

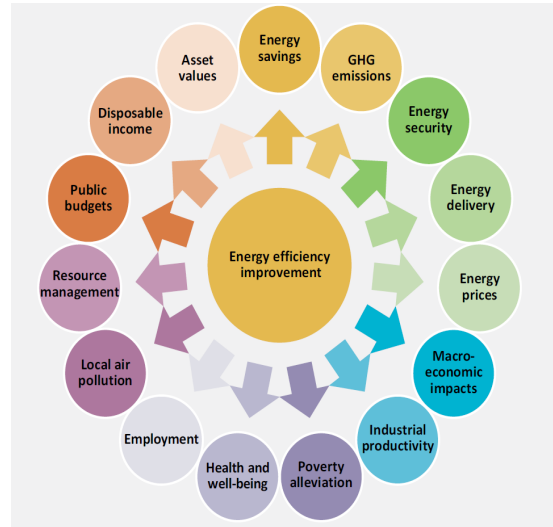
Strategic Energy Management

Tim Leach & Rob Jordan
AASB – Maintenance
Oct. 18, 2017



**Energy efficiency
is a smart
investment**

Multiple benefits of energy efficiency

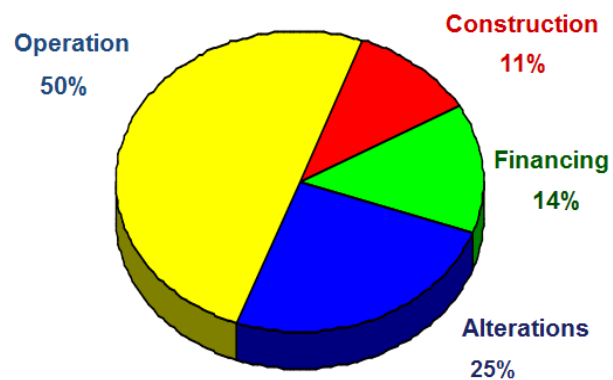


iea.org
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Affordability

The Big Picture: Lifecycle Costing

A buildings' costs over 40 years



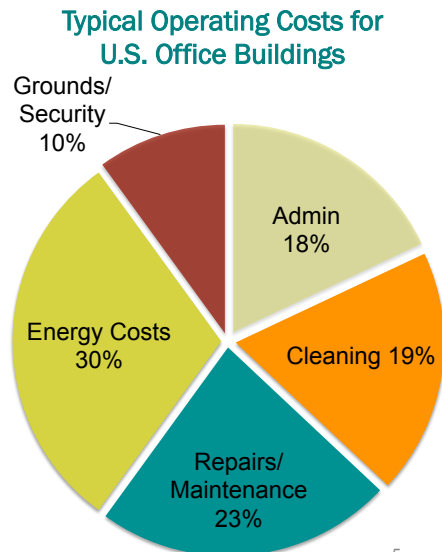
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ENERGY EFFICIENCY



Reduced Operating Costs

- Energy costs are typically the largest portion of a building's operating budget
- EPA estimates that a comprehensive energy management strategy can reduce energy use by 30%



Source: BOMA Experience Exchange Report

Background

American Recovery & Reinvestment Act funds

Benchmarking
Energy Audits
White Paper

Alaska Energy Efficiency Revolving Loan Fund

Outreach
Technical Assistance

Department of Energy funds

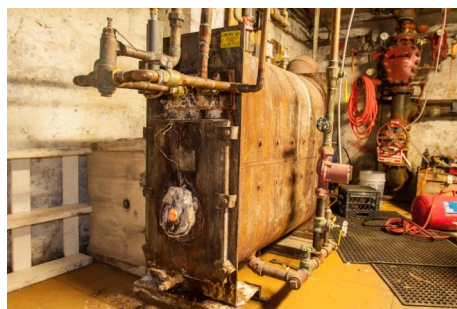
Strategic Energy
Management Practices Guide



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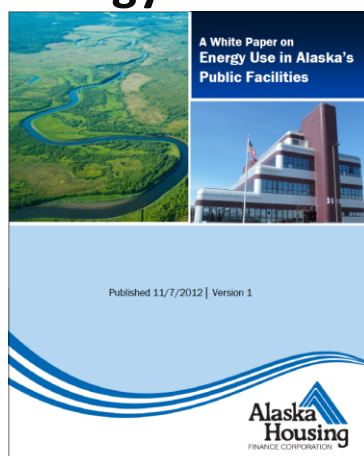
Energy Efficiency Potential

