly financed outsourced travel and solid waste management. The rationale here is that although an institution has no control over the fuel efficiency of individual airplanes or the waste management practices of a landfill, the institution finances air travel and waste management and is thus partially responsible. Also, including these emissions in an inventory provides an incentive to find ways to avoid or reduce them.

- **All Directly Financed or Significantly Encouraged Emissions, Plus Selected Upstream Emissions:** This includes all of Scopes 1 and 2, plus any directly financed or strongly encouraged Scope 3, plus selected Scope 3 upstream emissions. Some universities opt to
include certain Scope 3 upstream emissions in their inventories, generally for the sake of allocating reductions to these sources. For example, a university might choose to include in its inventory the Scope 3 upstream emissions from producing and transporting purchased paper. If the university then instituted a policy that reduced paper use, its emissions would be proportionately reduced. It is also possible to track selected Scope 3 upstream emissions but not include them in the institution’s footprint.

Temporal Boundaries
The Calculator is capable of collecting emissions data from 1990 onward, but that does not mean schools are required to track or report their emissions back that far. In fact, it is best to only go as far back in your data collection as you can find reasonably solid numbers. It is not considered best practice to try to extrapolate past years’ data based on more recent trends.

Another question related to setting temporal boundaries is that of whether you are collecting data based on calendar years or fiscal years. Most schools choose fiscal years, and that Calculator is designed with that convention in mind. More specifically, we name the fiscal year after the end date year, so FY06/07 = 2007 on the input sheet. Fiscal Year 2006 - 2007 (FY06/07) will typically begin on July 1, 2006, and end June 30, 2007 (but referred to as “2007” in the Calculator). Being mindful of this convention will be especially significant in the Solutions Module when inputting the timing of proposed projects.

GHG Accounting Concept: “De Minimis” Emissions
The “Corporate Accounting and Reporting Standard,” on which our methods are based, considers material emissions to be 95-100% of an institution’s footprint. Sources that add up to less than 5%, are considered “de minimis” and need not be inventoried. To assess these relatively insignificant sources, (e.g., students commuting to class on a residential campus from their dorms), the conventional method is to use assumptions that produce high-bound emissions estimates. Rather than invest resources in precise calculations each year, institutions assume high-bound emissions estimates, and then have the option of choosing to reject them from their inventories as immaterial.

We strongly recommend that your inventory estimate carbon as accurately as possible – even de minimus emissions. Understandably, investing time and effort in precise data collection for minute emissions sources is not always the most effective allocation of resources. However, we recommend that all high-bound estimates of “de minimis” emissions not calculated regularly be included in your inventories, despite the fact that corporate inventories reserve the right to dismiss them from the inventory. Basically, if you find a de minimus source on campus, take fertilizer use for example, and your preliminary data indicates that it represents no more than 0.5% of your total footprint, there is no need to collect data for that emissions source on a regular basis. Instead, simply add the same upper-bound emissions estimate to your footprint each year. That way, footprint estimates are as precise as possible – erring on the conservative side, if at all – without causing undue stress during data collection.

Some examples of de minimus emissions could be: wastewater, student commuting, methane and nitrous oxide from biogenic sources, propane, off-road diesel, emissions from buildings that are marginal to campus operations or have outdated energy monitoring systems.

GHG Accounting Concept: Biogenic Carbon
Following the GHG Protocol guidelines, the Campus Carbon Calculator separates out biogenic emissions of carbon. Biogenic CO₂ refers to carbon in wood, paper, grass trimmings, etc. that was originally
removed from the atmosphere by photosynthesis and, under natural conditions, would eventually cycle back to the atmosphere as CO₂ due to degradation processes. The quantity of carbon that these natural processes cycle through the earth's atmosphere, waters, soils, and biota is much greater than the quantity added by anthropogenic GHG sources. Examples of anthropogenic (human-caused) emissions of biogenic CO₂ include landfill gas, incinerator emissions, and biodiesel, ethanol, or biomass combustion.

The main driver of global climate change is the net increase in the amount of CO₂ in the atmosphere due to anthropogenic — resulting from human activities and subject to human control — emissions of fossil carbon. These emissions result in a net increase in the amount of carbon in the carbon cycle, because the carbon that was previously locked away in fossil fuels is now available. By contrast, anthropogenic processes that emit biogenic CO₂ can be thought of as simply "closing the loop" in the carbon cycle - they return CO₂ to the atmosphere that was originally removed from the atmosphere by photosynthesis, but they do not increase the total amount of carbon in the carbon cycle.

Anthropogenic emissions of biogenic carbon do not generally increase the total amount of carbon in the carbon cycle, though they may increase the speed at which the carbon is returned to the atmosphere. For that reason, past versions of the Calculator suggested that, in keeping with IPCC guidance, biogenic emissions essentially be ignored or counted as “0.” Current protocols for GHG accounting actually suggest a new best practice, however—that is to track biogenic emissions accurately, but report them separately from the rest of your carbon footprint. Thus, the summary sheets in version six do include a total for biogenic carbon, tracked and reported separately from all other campus emissions, outside of the scoped categories (i.e., CO₂ emitted as the result of combustion in an on-campus stationary source is not counted as “0,” but neither as it counted with the rest of your Scope 1 emissions or your total emissions.)

This approach, as in the past, ultimately assumes that anthropogenic emissions of biogenic CO₂ do not result in any long-term changes in the amount of carbon in the atmosphere. Such changes could occur if demand for biogenic carbon sources leads to long-term changes in land-use or land-cover. For example, burning wood from a sustainably harvested forest should not result in a net increase in atmospheric carbon, but burning wood from forest that is clear-cut to build parking lots probably will result in a net increase in atmospheric carbon. In the latter case the emissions could be reported as Scope 3 upstream emissions associated with fuel production.

Although few people bother to calculate or report Scope 3 upstream fuel production emissions for conventional fuels, when calculating biofuels it is common to consider how significant these emissions are. For example, corn-based ethanol is widely disparaged within the environmental movement because lifecycle analyses suggest that its use results in few or no net atmospheric carbon reductions and could lead to far-reaching market effects on many goods and services due to increased corn prices. If you are considering using any source of biogenic carbon, we recommend that you carefully evaluate whether your actions might lead to long-term changes in land-use, land-cover, or significant upstream emissions associated with fuel production.

While emissions of biogenic carbon may be discounted under some circumstances, emissions of other greenhouse gasses from biogenic sources should be included in your inventory. They are included in the Calculator as part of your total institutional emissions. For example, CH₄ emissions from landfilled waste or N₂O emissions from burning biomass should be included in your inventory because these emissions are the result of human activity (creating anaerobic conditions by landfiling waste or releasing N₂O through incomplete combustion) and so would not have occurred under natural circumstances.
Tracking your Greenhouse Gas Emissions: The Inventory Module

Once you’ve created your team and set boundaries, you’re ready to embark upon the GHG inventory process. This involves three basic steps:

1) Collecting data
2) Calculating emissions
3) Analyzing and summarizing the results.

The Calculator makes steps 2 and 3 listed above much easier. Once your data is entered into the appropriate cells of the spreadsheet, and a few other parameters are specified (such as the regional electricity pool from which the institution purchases), calculations are made through a series of cell references. All formulas, conversion factors, and emission factors are already built-in and are constantly updated with the latest information available. The formulas and factors can be altered — they can all be viewed and examined by anyone who is reasonably proficient with MS Excel — but they should ordinarily not be. The beauty of this Calculator is that you do not have to get into the fairly complex math, science, and economics involved in estimating greenhouse gas emissions from the many activities associated with the operations of a college/university — simply enter the data required in the proper units into the ‘Inputs’ worksheets, and the Calculator will do the rest.

Collecting Data

As you may suspect, data collection will probably be the most challenging step of the inventory process. Good places to start looking for the data you need are the Physical Plant or Facilities Office, the Campus Planning Office, local Utilities, the Farm Manager (if applicable) and related offices (see Appendix 1 for outline). It is critical that you maintain a detailed journal of every telephone call, inquiry, and successful data request throughout the data collection process. Keeping a detailed journal provides a resource to consult if questions arise about emissions and data down the road, especially when another person assumes responsibility for data collection, such as updating the inventory in subsequent years. Keeping the inventory up-to-date is a long-term project, so staff changes are inevitable. This journal should be backed up in a central location, such as the office or department or office that is taking the lead on the initiative. Box 2 describes a real-world experience in tracking down data, illustrating why detailed journal keeping is a critical component of the data collection and analysis process.

In some cases, data may simply not be available for given source. If all of the information is not available, or the resources needed to gather it are not available, gather complete data for as far back as possible. It is better to have solid numbers for back to 1995 than weak estimates back to 1990. In these cases, make note of the data gaps in the final report. The need to improve record keeping of a campus’s energy usage could well be illuminated by a project like this, so noting significant gaps could help support making this a recommended action step.

There is no set formula for this process; all universities are set up differently and you will undoubtedly come upon unknown challenges as you navigate the institutional bureaucracy. For example, at one school finding the information regarding electric consumption and fuel consumption from heating was easy because the Energy Manager had already performed some of the same analysis and had previously compiled historical information. On the other hand, finding information on university fleet fuel consumption at the same university was much more difficult and unreliable (see text box). Several people
will probably have to be contacted in search of one dataset and so it is important to keep a list of who was contacted, when they were contacted, and what their response was. As illustrated, sometimes this communication gets complicated and without a record it is easy to forget who has been talked to and when they were supposed to respond. It is important to set a deadline for a response to each person contacted. For example, when someone says they will respond at a later date with an answer, explain to them that if you do not hear from them by that day then you will try again. That will encourage them to follow through. Keep in mind that most of the people contacted will already have enough (or too much) work to do and be considerate of their timelines, though they will probably need to be pushed a little. Also keep in mind that they will likely need to be contacted again with more questions, so be sure to build a good working relationship, with plenty of recognition in your public documents and events.

In the data collection journal, it is also vital to keep track of the sources of all information collected. While at the time it may seem obvious that a certain number or set of numbers came from a certain person or office, three months later when writing up the results it is easy to forget. Don’t forget that there will also likely be staff changes in the offices from which you get data; record the full source if possible (i.e. if it is from a departmental report) or a person’s name and contact information if it is from a person. Keeping records, like annotated digital copies, of your sources will allow any future questions to be answered quickly and efficiently, while also making the inventory more reliable which is important because it will hopefully be used to shape university policy.

### Sample Data Collection Experience: A true record of a search for University Fleet Fuel Consumption

12/14/00 - Contacted the Director of Transportation - was told the supervisor of garage maintenance would have the information. Contacted the supervisor of garage maintenance - was told that he forwards all of that information to the facilities business office.

12/20/00 - Contacted the facilities business office - was told that they could prepare the data in a few days.

1/11/01 - Was contacted by the facilities business office - was told they did not have that information and that the State Department of Transportation handles the fuel distribution and should have the data. Contacted the DOT - was told they keep no historical records but University Dep. of Transportation should.

1/18/01 - Contacted the University Controllers Office, was told they didn’t have the information and forwarded my message to the Director of Facilities. Did not hear back.

1/25/01 - Contacted the Director of Facilities and was told he would get back to me. Did not hear back.

1/31/01 - Contacted the Dir. of Facilities; was told my message had been forwarded to the Dir. of Transportation.

2/7/01 - Received email from Dir. of Transportation suggesting I contact a specific person at the State DOT. Contacted the State DOT and was sent a file containing data from each vehicle fueling event (about 400 pages long) for the year 2000. Also learned that there used to be a University position that was charged with summarizing the vehicle data and reporting it to the state, but that this position had been eliminated in 1998.

2/21/01 - Contacted the supervisor of garage maintenance; was told he would look around for the old reports.

3/1/01 - Received a message from the supervisor of garage maintenance that he had found the reports in an old file cabinet. Photocopied reports. Discovered that they estimated fuel use at about half the amount estimated by the annual report received from the State DOT. The Dir. of Transportation was unable to explain the discrepancy. Used these reports, as they were relatively steady over the four years recorded (i.e. there would not have been a doubling of fuel use over 2 years).

4/18/01 - Dir. of Transportation called me to ask if I had found out the annual fuel consumption, average fuel efficiency, or up-to-date fleet size. He needed them for a report he was working on. I gave him what I had.
Compiling and Entering Data
When entering data in the Campus Carbon Calculator, remember that green cells are input cells for you to input data. It is important to have all the data from each year being inventoried (with the exception of data that does not apply — for example if there are no animals at the school the animal section can be left blank). If some data is simply unavailable, leave it blank but be sure it is noted in any report on the inventory. Remember to save often while entering data.

For intensely collaborative projects we also recommend Google docs, rather than shared files. Google docs are a free service that allows users to access fully collaborative work at the same time, in word and excel format on the web. This is ideal for your data collection journal, and data input sheets. For more information on Google documents go to http://docs.google.com.

There are four sheets for data entry in the input section of the inventory module: Input_InflAdj, Input, CustFuelMix, and Input_Commuter. Please see Appendix 1 for a data collection and entry matrix, for more detail about the definitions and parameters, units, and likely information sources for each category of emissions data to be collected.

Calculating Emissions
The Campus Carbon Calculator determines your emissions by applying emissions factors to the data you enter in the Input Module. These factors are stored in the Emissions Factors (EF) section of the inventory module, whose sheets are identified by the prefix “EF.”

The emissions factors are all taken from U.S. government documents, and are converted from the units in which they are given to the units the Calculator requires using the constants on the EF_Constants sheet. Specific sources for each of the emissions factors in the Calculator are noted on the EF_Reference spreadsheet. If you want to know where the numbers on any of the EF sheets come from, scroll down to the bottom of the column for the cell in question, and follow the hyperlink in the bottom cell.

Throughout the EF Module, cells that are color-coded blue contain original emissions factors. The emissions factors are all taken from U.S. government documents, and are converted from the units in which they are given to the units the Calculator requires using the constants on the EF_Constants sheet. Specific sources for each of the emissions factors in the Calculator are noted on the EF_Reference spreadsheet. At the bottom of each column in the EF worksheets is a grey cell containing a link to the reference for either the emissions factor reference, or the formula used for the calculation. If you want to know where the numbers on any of the EF sheets come from, scroll down to the bottom of the column for the cell in question, and note the formula or follow the hyperlink in that bottom cell.

You may replace emissions factors values if you have access to more recent, more accurate, or special customized emissions factors. Be sure to enter any values in the units given in the column label. If you change any emissions factors, be sure to add the reference for the value you enter to the reference sheet and update the reference at the bottom of the appropriate column; providing, in addition, an explanation for the change in the “notes” section of the reference sheet can also save headaches later.

Cells with white (no) fill contain the calculations necessary to convert emissions factors from the units in which they are given to the units the Calculator uses. DO NOT CHANGE THE FORMULAS OR VALUES IN THESE CELLS. Changing these cells will result in miscalculations or other errors.
The first five EF sheets are summary sheets that bring together per unit factors for all sources. EF_CO2 shows kg of CO2 emitted per source unit. EF_CH4 shows kg of CH4 emitted per source unit. EF_N2O shows kg of N2O emitted per source unit. EF_eCO2 combines the values from the previous three sheets with global warming potentials to give metric tons of carbon dioxide equivalents emitted per source unit. EF_Energy shows the energy content, in MMBtu, per source unit (when applicable). The rest of the sheets contain the values and calculations required to produce these emissions factors.

Note on emissions factors: Fuels have a higher heating value (HHV, also called a Gross Calorie Value, GCV) and a lower heating value (LHV, also called a Net Caloric Value, NCV). The HHV is the quantity of heat that would be liberated by the complete combustion of one unit of fuel, assuming that the produced water vapor was completely condensed and the heat from it recovered. The LHV takes the HHV and subtracts the heat content of the water vapor. The LHV provides a better estimate of the real-world heat value of a fuel, as most of the heat contained in water vapor is not recovered. Emissions factors are calibrated for either the HHV or LHV, and must be used with the corresponding fuel heating value. Following the US EPA’s example, the Calculator’s emissions factors are calibrated for HHVs. If you replace any of the heating values or emissions factors in the Calculator, be sure to use HHVs or factors calibrated for HHVs. If you are entering a custom fuel, be sure that the heating value and emissions factors you enter are compatible.
Viewing Summary Data and Graphs

Once it has calculated emissions totals based on the input data, the Calculator will also provide analysis and graphs of them. These totals are given in both the absolute weight of each of the gases, and in the internationally standard units of “Carbon Dioxide Equivalents, or eCO₂, according to their Global Warming Potential (GWP), a measure of each gas’ contribution of to climate change relative to that of carbon dioxide (colloquially referred to as “carbon”). For example, one molecule of methane (CH₄) is 23 times more potent than one molecule of CO₂ (whose GWP = 1) over the same timeframe.

Annual emissions are displayed and analyzed in the Summary Module, whose sheets are identified by the prefix “S.”. The first four Summary sheets multiply the values on the Input sheet by the relevant emissions factors to give the emissions from each source. S_CO₂ gives the kg of CO₂ emitted from each source, S_CH₄ gives the kg of CH₄ emitted from each source, S_N₂O gives the kg of N₂O emitted from each source, and S_Energy gives the MMBtu of energy used from each source.

The next five Summary sheets (identified by the suffix “_Sum”) sum the emissions from all the sources in a particular sector (such as transportation). S_CO₂_Sum gives the kg of CO₂ emitted by each sector, S_CH₄_Sum gives the kg of CH₄ emitted by each sector, and S_N₂O_Sum gives the kg of N₂O emitted by each sector. S_eCO₂_Sum combines the values from the previous three sheets with global warming potentials to give the metric tons of carbon dioxide equivalent emitted by each sector. S_Energy_Sum gives the MMBtu of energy used by each sector.

S_Annual sheet displays the emissions from any single year in a table and pie graph. The S_Demo sheet displays emissions and energy use data normalized by budget, population, square footage, and heating and cooling degree days.

The GraphControl sheet allows you to access pre-designed graphs of emissions and energy use data. Customize which years of data will be displayed by setting the “Start Year” and “End Year,” and then click on a graph title to go to its sheet. The left-hand column links to sheets with a summary of multiple graphs, while the right-hand column links to individual graph sheets. All graph sheets are identified by the prefix “G.”.
Projection Module

Purpose
Version 6.0 of the calculator offers a reworked Projection Module, formerly the Energy Demand and Cost Projection Module. Once you have gathered all of your inventory data, the Projection Module projects what your emissions profile might look like in the years up to 2060 if your university pursues “business as usual” (BAU). It uses the historical energy use of the university, follows the trend in each activity, and then calculates the emissions for each future year.

While it is a worthwhile effort to compile only the inventory data, your carbon management plan will be more effective and compelling if you can show stakeholders how energy use and greenhouse gas emissions will grow in the future if you stick with business as usual. First, this will help them think about how much the energy budget will need to increase, thus supporting your case for any emissions reduction projects that will produce a positive rate of return. Second, if they have or plan to set an emissions goal for some point in the future, such as 2020, then projecting what the BAU scenario will look like in 2020 will help set a context for emissions reduction projects.

What information you need
Once you have completed the Inventory Module, you have all of the information necessary to use the Projection Module. However, an understanding of several aspects of your university’s growth trends and plans will inform your choices of how to project your data and subsequently make your projection more relevant to policy discussions. First, it is helpful to know whether general energy use or specific inputs tend to change as the number of students or building square footage changes. For example, you may find that as the number of students enrolled increases 10% your university’s electricity usage also increases 10%. You may be able to make an educated guess about this by looking at your inventory data, or you might solicit either the technical analysis of a statistics professor/student or the experience of someone in your Facilities Department. The second helpful piece of information is your university’s plans for future growth. Many master plans project student body growth from year to year. It takes several years to bring a new building online, and additions to the campus are often projected far into the future. Taking this targeted growth into account will help your projection be a more realistic starting point from which you can set emissions goals.

Methods of Projection
There are four methods of projecting your data available in the calculator, and you can choose to have all activities projected by one method or you can choose the method for each activity.

- Linear: The simplest projection method is a basic linear projection using the trend created in your inventory data. For each activity, the calculator creates a linear function and extends it into the future.
- Normalized by students: This method is best for activities that you believe follow the growth in the number of students. In this method, for each year of your inventory data, each input is divided by the number of students in that year. Then the calculator finds the average input per student (gallons of diesel/student for example). To establish the magnitude of that input for a year in the future, such as gallons of diesel in 2015, that average is multiplied by the number of students projected to be at the university in that year. For the purposes of calculating the number of students, full time students count as 1, part time students count as 0.5, and summer students count as 0.25.
Normalized by square feet: This method works the same as normalizing by students, but it uses the building square footage instead of number of students. You may want to use this method for all inputs, or only inputs that buildings use like heating and cooling.

