February 2006

Implementing EcoStar Standards at Southern Container

Andrew P. Thayer
Worcester Polytechnic Institute

Justin S. Clark
Worcester Polytechnic Institute

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A Major Qualifying Project Report:
Submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
In partial fulfillment of the requirements
for the degree of Bachelor of Science by:

Andrew Thayer
athayer@wpi.edu

Justin Clark
juclark@wpi.edu

Submitted:
February 28, 2006

Advisor:

Isa Bar-On
ibaron@wpi.edu

ABSTRACT

The EcoStar program in Devens Massachusetts is a voluntary program with the goal of encouraging participating companies to be more environmentally friendly. The goal of this project was to further the compliance of Southern Container with the standards of the EcoStar program. In order to do this, an evaluation of energy usage by the facility's boiler was conducted, along with an analysis of waste streams within Southern Container. Results outline a plan for reduction of fuel use and emissions, and increase in monetary savings through modification to the operation of the boiler. Also the waste stream analysis provides a solid starting point for another MQP group.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

We would like to thank the following people for all of their time and efforts contributed to our project:

- Professor Isa Bar-On, our advisor
- Ron McGuigan, General Manager Southern Container
- Steve Cappellini, Human Resources Manager, Southern Container
- Peter Lowitt, MassDevelopment Representative and Director of Devens Enterprise Commission

INTRODUCTION

Eco-industrial parks are becoming popular around the world as proof of concept communities to show that industry, people, and nature can live in harmony. Eco-industrial parks are present in different varieties in Europe, Asia, and the United States (Indigo Development, 2005). The idea behind Devens, Massachusetts however, is a new one. Devens was an army base until 1996, when it was shut down due to military cutbacks. After the base was shut down, the land was given back to the state of Massachusetts, which then began to redevelop (Globalsecurity.org, 2005).

From the beginning, the community of Devens was to be laid out as an industrial park accommodating industries focused on advancing technology and the environment. Overseeing the rebuilding of Devens was MassDevelopment, an organization funded by the state of Massachusetts (Devens Enterprise Commission, 2005). MassDevelopment is the economic development authority for the State of Massachusetts. To entice businesses to move into Devens, MassDevelopment negotiates collective contracts for utilities and services, such as natural gas and trash removal, for the community of Devens. Also, MassDevelopment can offer financing and tax incentives to new businesses entering into the Devens community.

One of the companies to take advantage of the economic incentives that had been given to encourage growth was Southern Container. Southern container is the largest independent manufacturer of corrugated boxes (Southern Container, 2003). Headquartered in Happauge, NY, and with box plants up and down the east coast, Devens was a logical choice for expansion into northern New England in order to have seamless supply of Southern Container products up and down the east coast.

One of the main goals that MassDevelopment set out to achieve with the community of Devens was to create an ecologically friendly industrial park. In order to measure success in becoming more ecologically friendly, companies within Devens voluntarily choose to join the EcoStar program, created by MassDevelopment (EcoStar Action Guide, 2005). From the start, the EcoStar program was not set out to be a new set of regulations imposed on businesses within Devens, but a voluntary program that would encourage participation through positive community relations and pride within the Devens community. In the business world, the term "regulation" usually implies significant capital machinery or facility costs. Whether it is to retrofit an industrial process with new safety measures or merely install handicap access, regulations are mandatory costs for businesses. On the other hand, by structuring EcoStar as a voluntary program, companies are enticed to participate by positive advertising possibilities as well as possible money savings.

The goal for this MQP was to take some of the guidelines, also called standards, outlined in the EcoStar program and implement them into the way that Southern Container does business. Ideally, every business would be environmentally friendly. For too long businesses had been able to dump harmful waste directly into rivers and pollute the air around them with toxins without any repercussions. Current environmental regulations impose harsh penalties for gross pollution, but smaller causes of pollution still are not regulated. For example, a company can use as much electricity as they need, as long as they are willing to pay for it. In the end, the community around the power plant generating a huge amount of power for the wasteful business must bear the environmental side effects from the outputs of the plant, and the company that is grossly

misusing resources does not. The goal of this project was to find ways to implement the standards set forth by EcoStar at Southern Container in both an environmentally and fiscally responsible way, both conserving valuable resources for the community of Devens as well as saving money for Southern Container.

The two EcoStar standards which were most technically based focused on energy savings and waste reduction. Both of these areas have an impact on the environment, as well as an impact on the company's bottom line. In order for this project to be successful, the goals of both saving money and having a positive impact on the environment would need to be met.

BACKGROUND

Eco Communities

Eco Communities are a relatively new idea in the modern world. The goal of Eco Communities all over the world is fairly uniform and simple. These communities are created so that residents and businesses are able to economically support themselves, while at the same time being ecologically friendly, preserving natural resources and ecological systems. Different communities may have other more in depth site specific goals, but they all have the same general goal of a comfortable coexistence with nature.

Pura Jungla in Costa Rica is one example of a sustainable community. The community welcomes families and businesses alike to a local forest reserve that has recently allowed the development of buildings and eco-friendly infrastructure (lapurajungla.com, 2005). The community hopes to encourage the growth of businesses and homes in the area, while coexisting with the wildlife in the reserve. Another example of an Eco Community is the Green Way Neighborhood in Lexington, VA. This is a farming community which uses the land in order to practice sustainable agriculture. By practicing sustainable agriculture, the farmers feed the community as well as provide a sound economic base (livingearthecovillage.com, 2005). The homes there have been designed to be ecologically friendly, using materials that are made without detriment to the environment as well as making them more efficient in terms of heat and energy usage.

Becoming an eco-friendly community or industry is a real challenge in most cases. In an industrial setting, there are likely processes which have been used for a long time, simply because of their effectiveness. However, these processes may not be eco-friendly. The same is true for machinery; there is a known, familiar and effective set up

that a company has used for many years. Companies are often reluctant to give up or alter a process that they have been using for a long time that has been a proven method to bring in money needed to continue. Changing an entire process requires time, money, technology, and a great amount of creative thinking. Depending on the changes that would be necessary, the costs can easily become unreasonable from an economical standpoint.