- Public buildings - 5,000 in AK
- Average age - 33 yrs.
- Annual energy expenditure - \$640 million
- AK has some of the highest energy costs in the US



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Energy Efficiency Works

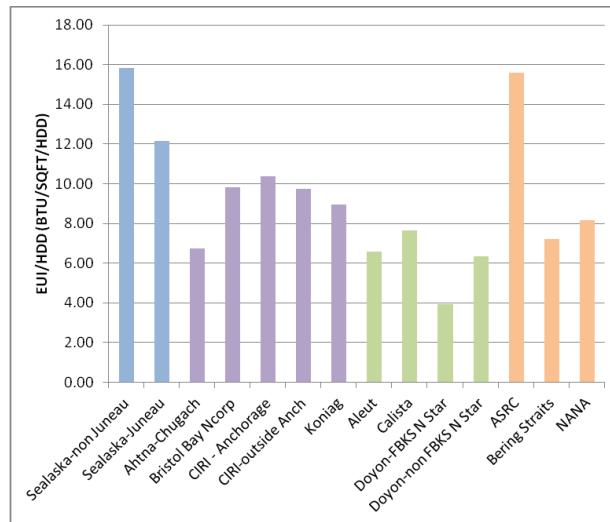


The take away:

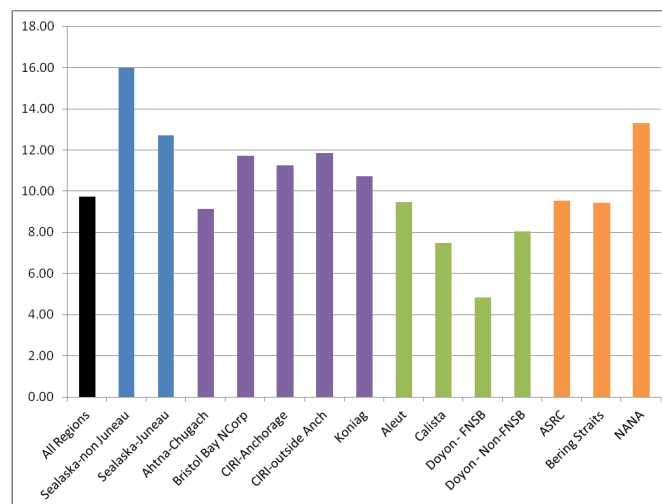
- Assuming average savings of 20%, potential **annual savings of \$125 million** in our public facilities
- EE can help reduce costs and focus limited public dollars on core activities

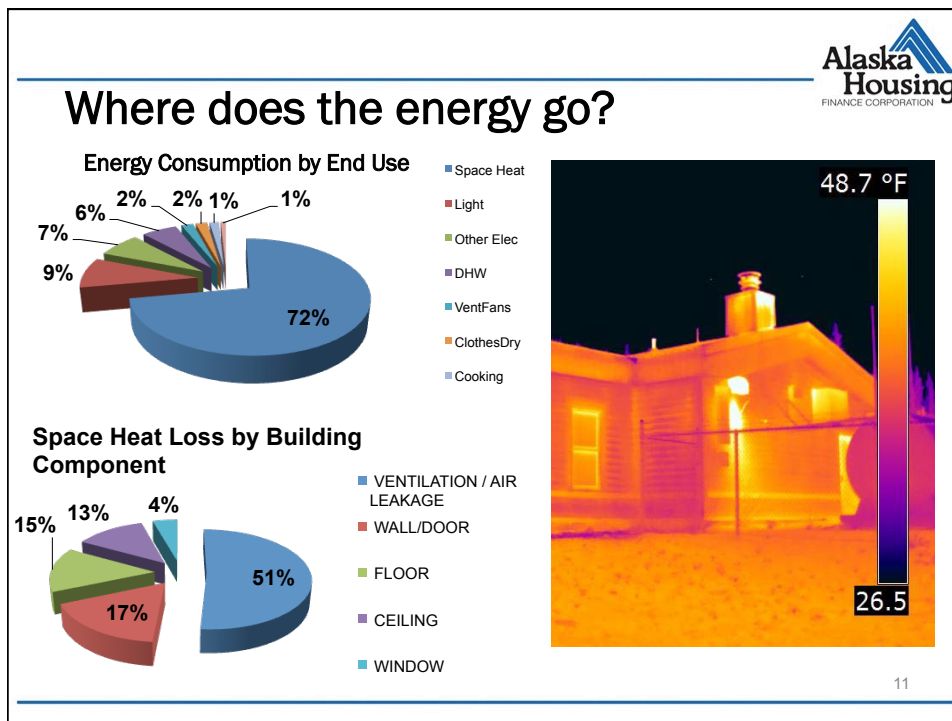
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Average EUI by region