Finally, custom trends: You also have the option of specifying an annual rate of growth for all inputs, a single input for all years, or for a specific input in a specific year. When using this option, the rate you specify will be multiplied by the previous year’s value to create the next year’s value. So for example, if you already know that fertilizer use is going to decrease 2% per year, you would input -0.02 for the annual rate of growth for fertilizer.

Steps in using the Projection Module
To begin using the Projection Module, start at the worksheet called “Detailed Projection.” You will notice that it has a series of steps laid out at the top in a way that is a little different than in the rest of the calculator. Hopefully, these steps will help you mark all of your projection method choices fairly easily.

In Step 1, use the drop down menu to choose to make your projections for the energy inputs all linear, all normalized by student, all normalized by square foot, all a custom growth rate, or to specify by activity. You can also choose between all linear, all a custom growth rate, or specify by activity for the institutional data (columns C-L). This is your last step if you choose all linear, all normalized by student, or all normalized by square foot.

If you chose a custom growth rate for the institutional data and/or the energy inputs, enter that growth rate in Step 2 and this is your last step. When entering growth rates, enter them in decimal form. 1.0 is considered a baseline of no growth; so if, for example, you want to specify a growth rate of 5% a year, you will need to enter 1.05 in cells F12 and/or F13. If you want to project a 4% annual decrease, enter 0.96.

If you chose to specify by activity, use the drop down menus in Step 3. You must make a choice for each activity, but they can all be the same except one if you want. In fact, they can all be the same but in that case it would be easier to simply stick with Steps 1 and 2. You only need to choose a method in Step 3 for the category or categories for which you chose “choose by activity” in Step 1. For example, if you chose “all linear” for the institutional data and “choose by activity” for the energy inputs, then in Step 3 you only need to choose a methodology for activities in columns M through DF.

If for any activity you chose to use a custom trend, click on the link in Step 4 to input your growth rates. Once you are on the “Custom trends” worksheet, first, choose in Row 15 for each activity to A) specify a growth rate for the entire column that will be constant over the years, or B) specify a growth rate for each year in your projection. If you chose to enter a constant rate, input a rate for each activity in Row 16. If you chose to enter a variable rate for each year, you may do so in the blue cells. Your choice in Row 15 dictates what rate is used in the projection for that activity even if you enter rates in both Row 16 and the blue cells.

Not a precise science
Deciding how to project your data will not be a cut and dry decision. There are a lot of factors that could be taken into account with varying levels of importance. Moreover, even if you choose the most appropriate projection method, we are talking about the future here. Things can, and will, change. That said, a defensible projection will still help your emissions reduction planning. For example, one university might look at their 2000 emissions and set the goal of being 20% below 2000 levels by 2015. Using the Solutions Module, they can access what the most cost effective projects will be and how many

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they will need to achieve their goal. However, if they don’t project their future energy needs and take into consideration that the Dean of Admissions plans to admit 15% most students each year by 2015, then they may have difficulty meeting their goal. So gather whatever insights into your university’s future growth and then make the best decision you can. It won’t be entirely precise, but it will still help your university achieve strong emission reduction goals.
Assessing the Costs and Benefits of Carbon Reduction: The Solutions Module

Getting Started: What can I do with the Calculator?

The Calculator will help your campus figure out the most cost-effective way to cut its carbon emissions. Basically, it’s a decision support tool. Much of the shift we need on our campuses can only be judged qualitatively, but the Calculator will help people who are interested in assessing the quantitative costs and benefits of cutting their carbon. Our goal is to take minimal numerical inputs and produce a comprehensive analysis of the reduction measures such that we can say with some certainty “how much will cutting carbon cost?” We’ve spent decades pondering the consequences of inaction on this issue – this is your chance to explore the consequences of action.

Similar tools have been used by college students and financiers alike to assess risks, revenues, costs, and benefits of carbon reduction and carbon neutrality. This information, when presented cogently, allows stakeholders (from grassroots groups to staff) to engage financiers on a level that assures mutual understanding of carbon reduction. As we hear throughout the environmental community, there is no “silver bullet” to dealing with the climate crisis, but there are many good ideas out there. This tool will help serve as a common denominator, to see how good your ideas really are.

Here’s a general overview of the process: come up with a number of ideas for projects that will dramatically reduce your school’s carbon footprint -- make better buildings, change purchasing policies, conserve energy, buy more efficient appliances, switch fuels, etc - then enter a few simple pieces of data on each proposal. The numbers you input are used to evaluate the projects over time with respect to each other. We use conventional tools of finance to prioritize the projects: Internal Rate of Return (IRR), Net Present Value (NPV), and Payback Time. We’ll go over what exactly these terms mean, and how you can use them to learn more about your project ideas – you don’t need to be a finance professor or professional to understand this stuff... but it wouldn’t hurt to befriend one. Good Luck!

A Brief Note on Accuracy: It’s important to be aware of the significant distinction between the first module of this tool that deals with the past (inventory), and the subsequent modules that deal with the future (Projection and Solutions Modules). In the inventory section, the numbers you input are the limiting factor in the accuracy of your product, and most of those numbers should be quite accurate because they are derived from financial records like bills of sale. Because we don’t have next year’s heating bill just yet, many of your calculations will be inaccurate by no fault of your own. It’s important to recognize this, but not let it limit your ability to propose project ideas. As long as you document exactly how inaccurate your input data is, you might as well just assign putative values for some of these projects. For example, if you know how much new steam piping costs, but you don’t know the efficiency of your current steam pipes, feel free to make some assumptions and document them, for example “Assume new pipes will be half as inefficient as the current pipes.” Such assumptions are not enough to finance the project, but they’re enough to get the ball rolling.

“Project” Inputs

We define a project as "a change in business-as-usual associated with a quantifiable reduction in carbon emissions." Projects can be as simple as a picnic outside that avoids electric lighting, or a multi-million dollar investment in on-campus wind power.

Inputs: The big three
1- Timing - Start Year and Project Duration
2- Cost - Total capital Cost and Cost Assumptions modifications if data is available
3- Activity Change - Will we be burning less fuel oil? Reducing our electric bill? Burning More Biodiesel?

1- Timing:

The timeframe of a capital cost project is very important when comparing it to similar projects. Knowing when a project can realistically start, and how long it will last, is crucial information for carbon reduction timelines. Here are some important timing conventions to be aware of:

**Fiscal Years** - First of all, bear in mind that there is an underlying fiscal year convention within the tool. Much of the data needed for the GHG inventory comes from data collected in July from the previous July-June fiscal year. Also, remember that years within the tool refer to the end year of your school’s fiscal year, so 2007 = FY06/07.

**Start Year** - It is assumed that at the very beginning of this year the project is off and running. The facility is built, the fuel is switched, and the annual savings will be building up throughout this given year. Therefore, the accounting for fiscal and GHG savings will be reported at the end of that given year. For example, if the “Start Year” for a project is 2008, the tool assumes that the capital cost will be accrued in the beginning of the 2008 fiscal year, and the annual cash flow assessed at the end. To simplify this, we just assume that all cash flows are evaluated at the end of each fiscal year, and take the project date back a year when we calculate capital cost, which is accrued at year Zero. To clarify that point, here’s a quick example:

You input the following:
- Project: 1 Hybrid Civic, as opposed to a normal Civic
- Start year: 2007
- Capital cost: -$3,000
- Activity Change: -450 gal of gasoline

What this means in terms of fiscal year convention, and our timing assumptions:
- July 1st, 2006 - You paid for the hybrid car in full
- July 1st, 2006 – June 30th, 2007 - You benefit from your investment by saving gas!
- June 30th, 2007 - Year 1 data is in! Now we know how much you cut costs and cut carbon.

**Bottom line:**
- Capital costs are accrued in year zero ("2006"), which means the very beginning of “year 1”
- The “Start Year” is the same as “year 1”
- Marginal costs/benefits for each year of operation are assessed at the end of the stated year (like activity data for “2007”).

2- Cost

Costs and benefits are the means by which all decisions are made. Our recommendation is that you try to quantify as many costs and benefits as possible. Here are some tips to help you out:

**Working With Marginal Cost** - You may notice that the Hybrid Civic Project in the example above has a very low cost. That’s because it’s the marginal cost of the decision to diverge from business as usual. In a situation where you don’t need to buy a vehicle at all, the marginal cost would be the difference between the cost of a new hybrid ($22,600) and $0. However, if you’re looking to purchase a new sedan anyway, and you are deciding between a new civic and a new civic hybrid the marginal capital cost is reduced to a mere $3,000. Here’s the math:

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Price of a 2008 Honda Civic EX Sedan: $19,500
Price of a 2008 Honda Civic Hybrid: $22,600
Marginal Capital Cost of Buying a Hybrid: $3,100

O&M: Operation and Maintenance. When talking about “new projects,” many college administrators are afraid of staff time. Human resources are costly, and take much administrative juggling to manage. Any reduction in O&M caused by your project ideas will be met with sighs of relief. However, any increases in person-hours should be recorded as an added annual cost over the duration in the “Annual marginal operating cost per unit” field. In the end, both increases and decreases in annual expenditures due to O&M should be accounted for if possible.

Financing Incentives and Disincentives:
Grants: Grants are free money. Sometimes they are designed to help out with startup costs, and other times they are offered annually. The input sheet has a field for “one-time grants,” but annual grants offered over the duration of a project can be input into the “misc. annual savings” field. As of Jan 08 there are no opportunities for federal level grants for renewable energy projects; however, is coupled with research funding, and/or state level grants, these can really helpful. We recommend that you speak with members of your engineering or business departments, to see if anyone has funding that includes to-scale implementation of educational/research subject matter.

Loans: Loans must be paid back, but, if you can get a loan with a lower interest rate than your discount rate, the net present value of the project will be higher and investment will be more feasible. There are probably issues with credit, and the ability to receive more loans in the future, so be sure to chat with whoever deals with capital project finance about loans before you make too many assumptions. However, it is not uncommon to have loans set up for annual discretionary projects, and in some cases, even “environmental” projects. In our calculations we assumed that interest would be compounded annually.

Bonds: Oftentimes you can get loans with a set payback time, but no interest. These are bonds. The way bonds usually work is like this: investors contribute capital to your project at a set interest rate to be paid back at the end of a given timeframe. The interest is not paid by you, it’s paid by the government, or whoever helped facilitate the bond. Some states offer bonds specifically for renewable energy investments, and recently the federal government introduced CREBs: Clean Renewable Energy Bonds.

The Discount Rate: The discount rate is critical if you hope to compare your proposed investment to business as usual. By definition, a discount rate is “the annual growth rate of an investment,” and in our case more specifically “the annual growth rate of an investment used when a future value is assumed.” In the case of a college or university, this is usually a little higher than the annual return on their endowment. Your school may also have a special endowment that it uses for “green” projects. The people to ask about this are professors in the economics business departments (namely in finance, or microeconomics), administrators who work on capital projects, and leaders in your student investment club. If you don’t know what your school uses to discount capital cost, we recommend using the Federal Funds Rate.

3- Activity Change
As with assessing costs, activity change data should be entered in terms of marginal values as well. These inputs can be a little demanding, and can require some external research, and most importantly, cut-off the box thinking. It’s a good idea to stay in touch with whoever worked on your inventory to make sure all the data you use is coming from the same places. To illustrate these points, let’s revisit the Hybrid example used earlier.
MPG of a 2008 Honda Civic EX Sedan: 24 Source: www.fueleconomy.gov
MPG of a 2008 Honda Civic Hybrid: 42 (city/hwy combined mpg)
(note, not enough data to calculate activity change)

Annual miles traveled per year: 8100 Source: James Brown, College Fleet manager, Facilities.
Marginal Activity Change of Buying a Hybrid: -(450) gal of gasoline

Your activity change input will then flow through the emissions and cost assumptions sheets to calculate the annual emissions reductions and annual $ reductions based on your emissions factors and year-specific fuel prices.

**Challenging Assumptions**

The General Flow of the Solutions Module is as follows: Inputs => Assumptions => Summary Data (graphs and charts). Entering simple inputs, and receiving summary data is important, but so is being precise and credible. Each campus runs on a unique blend of fuels, ideas, and frankly, markets. It’s up to you to zero in on what is more viable to your given institution/region, and therefore challenge the somewhat putative assumptions we make in this tool. Here’s a summary of the assumptions we made:

**Emissions Assumptions:**
These values should be quite accurate. For the vast majority of fuels, we have a very precise understanding of how much they contribute to climate change. This sheet is a resource as much as it is a place to update emissions factors. All values are given in terms of eCO2/unit, which should make shorthand calculations much easier if you’re trying to parse out the viability of project ideas. Things to change/update would be specific emissions factors tied to biogenic sources, and alternative fuels that vary by region and combustion technology.

A good example of a fuel source with varying data is “woodchips.” We used data from regions with a highly commoditized market, and a specific blend of mill residue and forest product. Your local woodchip market may vary greatly in terms of both chip quality and price. Let’s discuss woodchip combustion methods for a moment. Our tool assesses chip emissions by looking at the combustion of 80% moisture content chips in a crude wood chip stoker boiler. Now let’s say you find chips with a different moisture content, and assume a slightly different combustion method, like gasification – that’s fine – but we need to make sure we account for it in our emissions factors. Gasification of wood chips is far more efficient, and produces fewer CH4 and N2O emissions. To account for that reduction, we recommend that you make a note of it in your project documentation, and then change it in the “emissions factors assumptions” section of the Solutions Module. Changing numbers on this sheet will make your Solutions Module calculations more accurate without altering any of your emissions inventory calculations.

**Cost Assumptions:**
If you’re going to challenge any of your assumptions, it should be cost. Many of the renewable energy sources and fuels are rapidly developing, so updating the “per unit” costs of new fuels and technologies is important when assessing the benefits of high cost capital projects. It is important to note that changing the values in the two assumptions sheets will not impact the inventory module – these values are meant to be altered. To better understand the assumptions you’ll challenge, let’s look at assumptions by fuel type:
Fossil Fuels: Our assumed values are quite reliable for conventional consumers; however, campuses are not conventional consumers. This data may be very difficult to obtain, and not very easy to share. Most large corporations and institutions will bid on fuel delivery packages, using their high demand to argue for lower prices. Sometimes colleges will even work with multiple providers of the same fuel to keep costs down. Keeping track of fossil fuel prices will be a key component of your analysis, but it may also be important to assure the powers that be that the $/gal figures for petroleum products they share with you will not be made public. It can be helpful to note how volatile these markets are. The price of these fuels dictates the price of “business as usual”, and if there’s anything financiers value, it’s minimizing risk. Whomever deals with fuel procurement on campus can help you with this fuel price; on your campus it could be the Energy Manager at Facilities, Controller, and/or the VP of Finance —.

Biofuels: The prices of biological fuel sources are tied to the geography of your region. Soy-based biodiesel refineries are plentiful in the Midwest, but not on the east coast. Yet a thriving forestry sector makes wood chips more plentiful in the northeast. The prices we found for biofuels are quite volatile – especially for unprocessed solid fuel. Not only will you need to look into regional prices, it would also behoove you to explore recent price trends. Much of the biofuel market is in its infancy, which means that prices are subject to change, and will most likely go down. Then again, in some regions demand may be skyrocketing too, which will actually increase price. In the end, the best thing to do is get a sense of how the biofuel market works in your area. The best people to talk to are foresters, private forestry management services, associations and trusts, petroleum dealers, and the on-campus individuals who are in charge of procuring petroleum – chances are they’ve considered biofuels switching and have a sense for pricing.

Price Projections: Fortunes are made from predicting future energy prices. In the business world, investors pay large sums of money for energy price forecasts, and chances are your school may try to do some forecasting as well. Our projections are based on government forecasts, which are well sourced, but represent broad generalizations - especially with markets sensitive to political instability. In general, the government trends for fossil fuels depict a price peak in 2008, despite years of increasing prices. Prices then dip until around 2015, and then perk up in a linear fashion until 2030. For the sake of long-term price estimations, we extended the government’s linear projections until 2060 for all fossil fuels.

Projections for alternative energy are more difficult to make, so we took current values, and flatly extended them, assuming no change in average price over time. When comparing long-term energy changes, feel free to alter our predictions however you like within the “Cost Assumptions” sheet – you can always reenter the formula. In the end, it’s near-impossible predict energy prices with high degrees of accuracy, and it’s important to recognize that. However, we can make a few valid observations about the fossil fuels we’re using: their prices are increasing, supply is shrinking, demand is growing, and they are being phased out by legislation on the state, national, and international levels.

Data Logs, Journals, and Documentation:
Like the inventory itself, it’s important to source your data, whether that data is a conversation, a government document, a blog, whatever. As we mentioned earlier, Google docs are a fantastic way to document collaborative work: (http://docs.google.com). Don’t be afraid to account for values you’ve inputted as assumptions, or putative values either. As long as those values are tied to an individual, and some logical thinking, they’re better than nothing.

Understanding Final Product
Outputs: The Big Three
1- Internal Rate of Return (IRR)
2- Net Present Value (NPV)
3- Payback Time

1- IRR (Internal Rate of Return):
This is the average annual rate of return on investment for a specific project. Any project with an IRR higher than the discount rate is a project that should be done, environmental benefits aside. The executive summary will automatically prioritize projects by IRR, that way the most cost effective projects appear first.

2- NPV (Net Present Value):
The total value (+ or -) of an investment at a given time, discounted to internalize opportunity cost. The NPV at the duration of a project shows the value of that investment in terms of present day dollars. Investors will ask themselves -- will the value of my investment increase over time? Will it increase faster than the value of my other investments? In the Executive Summary a positive NPV dictates a net gain on investment, even with the discount rate internalized. NPV is a great way to assess the "Net" cost of carbon reduction over a set time horizon.

3- Discounted Payback Time:
There are actually two types of payback time -- simple and discounted. The Projection Module only uses discounted payback time. With a discounted payback period, the costs and benefits of the project are discounted as they occur over time to take into account the lost opportunity of investing elsewhere. Basically, over time the NPV of a project increases, and the discounted payback time is the time it takes for NPV to break zero. Payback time is a good way to assess risk in a project -- higher payback time means higher risk. Payback time is also a good tool to demonstrate how carbon reduction projects may eventually create revenue.

Summary Data:
We tried to make the summary section as streamlined and pertinent as possible. The Executive Summary takes all your inputs and boils them down into a page-sized table fit to be re-printed in a document. It contains the bare-bones data decision-makers need when assessing prioritization amongst your projects. For a more thorough data set by project, you can use the "Project Summary" page as well. Some interesting cumulative data appears here in the full summary, such as NPV and GHG reductions for all projects combined, or all projects with a positive IRR. Now if someone asks you "how much will this carbon reduction strategy cost," even if they're just asking the question rhetorically, you'll be able to give them a credible response!

Depending on what you look at first, you'll either see some ugly grey rows in the summary pages, or some hideously out-of-proportion graphs. These phenomena are related, and can be fixed very easily. The Summary page takes each unnamed project and turns the whole row grey, and adds the text "HIDE THIS ROW." If you highlight all the rows by number on the left margin, left click them and choose "hide," they will disappear from view on both the summary pages and the graphs.

RECs Offsets, and Additionality:
Many campuses have their sights set on Carbon Neutrality, a full negation of emissions associated with the college. Currently no institution can achieve carbon neutrality without offsetting emissions through the purchase of RECs or offsets. Though carbon neutrality is a goal sought by many, offsets and RECs have been subject to much controversy and confusion. We hope that the design of this tool will help you
distinguish between the merits of different types and calibers of footprint-negating purchases. Regardless of the distinctions we make, it is important to note that there is no concrete definition of carbon neutrality; it’s possible to argue that you are carbon neutral if you say you are - the question is whether or not your friends believe you.

**REC:** (Renewable Energy Certificate) A tradable commodity, representing the purchase of renewable energy. Usually sold by the MWh, but RECs are sometimes called “offsets” and sold by mass of CO2. Any transmission of qualitative energy consumption credits from one entity to another involves RECs, but not all RECs are additional.

**Carbon Offset:** A type of REC sold in units of CO2, usually short tons but sometimes metric tonnes.

**Additionality:** Emissions reductions are "additional" if they occur because of the incentives associated with the existence of GHG markets. A variety of additionality “tests” have been proposed, but at its root demonstrating additionality means showing that the emissions reductions being used as offsets are not “business as usual.”