Rather than completely redesign a current process from the ground up, in some cases there may be possible changes in the way a process is carried out or to how the machinery is run. Small changes in the appropriate areas can be effective while producing very little cost or even saving money. The large costs associated with revamping current processes in order to become more ecologically friendly often outweigh the possible benefits. When running a business, there is always something that requires attention and there always seem to be places where spending money will further the company, rather than spending it on an area that isn't likely to have a drastic impact on the bottom line. When companies choose not to spend money on areas that will lessen their impact on the environment, the costs must be picked up elsewhere. If a company is releasing contaminated water into the water table, it then becomes the responsibility of someone else to clean the water table. When there is an environmental issue that must be dealt with, it usually falls to the government to take care of it, and the government collects the money to do that from the tax payers. This is an example of an externality, where one consumer driven act invariable affects another. The county is making progress in this area, and forcing companies to take more responsibility for there actions. Since the founding of the Environmental Protection Agency and the National Environmental

Policy Act of 1969, there have been many laws and regulations passed which are set to protect the environment in broad term, such as The Clean Air Act and The Clean Water Act. These are positive steps, but there is still room for improvement on the finer points of becoming environmentally friendly and responsible, such as monitoring electricity and fuel efficiency.

Communities and industries both have a range of effects on the environment such as generation of waste, various pollutants, and depletion of resources, and disruption of ecosystems. Garbage must be collected and disposed of and there must be a well constructed and maintained sewer system along with treatment areas. Byproducts of industries can include toxic wastes which need to be treated. Pollutants such as excess fertilizer and road salt can affect a water supply. Emissions from vehicles and industries can cause smog and acid rain. Natural resources such as coal, timber, and water are often taken with little consideration for the surroundings. Drastic changes in ecosystems can result from deforestation for timber or paper manufacturing, or filling in marshland so that construction can begin on top of it.

The Devens Community and EcoStar

Devens, Massachusetts was once the site of New England's primary US Military base, Fort Devens. The base operated for almost 80 years, until 1996 when it was closed. Fort Devens covered a large footprint, covering area in the towns of Ayer, Harvard, and Shirley. Devens also had many modern buildings from the housing and workplaces of the soldiers who where stationed there. Such a resource of land and buildings couldn't simply be forgotten or destroyed, so when the base was shut down the creation of a reuse plan was handed to MassDevelopment. The former base was to be turned into the

Devens Community. "MassDevelopment is redeveloping Devens by creating a sustainable and diverse residential and business community," (devenscommunity.com, 2005). The community of Devens, with the help and guidance of MassDevelopment, is creating a community which holds a multitude of businesses, big and small, as well as providing residents with all the necessities and amenities that they would expect. Sustainability in Devens means that the community will be active and balanced in economics, community life, while still taking care of the environment and protecting the natural resources of the area (devenscommunity.com, 2005).

One of the major contributors to making and keeping Devens a sustainable and prosperous community is the EcoStar program, which some of the businesses are adopting. EcoStar is a program that seeks to make businesses more environmentally friendly, while still maintaining profitability and product quality. There are approximately 80 companies in the Devens community, large and small. The program is not mandatory for the companies at Devens and about 40% of them are regularly sending representatives to the EcoStar workshops. There are currently 18 companies that are fully registered with EcoStar, almost 25% of the business population, and are taking action to implement the program. This shows a strong interest but there are still no solid examples of success with the program. This project will demonstrate that environmental improvements can be made in companies without spending large amounts of money or drawing too much focus from the purpose of the business. This project will provide a possible model for other companies witch they can adapt to fit their needs.

The EcoStar program involves a list of 25 standards, which detail ways that a company can become more environmentally friendly. A company wishing to become

EcoStar certified must complete the required standards 1 through 10, and then choose any 5 standards from the list of 11 though 25. The implementation of these standards is fairly flexible, as it must be since businesses practices and processes vary. The standards are not made to place a financial burden on the company, but rather to encourage the company to seek ways to lessen their impact on the environment while still running their business efficiently from an economic standpoint. The ultimate goal of the EcoStar program is to promote environmentally friendly business practices that are also financially feasible. The standards are as follows:

Standards 1-10 (required)

1. Environmental Vision and Policy Statement
2. EcoStar Coordinator and Employee Team
3. Annual Assessment and Goal Setting for Continuous Environmental Improvement
4. Employee Training and Involvement in EcoStar
5. Business Linkages
6. Involve Suppliers
7. Educate Customers
8. Share Information with the Community
9. Water Conservation
10. Energy Efficiency/Conservation

Standards 11-25 (choose 5)

11. Green Building Design
12. Toxics Use Reduction
13. Material Reuse
14. Recycling
15. Product Design
16. Packaging
17. Environmentally Preferable Purchasing
18. Ecological Landscaping
19. Create Corridor or Habitat for Local Wildlife
20. Equipment Maintenance
21. Involvement with Community Environmental Projects
22. Transportation
23. Business to Business Mentoring
24. Climate Change Mitigation
25. Create your own Standard

Southern Container and Making Corrugated

Southern Container's business is the making of corrugated cardboard boxes for many companies with different products and needs. Southern Container manufactures different grades, weights, and thicknesses of corrugated board which they then convert and finish into a corrugated cardboard box, usually with some type of printing. Southern Container runs one corrugator for all of its production, changing paper type as well as several machine settings to produce the different types of corrugated board. The main quality issues that they run into while making the board are warp (twisting of the board), and delamination (separation or pealing of the different layers). Southern Container has several finishing stations which make cuts and create perforations in the board. The board can then be folded into a finished box. These finishing stations are where the printing and gluing of the boxes occur. The warehouse area of the plant floor is where the board and boxes are stored on pallets while waiting to be loaded onto a truck for shipping. Figure 1 shows the floor plan at Southern Container.