Average School EUI by region





Alaska Housing
FINANCE CORPORATION

Fruit on the ground

- Turn it off:
 - School Refrigerators in summer
 - Vending machines when building not occupied – cheap timers work well
 - Boilers, HVAC, lights, fans, pumps when building is unoccupied
 - Computers and office equipment when not occupied

Low Hanging Fruit

- Track energy use
- Re-program controls to actual operations
- Occupancy sensors
- Tune up existing equipment – boilers, HVAC, controls, etc.



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Overhead Fruit

- Build efficiency into planned maintenance
 - Pump, motor or ballast replacement
- Consolidate modular design to reduce energy load to underutilized areas
- Retro-commissioning
- Educate operators on specific systems – snowmelt, DDC, Lighting controllers, etc.
- Demand controlled ventilation
- Lighting retrofits

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Recommendations: Policy

1. **Develop an energy policy**
 - Set goals



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2. **Establish an Energy Conservation Coordinator/Manager**



16

Recommendations: Policy

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3. **Develop an energy management plan**
 - Establish a level of accountability



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Recommendations: Policy

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4. **Provide Operator Training**



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Recommendations: Policy

1. **Develop an energy policy**
 - Set goals
2. **Establish an Energy Conservation Coordinator/Manager**
3. **Develop an energy management plan**
 - Establish a level of accountability
4. **Provide Operator Training**
5. **Prioritize efficiency retrofits**



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Impact of Energy Policy



Photo credit McCool Carlson Green
mcgalaska.com

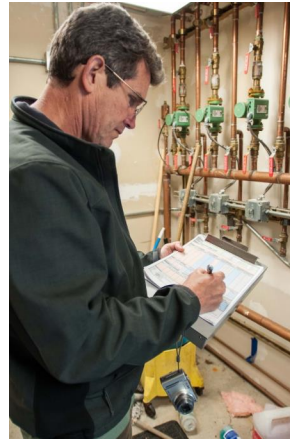
- Energy efficiency goals & design standards signal owner intent
- 70% annual savings - Machetanz School

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Impact of Energy Management



The Bottom Line:
It pays to know how much energy you use, and
where and when you use it.



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Energy Management, cont.

☐ Avoid this...



WHAT MARKETING
SUGGESTED



WHAT MANAGEMENT
APPROVED



AS DESIGNED BY
ENGINEERING



AS
MANUFACTURED

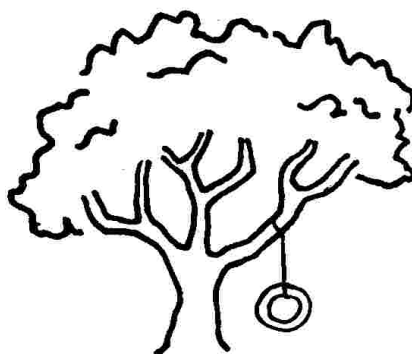


AS INSTALLED

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Energy Management, cont.

- ❑ Goals, Communication & Accountability



WHAT I REALLY WANTED !!

