

2008

Alumni Gym Energy Efficiency Plan

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Recommended Citation

Antonellis, Danielle; Dawson, Elizabeth; Hanson, Paige; and White, Elliot, "Alumni Gym Energy Efficiency Plan" (2008). *Great Problems Seminar Posters*. 34.
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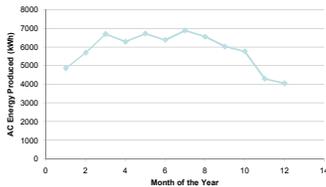
Alumni Gym Energy Efficiency Plan

Danielle Antonellis, Elizabeth Dawson, Paige Hanson, Elliot White
Advisor: Professor Brian Savilonis

Solar Panels

Table of Calculations for PV System:	
Total Energy Produced by	70,184 kWh
Proposed PV System Per Year	
Value of Energy Produced Per Year	70,184 kWh * \$.118/kWh = \$8,281.71
Cost of Solar Panels	548 panels * \$750.00/panel = \$411,000
Cost of a Solectria 60kW Inverter	\$51,900
Commonwealth Solar Rebate	57,495W * \$3.00/W = \$178,735
Total Cost of PV System After Rebate	\$411,000 + \$51,900 - \$178,735 = \$284,165
Payback Period	\$284,165 / \$8281.71 = 34 Years

Electricity Produced Per Month by Proposed PV System



Water Usage

Methods/Process

- Count the water fixtures in the building
- Evaluate the water consumption using present fixtures
- Research modern and efficient fixture candidates and choose the best option considering cost-efficiency and water consumption
- Develop a replacement design that will replace the athletic departments for new offices and classrooms
- Calculate payback periods (PB)

Results/Outcomes

- 13 sinks, 15 toilets, 23 showers, 6 urinals
- Sinks (13):** ~180 minutes of use per day total at 1.0gpm at 85°F Replaced by sensor faucet (\$486ea) PB=52 years
- Toilets (15):** 150 flushed per day at 3.5gpf Replaced by 1.28gpf toilets (\$128) saving 333 gallons per day total
- Showers (23):** 40 showers per day at 10min each at 2.5gpm heads at 120°F Replaced with no showers saving \$19,375 per year.
- Urinals (6):** 15 flushes per day each at 1.0gpf replaced with waterless urinals (\$344 ea) PB=31 years

HVAC

Heating: Continue using efficient (newly renovated) campus steam distribution system

Ventilation: Stack ventilation, naturally powered

Air Conditioning: HFC refrigerant, and Energy Star approved

Insulation

- R Value of the gutted Alumni Gym is 5.6
- Renovations will include the installation of R-38 Pink Fiberglass insulation
- R-value with renovations: 43.6
- approved by GREENGUARD Environmental Institute
- Add vestibule to reduce heat loss of Alumni



Vestibule

Payback period: cost/savings = \$34,920.90/\$7,810.34 = **4.8 years**

Abstract

This study of Alumni Gym shows the integration of energy efficient systems into a building that will remain cosmetically the same from the exterior, but will express modern technologies from the interior.

Using the LEED certification system as a guide, energy efficient systems were analyzed and assessed for their financial benefits to WPI with a focus on environmental safety. Among the areas covered in this study are: green roofs, air quality, HVAC, insulation, lighting, water usage, and windows.



Background

Alumni Gym was built in 1916 with the intent to enhance the athletic facilities on campus. Nearly a century after being built, operating costs and the building's efficiency is a rising concern. With plans of a new athletic building underway, Alumni will be converted into offices and classrooms. It would be profitable for WPI to reconstruction in a way that conserves energy and qualifies the building for LEED certification. Since Alumni holds historic significance to the school, the plan is to improve its energy efficiency without sacrificing its historic aesthetics.

Plan of Action

- Assess Alumni Gym's current efficiency ratings
- Research ways to improve the building's efficiency
- Determine the best possible solutions based on cost-efficiency and work towards the set minimum requirements for LEED
- Seek approval of design by Department of Facilities
- Become LEED Certified

Conclusion

Throughout researching technologies that improve the energy efficiency of Alumni Gym, the financial benefits of each were also analyzed. Even though insulation, lighting, and water have a short payback period, most of the major changes help only in the long run. The changes made for the renovation of Alumni Gym would be for the purpose of reducing the current negative, environmental impact than for the financial savings.

Windows

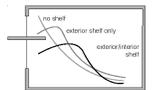
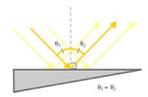
	Double Glazed (savings per month)	Double Glazed Low-E (savings per month)
Jan	626.95	789.86
Feb	626.95	789.86
March	626.95	789.86
April		
May		
June	34.60	43.59
July	34.60	43.59
August	34.60	43.59
Sept	34.60	43.59
Oct		
Nov		
Dec	626.95	789.86
Total Savings	2,646.20/ year	3,333.80/ year
Cost of Windows	43,200	62,400
Payback Period	16.3 years	18.7 years

Air Quality

- Measured by the amount of VOCs emitted by carpets, paints, and sealants
- VOC (volatile organic compounds) are regulated because of the risk for health defects
- Green Seal, South Coast Air Quality Management District, and Carpet and Rug Institute's Green Plus Program are all organizations that qualify products for low VOC emission.

Lighting

- Economy Square Edge Cloud Commercial Energy Star Ceiling Lights
- Energy Star reduces energy costs, maintenance costs, and cooling costs; lasts 2-5 times longer than fluorescent lighting.
- Lighting control system: occupancy sensors
- Total Cost of Lights = \$34,650.00
- Light Shelves: reflective pieces of material angled to reflect sunlight into the ceiling; uses natural light to illuminate a room.
- Total Cost of light shelves = (\$200/ft)(408ft) = \$81,600.00



LEED

LEED Core and Shell Certification Requirements:	
Certified	23-27
Silver	28-33
Gold	34-44
Platinum	45-61

LEED (Leadership in Energy and Environmental Design) was created by the U.S. Green Building Council as a voluntary national rating system for developing energy efficient and environmentally sustainable buildings. This system addresses issues such as materials selection, indoor environmental quality, water use, and energy efficiency for buildings of all types. There are several different LEED rating systems based on the kind of building that is attempting to be certified. Alumni Gym would undergo certification by the Core and Shell Rating System, since the proposed renovations are so extensive, a whole new core and shell could be designed to fit LEED standard. In order to be certified, Alumni Gym needs to meet the criteria for credits earning at least 23 points.