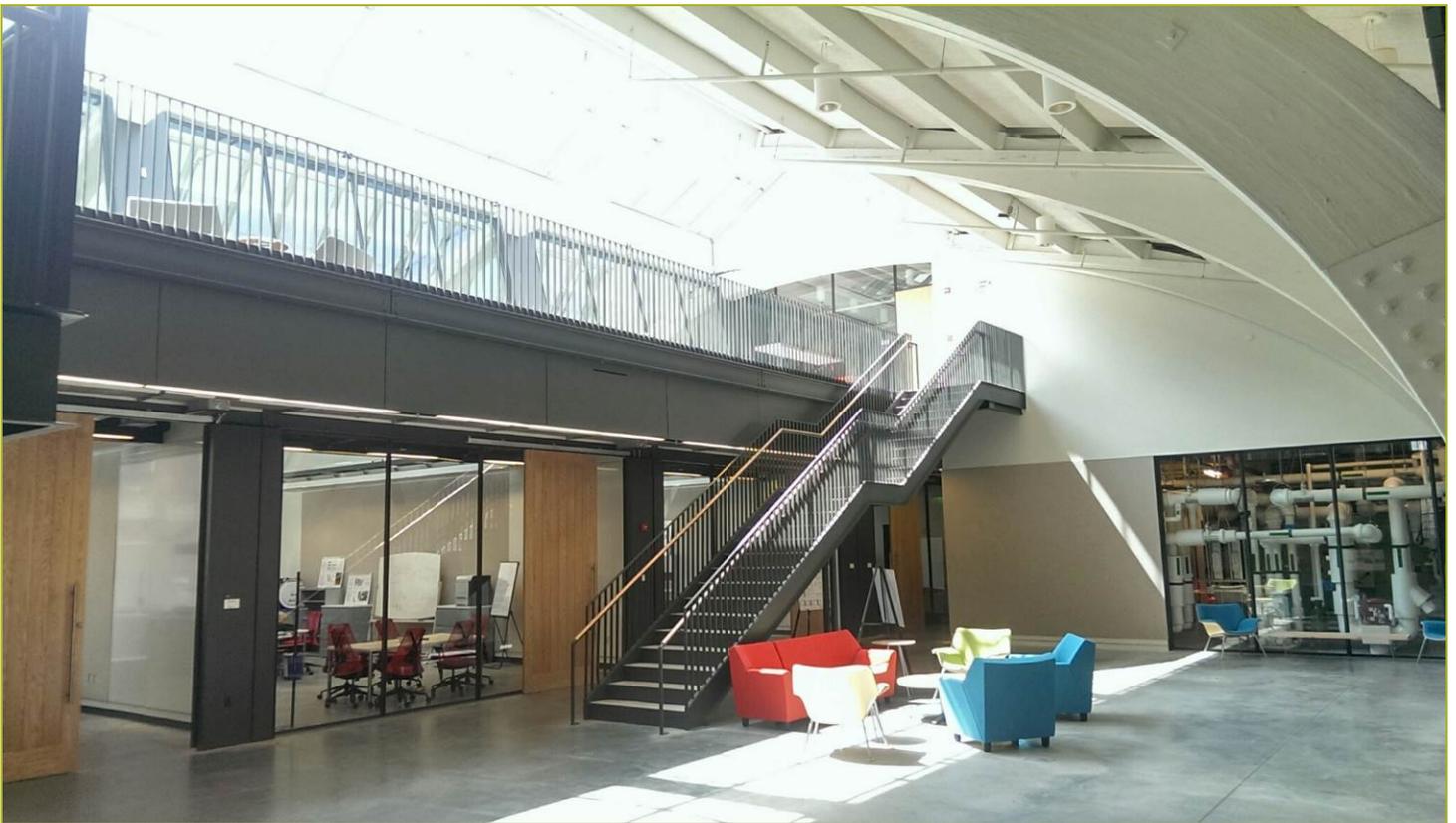


Title: Building Re-Tuning Automated Report Generator

Report Date: April 30, 2016

Report Author: Lisa Shulock



Report Abstract

Project objectives.

Deliverable Requirement: Automated BRT report generator tool and API for Asset Score Preview data ready for use by those conducting building re-tunes

Deliverable report: An automated BRT report generator with Asset Score Preview reporting capability is complete. It has been used by Penn State students to generate reports for the “Leadership in Building Energy Efficiency” course as well as demonstrated to BOMA and APPA BRT training participants. It has been incorporated into the BRT course content. BOMA is hosting a data-driven BRT training for BOMA fellows in June and it will be included in the program. The tool is a Word template that is populated with data from an Excel workbook for creating reports.