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RESEARCH

New Buildings Institute
sensitivity analysis, 2011

- analyzes how design, operation and tenant behaviors affect energy use
- 28 building characteristics
- 16 U.S. cities



Source: 2011 New Buildings Institute Sensitivity Report

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Impact of Operator Training



25

Tracking Energy Use and Costs

"You can't manage what you don't measure"



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Tracking Energy Use and Costs



- How to track:
 - Energy bills: separate electric and fuel oil/gas
 - Normalize by square footage and climate
 - Sensors
- Compare, look for anomalies
- Tracking software:
 - ARIS: Allows you to compare with buildings in Alaska
- Similar to EnergyStar Portfolio Manager



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Recommendations: Investigation Practices



- **Benchmark buildings and track energy costs**
 - Compare Energy use to comparable buildings



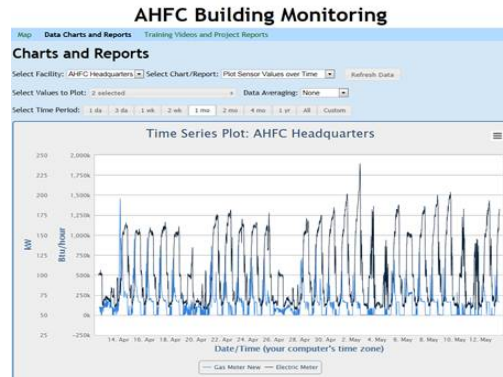
ARIS Web

7.5

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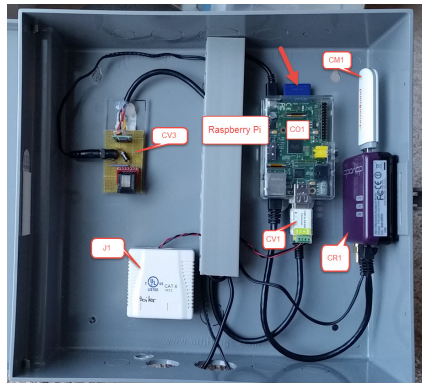
Recommendations: Investigation Practices

- Benchmark buildings and track energy costs
 - Compare Energy use to comparable buildings
 - Building Monitoring



What Is BMON

Hardware

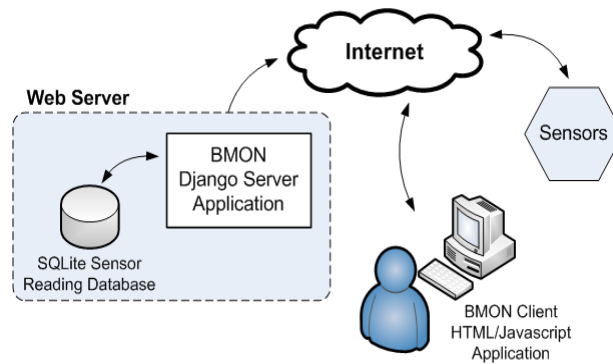


Software

```

1 # Holds the user modifiable settings for the application.
2
3 # Secure logging
4
5 # The unique ID of this particular logger, which will be prepended to
6 # sensor IDs.
7 LOG_ID = "alaskahousing"
8
9 # The intervals for reading sensors and for logging readings
10 READ_INTERVAL = 5 # seconds between readings
11 LOG_INTERVAL = 1000 # seconds between logging data
12
13 # Cellular Mode Related
14 # Set following to True if you are using a USB Cellular modem
15 # to connect to the Internet.
16 USE_CELL_MODEM = False
17
18 # If you are using a cell modem, set the following to a string indicating
19 # the type of cell modem you are using. This string must be one of the
20 # "carrier" sections in the wial.conf file found in the /usr/local/
21 # folder (the folder also containing the Mini-Monitor settings file.)
22 # Currently, the following values are supported:
23
24 # E173: Works with the Huawei E173 modem
25 # E3276: Works with the Huawei E3276 modem
26 # E1756C: Works with the Huawei E1756C modem
27
28 # Mini-Monitor uses the Wial Linux utility to connect the cell modem
29 # to the Internet. The /usr/local/Logger/wial.conf is the configuration
30 # file for Wial and can be edited to modify configuration settings and/or
31 # enter new carrier sections to support different models of modems. Also,
32 # the wial.conf file is set up with the APN of the GCF carrier in Alaska.
33 # Use the GCF configuration settings. This can be modified for other carriers.
34 # See documentation of the Linux wial program for further information on
35 # the configuration file.
36 # NOTE: some versions of the E1756C modem did not reliably connect using
37 # the current wial.conf settings. Use the E173 or E3276 modems if possible.
38 # Use this value must be in single or double quotes see:
39 CELL_MODEM_MODEL = "E3276"
40
41 #
42
43 # Set following to True to enable posting to a BMON server
44 ENABLE_BMON_POST = True
45
46 # BMON URL to post readings to, and required storage key
47 # An example BMON URL is "https://mo.ahfc.us"
48 # The Store Key must match the Store Key in the settings file for
49 # the BMON server.
50 POST_URL = "https://mo.ahfc.us/readings/readings/store/"
51 POST_STORE_KEY = "alaskahousing"
52
  