Now that you understand the tools of finance, we can have a brief discussion about how renewable energy projects, and therefore offsets, are financed. When the NPV of a project is positive over the time horizon of the project, the project pays itself back, and is considered cost effective. If that is the case with a renewable energy project, and RECs are sold in the GHG markets, and REC value is not included in the financing calculations, those RECs are NOT additional, because their sale alone was not responsible for creating new renewable energy. However, let’s say that at the time horizon of a given project the NPV is not yet positive. That difference, between the negative NPV and zero, is the amount of money needed to make that project economically feasible. That amount of money is divided by the tonnage of GHGs avoided by making that investment, and the result is the wholesale offset price for carbon offsets with additionality.

For more information on Offsets, RECs, and additionality, check out Clean Air-Cool Planet’s *A Consumer’s Guide to Retail Offset Providers*, a report put together by the firm Trexler Climate + Energy Services.

**Next Steps: The Beginnings of a Climate Plan**

Now that you’ve completed an emissions inventory and developed a list of reduction projects, you’re well on your way to the foundation of a climate action plan. Drafting a plan will help unite your institution around common goals. Good climate action plans include emissions reduction targets, concrete plans to continue reporting annual emissions, a portfolio of carbon reduction measures, and an outline of how to finance them. Most schools will also describe how carbon reduction will be incorporated into the educational process. For more concrete examples of what to look for in a climate action plan, we recommend consulting the ACUPCC implementation guide. No institution can foresee the exact path they will take, but what they do recognize is the need to start restructuring the definition of business as usual, and that process starts with a list of project ideas.

This section of the user’s guide is meant to help guide you through the process of presenting administrators and trustees with emissions reduction targets and other concrete asks so that your climate plan can develop into a fully institutionalized force on your campus. Much of our advice in this section is focused around building a persuasive argument in favor of meeting emissions reduction targets and
financing/ratifying various elements of your climate action plan. In the end, your good judgment will be essential to successfully navigating specific subtleties of your institution’s administrative processes. If you don’t know where to start your climate action plan, you just want to build a more nuanced argument, hopefully these passages will help.

Setting Goals:

There are two major goals for institutions seeking to enact bold and comprehensive carbon reductions: setting emissions reduction targets and drafting a climate plan. Setting concrete goals, even long term ones, is a key step towards uniting people under a common cause. It is important to send a persuasive message to everyone in the campus community that carbon reduction will be incorporated into the educational curriculum. Committing to concrete steps toward carbon reduction also sends a signal to clean technology markets and the higher education community. As more universities publicize their commitments, peer institutions that can assist each other by sharing valuable information as they work toward carbon reductions.

Carbon Reduction Targets: Since the US and other nations signed\(^7\) the Kyoto protocol in 1997, carbon reduction targets have been set in relation to 1990 emissions levels. Kyoto mandated 7% reductions below 1990 levels by 2012. Many campuses, cities, and communities exceeded the Kyoto goal, pledging to reduce their emissions >7% \textit{before} the year 2012 (Lewis and Clark), or at a higher rate than dictated (Middlebury, Tufts). Recently, many institutions have adopted the ACUPCC (American College and University President’s Climate Commitment), in which campuses pledge to reduce their footprints as much as possible, and then offset the remainder of their emissions by purchasing carbon offsets – effectively becoming “carbon neutral.”

Concrete “Asks”: Whether you’re a student or an administrator, coming up with tangible suggestions for policy change is key when presenting your data. Asks can be anything from a carbon reduction commitment to new personnel recommendations – like hiring a sustainability coordinator. More examples of policy asks include establishment of a revolving green loan fund, grant money for student-run pilot projects, hiring facilities staff to oversee GHG progress and the carbon reduction project portfolio, setting a carbon neutrality goal, or investing in better energy monitoring software so that more accurate project data can be harvested.

Reexamining Risk and Discount Rates:

Assessing financial risk when talking about the fate of our climate can be ironic at times and much ink has been spilled on the subject. There are a great number of risk factors at play here though: the risk of climate change, the risk of fossil fuel dependence, the risk of investing in developing technologies, and the risk of acting upon potentially incomplete information compiled by individuals with an obvious agenda (like student activists).

Sometimes risk is internalized within discount rates – for better, or for worse. Some colleges insist on using a discount rate of up to 15% to judge the viability of student-proposed projects. Others reduce the discount rate dramatically (or all together) to account for external benefits, like fuel diversification (a hedge), or a forthcoming national cap on carbon dioxide. An excellent discussion on adjusting discount

\(^7\) The US signed the protocol by failing to ratify it, so we as a nation are not actually bound by the treaty. However, our historic lack of national participation in national and international climate legislation has help propel over a decade of local, state and regional

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rates for clean technologies can be found in section 6.5 of Eban Goodstein’s definitive text: *Environmental Economics*.

Regardless of whether or not you’re advocating for a change in discount rate, inserting financial risk into the equation is always a good idea when talking about reducing dependence on fossil fuels. Much of our oil comes from volatile nations overseas, and demand from other nations is steadily increasing. Coal is coming under more and more scrutiny in the academic and social justice communities, and forthcoming national climate legislation will make it difficult to sell coal at consistently low prices. Natural gas is a lower carbon fuel than others, but as domestic natural gas supplies dwindle, prices are beginning to fluctuate more than they have in the past. Carbon reduction investments have the added benefit of reducing your campus’ reliance on potentially risky fossil fuel commitments. Financiers will generally take note of hedges like this, but it’s not a bad thing to point out.

**Alternative Finance Schemes:**
As comprehensive as this tool may be, its financial tools help you decide what to finance, not _how_ to finance. The Campus Carbon Calculator generally assumes that all expenditures come out of an endowment with a high, predictable interest rate. Project financing may include taking out loans to cover some or all of these expenditures, but the assumption is that any money invested in a project would otherwise have been earning interest in the endowment. Some schools are working to make green investments more accessible to students by establishing alternative financing methods.

One great example of a scheme that works well is Harvard's “revolving” Green Campus Loan Fund. As reported on 11/07 Harvard has been able to reduce over 33,200 metric tons of eCO2 by financing projects whose annual ROIs (Returns On Investment) average 27%.

These projects are all proposed by students, who have access to a revolving fund set aside for swift investment in such projects. Cash flow is monitored such that money recycles back into the “revolving” fund, so next year the students will have even more money to invest in high performance on-campus efficiency projects. For more examples of schools that have successfully adopted revolving loan funds, check out AASHE’s how-to guide for students.³⁹

**Using Your Data Effectively:**

**Recognizing the Calculator’s Limitations**
When unknowns become quantifiable they cease to be unknowns, but some uncertainty will always be a factor when making abstract decisions. It’s important to realize that this tool will help with prioritization of carbon reduction projects, but it is by no means the final word on whether or not these projects can or should be enacted. This will not be the first time your school has made decisions that are not solely based on quantitative economics.

A phrase that has popped into the business world’s vocabulary lately is the “Triple Bottom Line:” People, Planet, and Profit. Proponents of this concept argue that the fiscal bottom line does not properly evaluate the potential benefits of investing in social or natural capital. Though it is difficult to sum up this triune equation, the Calculator will let you do a fairly comprehensive job with the planet, and profit angles, but any assessment of social capital opportunities must be assessed by you. Many economists deal with social capital, and would be great allies in building a case for the social benefits of carbon reduction – this would mostly be qualitative data to supplement what you already know about emissions and cost.

³⁹ [www.greencampus.harvard.edu/1clf/achievements.php](http://www.greencampus.harvard.edu/1clf/achievements.php)
It’s up to you to present the quantitative data that you do have in a cogent manner such that uncertainty is minimized but not necessarily erased. Your project data will support key decisions, like the decision to spend more staff-hours looking into a project. The financial decisions involved take time—especially for large capital projects—so don’t be disheartened if your work does not seem to result in immediate fiscal action.

Obviously, the metrics in this tool cannot sum up the true benefits of carbon reduction projects. Unfortunately, most financiers aren’t used to weighing qualitative factors in their decision-making process. It’s up to you to demonstrate the more abstract benefits of climate friendly investments in an academic institution. Trustees and administrators want to see that students understand sacrifice if that’s what it will take. Take a serious look at your proposal and recognize the true cost of what you’re undertaking—then go for it if that’s your final decision.

**Getting Qualitative**

Qualitative suggestions that supplement your quantifiable ones can be acted on quickly, and add weight to your package of carbon reduction projects. In the end, decision makers don’t just look for logic; they look for qualities like resolve, confidence, and competence. Many of the most effective carbon reduction measures you start with won’t look or feel very different from business as usual, so painting a complete picture of all the subtleties and opportunities associated with these intrinsic and not-so-visual measures is key. Here are some angles you might include:

- Potential to . . .
  - Involve students and faculty
  - Connect with the local community
  - Assume a leadership role amongst peer institutions and in the state/region
  - Improve the college’s reputation amongst potential students
  - Make the college more appealing to potential employees
  - Increase satisfaction amongst students—giving the impression that the administration is on the same page with them.
  - Strengthen post-college bonds and alumni identity
  - Increase current alumni engagement
  - Increase on-campus student extracurricular involvement
  - Strengthen ties with overseas institutions who may judge us for our climate change policies
  - Better equip students to compete in a world increasingly concerned with sustainability and carbon accounting
  - Increase pre-entrepreneurial research
  - Lead the community fighting to preserve the cultural heritage of the school or region’s past climate (i.e. broomball, skiing, maple syrup)

**Conclusion: The Power of Narrative**

One of the most powerful ways people relate to climate change is through the larger narrative of people connected by one common campus-wide/community-wide/international goal. By participating in carbon reduction on your campus, you are joining that story. Communications, admissions, even athletics can be a part of the story you will tell. Be it “students and administrators working together,” “dining services partnering with local dairy,” or “football team switches to biodiesel!” the sound bytes associated with your journey will only add to the sense of intentional community we’re all trying to foster at institutions of higher education.
It's important to recognize that what's happening on America's campuses is more than just reducing emissions; it's building a base of knowledge and hope strong enough to tackle the defining challenge of our generation. This process is not just about carbon, it's about relationships - it's about building a microcosm of what needs to happen on a much greater scale. With your help, we can mobilize the next generation to action. Let's get to work!
Supplementary Materials
Appendix 1: Data Collection Outline

This outline summarizes the data you will need to collect to complete an emissions inventory and offers suggestions of people to contact to find this information. This information may also be useful when collecting data for project ideas, so be sure to stay in touch with these key individuals.

I. Institutional Data

It may seem odd to start a greenhouse gas emissions inventory by collecting data on your institution’s budget, population, and physical size, but this data is important to normalize your emissions for comparison with other institutions and for projecting future emissions trends. This data should also be fairly easy to find. That said, the number of full-time equivalent students, staff and faculty, and the number of gross square feet, are the most important pieces of information in this section—the rest is nice to know, but not worth expending a lot of time or effort on if not readily available.

a. Budget:

   Contact: Controller’s Office
   Data: Annual operating, research, and/or energy budget
   Definitions or parameters: The Operating Budget consists of all sources of funding the University has financial control of and is plainly considered as the cost to operate the institution. Research Dollars includes all sources of financial funding the institution receives for its cumulative research endeavors. The Energy Budget is total spent providing the energy needs for all operations.
   Units: Nominal dollars (i.e. 2005 dollars for 2005 budget, 2006 dollars for 2006 budget)
   Entry Sheet: Input_InflAdj
   Entry Info: Budget data is generally maintained in nominal dollar values for each year (2005 dollars in 2005, 2005 dollars in 2005, and so on). Enter these values on the Input_InflAdj worksheet. To allow meaningful comparisons across a historical timeframe, this sheet automatically adjusts budget data to 2005 dollars using the U.S. Bureau of Economic Analysis’ chained GDP deflator values. Projected deflator values are taken from the U.S. Department of Energy’s Annual Energy Outlook. These values will need to be updated as more accurate numbers become available, or if a new base year is selected. To ensure accurate adjustments in the future, it is very important that you enter budget info in nominal dollars from the appropriate year (enter the 2006 budget in 2006 dollars), and keep a record of these values. This should be easy because budget values will probably be reported in nominal dollars, so you need only enter these on the Input_InflAdj sheet and then ensure they are not changed.

b. Population

   Contact: Institutional Research and Assessment (best); or, try Registrar / Human Resources
   Data: Annual number of faculty, staff, and full-time, part-time, and summer school students
   Definitions or parameters: In the case of faculty and staff, you are looking for full-time equivalents. Different institutions have different formulas for coming up with these numbers; in fact, the same institution might have different formulas used for different purposes by different offices! The most important thing is that you are using a number derived from the same source/methodology from year to year. The Calculator generally counts part-time students as half-time; if your IR or Registrar’s office has a different average equivalency for part-time students, you will need to either adjust your input numbers, or change the projection...
and commuting formulas in the Calculator. The number of summer school students is included for reference, but not used in any calculations (so don’t spend too much time on this number!)

**Units:** Number

**Sheet:** Input

c. Physical Size

**Contact:** Institutional Research and Assessment / Energy Manager / Director of Facilities

**Data:** Annual total building space and research building space

**Definitions or Parameters:** Typically campus planners/development officers will keep records of square foot space which may include many details you would not normally consider in assessing building space, such as wall, stair and window space. We recommend using gross square foot data here. Remember, your organizational boundaries should guide your data collection; make sure they remain consistent (i.e., if your institution is renting out building space, include this gross square footage here only if information about the utilities for the space in question is also being included.) FYI, building space, like everything else, is meant to be tracked on the basis of fiscal years.

**Units:** Square feet

**Sheet:** Input

II. Scope 1 (Direct) Emissions Sources

a. On Campus Stationary Sources: all fuel used on campus, excluding vehicle fuel use

**Contact:** Energy Manager / Director of Facilities / Fuels Purchaser

**Data:** Annual on-campus stationary fuel use (residual oil, coal, natural gas, wood chips, etc.). Annual output and generation efficiency for electricity and steam from any cogeneration (combined heat and power) plants

**Definitions and Parameters:** On-campus stationary sources generally account for the majority of Scope 1 emissions. The category includes all emissions from stationary fuel combustion – mostly oil, coal, or natural gas for heating campus buildings. If you have a cogeneration (combined heat and power) plant, its emissions fall in this category. **NOTE:** Following IPCC protocol, CO2 emissions from biogenic sources are not reported as part of your Scope 1 emissions; they are calculated and reported separately. However, since the same “activity data” that results in biogenic carbon emissions also results in anthropogenic emissions of other greenhouse gases, the activity data for these sources (e.g. biomass burned in a physical plant or boiler) are included as part of your Scope 1 data inputs. For more information, see the “Biogenic Carbon” section.

**Collection:** Contact the Facilities Director or Energy Manager to find out the types and amounts of fuels used on-campus, excluding vehicle fuel use. If no such person exists, contact the Facilities Office and ask who is in charge of purchasing fuels. This person will probably also be in charge of purchasing electricity. If they have not already compiled the information, someone may need to dig through monthly bills or other statements. First ask if they can compile it, but offer to do it yourself if they feel they don't have the time. If you want it done quicker than they can promise it, you may have to do it yourself.

**Units:** Gallons, short tons, MMBtu, kWh, or % generation efficiency

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the amount of each type of on-campus stationary fuel used in the labeled units. **Note that there are separate columns for fuels used in cogeneration plants** – if your fuel is burned in a cogeneration plant, it will be entered somewhere in columns N-AC. All fuels burned in stationary campus applications that are not cogeneration
plants should be totaled and entered in columns AD-AO. If you have one or more cogeneration plants you will need to find out their total electricity and steam production, as well as the production efficiency of each. This allows emissions to be assigned correctly to either steam production or electricity production. If you do not enter these efficiencies, your emissions from cogeneration will not be calculated properly.

b. Direct Transportation Sources: all fuel used in university-owned vehicles

**Contact:** Director of Transportation

**Data:** Annual fleet vehicle fuel use (gasoline, diesel, biodiesel, etc.)

**Definitions and Parameters:** This category includes the emissions from any vehicles that are owned by your institution. Most universities keep a fleet of vehicles that are used for everything from moving equipment around campus, collecting solid waste or materials to be recycled, delivering campus mail, or managing the grounds and roads. The university will often have its own fueling station that may be filled by the state (at state universities) or by private arrangement.

**Collection:** Contact the Director of Transportation to find out who is in charge of managing fleet fuel use.

**Units:** Gallons, MMBtu, or kWh

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the amount of each university fleet fuel used in the labeled units. If you want, you can also enter the electricity used by any electric vehicles. Note that emissions from electricity production are already accounted for under Scope 2, purchased electricity (if you purchase electricity from off campus) or Scope 1, on-campus stationary sources (if you generate all your own electricity). Do NOT subtract the values you enter in this column from anywhere else – doing so will result in an under-estimate of your total emissions.

c. Refrigerants and Other Chemicals

**Contact:** Director of Facilities / Plant Maintenance / Air Conditioning Managers

**Data:** Annual Perfluorocarbon (PFC), Hydrofluorocarbon (HFC), and SF_6 emissions

**Definitions and Parameters:** When chlorofluorocarbons (CFCs) were found to be damaging to the ozone layer, alternatives such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) were required. Unfortunately, these chemicals were later discovered to also be strong greenhouse gases. These emissions will be estimated in this section. IPCC and US EPA protocol does not include CFCs in greenhouse gas inventories because they are being phased out under the terms of the Montreal Protocol and US Clean Air Act. You do not need to compile CFC release information, but the Campus Carbon Calculator has the capacity to include any other greenhouse gas, so you may want to include any CFC emissions as a sidebar in your report.

**Collection:** Information regarding the release of HFCs and PFCs should already be reasonably accessible, as universities are required to record all fluorocarbon releases for the EPA. You may need to be assertive, but this information should be available for use. The Energy Manager should know whom to contact for this information—it may be whomever is in charge of

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10 If you have multiple cogeneration plants, you’ll need to figure out the combined average steam and electricity production efficiency for all the plants


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environmental compliance at your institution. This number may be estimated by subtracting the amount of recovered refrigerant from the purchased refrigerant.

**Units:** Pounds

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the pounds of each chemical emitted. If a gas you need is not listed, select “Other” from the drop-down list, then go to the EF_GWP sheet. Scroll to the bottom, and replace the “Other” at the bottom of the list with your chemical. Enter the chemical’s 100-year global warming potential in the cell to the right, and the source for this number in the cell to the right again.

d. Agriculture Sources

**Contact:** Barn Managers / Grounds Managers / Agriculture-related departments

**Data:** Annual fertilizer use, type, and nitrogen content. Annual number of animals

**Definitions and Parameters:** This section includes methane and nitrous oxide emissions from agriculture. Many animals, especially dairy cows, release methane generated by microbes in their guts. Methane is also released from decomposing manure. While this source will likely be only about 1% of total emissions, it is worth noting if your university has animals. This section also includes fertilizer application on fields and grounds. After the application of any nitrogen-containing fertilizer, some percentage is released as nitrous oxide (N₂O).

**Collection:** To find this information, contact the people that manage the animal barns and agriculture. Look through a campus directory for “dairy barns,” “agriculture,” or any related department. You will need to collect headcounts of dairy cows, beef cows, pigs, goats, sheep, horses, and poultry that the university has maintained over the years. Herd size usually varies throughout the year and so you will need to develop an average annual herd size. You may need to take the first headcount of the year and average it with the last headcount of the year. Any small variations due to a changing herd size will probably be insignificant.

To estimate emissions from fertilizer use, you will need to know the total pounds of fertilizer (both synthetic and organic) applied and their percent nitrogen content. Synthetic fertilizers are labeled with their chemical makeup using three numbers to represent the percentages of nitrogen (N), phosphorus (P), and potassium (K). So 15-10-10 fertilizer is 15% nitrogen. Nitrogen contents for organic fertilizer are about 1% for manure and 4.1% for other organics.

**Units:** Pounds, % Nitrogen, or number

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the pounds of fertilizer used and number of animals. Be sure to include the % nitrogen content of fertilizers.

III. Scope 2 Emissions Sources

a. Purchased Electricity

**Contact:** Energy Manager / Director of Facilities

**Data:** Annual purchased electricity. Annual electricity production fuel mix (if known)

**Definitions and Parameters:** Unless you have an electricity fuel production mix that is high in renewables or produce much of your electricity on campus, Scope 2 emissions from purchased electricity are likely to be a significant emissions source. Electricity is used in many ways on the campus: lighting, computers, refrigeration, air conditioning, cooking, and sometimes even cooking.