Contact Information for lead researcher

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Contributors

Penn State: David Riley, Lisa Shulock, Somayeh Asadi, Parhum Delgoshaei, Shideh Shams Amiri, Mahsa Safari, Yumna Kurdi

An automated BRT report generator with Asset Score Preview reporting capability is a Word template that is populated with data from an Excel workbook for creating building re-tuning reports. A sample report is attached. The report components and sample report can be found at <https://psu.box.com/s/c99mzoxk4h0oqd2i8l7kwkw4fnme8f3e>



Dear Office of Physical Plant,

You are in charge of a facility that cares for Environment. Saving energy is more important and beneficial than ever, especially with rising energy costs. Like many other facilities, yours has opportunities to improve health and safety and reduce energy costs. Commercial buildings account for almost 20% of the total U.S. energy consumption. A significant portion (up to 20%) of the energy used in commercial buildings is wasted because of improper operations. The purpose of this report is to evaluate the building's operations and energy performance, as well as identify no-cost/low-cost opportunities that would lead to improved building comfort and reduced energy consumption. Our assessors conducted an on-site Energy Opportunity Survey of Leonhard Building on 2016-02-12.

Based on our assessment and some basic assumptions, following our recommendations could save you \$1980 to \$4521 annually on energy costs!

Important note: Our calculations are only estimates. A more detailed analysis by a professional energy auditor can help to develop a detailed plan for investments in improving the energy and health of your facility.

We hope that our visit and this report will help you move forward on a path to energy independence. The measures presented in this report should help you make tangible progress towards more comfort, safety, and energy cost savings in your facility.

Thank you! On behalf of a generation of students that are working hard to ensure a better future, thank you for participating in our program. It was a pleasure working with you on your building Re-tuning project. Please contact us with questions you may have.

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Location

310 S Barnard St, University Park,
State College,
PA, 16802



Google Map Image

Facility Pictures



Facility Picture 1



Facility Picture 2



Facility Picture 3

Facility Facts

Year Built: 2000
Size: 96843 Square Feet
Occupancy Classification: Education
Stories above Grade: 3
Stories below Grade: 0
Heating System: District heating
Heating Energy Source: District steam

Cooling System: District Chilled Water
Cooling Energy Source:
District chilled water
Domestic Hot Water Type: Heat Exchanger
Domestic Hot Water Energy Source:
District steam
Process Load Type: Air Compressor

Goals and Motivations

Based on our conversations and interview, here are your most important Re-tuning goals and motivations:

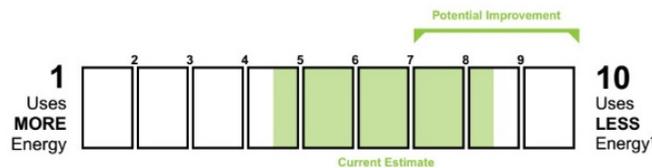
1. Reducing Cost
2. Improving Productivity/Comfort
3. Reducing environmental impact
4. Improving Reputation and Image

Current Annual Estimated Energy Usage

Electricity Usage: 1000326.61 kWh
 Electricity Cost: \$ 8590.32
 Heating Fuel Usage: 9227200 Pound of
 District steam

Heating Fuel Cost: \$ 195750.17
 Other Sources Usage: 361537.76 Ton/hr of
 District chilled water
 Other sources Cost: \$ 78306.57

Facility's Asset Score Preview



Your Asset Score Preview

Current score: Your building is likely to receive an Asset Score between 4.5 and 8.5 in Full Input Mode.

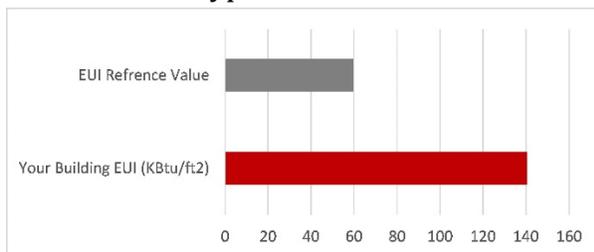
Potential score: On average, similar buildings may improve 2.5 point(s) with cost-effective upgrades.

Energy savings: On average, similar buildings may use 30% less energy with cost-effective upgrades.

The U.S. Department of Energy's Building Energy Asset Score (Asset Score) is a national standardized tool for assessing the physical and structural energy efficiency of commercial and multifamily residential buildings.

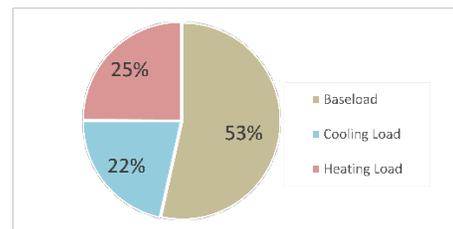
Annual Energy Spending Chart

You are using 136% more than average value for a building classified as Education use type.