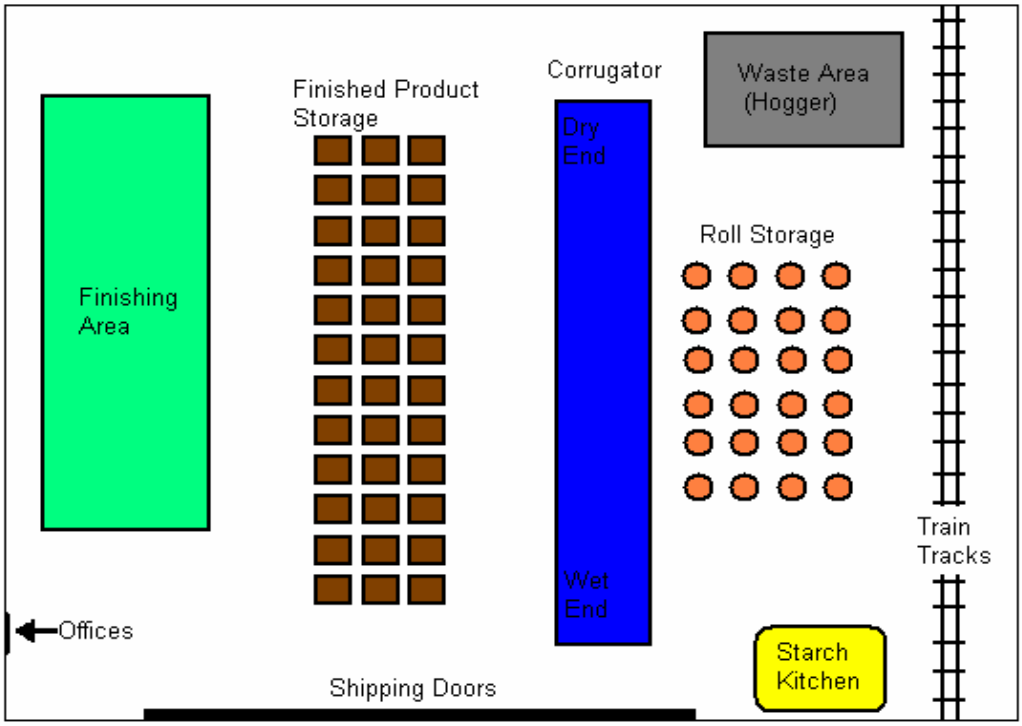

Figure 1: Southern Container Manufacturing Floor Layout

The manufacturing floor at Southern Container is laid out to maximize efficiency throughout the corrugation and finishing processes

The manufacturing process of corrugated board is a fairly simple process that has not been greatly altered since it was first put in to practice, however the machinery and technology of the process has moved forward. Kraft paper, which is very coarse and thick, is stored in large rolls which must be manipulated using a clamp or fork truck. Each roll can be between 6000 and 9000 pounds and up to 110 inches wide. There are rolls of liner, which become the outsides of finished corrugated board, and rolls of medium, which is the fluted interior. These rolls are placed on axles on one end of the corrugator, called roll stands. From here, the process is largely computer controlled.

Southern Container uses software that calculates the most efficient usage of kraft paper to produce the desired grade of corrugated board. The adjustments made to the settings of the machine during production, as well as adjustments when the job changes, are also controlled by computer. The liner paper is passed through heated rollers and also a steam shower in a unit called the liner pre-heater. This process ensures that the paper will have the proper heat and moisture content for the desired board type. Without achieving both a proper temperature and moisture content, the final corrugated board will suffer quality problems such as warp and delamination. The medium is run between two large gears whose interlocking teeth create the flutes. The first sheet of liner and the medium are combined in the single facer. This is done by coating the flute tips on one side of the medium with starch glue and adhering the medium to one sheet of liner. The board is run though the bridge, and into the triple stack pre-heater, which again heats and moistens the single faced board. The board is pulled through the double backer along with another pre-conditioned sheet of liner and they are combined to make single wall board. The board travels through an oven at a designated temperature for a length of time dependant on what type of board is being made. Everything up to this point of the corrugator is known as the “wet end” of the corrugator, all that follows is known as the “dry end” of the corrugator. After the board is passed though the oven, it comes to the rotary shear, whose primary function is to chop out bad sections of board. The board runs through the slitter/scorer where it is sliced and/or scored in the appropriate manner for the order that was given by the customer. Different slices of board are ramped either up or down by the web diverter, and then each is cut at the appropriate length by the cut-off knives. The board is automatically stacked up by the stackers at the end of the corrugator onto pallets

and is ready to go to the finishing part of the plant where the blanks can be cut into boxes, printed and glued. Figure 2 shows a flowchart of the major centers of the corrugator.