```

BMON Architecture

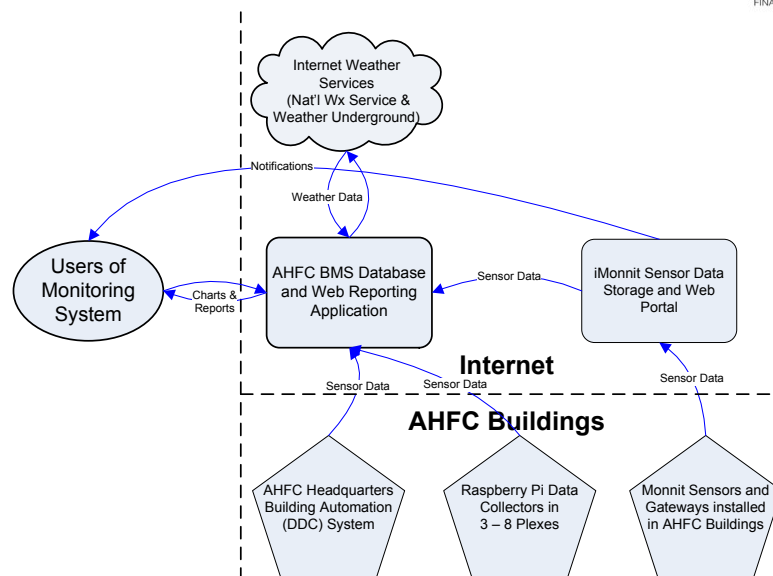


www.ahfc.us | 4300 Boniface Pkwy | 907-330-6100

4300 Boniface Parkway • Anchorage, Alaska 99504 • P.O. Box 101020 • Anchorage, Alaska 99510 • 907-338-6100 (Anchorage) or (Toll-Free) 1-800-478-AHFC (2432) • www.ahfc.us



AHFC System Architecture



Advantages over other systems

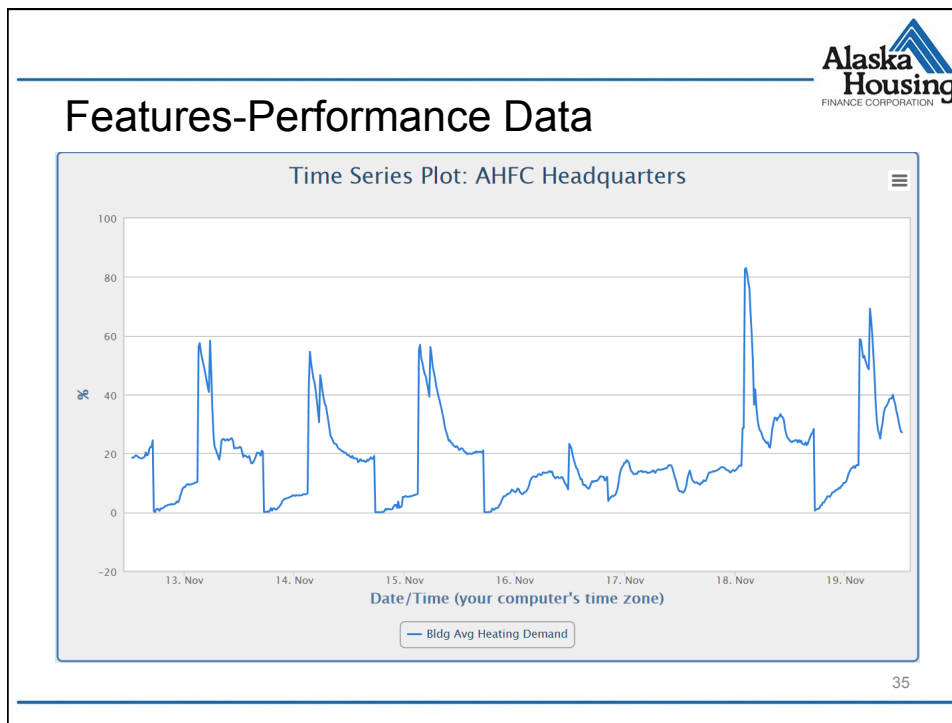
- Non-proprietary
- Open source
- Much less expensive
- Can be modified by user to adapt to local situations
- Can be seen by multiple users