Energy Spending Comparison Diagram

Disaggregation of energy cost in Leonhard Building



Your Building Energy Cost Disaggregation Diagram

Safety and Health Concerns

1- Lack of Carbon Monoxide Detector

Carbon monoxide poisoning is a serious public health concern. With the number of illnesses and death cause by high levels of carbon monoxide in homes and buildings, state legislatures have begun adopting laws mandating the use of carbon monoxide detectors. The use varies, from every enclosed room being required to have detectors, to every room that has a smoke alarm to have a detector, to only day-care centers and group homes

Recommendation: Install CO Detectors



Safety and Health Concern Picture 1

2- Lack of Humidity Control

Humidity control systems add or remove water vapor from indoor air to stay within proper humidity ranges. Humidity control is important for many reasons: It is a large factor in people's thermal comfort. Excess moisture in a building can lead to mold and mildew, causing problems for indoor air quality.

Recommendation: Install Humidity Controls



Safety and Health Concern Picture 2

Energy Related Observations

Observation 1: Overlit areas

Overlit Corridors - we measured 30-50fc but the standard amount for corridors are 10-20fc.



Observation 1

Observation 2: Lamps on when not needed

Room #112- Additive manufacturing and reverse engineering Lab:

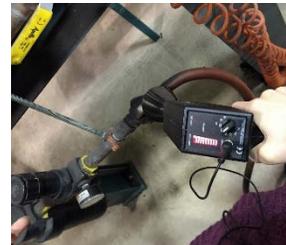
- One on/off switch for the entire room.
- Lights were on when nobody was in the room.
- Shades were closed.



Observation 2

Observation 3: Air Leaks

Room# 106- Fame Factory for ADV. MFG. ED- We found 6 small to medium size leaks at joints and connections



Observation 3

Observation 4: Missing pipe insulation

Insulation prevents heat from being lost through the piping. Heat is lost when the piping is bare, with an outside temperature significantly higher than the ambient temperature. The heat loss occurs at all times the pipe is in operation.



Observation 4

Top Energy Efficiency Measures (EEM)

- 1- Daylight Harvesting
Spend less on energy bills by daylight

Category: Lighting **Effort:** Low
Potential Saving: Medium

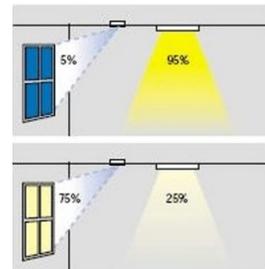
Benefits:

Considerable amount of money can be saved over energy bills daylight harvesting

Daylight harvesting improves thermal comfort and controllability through providing natural light.

By daylight harvesting you will use less energy reduce the carbon footprint of your building

Through reducing your costs, you will be on the right track towards energy dependence.



EEM 1

Potential Energy Reduction: 1%- 3%= \$ 855 to \$ 2563 over 5 years

- 2- Install/verify occupancy based control sensors for rooms where it makes
Spend less on energy bills by installing occupancy based

Category: Lighting **Effort:** Low
Potential Saving: Low

Benefits:

Installing occupancy based sensors can result in significant energy savings, reducing utility costs.

Installing occupancy based sensors contributes to making your building more comfortable.

Enourmous amount of energy can be saved by installing occupancy based sensors

Installing occupancy based sensors represent that you know about energy saving and you care about environment



EEM 2

Potential Energy Reduction: 1%- 2%= \$ 855 to \$ 1709 over 5 years

3- Eliminate Leaks

Spend less money on energy bills by eliminating

Category: Air Compressor **Effort:** Low

Potential Saving: High

Benefits:

Spend less money on energy bills by eliminating

Improve comfort by reducing the noise of

Stop wasting energy by eliminating leaks.

Improve your company's image by reducing the amount of energy consumption



EEM 3

Potential Energy Reduction: 5%- 10% = \$ 4272 to \$ 8544 over 5 years

4- Insulate Pipes

Save money through reducing energy loss from the surface of uninsulated pipes

Category: Hot Water **Effort:** Low

Potential Saving: Medium

Benefits:

Lockout of boiler and pumps during hot weather can help saving considerable amounts of money throughout the year

Lockout of boiler and pumps during hot weather improves thermal comfort and controllability.

Lockout of boiler and pumps during hot weather can reduce energy consumption which reduces carbon emissions associated with energy production.

Lockout of boiler and pumps during hot weather represent that you know about energy saving and you care about environment



EEM 4

Potential Energy Reduction: 2%- 5% = \$ 3916 to \$ 9788 over 5 years