**Collection:** This data will hopefully already be compiled, but may require digging through monthly records in the Energy Office. You will need to know how much electricity was
purchased each year. This information will probably be gathered in kilowatt-hours (kWh) - one kWh is the amount of energy that will power ten 100-watt light bulbs for an hour.

**Units:** kWh

**Entry Sheet:** Input, CustFuelMix

**Entry Info:** On the Input sheet, enter the annual electricity purchased in kWh. Then click the link in the Purchased Electricity column to go to the EF_ElectricMap sheet and select your state and pre- and post-2006 eGRID region. This allows the Campus Carbon Calculator to select the proper emissions factors and fuel mix for your electricity region from the EPA’s eGRID database. If you know the exact fuel mix that your electricity provider uses, check the “Use Custom Fuel Mix” box at the bottom of this sheet. Then click on the link to the right to go to the CustFuelMix sheet and enter the fuel mix of your electricity provider.

**NOTE:** If you check the “Use Custom Fuel Mix” box but do not fill in the CustFuelMix sheet, your electricity emissions will not be calculated. You should also still set your state and eGRID regions even if you use a custom fuel mix.

b. Purchased Steam / Chilled Water

**Contact:** Energy Manager / Director of Facilities / Steam or Chilled Water Provider

**Data:** Annual purchased steam and chilled water, production fuel mix, and transport losses

**Definitions and Parameters:** This section will estimate emissions from off-campus steam / chilled water production. If your campus produces its own steam and/or chilled water, the associated emissions will be captured in the “On-Campus Stationary Sources” section (since it will be produced with the other fuels) and should not be included here. Imported steam is a common energy source for urban campuses in cities with centralized steam production.

**Collection:** This data will hopefully already be compiled, but may require digging through monthly records in the Energy Office. Steam and chilled water use data will be collected in “MBtu” (million British Thermal Units). Chilled water data may also be recorded in “tons,” which actually refers to the equivalent of the amount of cooling from one ton of ice melting in an hour (This factor is equivalent to 12,000 Btu/hour. Multiply “Tons” by 0.012 to get MBtu). You will also need to know how the steam/chilled water was produced and the approximate loss of energy in the pipes between the generation facility and the campus. You may need to contact the steam provider to find the types of fuel used to produce the steam each year. The provider's website is a good place to start and you may find it there. This information will be in terms of percent fuel type. (For example, your steam production for the year 2000 could be 11.8% natural gas, 0.6% distillate oil, 25.7% coal and so on). The default fuel mix in the Calculator is 50% natural gas and 50% distillate oil, with 5% transportation loss between the generation facility and campus. This information is needed because the emissions associated with the production of the university's steam will be included in the inventory under Scope 3, transmission losses for steam / chilled water.

**Units:** MBtu, % generation fuel use, and % transportation loss

**Entry Sheet:** Input, EF, Steam, EF, Water

**Entry Info:** On the Input sheet, enter the MBtu purchased of steam and chilled water. Then click the links in the Steam and Chilled Water columns to set the production fuel mix and transmission loss.

## IV. Scope 3 Emissions Sources

a. **Commuting:** daily commuting by faculty, staff, and students

**Contact:** Director of Transportation / Human Resources / Registrar

**Data:** Annual number of commuters, mode of transportation, number and distance of trips
Definitions and Parameters: This category may be one of the most difficult to estimate. The goal is to estimate the number of annual miles traveled by faculty, staff, and student commuters. This estimation should be limited to home to school to home trips. This is included in university emissions because the university could influence this travel by offering alternatives (bus, shuttle, etc.). To estimate this you will need to know how large these communities are, what their "average" commuter habits are (frequency of trips from home to school and back), the distance from home to school, and the number of commuting days.

Collection: The community size can probably be gathered from the Human Resources (Personnel) Office for employees and the Registrar for students. In addition, these offices may have a list of where these people live, which will assist in determining from where they are commuting. The Transportation Office may have completed a survey to estimate commuter habits in order to better meet commuter's needs with buses or shuttles, and a good deal of information may be able to be deduced from the vehicle parking permit database. If not, you may need to come up with your own estimates to approximate commuter habits. Faculty and staff are calculated separately because most staff will work 40 hours a week on campus while faculty may have more variable hours and habits. You may want to estimate the average fuel economy for faculty, staff, and students if there is a noticeable variation in vehicle preference in your region from the national norm (the default national averages for each year are already entered in the spreadsheets).

Units: % commuting, trips per week, weeks commuting per year, miles per trip

Entry Sheet: Input_Commuter

Entry Info: On the Input_Commuter sheet, enter the information on commuting. Note that the columns labeled "% [mode of transit]" refer to the % of the total number of faculty/staff/students that use that mode of transit – so in the "Faculty" section, "% Light Rail" means the % of the number listed in the "Faculty" column that commute via light rail. For students, the Calculator automatically enters the number of full-time students plus half the number of part-time students in the "Students" column – you may adjust this value if you have more accurate data on student commuting habits.

b. Directly Financed Outsourced Travel: travel paid for by the university

Contact: Director of Transportation / University Travel Office / Travel Agent

Data: Annual faculty, staff and student miles traveled and mode of transportation

Definitions and Parameters: This category includes any travel that is paid for by the institution but uses vehicles (or aircraft) that are not owned by the institution. The ACUPCC requires signatories to report emissions from directly financed faculty and student air travel, to the extent that data are available. You may also choose to report directly financed travel via train, taxi, bus, ferry, rental car, or travel in personal vehicles that is reimbursed by the university.

Collection: This data should be collected in terms of "(passenger) miles traveled" for students and faculty/staff and may be available through the university Travel Office, the Student Activities Office, or individual departments.

Units: Miles

Entry Sheet: Input

Entry Info: On the Input sheet, enter the miles traveled for each category.

c. Study Abroad Air Travel

Contact: Study Abroad Office

Data: Annual air miles traveled by students studying abroad

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Definitions and Parameters: Although student air travel for study abroad programs is rarely directly financed, many universities encourage or even require their students to study abroad and so feel a responsibility to estimate and report the emissions associated with this travel. Collection: This number will almost certainly have to be estimated. The Study Abroad or Registrar's Office may be of assistance in this process. Units: Miles Entry Sheet: Input Entry Info: On the Input sheet, enter the air miles traveled by students studying abroad.

d. Solid Waste
Contact: Waste Management Supervisor, Grounds and Roads department, or Director of Facilities. You may need to contact the landfill with questions regarding the type of landfill. The EPA also has information on some landfills, check out: U.S. E.P.A.'s Landfill Methane Outreach Program (http://www.epa.gov/lmop/profiles.htm) for more info. Data: Annual waste production and disposal method (incinerated, landfill without methane control technology, landfill with methane flaring, or landfill with methane recovery) Definitions and Parameters: Institutions have several methods for managing solid waste. The two most common are incineration and landfilling. Waste that is incinerated releases greenhouse gases when combusted and waste sent to landfills releases methane as it decomposes. Collection: First, contact the person in charge of waste management to inquire about historical data for the amount of solid waste generated that is sent to a landfill or incineration. The institution will likely pay a tipping fee each month and will hopefully have records of the amount of waste disposed. Second, find out where the waste goes: (1) a mass burn incinerator, (2) a refuse-derived fuel incinerator, (3) a landfill with no methane collection, (4) a landfill that collects methane emissions for flaring, or (5) a landfill that collects methane emissions for electricity generation. You may need to contact the landfill to find this information. Units: Short tons Entry Sheet: Input Entry Info: On the Input sheet, enter the short tons of solid waste in each category. The Campus Carbon Calculator uses emission factors for an “average” composition of solid waste. If you have access to specific information regarding the composition of your waste, you can use the EPA’s Waste Reduction Model (WARM) to develop a specific emission factor for your institution. Follow this (link) and enter your waste mix as percents. Then enter your emission factors on the EF_SolidWaste sheet in the Calculator.

e. Offsets
Contact: Campus Sustainability Coordinator / Energy Manager / Director of Facilities Data: Annual offsets purchased or created (composting, forest preservation, renewable energy credits, retail offsets, etc.) Definitions and Parameters: It is increasingly common for universities to offset some portion of their greenhouse gas emissions in various ways. An offset is achieved when the campus invests in a reduction in GHGs outside of it’s institutional boundaries, such that it exerts some financial control on that

12 http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteWARMOnLine.html

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entity, and is therefore responsible for that entity’s reduction in GHGs. Examples of offsets include on-campus carbon sinks, like compost, off-campus institution-funded carbon reduction projects, and the purchase of Renewable Energy Certificates (RECs), also known as “green electricity” or “green tags.” It is assumed that purchasing a given MWh of RECs can be equated to the same MWh of electricity produced using one or several renewable technologies, such as wind, solar or small-scale hydroelectric. The actual electricity associated with the credits is not necessarily being produced near the university or even on the same electric grid. Because they do not directly reduce the institution’s carbon footprint, RECs are not simply subtracted from total electricity emissions, but instead are entered in a separate section for “offsets,” apart from the three Scopes. Another type of offset is the purchase or protection of forest lands that function as a carbon sink. These lands could be near campus or in another country. An on-campus offset practice that many universities are engaged in, though often for reasons other than carbon sequestration, is composting. Composting, when managed properly, does not generate CH₄ emissions, but does result in some carbon storage (associated with application of compost to soils). Retired offsets are available for purchase by institutions like yours, but there can be vast differences in offset quality in the booming offset market, so it’s important that your campus community understands the difference between various calibers of offsets. For a more thorough discussion of offsets, see the project module section of this document.

**Collection:** For information on RECs or retail offsets, contact your Campus Sustainability Coordinator, Environmental Affairs, or Energy Manager. For forest preservation, contact the Land Manager or Project Coordinator. For composting, contact the Waste Manager.

**Units:** Short tons, MT eCO₂, kWh

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the number or amount for each type of offset.

**Adding Custom Emissions Sources**

The Campus Carbon Calculator allows you to add custom fuels or other emissions sources that have not been built-in. To add a custom on-campus stationary fuel (either for use in a cogeneration plant or not), a custom direct transportation fuel, or a different animal, go to the Input sheet, find the relevant section, and click the “Other” label at the end of the section. This will take you to an EF sheet with a column labeled “Other...” (i.e. “Other Fuel”). Change this label to the name of your custom emissions source and enter the emissions factors in the blue columns using the indicated units. You must fill in all the cells in any blue emissions factors column. Be sure to use the units indicated, and note the source for these emissions factors at the bottom of the column.

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Appendix 2: Campus Carbon Calculator FAQs

1) When I open the Calculator, I am always prompted with an Excel pop-up window that asks if I want to enable macros, and that macros can harm my computer. Why is this and what should I do?

The pop-up is there because some computer viruses are written in macros; Excel’s security features are only looking after the best interests of the user with this prompt. In this case, you should click to enable the macros. If you disable them, some features of the Calculator will not work and could cause some problems. The macros in the Calculator do not contain viruses and will not cause harm to your system. If you have been working with macros disabled, and some features do not appear to be working, save your work, close the Calculator and re-open it with macros enabled. This should help the user-friendly features of this tool to function properly.

If you would like to see a list of the macros to know if they could be the source of your problems, select Tools>Macro>Macros from the menu bar or press Alt+F8.

2) Is there a user’s guide to the Calculator?

Yes! When you downloaded the Calculator from the CA-CP website, there was a separate link to download the user guide. If you did not access it when you downloaded the Calculator, you can find it by clicking on the "1.2-Calculator" menu now.

3) My school does not have historical records which go back to 1990. What should I do?

Unfortunately some schools may not have found it in their interest to maintain historical records of previous energy use data. If gaps exist in your data, you should include what you can and reference the first complete energy year for your institution’s baseline. You may want to contact your professor/faculty advisor to determine how best to estimate previous emissions for which no records exist. In any event, be sure to document data gaps in your inventory write-up to highlight the need for more successful record keeping in years to come.

4) My school does not have data recorded for some of the data input fields in the Calculator. Will this effect the emissions calculations?

Yes and no. The tool calculates emissions based on the data you enter into it, so you will only be calculating emissions based on the data you are able to enter. In particular, some smaller colleges and universities may not have many of the energy features the Calculator is capable of working with. In the end, the more you are able to enter for your institution, the more complete your inventory will be.

5) What is meant by "Research Dollars" in the budget section?

"Research Dollars" is simply the amount of money your institution receives in research grants from external sources. It is a convenient measure to use in showing your school’s emissions, especially when institutions have operating budgets highly dependent on research grants.
6) In the "Physical Size" section of the input worksheet, what is meant by, "Total Building Space" and "Total Research Space"?

Typically campus planners/development officers will keep records of square foot space which may include many details you would not normally consider in assessing building space, such as wall, stair and window space. We recommend using gross square foot data here. Your institution may also own facilities off campus which it maintains. In general, you should include data for as many institutional facilities as possible. However, if your institution is renting out building space, include this gross square footage only if your institution is paying the utility bills. FYI, building space is meant to be tracked on the basis of fiscal years.

7) Is electricity use tracked on a calendar year basis, or fiscal year basis?

Your campus energy office may keep this data on a month to month basis, or over the period of a fiscal year. Use the fiscal year period for this data.

8) My institution does not keep track of air travel. How important is it that I include this data?

GHG emissions from air travel are a very significant source for all institutions, although it may not be an area of emissions easily influenced by greenhouse gas reduction efforts. While this part of the inventory is probably going to be most useful when your institution adopts a policy of keeping air travel records, you are most likely to get a good estimate of air travel by conducting a survey from a representative body of population from your institution or contacting your schools primary travel agents. You can also track down a lot of information by asking to see receipts from the respective accountants.

9) In the 'Offsets' section of the inputs, how do I calculate the carbon sequestered by forest preservation?

The IPCC has a list of coefficients for calculating carbon sequestration here: [link]15. From there, you can calculate the amount of C sequestered by various ecosystem types in the different climatic regions in North America. Because it is a fairly common practice to purchase lands in tropical climates (outside of the U.S.) where C sequestration is high, it is important to know what type of land is acquired. You can continue to use the same source of land year after year, as the forest preservation figures represent annual C storage. Caution: the units used by the IPCC here are short tons, so be sure to convert to tonnes, (a.k.a. metric tons).

10) A refrigerant my school uses are listed in the Calculator. Where can I find the appropriate GWP value?

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15 http://www.grida.no/climate/ipcc/land_use/997.htm
Some of the most common values can be found on the IPCC website at http://www.grida.no/climate/ipcc/emission/123.htm and if you do not see your specific refrigerant in that list, then a good Google should do the trick.

11) I can't find the unit conversions I need in the "EF_Constants" worksheet of the Calculator. Where can I find an accurate conversion factor for entering data in the units the Calculator is set up to handle?

Most chemistry and physics textbooks have tables of common conversion factors. A very easy to use online resource for converting units can be found at http://www.onlineconversion.com. If you can't find the units you are looking for there, it's probably best you first try to understand what the units mean before tracking down someone to ask them for help.

12) How do I change the graphing features to show the new data that has been entered?

Actually, the graphing features should automatically show the new data. What happens is, as you change the input data, the result data automatically renews itself, and so do the graphs. If this is not the case, then check to see if you changed the source data used by the pre-configured excel charts. If you changed the source data for the charts, or edited their format in certain ways, you will need to reformat the source data by right clicking over the graph and re-referencing the data from which each graph originates.

Troubleshooting
You get the message: “The cell or chart you are trying to change is protected and therefore read only”

In order to reduce accidental changes to the spreadsheets, they have all been ‘protected’ against change (except the input cells). If you are sure that you want to change a protected cell (or after a graph), put the arrow over ‘Protection’ in the tools menu and choose ‘Unprotect Sheet.’ Be sure to turn protection back on after you make the change to eliminate any accidental changes.

You see “###” where you think there should be numbers

There is a number that is too big to fit within the column – make the column bigger by dragging one of its borders wider (at the top by the row of letters). You may need to disable protection (see above).

You see labels on a graph that are jumbled on top of one another and unreadable

Double click slowly on the label that needs to be moved. When a box has appeared around it, drag it to the desired position. You may need to turn off protection (see above) to alter the graph.

You see labels on graphs that say “HIDE THIS ROW”

Scroll down until you can see a text box below the graph. Follow the instructions in the box.

You see labels on graphs that do not apply to your institution

You can simply click slowly on the label that does not apply (i.e. if your school has no animals) and press delete when the label is highlighted. This deletion is permanent, so be sure the label is not needed.

When saving the calculator, you get an error that reads “A formula in this worksheet contains one or more invalid references.”
If you have not yet completed the Inventory Module, the message is probably just referring to the errors in the Projection Module due to trying to project data that doesn’t exist. Click “okay” and it should continue to save.

When saving the calculator, the Compatibility Checker lists that some cells have a “Minor loss of fidelity.”

This is telling you that if you reopen the tool in an earlier version of Excel, some of the formatting may look different. However, the calculator should function the same. If you have a more strongly worded error it is worth looking into.
Appendix J – Integrated Campus Sustainability Policy

This Appendix was developed by our team project. It is done by looking at the policy of different institution. This Appendix helps the institution have some ideas of what type of policy they should implement.

Integrated Campus Sustainability Policy is organized into six disciplines, building, energy management, carbon offset, waste minimization, transportation and green purchasing.

Green Building Policy

This policy can be the ones that require all the new constructions on campus should meet the LEED Silver Standard at minimum and require all the main buildings on campus shall be renovated to be sustainable. Renovation on the major existing buildings is required to meet the LEED certification.

Example: Clemson University

“All new facilities over 5,000 gross square feet and major capital renovations costing more that 50% of building replacement value shall seek to acquire LEED Silver rating at a minimum.”

Example: Northwestern University

“All new buildings will be LEED-certified at a minimum; each project will be assessed on an individual basis for further certification at the Silver or Gold levels.”

Energy Management Policy

Energy management policy will be divided into two part, energy efficiency and conservation policy, and green energy production/purchasing policy.

Energy Efficiency and Conservation Policy
To develop energy efficiency and conservation policies, sustainability committee should roughly analyze the campus’ unique energy consumption circumstances first, and then develop as many effective strategies as possible on energy conservation, such as making a “space temperature control policy” for all the buildings on campus. More examples are shown as following:

- **Lighting Level Control Policy:**

  “Lighting Levels - Unless special needs are required, lighting levels shall be maintained at the following average level of foot candles:

  - Classrooms - 40 foot candles
  - Offices & Conference rooms - 30 foot candles
  - Reception Areas & Lounges - 20 foot candles
  - Corridors - 10 foot candles
  - Kitchens - 50 foot candles
  - Cafeterias - 20 foot candles
  - General & Other - 20 foot candles”

- **Space Temperature Control Policy:**

  “Unless special needs are required, the following minimum and maximum room temperatures shall be maintained, in as far as reasonably possible, in all university department areas:

  During “Occupied” Hours: Heating - 72 Deg. F and Cooling - 75 Deg. F
  During “Unoccupied” Hours: Heating - 60 Deg. F and Cooling - 85 Deg. F”

- **Facility Operation Policy:**

  “The following equipment and components will be switched off at the end of each work day when feasible:
  * Office Lights
  * Office Computers, Printers and Monitors
  * Office Copy Machines
  * All Other Electronically Operated Equipment”

**Green Energy Production/Purchasing Policy**

The institution can create policies to increase the percent of renewable energy usage on campus by either installing renewable energy devices on campus or purchasing renewable energy generated by off-site plants, such as the renewable energy credits (RECs) provided by the school’s utility supplier.

Published policies on this theme are hard to find, but we are able to find many projects or actions implemented under their related policies, such as the following examples:
Wind Turbine, University of Minnesota, Morris
A 1.65 MW wind turbine is working on the campus of University of Minnesota, Morris. The annual power output from this turbine is 5.6 MkWh, which is over half of the school’s electricity demand.

Renewable Energy Credits (REC) Purchasing, New York University
In 2006, 118,000,000 KWh of wind power RECs, equivalent to 100% of the university’s electricity need, was purchased by New York University.

Carbon Offset Policy

From research, many schools set policies on carbon offset² purchasing to offset unavoidable green house gas emission generated by the school activities, such as all the campus air travel paid by school.

Associated with this policy, school should also set up a tracking system to estimate the amount of school’s annual GHG emission and to decide the quantity of offsets that need to be purchased.

Example: College of the Atlantic
College of the Atlantic established a policy that states
“In College of the Atlantic, emissions that cannot be avoided will be offset by investing in energy efficiency and renewable energy production in such manner as to reduce actual emissions to the atmosphere in an amount that equals or exceeds emissions generated by College of the Atlantic activities. All offsets will be quantifiable and verifiable according to international standards and best practices.”