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Features

- Real time performance data on building operations
- Analysis of energy use during occupied and unoccupied periods
- System design input (flow rates, BTU demand).
- Troubleshooting of systems
- Push notifications for system failures

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Alaska
Housing
FINANCE CORPORATION

Features

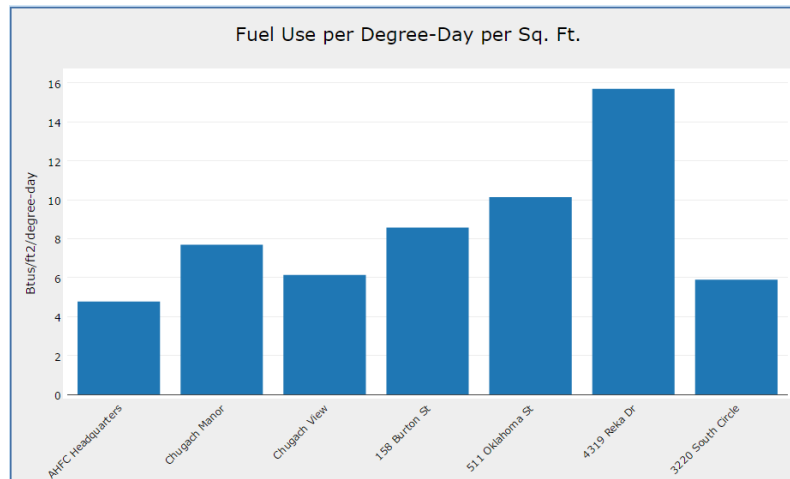
Design Benefits –

- Track actual flow rates
- Track actual BTU demand
- System sizing based on actual data *not estimates*

Electric Meter
(Chugach Manor)

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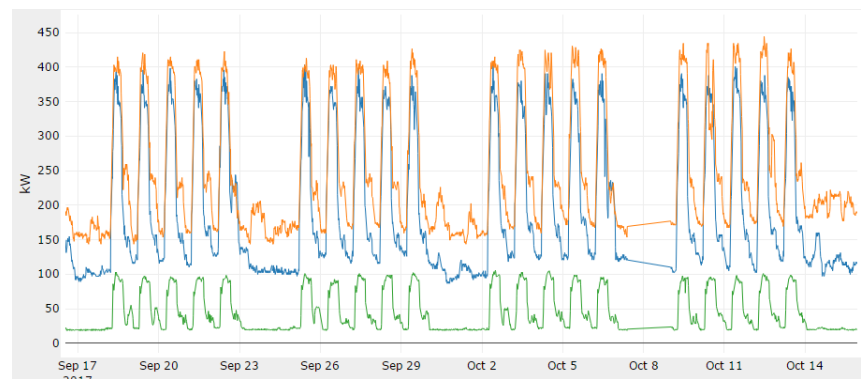
Uses Data Analysis



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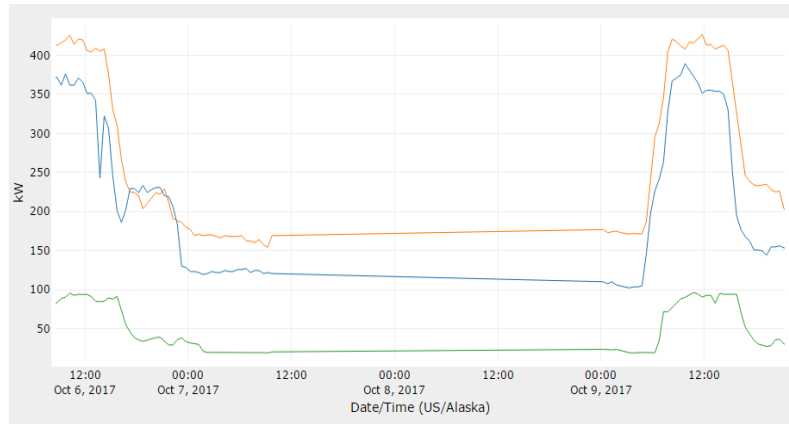
Uses Data Analysis