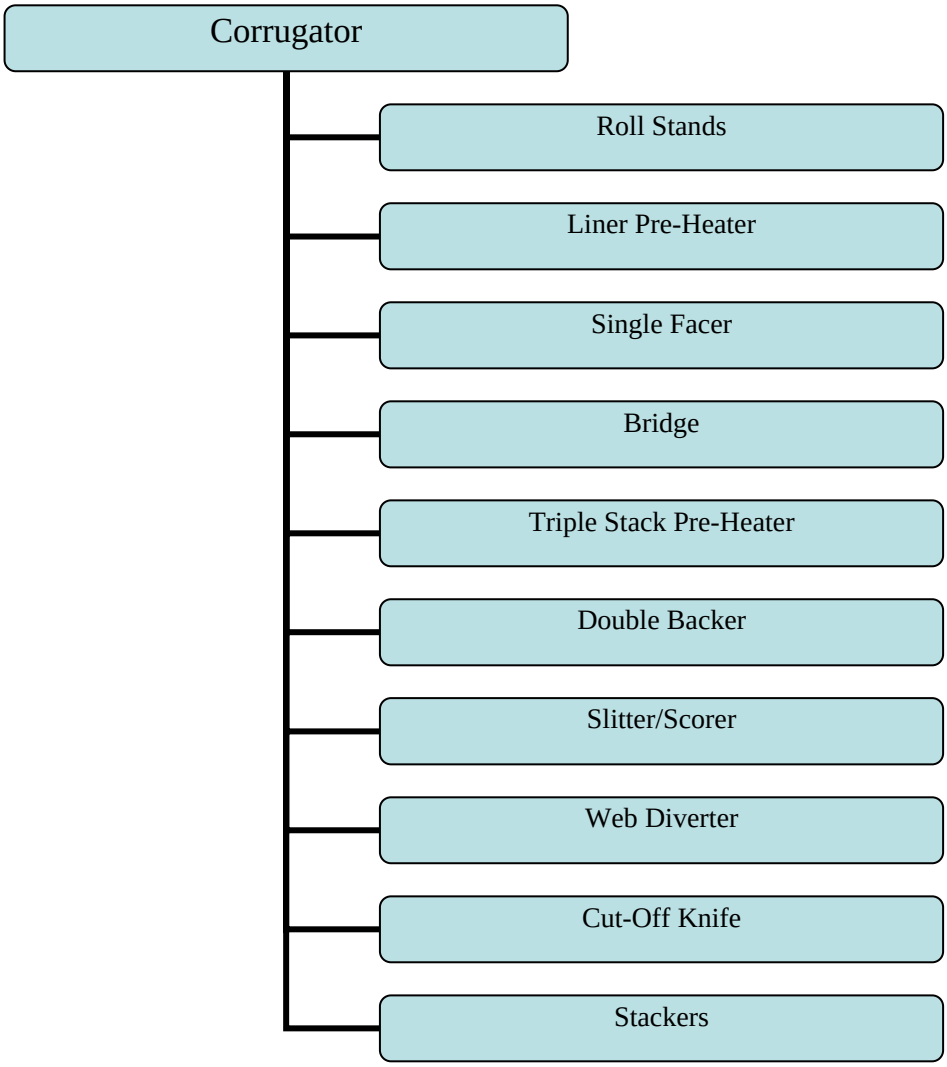

Figure 2: Corrugator Process Flowchart:

The corrugator at Southern Container contains all the necessary machine centers to convert kraft paper into corrugated board

Cleaver-Brooks Boiler

Southern Container utilizes a Cleaver-Brooks Model CB-LE 500 horsepower boiler for the steam needs of the plant. This boiler both heats the corrugator machine and provides steam for the steam showers used to alter the humidity level of the kraft paper. Southern Container's current boiler operation practice involves shutting down the boiler

every night when the plant is not in operation. The model CB-LE is a low emissions model boiler which is guaranteed to have a reduced nitrogen oxide (NOx) emission rate, compared to other modern boilers, as well as an improved fuel burning process (cleaver-brooks.com, 1997). This boiler was designed for industrial applications, meant to be run nearly 24 hours a day, 7 days a week, coming off line only for maintenance. A phone interview with a Massachusetts regional representative of Cleaver-Brooks yielded the information that continually shutting the boiler down would greatly reduce the life of fire tubes, the seals, and other integral parts of the boiler (Derek Conlin, Sales Engineer, 2005). It was also stated that continually shutting the boiler down would reduce the efficiency of fuel usage. In conjunction with this information, the operator records of the boiler at Southern Container also indicate that the seals needed to be changed much more often than they should.

Pollutants

Southern Container burns natural gas to heat the steam. As with all combustion, the use of natural gas releases several different types of pollutants into the atmosphere, in varying quantities. The major contributors to pollution from natural gas are CO_2, NO_x, N_2O, SO_2, PM_{10}, VOC, and CO (abraxasenergy.com, 2005). These are materials that contribute to such things as the greenhouse effect, smog, acid rain, and some VOCs (Volatile Organic Compounds) can cause cancer in humans and animals. Abraxas Energy Consulting provides much information on the use of energy, efficiency, as well as emissions. Their website provides a free emissions calculator which will accurately convert an input quantity of fuel to the various output quantities of emissions using data generated from studies done by the EPA (Environmental Protection Agency).

METHODS

Boiler Operation

While the EcoStar standard outlining energy conservation is vague in wording, it leaves room for interpretation and implementation to the many different types of businesses in Devens. In the case of Southern Container, a great deal of steam is used in order to produce corrugated board. From making the starch glue to preconditioning the kraft paper before it is processed, there is a large amount of steam necessary to run the corrugator. Southern Container fills all of its steam needs with a 500 horsepower Cleaver Brooks boiler. The boiler is the largest consumer of natural gas at Southern Container, using about 1400 therms per day. To give a sense of scale, a typical 4 bedroom apartment in Worcester, Massachusetts uses about 5 therms of natural gas per day. This initial observation showed the boiler was a key target for energy conservation.

Every day, the boiler operators would take readings from the natural gas meter right outside the boiler room and write them down into a log book. Using this logbook, a plot of daily gas usage over the period of one year was created.