Transportation

Transportation policies will be discussed in four aspects: Anti-Idling Policies, Public Transit Policy, Car Share Policy and Bicycle Share Policy.

Anti-Idling Policies

Example: University of Waterloo
"All vehicles should be turned off when not in use or when the driver leaves the unit for any length of time."

Example: University of Washington
"No vehicle operator in charge of a motor vehicle shall permit it to stand unattended without first stopping the engine, locking the ignition, removing the key and effectively setting the brake, and, when standing upon any perceptible grade, turning the front wheels to the curb or side of the roadway."
Public Transit Policy

Published public transit policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

Example: Lewis & Clark College
A fare-free shuttle is provided on campus, which can give faculty, staff and students access to the local neighborhoods, the downtown area and grocery stores.

Example: University of Colorado at Boulder
University of Colorado at Boulder provides faculty, staff and students with unlimited usage of fare-free transit passes, which is called “Ecopasses”, within the campus and surrounding neighborhoods. A mandatory student fee approved by the students funds the student part of this “Ecopasses”.

Car Share Policy

Published car share policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

Example: Zipcar Programs, American University

American University started a zipcar program on campus, which is available 24 hours per day, 7 days per week. The annual fee for this program is $25. The only requirement for faculty, staff and students is that their age has to be over 21.

Example: Hourcar, Augsburg College
A hourcar hub funded by institution was established at Augsburg College in 2006 and was expected to keep active for the next three years.

**Bicycle Share Policy**

Published bicycle share policies are hard to find, but we are able to find many programs implemented on campus under their related policies, such as the following examples:

**Example: Bike Library, University of Alberta**

University of Alberta launched a bike library program in 2005. The bike library provides approximately 30 bikes for rental every month and the bikes “ranges from mountain bikes, cruisers, road bikes and various hybrids”. Each of the bikes is “equipped with a U-lock, front and back light, and a bell”. “$40 deposit is required to ensure the bike is returned in good working condition” and the “hours of operation vary depending on the time of year and the client demand”.

**Green Purchasing Policy**

Colleges and universities usually have the demand for a large amount of many items, and the environmental impact associated with the items can be greatly reduced by altering the schools’ purchasing choice. Therefore, green purchasing policies are intended to set the rules for campus to follow to turn their purchasing choice more sustainable and to minimize the environmental harm brought from products purchased, such as the products of paper, appliance and food. For those schools that have their own stores on campus, a marketing strategy to encourage people to choose the environmentally friendly products should be included in this policy, too. Following are some sample green purchasing policies, including paper, appliance, food and general purchasing policies.

**Paper Purchasing Policy, Hampshire College**

Hampshire College’s paper purchasing policy states that

"Effective on July 1, 2003, Hampshire College will begin purchasing 100% post consumer content, 100% processed chlorine free recycled paper” to "be used campus wide on all convenience copiers and office printers whenever possible." Besides, “Colored paper and paper of other
sizes will be purchased as a 30% or higher post consumer waste, 100% processed chlorine free paper.”

Appliance Purchasing Policy, University of California, Davis

“The University is committed to purchase energy efficient equipment that meets EPA Energy Star requirements. These include but are not limited to personal computers, printers, copiers, faxes, laboratory equipment, lighting, refrigerators, and HVACs.”

Food Purchasing Policy, Harvard University
Harvard’s food purchasing policy requires Harvard alter its food choices to be locally and organically produced products. Based on this policy, Harvard changed its wholesalers to be ones who cooperate with local farmers and now most of products purchased by Harvard is organic and Integrated Pest Management (IPM)

General Green Purchasing Policy, Duke University
Duke University established a comprehensive green purchasing policy, in which they set detailed criteria Duke should follow when selecting products. Besides, Duke made its own strategies to apply in Duke’s stores to promote environmentally friendly products on campus. To see the complete Duke Green Purchasing Policy, please go to Appendix I

Waste Minimization Policy

For this policy, the institution needs to develop a series of effective strategies to minimize their campus’ waste. It can be realized by establishing policies about source reduction, recycling program and participating in the national wide campus recycling and waste reduction competition, such as the RecycleMania

The following are some examples of campus policies on source reduction, recycling and waste minimization competition.

Source Reduction
Example: Source Reduction Policies, University of California, San Diego (UCSD)

To reduce UCSD’s waste source, UCSD created policies which require campus use durable and reusable products, require the vendors provide products with minimal and reusable packaging to UCSD, encourage paper reuse in offices, and encourage campus to use electronic bulletin boards to distribute newsletters and so on.

As below, we will demonstrate part of the UCSD source reduction policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which sources reduction policy is located, please go to **Appendix I**

1. Durable and Reusable Products

*Whenever possible, UCSD and external contractors will promote the use of durable and reusable products, i.e., reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.*

4. Packaging Minimization

*Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.*

6. Newsletters

*The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department.*

Recycling

Example: **Recycling Policy**, University of California, San Diego (UCSD)

UCSD established recycling policies regarding new construction, building materials, and require all the employees in UCSD to be instructed with general practices of recycling, such as giving lectures in new employee job orientation.

As following, we will demonstrate part of the UCSD recycling policy. To see the complete version of the policy and its Waste Prevention and Recycling Policy under which recycling policy is located, please go to **Appendix I**

1. General Practices
General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials

Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.”

Waste Minimization Competition Policy

Published policy about waste minimization competition is hard to find, but we are able to find many programs implemented on campus due to their related policies, such as the following example:

Example: University of Texas at Austin

University of Texas at Austin launched many waste reduction programs on campus and in 2007; they recycled around 40% of its waste and won the Waste Minimization Competition in “RecycleMania”.

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Appendix K – Campus Policy Case Studies

Below are some campus policy examples from several leading sustainable institutions in North America. It shows us how a campus sustainability policy could be established. These example are from selected institutions’ websites.

Green Purchasing Policy, Duke University²⁰⁶

“Duke Stores will give preference to environmentally superior products, where quality, function and cost are equal or superior. Products and packaging materials will contain a prescribed minimum post-consumer recycled content and will be minimized and/or substituted with more environmentally appropriate alternatives whenever possible. All products will be chosen based on efficient use of energy, natural resources, and potential for safe, non-hazardous disposal.

Duke Stores will inform all suppliers / vendors of products and services about the policy and will work with them to meet its criteria.

Where practical and cost effective, products will be ordered in appropriate quantities to avoid having to dispose of obsolete products.

‘Whenever practicable,’¹* products should be purchased which meet the criteria specified in the EPA’s Environmentally Preferable Purchasing (EPP) database which is available on the EPA website (www.epa.gov).

When a candidate product meets some of the EPP criterion but not others, preference will be given in the following order:
1) The highest percentage of post-consumer² * recovered material available in the marketplace; and
2) The highest percentage of pre-consumer recovered material available in the marketplace

¹*“Whenever practicable” means a) the recycled products can perform the function intended at least as well as a product produced from only virgin material, and b) the cost of the recycled product reasonably approximates the cost of the product produced from only virgin materials.

²* “Post-consumer” materials are those materials that have been used by consumers, collected by recycling programs and then remanufactured into a new product. “Pre-consumer” material consists of the leftover scraps from milling and industrial processes. While both are environmentally preferable to virgin materials, post-consumer recycled material is given priority because it supports local recycling programs by creating demand for the materials collected.

In addition to the recovered material content of a product, the EPP database specifies other important criteria that should be considered in selecting products:
1) The ability of a product and its packaging to be reused, reconditioned for use, or recycled through existing recycling collection programs; and
2) The volume and toxicity of waste and by-products a given product and its packaging generate in their manufacture, use, recycling and disposal.

²⁰⁶ (Duke University)
Equipment purchased or rented by Duke Stores are to be compatible, whenever practicable, with the use of recycled-content products (e.g. photocopy machines). Product specifications and requisitions for products must conform to the following guidelines:

1) Specifications and requisitions shall not require the exclusive use of products made from virgin materials, nor specifically exclude the use of recycled-content products;
2) Performance standards must be reasonable and related to function, and shall not be designed to exclude the purchase of recycled-content products;
3) To the extent such information is known, Duke Stores staff shall identify in the purchase requisition products available with recycled content and vendors from whom such products are available; and
4) The Purchasing Agent has the authority to specify a minimum recycled-content standard in bid solicitations.

Duke Stores will promote this green purchasing policy on its website, inside its stores and within its marketing materials.

Duke Stores will promote environmentally preferable products within its stores through green tagging, preferential shelf placement and special displays. Within its catalog, environmentally preferable products will be denoted through a green labeling scheme.”

UCSD WASTE PREVENTION AND RECYCLING POLICY

XVI. RELATED POLICES AND PROCEDURES

UCSD Policy and Procedure Manual (PPM)
520-4 Use of Disposable Polystyrene Products

XVII. SCOPE

This policy applies to all facilities under the jurisdiction of UCSD, including the La Jolla campus, the UCSD Medical Centers, Hillcrest, Mt. Soledad, Nimitz Marine and the Elliott Field Station. This policy applies to office practices and purchases made both through the Purchasing office and by individual departments.

XVIII. POLICY

207 (UCSD)
UCSD recognizes its role as a leader in the community with regard to environmental policies and, with the adoption of this policy, demonstrates its intention to ensure responsible stewardship of the environmental resources under its influence. More specifically, the purpose of this policy is to set forth standards and organizational processes aimed at: 1) reducing waste at the source; 2) encouraging the purchase and use of durable and reusable products; 3) encouraging the purchase of high post-consumer content recycled products; 4) increasing the total volume of waste materials diverted from landfills to recycling processes; 5) ensuring the long term viability of campus recycling operations through appropriate educational programs, coordination, management and oversight; and 6) remaining in compliance with Federal and state mandates.

XIX. PROCEDURES

The following practices shall be implemented and maintained throughout all UCSD operations.

A. Source Reduction

1. Durable and Reusable Products

Whenever possible, UCSD and external contractors will reduce the use of nonrecyclable materials and products, and promote the use of durable and reusable products, i.e., manila envelopes, reusable plastic or ceramic mugs instead of disposable cups, canvas sheeting instead of plastic garbage bags for landscape wastes, recycling reusable silverware/dinnerware instead of using disposable items.

2. Copying and Printing

Employees will reuse office paper whenever practical. Office papers shall be recycled. All departments shall encourage two-sided copying. Whenever practical, scrap paper printed only on one side shall be used for producing rough drafts. Paper printed only on one side shall also be used as scratch paper.

3. Documents

All proposals and reports received from outside vendors and consultants should be printed on both sides using recycled content paper that meets standards established in IV. B. below. Furthermore, the documents shall be clearly marked to indicate that they are printed on recycled content paper.

Letters, reports and documents produced by campus administrative departments should be printed on both sides using recycled paper that meets the standards established in IV.B. below. To the extent possible, academic activities shall also be encouraged to meet these standards.
All forms used on the campus should include only the necessary information and number of copies. Instruction sheets, if necessary, shall be printed on the back of the last page of the form. Whenever possible, forms should be filled out and processed electronically.

4. Packaging Minimization

Vendors from which the University purchases products will be required to utilize minimal and reusable packaging materials as deemed in products specifications. If no local market for packaging materials exists, Vendors may be required to take back their packaging at their expense.

5. Correspondence

Whenever feasible, electronic correspondence shall replace written correspondence. Unnecessary printed copies of electronic correspondence are discouraged.

6. Newsletters and Mailing Lists

The producers of all campus newsletters are encouraged to use electronic bulletin boards for distribution, and to only provide one printed copy of the newsletter to each department. Printed copies should be routed or posted for interested parties to read. Annually, staff shall review mailing lists and delete out of date subscribers.

7. Student Phone Books

All phone books shall be distributed to students only once per calendar year.

B. Standards and Specifications

UCSD shall, at a minimum, conform to the federal purchasing guidelines developed by the Environmental Protection Agency (EPA). Standards and specifications for additional recycled content products as established by the EPA and all such standards shall be reviewed and revised on an ongoing basis by the Waste Minimization Advisory Committee. See Supplement I for a listing of the most common recyclable materials.

C. Purchasing

1. General

UCSD shall continue to improve its efforts toward recycling and waste reduction goals by defining purchasing policies aimed at encouraging the procurement of recycled products.
Because they are by far the largest volume recycled commodity handled by the campus, these purchasing policies will initially focus on paper products. Additional detailed purchasing policies shall be considered in the future by the Waste Minimization Advisory Committee described in Section V. of this policy.

2. Purchasing Authority

Purchasing authority for all campus paper products purchased through the Purchasing Department should remain consolidated under one contract administrator within the Purchasing Department. This consolidation of purchasing power allows for economies of scale in paper purchases to offset any potential price differentials between recycled and virgin products. Further it enables the campus to significantly increase recycled content paper purchases while reducing costs. Letter and legal size paper purchases should not be made through the use of Low Value Purchase Orders (LVPO's).

3. Requirement to Purchase Recycled Paper Products

The UCSD Storehouse should be used for the purchase of all paper products which include but are not limited to: cut paper for copiers and laser printers, computer paper and custodial paper products. The Storehouse provides the service of procuring, storing and distributing all types of paper supplies for UCSD. With the ability to negotiate purchases through an annual high volume purchase program the price stabilization of paper products is favorably maintained for UCSD. The long term goal is to pursue the commitment to obtain and supply recycled paper products through all available sources.

The UCSD Storehouse shall strive to procure paper products with the highest percentage of recycled content available providing these products meet established performance standards and are within 5% of the price of virgin paper products.

4. Elimination of Prohibitions

Upon review and update of any University policy, limitations which restrict the purchase or use of recycled product shall be amended to encourage use of recycled products wherever possible, providing the necessary performance standards can be met.

D. Recycling

1. General Practices
All University employees shall be instructed with regard to their responsibility to participate in campus recycling efforts. General practices regarding recycling, reuse and waste reduction shall be included as part of the standard job description and job orientation for all new employees.

2. New Construction

The Office of Facilities Design and Construction and the Campus Planning Office shall work with the Waste Prevention and Recycling Coordinator to ensure that all new construction is designed to facilitate recycling in both interior and exterior locations.

3. Building Materials

Whenever possible and economically feasible, the University and its contractors shall reuse or recycle materials resulting from the demolition or remodeling of campus facilities.

E. Education

1. Faculty and Staff

Physical Plant Services will be responsible for providing educational programs and materials for faculty and staff including a discussion of UCSD's commitment and responsibilities regarding waste prevention and recycling instructions on how various commodities can be recycled, information contacts and phone numbers, and any applicable incentives. Educational programs shall be implemented under the advice and guidance of the Waste Minimization Advisory Committee described in Section V. Responsibilities.

2. Departmental Contacts

Each Department should appoint a recycling contact person who will serve as the primary contact person for the Department.

3. Students

Educational presentations regarding the need for recycling and waste reduction and ways to participate in campus recycling efforts will be made to all new students as part of their orientation. Additional educational programs shall be devised and implemented under the advice and guidance of the Waste Minimization Advisory Committee as described in Section V. Responsibilities.

XX. RESPONSIBILITIES

A. Waste Prevention and Recycling Coordinator
Coordination - The coordination of the following waste reduction, reuse and recycling programs shall be consolidated under the Waste Prevention and Recycling Coordinator:

- Aluminum
- Cardboard
- Computer paper
- Glass
- Yard Wastes
- Mixed paper
- Newspaper
- Plastic
- White paper
- Metal
- Tin & Steel cans
- Building Materials
- Oil and Batteries
- Reuse Programs
- Ship & Vehicle Waste

The campus Coordinator shall oversee the day to day operations of UCSD's recycling programs, maintain records of recycling activities, and staff the Waste Minimization Advisory Committee.

B. Departments and Organizations

All departments and organizations engaged in individual recycling programs shall provide records of their operations to the campus Waste Prevention and Recycling Coordinator on a quarterly basis within fifteen days following the end of each calendar quarter. Individual program record keeping shall be computerized if possible, and shall be done in a uniform format to be supplied by the coordinator, by all departments and organizations engaged in recycling efforts addressed under this policy. Data shall include the commodity, the quantity (in lbs/month), revenues, vendors and expenses.

C. Waste Minimization Advisory Committee

UCSD shall maintain a standing "Waste Minimization Advisory Committee" to provide guidance and oversight for the campus waste prevention and recycling operations. The Waste Minimization Advisory Committee shall be advisory to the Vice-Chancellor-Business Affairs. The Committee shall be appointed on an annual basis and shall include representatives from the faculty, staff and student body. The Waste Minimization Advisory Committee shall be responsible for staying abreast of current regulations, technologies, and opportunities in recycling, and shall support and direct the implementation of recycling education programs.

The Waste Minimization Advisory Committee shall review quarterly recycling reports and determine whether any commodities should be added to or deleted from UCSD's recycling operations. The Committee shall also prepare an annual report to the Vice-Chancellor-Business Affairs by June 30 each year, summarizing the campus waste prevention and recycling activities and progress, and include any suggestions for improvements to recycling programs.
### EPA STANDARDS AND SPECIFICATIONS

**FOR RECYCLED CONTENT PRODUCTS**

**Recommended Recovered Fiber Content Levels For Uncoated**

**Printing and Writing Papers**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reprographic Paper (e.g. mimeo and duplicator paper, high-speed copier paper, and bond paper) (1)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Offset Paper (e.g., offset printing paper (1), book paper, bond paper (1))</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Table Paper (e.g., office paper such as note pads, stationery (1) and other writing papers)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Forms Bond (e.g., forms, computer printout paper, ledger) (1)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Envelope paper:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wove</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Kraft:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White and colored (including manila)</td>
<td>10-20</td>
<td>10-20</td>
</tr>
<tr>
<td>Unbleached</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Cotton Fiber Paper (e.g., cotton fiber papers, ledger (1), stationery (1) and matching envelopes, and other writing (1) papers)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Text &amp; Cover Paper (e.g., cover stock, book paper (1), stationery (1) and matching envelopes, and other writing (1) paper)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Supercalendered</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Machine finish groundwood</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Papteries</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Check Safety Paper</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

(1) These items can be made from a variety of printing and writing papers, depending on the performance characteristics of the item. Some of the papers are a commodity-type and some are specialty papers. EPA recommends that
procuring agencies determine the performance characteristics required of the paper prior to establishing minimum content standards. For example, bond, ledger, or stationery made from cotton fiber paper or a text & cover paper have different characteristics than similar items made from commodity papers.

Supplement I (Page 2 of 3)

**Recommended Recovered Fiber Content Levels**

**for Coated Printing and Writing Papers**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coated Printing Paper</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Carbonless</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

**Recommended Recovered Fiber Content Levels for Bristols**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Folders (Manila and Colored)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Dyed Filing Products</td>
<td>20-50</td>
<td>20</td>
</tr>
<tr>
<td>Cards (index, postal, and other, including index sheets)</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Pressboard Report Covers and Binders</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Tags and Tickets</td>
<td>20-50</td>
<td>20</td>
</tr>
</tbody>
</table>

Supplement I

(Page 3 of 3)

**Recommended Recovered Fiber Content Levels**

**for Paperboard and Packaging Products**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Recovered Fiber</th>
<th>Postconsumer Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrugated containers: (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Component</td>
<td>Range 1</td>
<td>Range 2</td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>(&lt;300 psi)</td>
<td>25-50</td>
<td>25-50</td>
</tr>
<tr>
<td>(300 psi)</td>
<td>25-50</td>
<td>25-30</td>
</tr>
<tr>
<td>Solid Fiber Boxes</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Folding cartons (2)</td>
<td>100</td>
<td>40-80</td>
</tr>
<tr>
<td>Industrial paperboard (e.g., tubes, cores, drums, and cans)</td>
<td>100</td>
<td>45-100</td>
</tr>
<tr>
<td>Miscellaneous (e.g., pad backs, covered binders, book covers, mailing tubes, protective packaging)</td>
<td>90-100</td>
<td>75-100</td>
</tr>
<tr>
<td>Padded mailers</td>
<td>5-15</td>
<td>5-15</td>
</tr>
<tr>
<td>Carrier board (3)</td>
<td>10-100</td>
<td>10-15</td>
</tr>
<tr>
<td>Brown papers (e.g., wrapping paper and bags)</td>
<td>5-40</td>
<td>5-20</td>
</tr>
</tbody>
</table>

(1) The recovered fiber and postconsumer fiber content is calculated from the content of each component relative to the weight each contributes to the total weight of the box.

(2) The recommended content ranges are not applicable to all types of paperboard used in folding cartons. Cartons made from solid bleached sulfate or solid unbleached sulfate contain no or small percentages of postconsumer fiber, depending on the paperboard source.