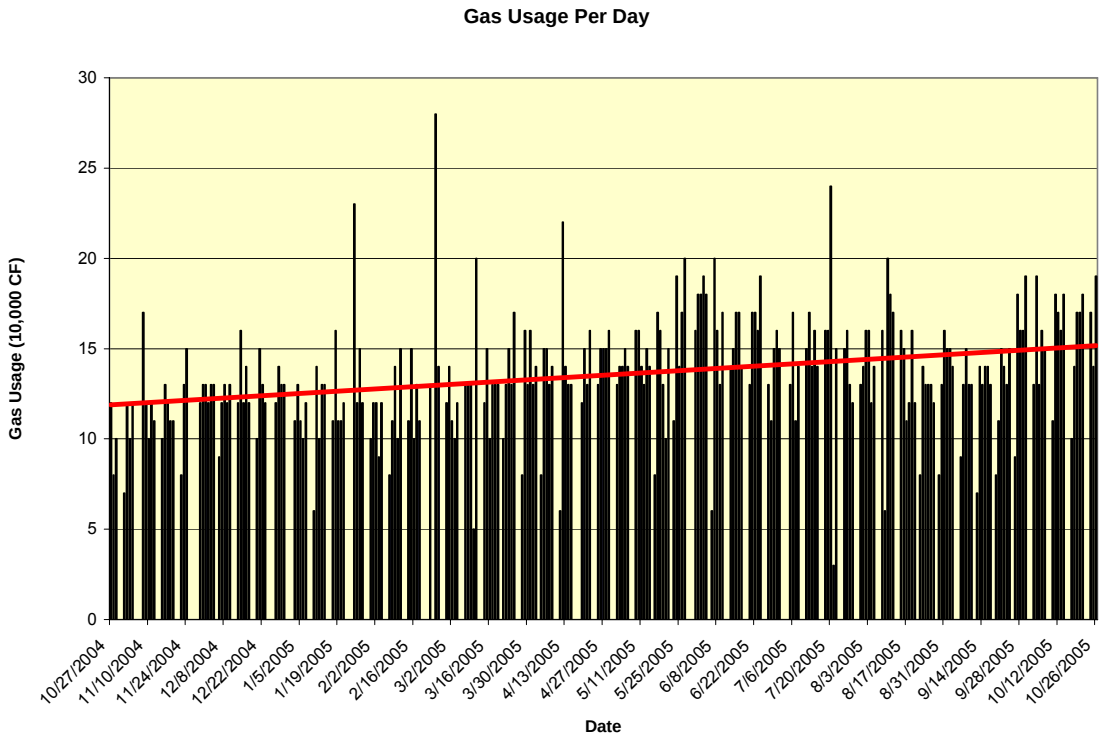

Figure 3: Southern Container Natural Gas Usage per Day

There is a clear upward trend in gas usage, which can be attributed to increasing production volume

In Figure 3, the black bars represent the amount of gas used per day, and the red line represents a linear trend line for the data. There is a clear upward trend in the natural gas usage at Southern Container. This trend can be attributed to increased production in the past year, which corresponds to the increased volume of orders due to the acquisition of a smaller corrugated plant by Southern Container.

Using the daily gas consumption data, along with other data including current gas prices and boiler operation, a cost model for operating the boiler was constructed. In order to take into account all of the major costs associated with each scenario, the cost of employing the operators as well as the actual cost of the natural gas were considered. Current boiler operator wages at Southern Container are $20 per hour. In addition to base

wages, boiler operators receive benefits, which total an additional 30%, or $6/hour. On top of base wages, overtime wages are paid for each additional hour worked over 8 hours per day. Overtime pay is 1.5 times base pay, or $30/hour plus benefits. This data, combined with the natural gas data compiled, facilitated the creation of an accurate model to represent current practices of running the boiler. Entering values corresponding to current operating practices into the model and comparing the result with invoices from the past year showed that this model within about 10% of actual expenditures.

Alternative operating methods that would both conserve natural gas and save money for Southern Container needed to be investigated. The maintenance manager had mentioned that the boiler was capable of running in a "low fire" mode, but he didn't know exactly what that meant in terms of gas usage. The local Cleaver Brooks distributor clarified that the low fire mode can be used to maintain steam temperature and pressure in the boiler overnight while no equipment is running. Low fire mode burns $1/10^{th}$ the amount of gas that high fire mode does. The fact that Southern Container already had a boiler that was capable of running in low fire mode was very helpful. Rather than investing a large sum of capital into new equipment, the solution was to use a feature already in place that was simply not utilized.

Current practices at Southern Container consist of the boiler operator coming in at about 3 am to turn on the boiler in high fire mode. The boiler is run on high fire until about 11 pm, shut off and cooled down completely, only to be reheated in the morning. Massachusetts state law requires that the boiler operator be present at all times that the boiler is running, so a qualified boiler operator must be present in the boiler room at Southern Container from 3 am until 12 pm. Currently, there are two operators. Each

operator works 10 hours per day consisting of 8 hours regular and two hours overtime pay. Since the boiler must be heated up from cold every single morning, there are about 4 hours that the boiler is running on high fire, but the corrugator cannot be operated due to lack of steam pressure.

RESULTS AND DISCUSSION

Alternative Boiler Operation Scenarios

Using the low fire data received from the boiler distributor, two alternative cost model scenarios were created for gas usage and overall cost. These scenarios were based on employing three boiler operators working 8 hour shifts and running the boiler on high fire while the corrugator was operating and running on low fire overnight. Moving from two boiler operators working 10 hour shifts to three boiler operators working 8 hours shifts, there was a significant cost savings by eliminating overtime pay. This made employing a third boiler operator almost pay for itself.

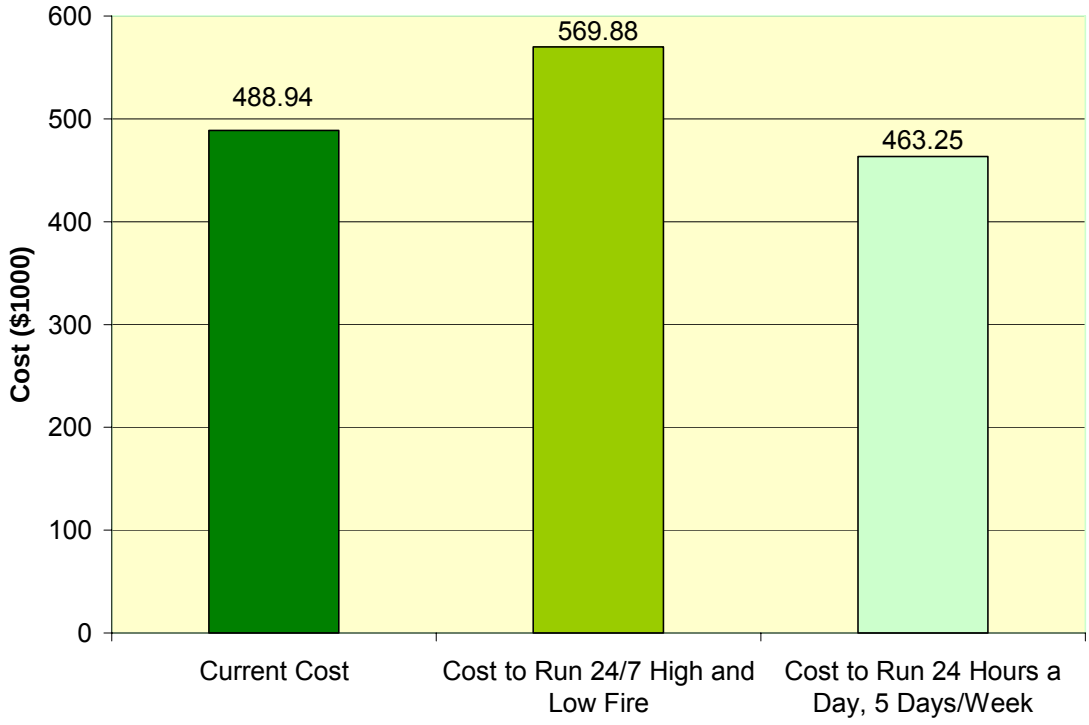

Figure 4: Overall Cost Comparison

Overall cost of each scenario compared

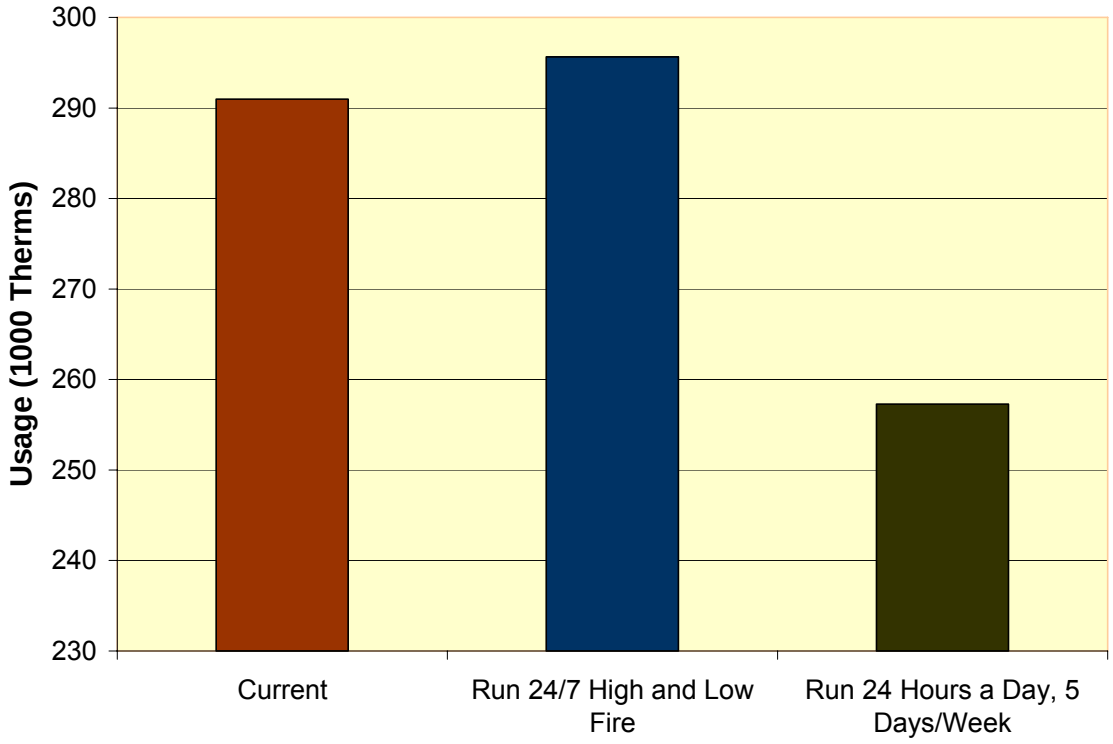

Figure 5: Natural Gas Usage Comparison

Natural gas usage of each scenario compared

The first scenario created consisted of employing three boiler operators, and running the boiler 24 hours a day, 7 days a week. The boiler would only be run on high fire while the corrugator was operating, which is currently 16 hours per weekday. This scenario required that Southern Container run the boiler on low fire over the weekend, and employ operators over the weekend as well. As shown in Figure 5, this scenario would end up using about 1.6% more natural gas than the current scenario. In addition, this scenario would cost an additional $80,940, as shown in Figure 4. This scenario was clearly not a viable alternative.

The second alternative scenario that was created consisted of the same framework as the first alternative, but this time the boiler was shut off over the weekend. There is no

reason for the boiler to be running and a person to be tending it for 48 hours while the corrugator is not producing anything. By eliminating the dead time over the weekend, cost savings of $25,690, or about 5% was created. Additionally, this second model reduces natural gas consumption by almost 12%, with a corresponding reduction in emissions. This alternative model met both of our criteria; it would save money for Southern Container, and also be environmentally friendly by burning less natural gas.

Sensitivity Analysis

The sensitivity of the cost model was evaluated by plotting the model using current natural gas and labor prices, and then adjusting those prices +/-30%, as shown in Figures 6 and 7. This adjustment will account for a reasonable window of price fluctuations, and show the sensitivity of the model to changes in price.

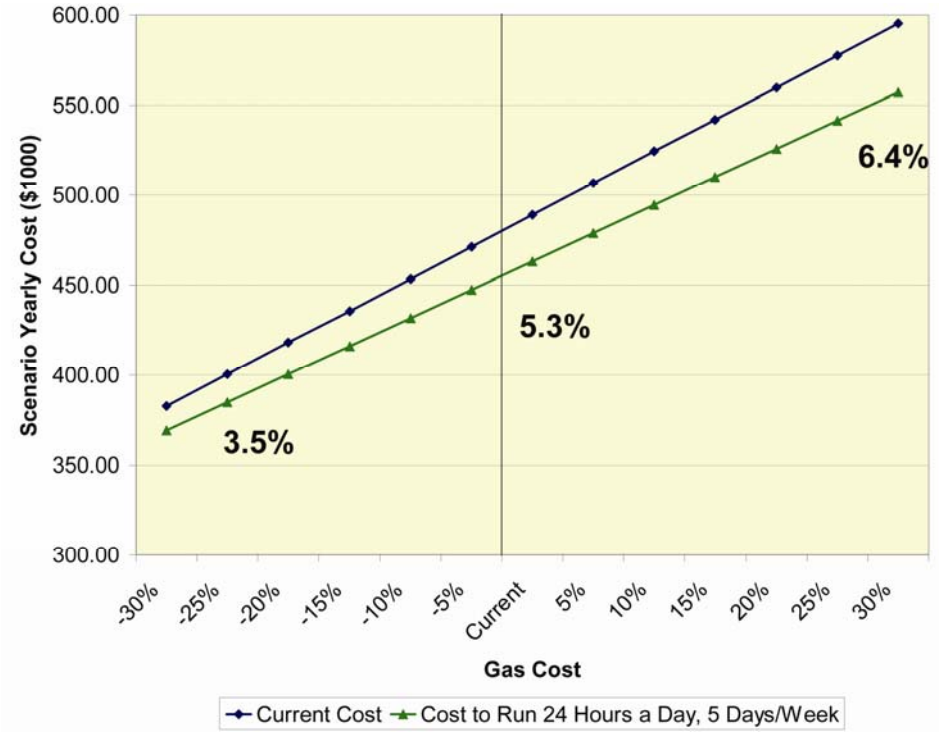

Figure 6: Gas Price Sensitivity Analysis

Over the range of +/-30% there is still a significant savings to be had by utilizing low fire mode 5 days a week