(3) Carrier board made from unbleached draft contains up to 25% recovered fiber, while carrier board made from recycled paperboard contains up to 100% recovered fiber.

**MISCELLANEOUS:**

Recommended Recovered Fiber Content Levels for Miscellaneous Paper Products, Commercial/Industrial Sanitary Tissue Products, Traffic Cones, Traffic Barricades, Running Tracks, Playground Surfaces Floor Tiles and Patio Blocks are also available.
Appendix L – Windows Selection

This Appendix was developed by Efficient Windows to help institutions have some ideas about choosing the appropriate windows for campus buildings.

The U.S. region is broken down in the figure below.

![Energy Star Zones](http://www.efficientwindows.org/factsheets/MultiBenefitsFactsheet.pdf)

**Figure L-1**


Based on these regions, the recommended windows properties are presented in the chart below.

**Table 16: Window’s properties**

<table>
<thead>
<tr>
<th>Regions</th>
<th>U-value</th>
<th>SHGC</th>
<th>VT</th>
<th>Air leak (AL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Climate Zone</td>
<td>0.35 or less</td>
<td>To reduce heating, select the highest SHGC you can find so that winter solar gains can offset a portion of the heating energy</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td>Select windows with an AL of 0.30 or less.</td>
</tr>
</tbody>
</table>

If air conditioning loads are minimal, windows with U-factors as high as 0.40 are also.

500
<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>SHGC or U-factor</th>
<th>VT or AL</th>
<th>VT or AL</th>
<th>VT or AL</th>
</tr>
</thead>
<tbody>
<tr>
<td>North/Central Climate Zone</td>
<td>0.40 or less</td>
<td>0.55 or less</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td>Select windows with an AL of 0.30 or less.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South/Central Climate Zone</td>
<td>0.40 or less</td>
<td>0.40 or less</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td>Select windows with an AL of 0.30 or less.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southern Climate Zone</td>
<td>0.65 or less</td>
<td>0.40 or less</td>
<td>Select windows with a higher VT to maximize daylight and view.</td>
<td>Select windows with an AL of 0.30 or less.</td>
</tr>
</tbody>
</table>

energy-efficient if the Solar Heat Gain Coefficient is 0.50 or higher. need. If cooling is a significant concern, select windows with a SHGC less than 0.55.

If cooling is a significant concern, select windows with a SHGC less than 0.55. If you have significant air conditioning costs or summer overheating problems, look for SHGC values of 0.40 or less. If you have moderate air conditioning requirements, select windows with a SHGC of 0.55 or less. While windows with lower SHGC values reduce summer cooling and overheating, they also reduce free winter solar heat gain.

A low U-factor is useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates.

A low U-factor is 0.40 or less. A low SHGC is the most important window property in warm climates.

A low U-factor is 0.65 or less. A low U-factor is 0.40 or less. A low SHGC is the most important window property in warm climates.
useful during cold days when heating is needed. A low U-factor is also helpful during hot days when it is important to keep the heat out, but it is less important than SHGC in warm climates. Select windows with a U-factor lower than 0.65 and preferably lower than 0.60.

with a SHGC of less than 0.40. A low SHGC is the most important window property in warm climates.

daylight and view. or less.

Source: efficient windows collaborative
Appendix M – Detailed Research of Renewable Energy Technologies

Below were written by our team. It details characteristics, feasibility and examples of every most commonly used renewable energy technology on campus.

Renewable Energy Technologies

The renewable energy technologies discussed in this section will be divided into renewable energy for electricity, renewable energy for space and water heating and renewable energy for vehicle fuel.

Strength of Renewable Energy

- Little to zero GHG emission
- Public health hazard reduction
- Independence on foreign energy sources
- Renewable energy implementation ensures at least 20 years’ continuous energy supply without any future energy price volatility, such as recent fluctuating oil price.
- LEED
  Installing any of the renewable energy systems can earn points of LEED, depending on the category:

<table>
<thead>
<tr>
<th>LEED Category</th>
<th>Maximum Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Buildings</td>
<td>4</td>
</tr>
<tr>
<td>New Construction</td>
<td>3</td>
</tr>
<tr>
<td>Commercial Interiors</td>
<td>1</td>
</tr>
<tr>
<td>Homes</td>
<td>10</td>
</tr>
</tbody>
</table>

Table K- 1 LEED Points Related to Renewable Energy Technologies

Weakness of Renewable Energy

- Renewable energy technologies are still new, not fully developed
- Although the cost of renewable energy plants varies depending on the size of the plan and the type of renewable energy sources used, the general initial cost of renewable energy plants is high.

Renewable Energy for Electricity

In this chapter, we will introduce current renewable energy technologies applicable for campuses to generate their own electricity, which include: Photovoltaic System, Solar Glass, Wind Technology, Fuel Cell Power Plant, Biomass and Renewable Energy Certificates (RECs).

---

208 (HGCI, Renewable Energy)
Photovoltaic (PV) System

Figure K - 1: PV panels


Photovoltaic System is used to convert sun’s energy into electricity. Most application of PV panels on campus is to supply power for one or several buildings, due to PV system’s high initial cost.

The Type of PV:

**Mounted PV**: the most commonly used PV on campus. It is preferable that panels can be placed on the ground, so that during winter snow drift on the panel can be easily swept. If no ground space is available, panels can also be installed on the roofs or the walls of campus buildings.

**Building Integrated PV (BIPV)**: BIPV is designed to put over thermoplastic roofs. BIPV has the merits of being thin, light, flexible and cheaper than mounted PV, but at the same time, BIPV is less efficient than mounted PV.

**Solar Tiles**: Traditional-looking solar tiles, which can be put on roofs of campus buildings to generate powers.

Weakness of PV System

The solar energy is not stable because PV systems stop working during night and cloudy days, due to the lack of sunshine.

The Amount of Electricity PV can Produce:

Normally, 1200 kWh/yr of electricity can be produced from 1 kW mounted PV, which is also equal to about 100 ft² of mounted PV. 816 watts of electricity is produced from every 200 ft² of BIPV panels.

Cost of Installing PV System:

---

209 (HGCI, PV Fact Sheet) (Chicago Solar Partnership)
In general, mounted PV costs approximately $8000 to $12,000 per kilowatt and this cost is before sales tax, any rebates or grants from states

Estimated Life Span: 20-25 years

Issues to Consider before Installing PV System:

Shade. PV arrays are very sensitive to shading. PV system can stop functioning because of only 10% shading. A vendor can take assessment of a campus building roof.

Roof condition. To remove a PV system is costly, so a roof should be in good condition and can support the panels for at least 25 years.

The weight a roof can hold. Usually, the weight of mounted PV ranges from 5 lbs/ ft² to 10 lbs/ ft²; the weight of BIPV is around 12 oz/ ft².

Whether the campus building is historical. PV panels may not be allowed to be installed on historical buildings.

The orientation of the campus building. The campus building is better to face south so that the panels can obtain most sunlight

Case Studies

Butte-Glenn Community College; Shad Hall Photovoltaic Project; Science Center Solar Lamp

Solar Photovoltaic Project. Butte-Glenn Community College
This 1.06 MW, 4 acre PV array consists of 5700 solar panels and is one of the largest solar power projects in the US. It is estimated that this project will result in 1/3 reduction of the college’s utility bill.

- Annual Electricity Generation: 1.6 million KWh/yr
- Installation Cost: $7.4 million and $3.7 million of it were from Pacific Gas & Electric as rebate due to the California law.
- Annual Saving: $300,000
- Payback Time: about 10 years.
- Environmental Impact Reduction: 1,238 tons of carbon dioxide, 870 pounds of nitrous oxide, and 21 pounds of sulfur dioxide annually.\(^{210}\)

Shad Hall Photovoltaic Project. Harvard Business School
A 36kW photovoltaic array was installed on the roof of the Shad Hall in Harvard Business School. It is an off-grid system and avoids the grid failure. It helps with the peak load shedding as the system is most productive during summer days when there is a higher need of air conditioning. It is expected that the PV array will produce 45 MWh /yr of electricity for 20-25 years and at a rate of $0.09/kWh.

- Annual Electricity Generation: 45 MWh /yr for 20-25 years and at a rate of $0.09/kWh.
- Installation Cost: $378,487 in which $129,960 was from grant.

\(^{210}\) (Renewable Energy Access)

505
- Annual Saving: $11,169
- Payback Time: 22.3 years
- Environmental Impact Reduction: totally 203,524 lbs of CO2

**Science Center Solar Lamp**, Harvard University
A street lamp run by PV panel was installed in front of the Science Center in 2006.

- Annual Electricity Generation: The panel produces 2 kWh/d in summer and 0.6 kWh/d in winter.
- Annual Saving: $200
- Environmental Impact Reduction: 1170 lbs of CO2 annually

**Solar Glass**

![Solar Glass Image]

**Figure K-2 Solar Glass**

**Source:** HGCI [http://www.greencampus.harvard.edu/cre/documents/solarglassfactsheet.pdf](http://www.greencampus.harvard.edu/cre/documents/solarglassfactsheet.pdf)

Solar glass, a type of thin-film PV panel glass, can be incorporated into campus buildings’ windows, skylights, awnings, balcony rails and building walls. “It is not a fully transparent glass. Therefore windows or campus building walls that are designed to be tinted or patterned to minimize heat gain and control glare are ideal candidates.” Solar glass can be produced in any transparency based on campus’ demand,

**Cost of Solar Glass:**

Traditional glass costs $20/ft², whereas the solar glass costs $80-$100 excluding the cost of wiring, concealed conduits, and balance-of-system components.

---

211 (HGCI, Category: Photovoltaic Power Generation (1))
212 (HGCI, Solar Lighting System)
213 (HGCI, Solar Glass Fact Sheet)
Estimated Life Span

25 years. The efficiency of solar glasses can be reduced because of the UV light.

Issues to Consider for Installing Solar Glass:

The orientation of windows. When incorporated into campus buildings, solar glasses are better to face south or used on skylights so that the panels can obtain most sunlight.

Manufacturers:

According to HGCI, following is a list of manufactures that produce solar glasses

**Atlantis Energy**
www.atlantisenergy.org

**Dansk**
www.dansksolenergi.dk
Dansk produces a range of glass – from 44 watts (1% light transmission) to 55 watts (10% transmission). Panels cost about 600 Euros each.

**EPV Solar**
www.epv.net
EPV solar produces glass in a range of transparencies for all projects, including windows, glass walls, and balcony railings.

**Schott Solar**
www.us.schott.com
Schott’s solar glass costs $75/square foot for the glass alone (this does not include the framing or shipping from Europe.) The maximum size is 1.2m x 2.4m.

**Spire Solar**
www.spirecorp.com/spire-solar
Spire produces glass for curtain walls, windows, awnings and custom projects.

Case Studies:

Solar Louvers, Red Kite House

**Solar Louvers**, Environment Agency, Red Kite House
Red Kite House is an Environment Agency office in England. On the concave south facade of the building, a louver canopy comprised solar panels. It was expected that the energy derived from the solar louvers will meet 20% of the electricity need in this building and at the same time, the louvers also make the building cooler by reducing the thermal gain from sun. 7749 kg of CO2 saved from this project214

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214 (Merton Rule.org)
**Wind**

Wind turbines installed on campus can convert wind energy into electricity.

**The Type of Wind Turbine:**

**Large Scale Wind Turbine**: more than or equal to 1000kW. Large scale wind turbines are usually used to supply a large amount of powers for campus, such as campus’ half power consumption need.

**Small Scale Wind Turbine which includes Architectural wind turbine**: less than or equal to 100kW. Small scale wind turbine is usually used to supply a small amount of powers for campus, such as the power amount for a single building.

---

215 (HGCI, Architectural Wind Fact Sheet) (Natural Resources Canada) (South East Energy Efficiency Project)
Architectural Wind Turbine: it is a type of small scale turbine which can be installed on the top of campus buildings.

Weakness of Wind Technology:

- Bird issue. Birds are killed by rotor blades.
- The wind energy generation is not stable, which is intermittently productive.
- In some regions, the local authorities prohibit installing wind turbine

Cost of Wind Turbine:

Large scale wind turbine costs approximately $1000 to $2000 per kilowatt. Small scale wind turbine can cost up to $3000 per kilowatt. The price of Architectural wind turbine depends on the type and the capacity of the architectural wind turbine and the vendors. A table from HGCI shows the detail about the price of different architectural turbines:

<table>
<thead>
<tr>
<th></th>
<th>Watts per unit</th>
<th>Price per unit</th>
<th>$/watt</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WIND</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacwind</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seahawk</td>
<td>500</td>
<td>$3,500</td>
<td>7</td>
<td>module only</td>
</tr>
<tr>
<td>Delta 1</td>
<td>2,000</td>
<td>$4,750</td>
<td>2.4</td>
<td>module only</td>
</tr>
<tr>
<td>Delta 2</td>
<td>5,000</td>
<td>$22,000</td>
<td>4.4</td>
<td>module only</td>
</tr>
<tr>
<td>Aeolian</td>
<td>10,000</td>
<td>$35,000</td>
<td>3.5</td>
<td>module only</td>
</tr>
<tr>
<td>Aerotecture</td>
<td>1,000</td>
<td>$15,000</td>
<td>15</td>
<td>module only</td>
</tr>
<tr>
<td></td>
<td>1,800</td>
<td>$21,000</td>
<td>11.7</td>
<td>module only</td>
</tr>
<tr>
<td>AeroVironment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No canopy</td>
<td>6,000</td>
<td>$46,000</td>
<td>7.7</td>
<td>turn key</td>
</tr>
<tr>
<td>With canopy</td>
<td>6,000</td>
<td>$73,000</td>
<td>12.2</td>
<td>turn key</td>
</tr>
<tr>
<td><strong>Skystream 3.7</strong></td>
<td>1,800</td>
<td>$5,400 (12-15K installed)</td>
<td>3</td>
<td>turbine only (not tower)</td>
</tr>
<tr>
<td>Windside</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gus 1</td>
<td>1,000</td>
<td>$4,500</td>
<td>4.5</td>
<td>turbine only (not tower)</td>
</tr>
<tr>
<td>Gus 5</td>
<td>5,000</td>
<td>$22,000</td>
<td>4.4</td>
<td>turbine only (not tower)</td>
</tr>
<tr>
<td>Gus 10</td>
<td>10,000</td>
<td>$35,000</td>
<td>4.3</td>
<td>turbine only (not tower)</td>
</tr>
<tr>
<td><strong>Bergey Excel</strong></td>
<td>10,000</td>
<td>$27,900</td>
<td>2.8</td>
<td>turbine only (not tower)</td>
</tr>
</tbody>
</table>

Table K-2 Price of Different Kinds of Architectural Wind Turbine


Estimated Life Span: 20-25 years

Issues to Consider before Installing Architectural Wind Turbine:
The orientation of the building. It is best to install architectural wind turbines on campus buildings that face wind direction in that region.

The shape of the campus building. Buildings with long axes are also suitable for architectural wind turbines.

Case Studies

Wind turbine at West Central Research and Outreach Center, University of Minnesota; University of Vermont

Wind turbine at West Central Research and Outreach Center, University of Minnesota

In March, 2005, a 1.65 megawatt, 230 feet high wind turbine was installed at the West Central Research and Outreach Center of University of Minnesota and it is expected to provide wind power to the university’s Morris campus (UMM). The minimum wind speed required for this turbine is 7.8 miles/hr at 230 feet height.

- Annual Electricity Generation: 5.6 MkWh, more than half of the UMM electricity usage
- Installation Time: about half a year

University of Vermont

A 10 kilowatt small scale wind turbine was installed on campus. Its main purpose is to provide students a real example to study and research on renewable energy technology. The wind turbine has been included into the university’s three courses.

- Annual Electricity Generation: 3000-5000 KWh/yr
- Installation Cost: $30,000, a matching grant from the Department of Public Safety
- Environmental Impact Reduction: 3,500 to 5,900 lbs/yr of CO2 reduction

Fuel cell

A fuel cell is an electrochemical device deriving powers from chemical reaction of a fuel and an oxidant. The fuel can be hydrogen, hydrocarbon, natural gas, gasoline and alcohol. Fuel cells run on hydrogen are the most commonly used and cleanest application on campus. The only exhaust of hydrogen fueled cell is H2O.

Fuel cell is especially suitable for providing power in remote places, such as campuses in rural areas. This is because that fuel cells do not have moving parts, do not need combustion and can work unattended for very long time.

Strength of Fuel Cell

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216 (West Central Research and Outreach Center)
217 (Wakefield)
218 (Udomi)
- No greenhouse gas emission and the only exhaust is H2O, if the fuel is hydrogen.
- High efficiency, more than 60%
- Direct generation of electricity
- No moving parts
- Unlike wind or solar, fuel cell is reliable
- Unlike wind turbines, fuel cell plant has no to little noise

**Weakness of fuel cell**

- Not price-competitive compared with other renewable energy technologies

**Case Studies**

Fuel Cell Facility in Student Residence, UTM; Fuel Cell Program, Cape Cod Community College

**Fuel Cell Facility in Student Residence**, University of Toronto at Mississauga (UTM)

A solid oxide fuel cell facility was developed by Fuel Cell Technologies Ltd and is used as both power and heat sources for 12 townhouse units at the student residence. This facility consists of four 5-kilowatt (totally 20 kilowatts) solid oxide fuel cell systems. It is on-grid and continues running even if the grid is down. The **Sponsors of this project include** the Government of Canada's Hydrogen Early Adopters Program, UTM, Fuel Cell Technologies Ltd and Air Liquid Canada.

- Project cost: $2 million
- Fuel used: the system will first run on natural gas and later one of the 5-kilowatt fuel cells will operate on hydrogen gas.\(^{219}\)

**Fuel Cell Program**, Cape Cod Community College

A 200 kW phosphoric acid PC25TM fuel cell plant was installed at Cape Cod Community College in 1999. It generates 124 MWh of electricity every month for the college and the thermal energy from plant heats 40,000 ft\(^2\) of library building.

- Fuel used: natural gas, 1243 Mcf used per month
- Environmental Impact Reduction: CO2 emissions is greatly reduced and no Nox and SO2 emissions
- Annual energy saving: $189,319.49 which includes $4,096.00 in demand savings, $148,130.40 in kWh savings and $37,093.09 in heat recovery savings.
- Annual cost associated with fuel cell: $142,629.10 which includes $117,629.10 in gas usage cost and $25,000 in maintenance cost.
- Payback time: 9 years\(^{220}\)

\(^{219}\) (U of T Mississauga)
\(^{220}\) (Cape Cod Community College)
**Biomass**

Please refer to the Biomass section under Multifunctional Renewable Energy Technologies Chapter (Multifunctional Renewable Energy Technologies → Biomass)

**RECs**

Instead of installing renewable energy plants on campus, an institution can choose to purchase Renewable Energy Certificates (RECs) to claim their usage of renewable energy and consequently diminish their GHG emission. RECs may also be called as tradable renewable certificates (TRCs), renewable energy credits, green tags or green tickets. These certificates represent the tradable renewable energy, like the electricity from photovoltaic arrays, which are generated and sold from a utility supplier or a local eligible renewable energy plant (a solar or biomass plant etc.). These certificates are regarded as the attributes of environment, such as reducing the pollution from burning coals or oil and reducing GHG emission due to the utilization of renewable sources.

**Cost of RECs**

According to the Green Power Network, in 2006, the price of RECs ranged from $5 to $90 per MWh and the median was approximately $20. The factors influencing the price of RECs are various, such as the type of renewable power produced the location of the renewable power plant and the situation of supply-demand in that region. In a number of US states, the “regulatory policy of Renewable Portfolio Standard “compliance is also a factor to decide the price of RECs.

**RECs Providers**

Many providers double counted the RECs they sold to their customers. Therefore, before purchasing RECs, campuses should make sure the provider is certified by an authoritative organization. For example, in the US, REC vendors must be certified by Green-e. Green-e certified retailers located in different US regions can be searched on Green-e’s website.

**Case Study**

Harvard University; Western Washington University

**Renewable Energy Purchases** at Harvard University

In fiscal year of 2006, Harvard purchased 24,000 MWh of Renewable Energy Certificates (RECs), which was 7.36% of Harvard’s electricity load and all the certificates were from wind power.