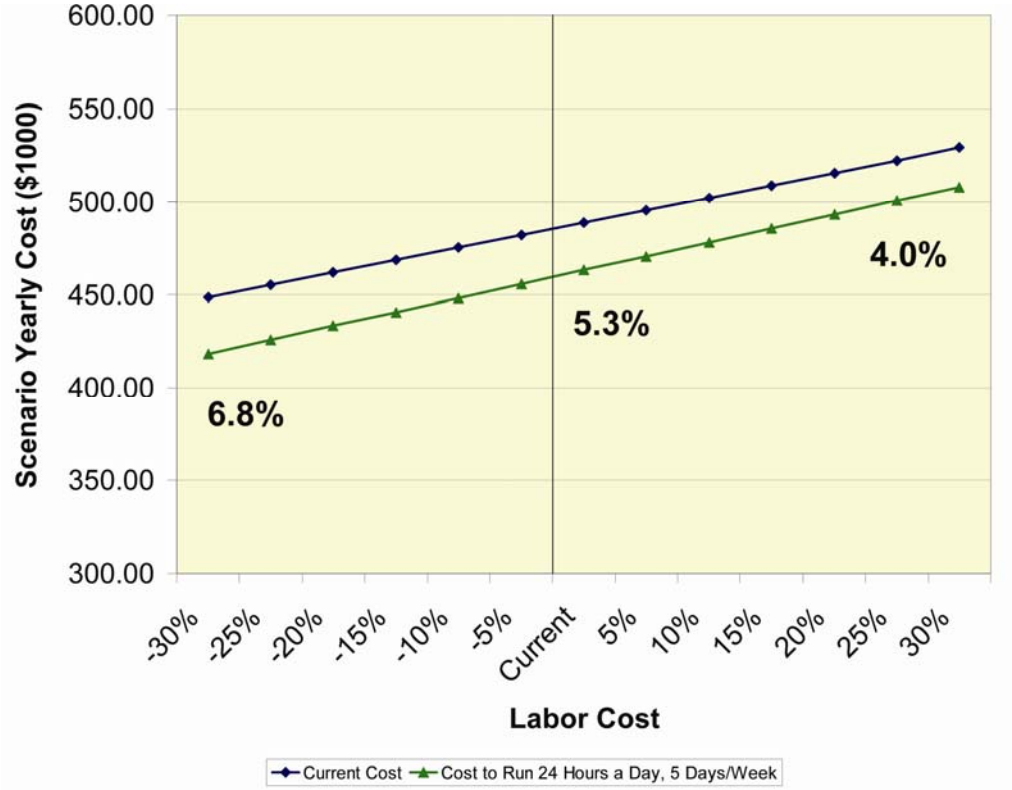

Figure 7: Labor Cost Sensitivity Analysis

Over the range of +/-30% there is still a significant savings to be had by utilizing low fire mode 5 days a week

Emissions Reduction

A reduction in gas usage of the boiler will mean a reduction in the emissions that are released from the boiler to the atmosphere. The combustion of natural gas releases numerous pollutants into the air. The major contributors to pollution from natural gas are CO_2, NO_x, N_2O, SO_2, PM_{10}, VOC, and CO. These are materials that contribute to the Greenhouse Effect, smog, acid rain, and some VOCs (Volatile Organic Compounds) can cause cancer in humans and animals. Any reduction in these emissions will be beneficial to both the environment and the population.

Through the suggested course of action, there would be a fairly substantial reduction in the pollutants released from the boiler. There is a strong correlation between the amount of fuel burned and the amount of pollutants released. There is an almost 12% reduction in natural gas usage, and a corresponding reduction of the emissions. These reductions can be seen in Figure 8.

	Current Usage	Option 3 Usage	% Decrease
Natural Gas (Therm)	290,980.00	257,287.00	11.58
CO_2 (tons)	1,703.40	1,506.20	11.58
NO_x (tons)	2.2	1.9	13.64
N_2O (lbs)	64	56.6	11.56
SO_2 (lbs)	174.6	154.4	11.57
PM_{10} (lbs)	541.2	478.6	11.57
VOC (lbs)	1,568.40	1,386.80	11.58
CO (tons)	3.5	3.1	11.43

Figure 8: Reduction in Emissions

By reducing the amount of natural gas used by the boiler, there is a corresponding reduction in emissions

An 11.5% decrease in emissions represents a significantly less amount of greenhouse gasses released into the atmosphere. In addition to helping the environment by burning less natural gas, Southern Container would be saving money for the company on the order of $25,000, reducing downtime related to maintenance issues, as well as providing another job for the community of Devens.

Qualitative Waste Analysis

The waste analysis consisted of an observation of the manufacturing floor, followed by an analysis of waste data from the corrugator. Material waste is a costly output for any operation. Waste consumes raw materials, energy, and machine time, all

of which are valuable assets. Two days on the manufacturing floor talking to operators and looking for obvious waste streams gave valuable insight to the main waste producing areas. On the floor, small waste is put into bins, and then brought to the hogger, where it is ground up and baled to be sold and recycled. Larger lots are bound by unit and marked with a pink waste tag to be hogged and baled. Current protocol at Southern Container consists of inspecting a small sample of larger batches of corrugated board as it comes off of the corrugator. If any one sample of a batch turns out to be out of specification, whether it is due to warp, delamination, or any other defect, the entire batch is declared waste. At Southern Container, it is more costly sort through an entire batch than it is to throw away some good product along with out of spec product.