**Student-Funded REC Purchase, Western Washington University**

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221 (American Wind Energy Association)
222 (Great Lake Water Institute)
223 (HGCI, Renewable Energy Purchases at Harvard University)
Western Washington University is the first university in the US that purchases renewable energy certificates with student fee increase per quarter. “In spring 2004, 85% of voting students supported a fee increase of up to $19 per quarter to purchase RECs. In response to the student request, the WWU Board of Trustees approved a Renewable Energy Fee of $1.05 per credit with a maximum of $10.50 per quarter.” This fee increase enables the university to consume electricity 100% from renewable energy.224

Carbon Offset

Renewable Energy for Space and Water Heating

In this chapter, we will introduce current renewable energy technologies applicable for campus space and water heating, which include: Ground-Source Heat Pump (GSHP), Solar Thermal, Bioheat and Biomass.

Ground-Source Heat Pump (GSHP):225

![Campus GSHP System](http://www.greencampus.harvard.edu/cre/documents/GSHPfactsheet.pdf)

In GSHP system, stable heat from earth’s crust is utilized to provide campus with heating, cooling and hot water. It is preferable for those institutions which require both heating and cooling operations, rather than ones need only space heating or only space cooling all over the year. In summer, the GSHP releases the heat from buildings into the earth and in winter, the earth is used as a heat source to provide heating for campus buildings.

Strength of GSHP

- Renewable energy source
- Year-round operation
- One GSHP can provide both heating and cooling, whereas the two separate conventional systems are needed to meet the demand
- GSHP can also provide hot water
- Higher efficiency and less energy usage than conventional HVAC system. Energy cost can be lowered by 20%-50%

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224 (WWU University Communications Office)
225 (HGCI, Ground Source Heat Pumps Fact Sheet) (Consumer Energy Center)
• Preferable than air source heat pump because GSHP’s efficiency and capacity stay the same at temperature extremes
• Green house gas reduction
• Lower maintenance costs
• No noise

Weakness of GSHP

• Installing ground loop is not allowed in some urban areas
• Horizontal loop makes soil dry out

Cost of GSHP

Each ton of capacity of GSHP costs about $2500. Besides, if the system needs to drill vertically underground, the additional cost of drilling is $10,000 to $30,000

Payback Time: Approximately two to ten years.

Life Span: 25 to 50 years

Issues to Consider before Installing GSHP:

The regional climate. Campuses in climate regions that need both heating and cooling are preferable candidates for this technology. This is because unequal loads in summer and wind will lead to a continuous heating or cooling of the ground and this reduces GSHP system’ life span and efficiency.

Case Studies

University of Gloucestershire

University of Gloucestershire
University of Gloucestershire is a university in England. Their Ground-Source Heat Pump system generates 28,000 kWhs of heating annually. This system’s installation Cost is around £30,000, $19480, and it was estimated that 2954 Kg CO2 is reduced each year due to this renewable technology.226

Solar Thermal:227

When an institution considers incorporating solar technologies into campus, solar thermal is the best choice. Unlike PV panels for producing electricity, solar thermal technology is used to convert sun’s energy into heat. PV panels convert at most 18% of collected solar energy into electricity (which is said efficiency is 18%), whereas the efficiency of solar thermal can be as

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226 (University of Gloucestershire)
high as 60%. Moreover, solar thermal is much cheaper and have shorter payback time compared to PV panels.

Solar thermal can be applied to heat campus water (domestic hot water or pool) and provide space heating. The most cost-effective application of solar thermal for campus is recognized to be swimming pool heating. This is because pool water needs lower temperature than space and domestic water heating. Therefore, pool heating can use cheaper unglazed flat plate collectors in the system and then shorten the payback time.

According to the HGCI, in the US, there are already over 300,000 solar heating pools as did the Atlanta Olympic Games. In countries such as Israel and Greece where can gain plentiful sunshine, the implementation of solar thermal have been normalized.

![Figure K-6 Solar Thermal for Domestic and Pool Water Heating](http://www.aegiselectric.com/solar-thermal.htm)

**Cost of Solar Thermal**

**General Cost Analysis:**

Solar thermal systems are generally more expensive than conventional heating systems, but it helps to save institution’s money in long term. According to the US Department of Energy, “On average, if you install a solar water heater, your water heating bills should drop 50%—80%.”

**Cost for Domestic Hot Water Heating**

According to the SOLID solar Inc., a typical solar heating system costs around $60 to $70 per square foot and if both heating and cooling provision are needed, the system costs around $80 per square foot. The total installation cost of a residential solar heating system is between $5,000 (for 2-3 people) to US $9,000 (5-7 people)

**Cost for Pool Water Heating**
According to the US Department of Energy (DOE), “a campus solar pool-heating system costs between $2,000 and $10,000 to buy and install, depending on size. Costs run between $7 to $12 per square foot depending on system design and collection type. This provides a return on investment between 1.5 and 7 years, depending on the cost of the auxiliary energy being displaced.” Besides, solar heating equipment for campus indoor pools is more expensive than outdoor pools.

**Issues to Consider before Installing Solar Thermal System.**

**Site's Solar Resource:** No matter where the campus is located, if the building generally faces south and is not fully shaded, then it could be a good site to apply the solar water heating system

**Payback Time**

For Solar domestic hot water systems, 1.3 to 4 years  
For solar pool water systems, 1.5 and 7 years

**Life Span of Solar Thermal Systems**

20-25 years or more

**Case Studies**

Guilford College, NC

**Guilford College, NC**  
In 2007, Guilford College spent about $30,000 to install 12 solar panels on the roof of its Shore Hall. This solar heating system is able to heat all the water in this building (over 650 gallons of water per day), which equals to the amount of water use of nine homes. It is estimated that more than US $86,000 will be saved from this system during its life.²²⁸

**Bioheat(Biodisel)**

Please refer to the Bioheat section under Multifunctional Renewable Energy Technologies Chapter  
(Multifunctional Renewable Energy Technologies → Biodisel → Bioheat)

**Biomass**

Please refer to the Biomass section under Multifunctional Renewable Energy Technologies Chapter  
(Multifunctional Renewable Energy Technologies → Biomass)

**Carbon Offset**

²²⁸ (HGCI, Solar Thermal Opportunities for Harvard)
Renewable Energy for Vehicle Fuel

In this chapter, we will introduce current renewable fuels and technologies applicable for campus fleets, which include: Hybrid, Biofuel (Biodiesel), Electric and Fuel cell. Based on research, hybrid and biodiesel vehicles are the preferable choices for campus to apply to their fleet and fuel cell vehicle has been one of the “hottest” research theme in institutions.

A chart from Harvard University compares the grams of GHG produced from different types of vehicle fuels.

![GHG Emissions / Mile for a Passenger Car](http://www.greencampus.harvard.edu/cre/documents/DaveHarris_biodiesel.pdf)

From the chart above we can see that renewable fuels, which include BD20, diesel hybrid, electric and BD100, greatly lower the emission of GHG.

**Hybrid Vehicle**

Hybrid vehicle is an automobile that uses both electric motor and diesel internal combustion engine (or gasoline compression ignition engine) for propulsion. Different from pure electric vehicles which need plug-in charging, hybrids has an on board system to recharge the battery during driving. Some hybrid vehicles use very efficient internal combustion engine all the time.

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229 (Intellichoice)
and use electric motor to give a boost; some hybrid cars use electric motor with low speed driving, use regular engine with high speed driving and use both under certain conditions.

**Strength of Hybrid Vehicle**
CO2 emissions reduction. On average, a hybrid vehicle emits 3.5 to 4.1 metric tons of CO2, which is lower than the recommended level by the US Environmental Protection Agency (EPA), 5.5 metric tons.

**The Cost of Hybrid Vehicles:**
Toyota and Honda are the two main manufacturers of gasoline-electric hybrid cars. The suggested retail price from them is about $20000.

**Case Study**
Oberlin College

**Hybrid Vehicles, Oberlin College**
In 2005, two Ford Escape hybrid SUVs were brought to the Office of Safety and Security of Oberlin College. “These gas/electric vehicles offer 41% better fuel economy than the standard 4 cylinder gas engine and are well suited to the sort of stop and go driving that the Safety and Security office does” 230

**Biofuel/BiodieselVehicle**
Please refer to the Biofuel section under Multifunctional Renewable Energy Chapter (Multifunctional Renewable Energy→ Biodiesel→ Biofuel)

**Electric Vehicle** 231
An electric vehicle is powered by electricity via an electric motor and the electricity is stored in rechargeable battery packs.

**Strength of Electric Vehicle:**

- Better performance. According to DOE, “electric motors provide quiet, smooth operation and stronger acceleration and require less maintenance than internal combustion engines (ICEs).”
- Electric motors are more efficient. The energy conversion efficiency of electric motors is as high as 75%, whereas the ICEs’ is only 20%.
- Environmental benefit. No tailpipe pollution and if the electricity used is from renewable energy plants such as wind turbine, there is no air pollution, too.

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230 (Oberlin College)
231 (Fueleconomy.gov, Fuel Cell Vehicles) (DOE, Electric Vehicles)
Weakness of Electric Vehicle
- Long time recharging—4-8 hours
- Limited driving distance. Before recharging, electric vehicles can only drive 150 miles, whereas gasoline fueled vehicles is able to drive more than 300 miles.
- High price of large battery packs and the battery packs usually needs to be changed for times.

Case Study
Oberlin College

Electric Vehicle, Oberlin College
In 2005, a plug-in electric vehicle--Tiger Star cargo van was brought to Oberlin College for mail delivery.232

Fuel Cell Vehicle233
Fuel cell is an emerging technology. It propels the vehicles by creating electricity through the chemical reaction between hydrogen and oxygen. According to DOE, besides pure hydrogen gas, fuel cell vehicles can also be fueled with “hydrogen-rich fuels, such as methanol, natural gas, or even gasoline; but these fuels must first be converted into hydrogen gas by an onboard device called a ‘reformer’”

An article from DOE commented on the future of fuel cell, “Although they are not expected to reach the mass market before 2010, fuel cell vehicles (FCVs) may someday revolutionize on-road transportation.”...“This emerging technology has the potential to significantly reduce energy use and harmful emissions, as well as our dependence on foreign oil. FCVs will have other benefits as well.” Research on FCVs has been one of the “hottest” topic in institution.

Strength of Fuel Cell Vehicle:
- High efficiency. Fuel cell vehicles can be two to three more efficient than internal combustion engine vehicles.
- Abundant sources of hydrogen.
- Environmentally harmful emission reduction. Fuel cell vehicle emits only water and heat.

Weakness of Fuel Cell Vehicle:
- This technology is still underdeveloped.
- For institution, fuel cell is very expensive to be applied into fleets.

The Cost of Hydrogen Fuel

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232 (Oberlin College)
233 (Fuelcells.org, Hydrogen Basics) (Fueleconomy.gov, Fuel Cell Vehicles)
According to the U.S. Department of Energy's Hydrogen, Fuel Cells & Infrastructure Technologies Program, “by 2005, the technology will be available to produce hydrogen at the pump for $3.00 per gallon gasoline equivalent, and DOE wants to validate this technology by 2008. By 2010, the price goal is US $1.50 per gallon of gasoline equivalent (untaxed) at the station.”

Hydrogen Fueling Station

![Hydrogen Station](image)

**Figure K-8 Hydrogen Station for Fuel Cell Vehicles**

**Source:** DOE [http://www.afdc.energy.gov/afdc/fuels/hydrogen_stations.html](http://www.afdc.energy.gov/afdc/fuels/hydrogen_stations.html)

In the U.S, most of the hydrogen fueling stations are distributed within California. The Online Fuel Cell Information Resource website gives a list of all the stations worldwide.234

**Case Study**

Georgetown University

**Georgetown University**

Georgetown University has researched on the application of fuel cell technology to transit buses for more than 20 years. Its Generation II Fuel Cell Bus Program produced two fuel cell powered transit buses and this program was funded by the US Federal Transit Administration.235

**Multifunctional Renewable Energy Technologies**

In this chapter, we will introduce renewable technologies applicable for more than one area (areas of electricity generation, space and water heating generation and vehicle fuels), which include: Biodiesel, Biomass and CO₂ Offsets.

**Biodiesel**236

Biodiesel is a type of oil made from soybean, palm, canola and even used vegetable oil. It can be blended with all kinds of heating oil and diesel. Therefore, biodiesel is applicable both in campus heating (Name “bioheat” replaces “biodiesel” for heating application of biodiesel) and in campus fleet fueling (Name “biofuel” replaces “biodiesel” for vehicle fuel application of biodiesel).
biodiesel). When biodiesel is used for heating, it replaces the #2 or #6 heating oils and when biodiesel is used as a fuel for vehicle, it replaces the diesel fuel.

Bioheat

Bioheat is a mixture of biodiesel and heating oil. Biodiesel can be mixed with various heating oil such as #2 and #6 heating oil. “B5”, “B20” or “B100”, symbols of bioheat, indicate the percentage of biodiesel within the mixed oil, which is 5%, 20% or 100% of biodiesel. Bioheat with 20% or less biodiesel can be used in any conventional boiler and at the same time, efficiency, cleanliness and lubricity of the burning in boiler is improved. Therefore, if an institution has utilized central boiler to heat campus, replacing regular heating oil with bioheat is one of ideal ways to increase campus’ renewable energy usage.

Strength of Bioheat

- A non-toxic, biodegradable, and renewable energy source
- Conventional burner can be used with B20 or less.
- Dependence on imported oil will be lessened
- Environmental benefits. Instead of using heating oil, bioheat can greatly reduce the emission of NOx, SOx, CO, smoke, hydrocarbons, and particulates. A table from HGCI shows the environment benefits of B20 compared to #2 heating oil.

Emissions Reductions: B20 compared to #2 fuel oil

<table>
<thead>
<tr>
<th></th>
<th>NOx</th>
<th>SOx</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>B20 in a commercial boiler</td>
<td>6% reduction</td>
<td>-</td>
<td>6% reduction</td>
</tr>
<tr>
<td>B20 in a residential boiler</td>
<td>6% reduction</td>
<td>-</td>
<td>9% reduction</td>
</tr>
<tr>
<td>B20 and low sulfur highway diesel: mix of boilers</td>
<td>20% reduction</td>
<td>83% reduction</td>
<td>No change</td>
</tr>
<tr>
<td>B20 in Rhode Island school boilers</td>
<td>19% reduction</td>
<td>18% reduction in sulfur</td>
<td>No change</td>
</tr>
</tbody>
</table>

Table K- 3 Emissions Reductions: B20 Compared to #2 Heating Oil

Cost of Bioheat

237 (HGCI, Bioheat Fact Sheet)
HGCI research shows, “heating oil prices have increased by 64% over the past three years… In August 2007, Mass Energy’s (a discount oil provider) price of B20 bioheat was 5 cents per gallon less than #2 heating oil” Besides, bioheat price is much more stable than regular fuel oil and its price will decrease as more bioheat distributors appear.  

*Issues to Consider before Utilizing Bioheat*

**The type of bioheat applied.** The campus boiler needs to be retrofitted when fueled with bioheat greater than B20.  

**Case Study**

Middlebury College  

**Middlebury College**

All the heating oil used in Middlebury College’s furnaces was replaced by bioheat B20—a blend of 20% vegetable oil and 80% #2 heating oil. Before this switch, a test burning of B20 was conducted in 21 Middlebury buildings and the result showed that B20 worked very well with different heating equipment.  

**Biofuel**

Biofuel is a mix of biodiesel and petroleum diesel. Similar to bioheat, “B5”, “B20” or “B100”, symbols of biofuel, indicate the percentage of biodiesel within the mixed diesel, which is 5%, 20% or 100% of biodiesel. B20 or less can be put directly into conventional engines. Therefore, if an institution has fleet fueled with petroleum diesel, replacing regular diesel with biofuel is one of ideal ways to increase campus’ renewable energy usage.  

**The Type of Biofuel**

**Biodiesel Blend** (such as B5, B20)

Biodiesel blend is able to be put directly into the regular diesel engine

**Straight Vegetable Oil (SVO)—B100**

Vehicle diesel engine needs to be retrofitted to use SVO. Because SVO has to reach a certain temperature to be used, petroleum diesel is required at the first and last 10-15 minutes of a trip.  

Schools benefit a lot from SVO technology as waste vegetable oil in dining hall is reused.

**Strength of Biofuel**

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238 (Middlebury College)  
239 (HGCI, BIOFUELS AT HARVARD )
• A non-toxic, biodegradable, and renewable energy source
• Environmental benefit. Instead of petrodiesel, using biofuel can greatly save the GHG emission and pollutant production. For example, B20 reduces CO2 emission by 15.66% and hydrocarbon emission by 30% and simultaneously, the amount of CO, SOx, smoke and particulates are all evidently reduced.

Case Study

B20 in Diesel Powered Vehicles and Straight Vegetable Oil in Recycling Truck, Harvard University

B20 in Diesel Powered Vehicles and Straight Vegetable Oil in Recycling Truck, Harvard University
In 2004, 25 diesel vehicles in Harvard’ fleet started to be fueled with biofuel B20—a blend of 20% soybean oil and 80% regular diesel oil. In 2006, a recycling truck in Harvard was retrofitted and started running on straight waste vegetable oil from Harvard’s Annenberg Dining Hall. This vegetable oil-fueled truck was commented that its exhaust smells much better!240

Biomass

Biomass technology produces energy by burning biological products, such as agriculture waste and dead trees. It can be used to produce electricity, provide space heating and heat water for campus. According to HGCI, biomass is the most commonly used renewable energy technology in the world. In the US, biomass generates 1-2% of the US’ electricity.

Strength of Biomass

• In most place of North America, biomass is continuous supply and locally available. The founding director of HGCI, Leith Sharp compared the wood in northeast America to the oil in the Middle East. She said biomass can grow quickly in the northeast US and is an important tool to drive down the northeast region’s GHG emission.

• Unlike solar and wind, biomass is reliable source of renewable energy.
• Ash produced from coal burning is harmful to human’s health, whereas biomass ash is nontoxic and can be used as a soil amendment

Sustainability of Biomass

CO2 is absorbed when plants grew and is released when plants are burned to provide energy—this process produces no net release of CO2, so because of this fact, biomass is commonly regarded as to be carbon neutral.

Cost of Biomass

240 (HGCI, BIOFUELS AT HARVARD )
241 (HGCI, Biomass Fact Sheet)
Biomass is an ideal renewable energy for campus to use. Not only because it can simultaneously supply power and heating, biomass is also a cheaper and more stable energy source compared to other fuels. For example, in the Northeast America, wood chips are 2-2.5 times cheaper than oil and gas and 8-10 times cheaper than electric heat. The price of biomass has been very steady for 20 years because it is not linked to the global instability.

Case Study

Middlebury College

Wood Chip Fired Biomass Plant, Middlebury College
A wood chip fired biomass plant was installed at Middlebury College, which ends Middlebury’s history of using one million gallons of #6 fuel oil as fuel source every year. This plant cost $11 million and was funded by state grants and loans. It was estimated that Middlebury will consume 20000 to 21000 tons of wood chips annually and 12500 metric tons of GHG emission will be reduced each year.

- Installation Cost: $11 million, from state grants and loans
- Installation time: spring 2007 to fall 2008.
- Environmental Impact Reduction: totally 12500 metric tons of GHG emission

CO2 Offsets

To achieve carbon neutrality is a goal for many institutions. However, in reality, GHG cannot always be avoided due to certain circumstances or time limitation. “A carbon offset is a payment that a purchaser makes to counter balance his or her GHG emissions” and this payment will go to projects which will result in reducing emission. In this way, institutions are able to compensate their GHG release into the atmosphere.

Usually, there are three types of carbon offset projects which can be invested: 1. Renewable energy projects, 2. Energy efficiency projects, 3. Biological sequestration projects, such as reforestation or land use change. Renewable energy and energy efficiency projects are considered to be the best types of offsets, such as the projects of methane capture, wind turbine. Reforestation projects are not recommended because it is hard to know how carbon is stored in forests over the long term.

Weakness of Offset:

Offset market is new and no strict standards have been developed.

Cost of CO2 Offsets

Tons of CO2 reduced are sold as carbon offsets and cost of highest quality offsets ranges from US cost $15 to $19 per ton.

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242 (HGCI, Biomass Fact Sheet)
243 (HGCI, Carbon Offsets Fact Sheet)
How to Choose the Offset

When an institution considers buying offsets, there are at least two aspects they have to notice first to ensure the quality of the carbon offset. One is whether the offset is “additional”, the other is whether the offset has been certified and by whom.

Additionality

The general process of carbon offset is that an offset purchaser pays for offset projects so that the projects can be completed which result in GHG emission reduction. The additonality test can help to determine if the projects would have been able to happen without the payment from offset purchaser. If the test answer to a project is yes, the project is determined to be not additional.

Recommended Certifiers

The responsibility of an offset certifier includes assessing additionality, assessing the quality of offset sold by project and determining whether the offsets are being double counted. According to HGCI, the Gold Standard is the most rigorous carbon offset verifier. Gold Standard is an international non government organization (NGO) and they audited additionality of carbon offset using the United Nation’s additionality protocol. Gold Standard verified carbon offsets are recognized to have the highest quality.

Carbon Offset and Renewable Energy Certificates (RECs)

There is still not a clear answer that whether Renewable Energy Certificates (RECs) belong to Carbon Offset or not. According to the Gold Standard Foundation, a commonly accredited international NGO certifier for carbon offset, RECs cannot be considered as an appropriate offset tool, because of the lack of additionality testing to RECs.

Case Study

Allston Campus, Harvard University

Allston Campus, Harvard University
In Allston campus’ Sustainable Design Guidelines, it stated that 13% of the total energy consumed by Allston campus will be from carbon offsets, which are certified by the Gold Standard, a commonly accredited international NGO certifier for carbon offset.244

244 (Sharp, The Harvard Green Campus Initiative: A Case Study in Organizational Change for Sustainability, 2008)
Appendix N – Renewable Energy Potential Maps

This Appendix is the collection from different sources about the renewable energy potential maps. It might help the institutions decide whether or not renewable energy is an option.

Figure 24: Geothermal Source Potential in the US
Source: Geotherma.info  http://geotherma.blogspot.com/2008/08/geothermal-energy-companies-including.html

From this US geothermal map, institution is able to decide if their campus is within the region with good geothermal source.

Figure 25: Geothermal Source Potential in Canada
Source: Geotherma.info  http://geotherma.blogspot.com/2008/08/geothermal-energy-companies-including.html
From this Canada geothermal map, institution is able to decide if their campus is within the region with good geothermal source.

**Figure 26: Biomass Source Potential in the US**  
**Source:** Princeton University  

From this US biomass map, institution is able to decide if their campus is within the region with good biomass source.

**Forest Regions and Principal Tree Species**
**Figure 27: Biomass Source Potential in Canada**

**Source:** Natural Source Canada [http://cfs.nrcan.gc.ca/subsite/oldgrowth/maps](http://cfs.nrcan.gc.ca/subsite/oldgrowth/maps)

From this Canada biomass map, institution is able to decide if their campus is within the region with good biomass source.
Appendix O – Tufts’ sustainability commitment

This Appendix was developed by Tuft University and is used for references purposes.

“We, the Tufts University community, affirm our belief that university faculty, staff, and students have a responsibility to take a leadership role in conducting activities as responsible stewards of the physical environment and using educational activities to promote environmental awareness, local action, and global thinking.

In our university functions, Tufts University will strive to:
• conserve natural resources and support their sustainable use;
• conduct affairs in a manner that safeguards the environmental health and safety of students, faculty, staff, and communities;
• reduce the use of toxic substances and the generation of wastes and to promote strategies to reuse and recycle those wastes that cannot be avoided;
• purchase renewable, reusable, recycled, and recyclable materials;
• conduct our business practices in accordance with this policy.

In our education and research missions, Tufts University will strive to:
• foster an understanding of and a responsibility for the physical environment;
• ensure that individuals are knowledgeable about the environment and health issues that affect their discipline;
• encourage environmental research;
• conduct research and teaching in an environmentally responsible way;
• provide a forum for the open flow of information among governments, international organizations, industry, and academia to discuss and study environmental issues and their relationship to other social issues.

In our student and employee relations, Tufts University will strive to:
• delineate individual responsibility and guide action for ensuring safety and minimizing adverse environmental impacts in the implementation of this policy.

Tufts will consider full compliance with the law to be the minimally acceptable standard and will exercise whatever control is reasonable and necessary to avoid harm to public health and the environment, whether or not such control is required by regulations.

Tufts will initiate, promote, and conduct programs that fully implement this policy throughout the university and global community.”

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245 (Tufts University)
Appendix P – Green Roof Design Analysis

This Appendix was developed by our team to illustrate the analysis of Salisbury Lab green roof design. It included the hand calculation, drawings and tables to show the procedure of design.

Water Runoff Reduction

Equation 1 was used to determine the peak runoff rate without and with various green roof designs, using a rainfall intensity of 3.18 mm/hr. The total area of the roof is 1115 m². The total area of the green roof that would be laid is 868 m². The area not covered by the green roof is 246 m². Using a runoff coefficient of 0.80 for the roof, the current water runoff for the given intensity is 2.86 m³/hr. Table 3 shows the reduction of peak runoff rate achieved with various green roof designs.

<table>
<thead>
<tr>
<th>Type of Greening</th>
<th>Thickness (cm)</th>
<th>Form of vegetation</th>
<th>Peak Runoff Rate (m³/hr)</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive</td>
<td>2 - 4</td>
<td>Moss-sedum</td>
<td>2.30</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>4 - 6</td>
<td>Sedum-moss</td>
<td>2.16</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>6 - 10</td>
<td>Sedum-Moos-herb</td>
<td>2.03</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>10 - 15</td>
<td>Sedum-herb-grass</td>
<td>1.89</td>
<td>34%</td>
</tr>
<tr>
<td></td>
<td>15 - 20</td>
<td>Grass-herb</td>
<td>1.75</td>
<td>39%</td>
</tr>
<tr>
<td>Intensive</td>
<td>15 - 25</td>
<td>Lawn-perennial-small shrub</td>
<td>1.75</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>25 - 50</td>
<td>Lawn-perennial-shrub</td>
<td>1.47</td>
<td>49%</td>
</tr>
<tr>
<td></td>
<td>50 - 50</td>
<td>lawn-perennial-shrub-tree</td>
<td>0.91</td>
<td>68%</td>
</tr>
</tbody>
</table>

The cost range of installing an extensive or an intensive, green roof design for an area of 868 m² is shown in table 3.

<table>
<thead>
<tr>
<th>Extensive Green Roof</th>
<th>Cost range for this project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design &amp; Specification</td>
<td>$10,076.48 - $39,263.52</td>
</tr>
<tr>
<td>Project Administration &amp; Site Review</td>
<td>$5,038.24 - $19,631.76</td>
</tr>
<tr>
<td>Re-roofing with root-repelling membrane</td>
<td>$86,866.20 - $138,985.92</td>
</tr>
<tr>
<td>Green Roof System</td>
<td>$47,776.41 - $95,552.82</td>
</tr>
<tr>
<td>Plants</td>
<td>$9,555.28 - $27,797.18</td>
</tr>
<tr>
<td>Installation/Labor</td>
<td>$27,797.18 - $74,704.93</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$11,292.61 - $18,241.90</td>
</tr>
</tbody>
</table>
Irrigation System $18,241.90 $37,352.47

Total $216,644.30 $451,530.51

### Intensive Green Roof

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost Range For This Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design &amp; Specification</td>
<td>$18,806.53 - $250,956.45</td>
</tr>
<tr>
<td>Project Administration &amp; Site Review</td>
<td>$9,403.27 - $125,478.23</td>
</tr>
<tr>
<td>Re-roofing with root-repelling membrane</td>
<td>$86,866.20 - $138,985.92</td>
</tr>
<tr>
<td>Green Roof System</td>
<td>$138,985.92 - $277,971.84</td>
</tr>
<tr>
<td>Plants</td>
<td>$46,907.75 - $1,867,623.30</td>
</tr>
<tr>
<td>Installation/Labor</td>
<td>$73,836.27 - $169,389.09</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$11,292.61 - $18,241.90</td>
</tr>
<tr>
<td>Irrigation System</td>
<td>$18,241.90 - $37,352.47</td>
</tr>
<tr>
<td>Total</td>
<td>$404,340.44 - $2,885,999.20</td>
</tr>
</tbody>
</table>

Using the density of 292.6 kg/m³, the volume and weight of the green roof is summarized in table 16.

### Table 19: Volume and Weight of Green Roof

<table>
<thead>
<tr>
<th>Type of Greening</th>
<th>Thickness (cm)</th>
<th>Volume of Soil Required (m³)</th>
<th>Weight of Green Roof (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive</td>
<td>2 - 4</td>
<td>17.37 - 34.75</td>
<td>5083.41 - 10166.82</td>
</tr>
<tr>
<td></td>
<td>4 - 6</td>
<td>34.75 - 52.12</td>
<td>10166.82 - 15250.23</td>
</tr>
<tr>
<td></td>
<td>6 - 10</td>
<td>52.12 - 86.87</td>
<td>15250.23 - 25417.05</td>
</tr>
<tr>
<td></td>
<td>10 - 15</td>
<td>86.87 - 130.30</td>
<td>25417.05 - 38125.58</td>
</tr>
<tr>
<td></td>
<td>15 - 20</td>
<td>130.30 - 173.73</td>
<td>38125.58 - 50834.10</td>
</tr>
<tr>
<td>Intensive</td>
<td>15 - 25</td>
<td>130.30 - 217.17</td>
<td>38125.58 - 63542.63</td>
</tr>
<tr>
<td></td>
<td>25 - 50</td>
<td>217.17 - 434.33</td>
<td>63542.63 - 127085.25</td>
</tr>
<tr>
<td></td>
<td>50 - 50</td>
<td>434.33 - 434.33</td>
<td>127085.25 - 127085.25</td>
</tr>
</tbody>
</table>
Structure Design of Salisbury Lab Roof

Concrete Design: Greenroof Structure

1. Extensive greenroof: 0.66 ft thickness (20 mm) = 11.98 lb/ft²

- Dead load:
  - Concrete slab: 150 x \( \frac{8}{12} \) = 50 psf
  - Green roof (fully saturated): \( \frac{11000 \times 25}{9550 \times 2} \) = 11.98 psf
- Live load:
  - Snow load: 20 psf
Design for $E_{1}$

\[ w_i = 1.2 \times \left[ (50 + 11.92) \times 5 \right] \times 1.6 \times (20 \times 5) = 30.8 \times 5 \times \text{lb/ft} \]

\[ M_i = \frac{30.8 \times 5 \times 54^2}{8} = 44.2 \times \text{ft-lb} \]

Assume $a = 2\text{in}$  \( \Rightarrow \) $Y_1 = 0 \text{in}$, $Y_2 = 3\text{in}$

- $W10 \times 12$ ($A = 3.54 \text{in}^2$, $I = 58.8 \text{in}^4$)

Checking

\[ \Sigma d_m = 3.54 \times 10 = 35.4 \text{in} \]

\[ a_{required} = \frac{\Sigma d_m}{0.85 \times 60} = \frac{174}{0.85 \times 60} = 0.84 \text{in} \]

\( \Rightarrow Y_1 = 0 \)

\[ Y_2 = 9 - \frac{0.84}{2} = 3.56 \text{in} \]

\[ P = P_{\text{min}} + \left( \frac{0.966}{0.5} \right) (12.8 - 3.56) = 11.79 \times 4.96 \approx 90 \]

\( \Rightarrow B_{d1} = W10 \times 12 \)

Design for $E_2$

\[ \frac{1}{1} \]

\[ 90 \]

\[ 35' \]
Same Procedure: \( E_2 = W10 \times 12 \)

- Typical beam: \( W10 \times 12 \)

Design for exterior girder

* Girder \( G_a \)

\[
DL = 50 \times 19.5 + 11.62 \times 19.5 + \frac{12 \times 19.5 \times 5}{80} = 1119.65 \text{ kips}
\]

\[
LL = 20 \times 19.5 = 390 \text{ kips}
\]

\[
W_u = 1.2 \times 1119.65 + 1.6 \times 560 = 1903.5 \text{ kips}
\]

\[
M_u = \frac{1903.5 \times 50^2}{2} = 214.15 \text{ kips ft}
\]

Assume \( a = 2 \text{ ft} \) \( \Rightarrow y_1 = 2 \text{ ft} \) \( \Rightarrow y_2 = 3 \text{ ft} \)

Try \( W12 \times 22 \) \( (A = 6.44) \)

\[
E_a = A \gamma_y = 6.44 \times 50 = 322 \text{ kips}
\]

\[
\text{Required} = \frac{\sum M_u}{b_c} \frac{0.25 \gamma_c y_c}{0.82(4)} = 1.06
\]

\[
y_c = 4 - \frac{1.06}{2} = 3.47
\]

\[
M_u = 223 + \left( \frac{0.5^2}{12} \right) (235 - 223) = 234.25 \text{ kips ft} > 214.15 \Rightarrow OK
\]

\( G_a = W12 \times 22 \)

* Girder \( G_b \)

\[
DL = (50 + 11.62) \times 15 + 3 \times 12 = 965.7 \text{ kips}
\]

\[
LL = 20 \times 15 = 300 \text{ kips}
\]

\[
W_u = 1.2 \times 965.7 + 1.6 \times 560 = 1938.84 \text{ kips}
\]

\[
M_u = \frac{1938.84 \times 50^2}{2} = 250.95 \text{ kips ft}
\]
Assume $n = 2$ so $Y_1 = 0$, $Y_2 = 3.5$

1. Try $W12 \times 26$ ($A = 7.65$ in$^2$)

\[ \Sigma M_u = A_y F_y = 7.65 \times 50 = 382.5 \text{ in-lb} \]

\[ \text{required} = \frac{291}{0.85(4)} = 1.07 \text{ in-lb} \]

\[ Y_2 = \frac{4}{2} = 3.405 \]

\[ \phi_3 M_u = 261 - \left( \frac{0.465}{0.85} \right) (276 - 261) = 279.35 > 250.35 \text{ in-lb} \]

2. Typical exterior girder: $W12 \times 26$

Design for interior girder

\[ \text{Girder} \]

\[ \text{DL} = (50 + 11.8 \times 30) + 6 \times 12 = 1981.4 \text{ lb/ft} \]

\[ LL = 20 \times 30 = 600 \text{ lb/ft} \]

\[ W_{u} = 1.2 \times 1981.4 + 1.6 \times 600 = 3277.6 \text{ lb/ft} \]

\[ M_u = \frac{3.277 \times 36^2}{8} = 502.73 \text{ ft-lb} \]

Assume $a = 2$ in so $Y_1 = 0$, $Y_2 = 3.5$

1. Try $W18 \times 40$ ($A = 11.8$ in$^2$)

\[ \Sigma M_u = A_y F_y = 11.8 \times 50 = 590 \]

\[ \text{required} = \frac{590}{0.85(4)} = 1.65 \text{ in} \]

\[ Y_2 = \frac{4}{2} = 3.175 \text{ in} \]

\[ \phi_3 M_u = 527 + \left( \frac{590}{15} \right) (590 - 527) = 534.7 > 501.79 \text{ in-lb} \]

\[ = W18 \times 40 \]

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Girder E2,4

\[ D_k = (30 + (1.98) \times 3.5) + \frac{52.8 \times 24.5}{30} = 2807.3 \]

\[ L_1 = 20 \times 34.5 = 690 \text{ in} \]

\[ W_n = 1.2 \times 2207.31 + 1.0 \times 690 = 3062.31 \]

\[ M_n = \frac{8.35 \times 36^2}{8} = 921.8 \text{ k-in} \]

Assume \( a = 2 \text{ in} \Rightarrow \gamma_2 = 57\) \( \gamma_2 = 0 \)

\[ \gamma_2 = 4 \Rightarrow \frac{1.54}{2} = 8.18 \text{ in} \]

\[ M_0 = 457 + \left( \frac{12}{12} \right) \left( 477 - 457 \right) = 464.2 \Rightarrow 421.8 \text{ k-in} \]

\[ \Rightarrow W18 \times 3.5 \]

\[ \Rightarrow \text{Typical Interior girder} : W18 \times 3.5 \]

Intensive greenroof: 1.64 ft (50 cm) thickness: 0.15 in/ft²

Same procedure as for extensive greenroof except the weight of the greenroof is 20.96 lb/ft² instead of 11.98 lb/ft²

Typical beam: W10 x 12
Typical exterior girder: W12 x 30
Typical interior girder: W18 x 46

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## Conclusion

<table>
<thead>
<tr>
<th></th>
<th>Extension greenroof</th>
<th>Intensive greenroof</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical beam (15&quot;)</td>
<td>W10 x 12</td>
<td>W10 x 12</td>
</tr>
<tr>
<td>Typical exterior joist (18&quot;)</td>
<td>W12 x 2c</td>
<td>W12 x 30</td>
</tr>
<tr>
<td>Typical interior joist</td>
<td>W18 x 40</td>
<td>W18 x 40</td>
</tr>
</tbody>
</table>
Cost of the Structural construction

The cost to construct the roof framing system that can support the extensive green roof with 0.66ft (20cm) thickness is presented in the Table 17

Table 20: Roof framing construction cost (extensive green roof)

<table>
<thead>
<tr>
<th>Member size</th>
<th>Member length</th>
<th>Number of members</th>
<th>Total linear feet</th>
<th>Unit cost (LF)</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>W10x12</td>
<td>35</td>
<td>10</td>
<td>350</td>
<td>$25.50</td>
<td>$8,925.00</td>
</tr>
<tr>
<td>W10x12</td>
<td>34</td>
<td>48</td>
<td>1632</td>
<td>$25.50</td>
<td>$41,616.00</td>
</tr>
<tr>
<td>W12x26</td>
<td>30</td>
<td>8</td>
<td>240</td>
<td>$41.00</td>
<td>$9,840.00</td>
</tr>
<tr>
<td>W12x26</td>
<td>35</td>
<td>2</td>
<td>70</td>
<td>$41.00</td>
<td>$2,870.00</td>
</tr>
<tr>
<td>W12x26</td>
<td>34</td>
<td>4</td>
<td>136</td>
<td>$41.00</td>
<td>$5,576.00</td>
</tr>
<tr>
<td>W12x26</td>
<td>25</td>
<td>2</td>
<td>50</td>
<td>$41.00</td>
<td>$2,050.00</td>
</tr>
<tr>
<td>W18x40</td>
<td>35</td>
<td>1</td>
<td>35</td>
<td>$61.00</td>
<td>$2,415.00</td>
</tr>
<tr>
<td>W18x40</td>
<td>34</td>
<td>8</td>
<td>272</td>
<td>$61.00</td>
<td>$16,592.00</td>
</tr>
<tr>
<td>W18x40</td>
<td>30</td>
<td>6</td>
<td>180</td>
<td>$61.00</td>
<td>$10,980.00</td>
</tr>
<tr>
<td>W18x40</td>
<td>25</td>
<td>1</td>
<td>25</td>
<td>$61.00</td>
<td>$1,525.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>$102,109.00</strong></td>
</tr>
</tbody>
</table>

The cost to construct the roof framing system that can support the intensive green roof with 1.64ft (50cm) thickness is presented in the Table 18

Table 21: Roof framing construction cost (intensive green roof)

<table>
<thead>
<tr>
<th>Member size</th>
<th>Member length</th>
<th>Number of members</th>
<th>Total linear feet</th>
<th>Unit cost (LF)</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>W10x12</td>
<td>35</td>
<td>10</td>
<td>350</td>
<td>$25.50</td>
<td>$8,925.00</td>
</tr>
<tr>
<td>W10x12</td>
<td>34</td>
<td>48</td>
<td>1632</td>
<td>$25.50</td>
<td>$41,616.00</td>
</tr>
<tr>
<td>W12x30</td>
<td>30</td>
<td>8</td>
<td>240</td>
<td>$47.25</td>
<td>$11,340.00</td>
</tr>
<tr>
<td>W12x30</td>
<td>35</td>
<td>2</td>
<td>70</td>
<td>$47.25</td>
<td>$3,307.50</td>
</tr>
<tr>
<td>W12x30</td>
<td>34</td>
<td>4</td>
<td>136</td>
<td>$47.25</td>
<td>$6,426.00</td>
</tr>
<tr>
<td>W12x30</td>
<td>25</td>
<td>2</td>
<td>50</td>
<td>$47.25</td>
<td>$2,362.50</td>
</tr>
<tr>
<td>W18x46</td>
<td>35</td>
<td>1</td>
<td>35</td>
<td>$69.00</td>
<td>$2,415.00</td>
</tr>
<tr>
<td>W18x46</td>
<td>34</td>
<td>8</td>
<td>272</td>
<td>$69.00</td>
<td>$18,768.00</td>
</tr>
<tr>
<td>W18x46</td>
<td>30</td>
<td>6</td>
<td>180</td>
<td>$69.00</td>
<td>$12,420.00</td>
</tr>
<tr>
<td>W18x46</td>
<td>25</td>
<td>1</td>
<td>25</td>
<td>$69.00</td>
<td>$1,725.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>$109,305.00</strong></td>
</tr>
</tbody>
</table>