Quantitative Waste Analysis

Since visually analyzing waste streams on the floor would be very difficult to quantify, another approach was necessary. The corrugator that is used at Southern Container has a control program called KIWI, which handles all of the scheduling and settings. KIWI keeps track of roll stock and on time deliveries. One important feature of KIWI that it keeps track of roll width, average percent side trim, length, material trim value, extra waste value, and upgrade value. Average percent side trim is an important waste statistic to look at when pinpointing problem products. Side trim is the small amount of corrugated that is cut off of either side of the corrugated sheet as it moves through the corrugator to ensure the edges are perfectly square. Depending on the overall width of the product that is being run, the trim may vary a few percentage points. Side trim is minimized by either choosing a narrower roll of kraft paper or scheduling products that take up the entire width of corrugated. In order to reduce side trim, sometimes a run

of corrugated is upgraded. For example, if Southern Container needed to produce a run of corrugated that was 100 inches wide but there is only roll stock of the appropriate kraft paper that was 104 inches wide available, they could either run the wider roll and have 4 inches of additional side trim for the whole run, or upgrade to a heavier kraft paper that was in stock at the appropriate 100 inches wide. Although heavier kraft paper costs more per roll, there would still be significant cost savings and reduction in both raw material use and waste.

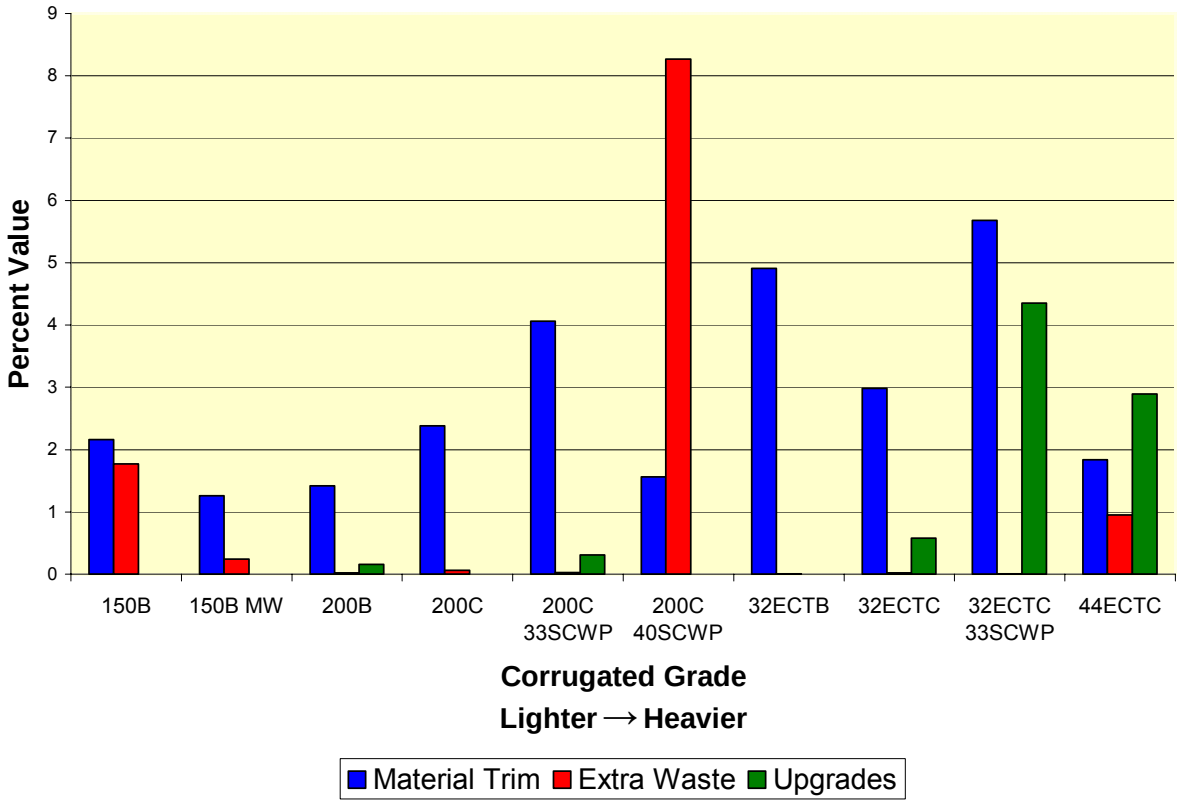

Figure 9: Waste Analysis Data

Waste quantified as a function of percentage value of finished product, sorted by corrugated grade

By looking at the value statistics that KIWI keeps track of, there could be some correlation between the weight of corrugated board and the amount of waste produced.

Figure 9 shows that there is an upward trend in percent value of waste as the grade of corrugated gets heavier. This means that as heavier kraft paper is being used, Southern Container may stock less roll sizes and be forced to have a large percentage side trim. Also, it is interesting to note that one grade in particular, 200C 40SCWP, has a very large extra waste value, which may indicate quality control problems for this particular grade. Future work suggestions are to follow up on this data from KIWI and identify problem products and possible solutions.

CONCLUSIONS

The goals of this project were to implement the standards laid out by the EcoStar program at Southern Container. By making a slight change to how the boiler is operated, more specifically running it on low fire overnight rather than cooling it down and heating it back up in the morning, a 5% cost savings was achieved. The best case scenario reduces the amount of natural gas burnt by 12%. This also reduces the emissions into the environment by a similar margin. Additional fringe benefits of the proposed changes include the creation of another job for a member of the Devens community, and a reduction in heat cycling of the boiler.

Relating back to the EcoStar standards, the boiler analysis achieved the goals of one required and two optional standards. They are as follows:

Standard 10 – Energy Efficiency and Conservation

Standard 20 – Equipment Maintenance

Standard 24 – Climate Change Mitigation

In addition to the accomplishments made in regards to the boiler, the analysis of waste value has brought new research possibilities to light. While the data compiled is a small sampling, it shows that there are possible correlations between corrugated grade and waste produced. Further data compilation and analysis will hopefully reinforce this idea, and identify problem products so that the cause of the waste can be identified and addressed.

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