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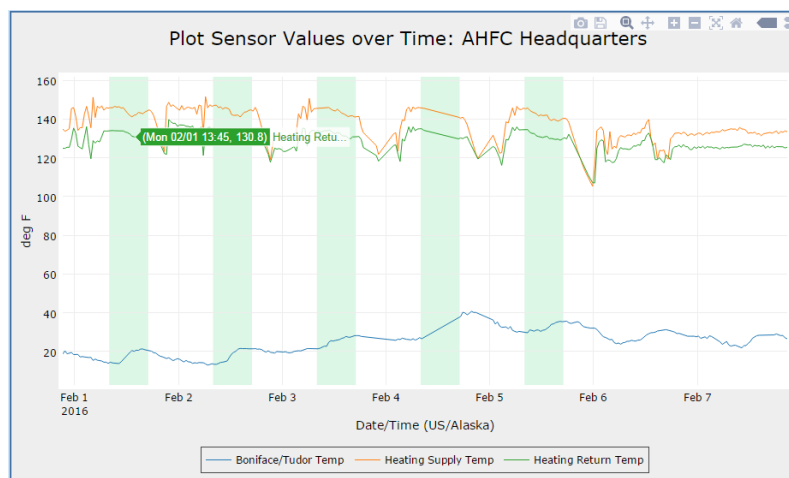
Uses Data Analysis



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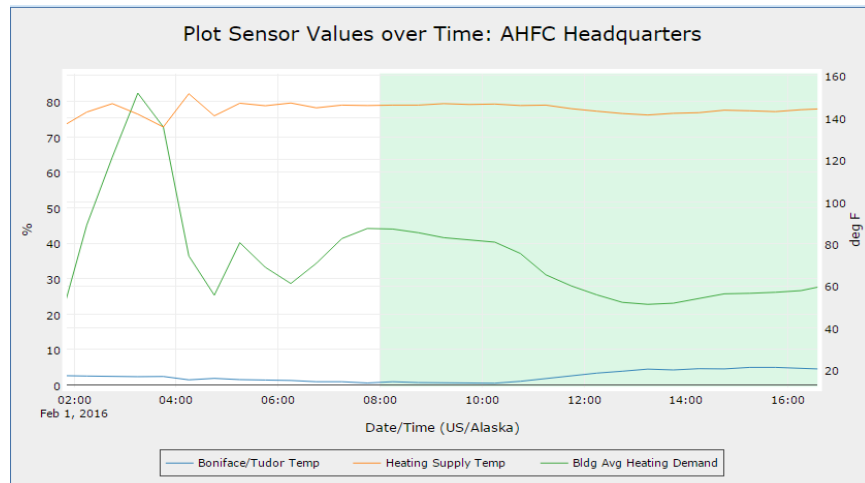
Uses Data Analysis



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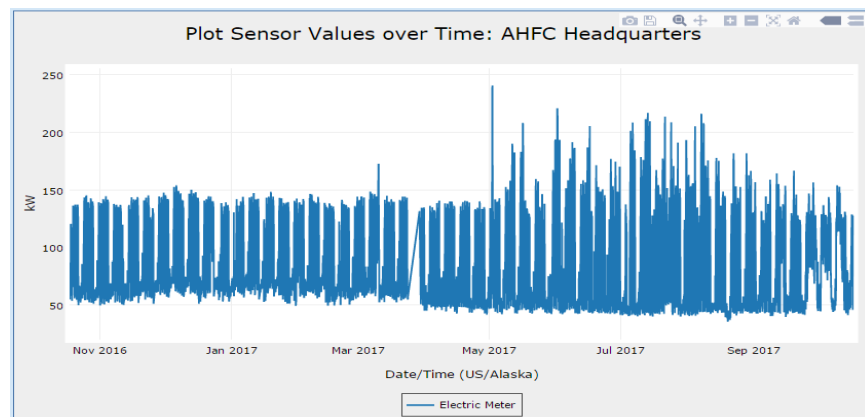
Uses Data Analysis



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Peak Demand Management



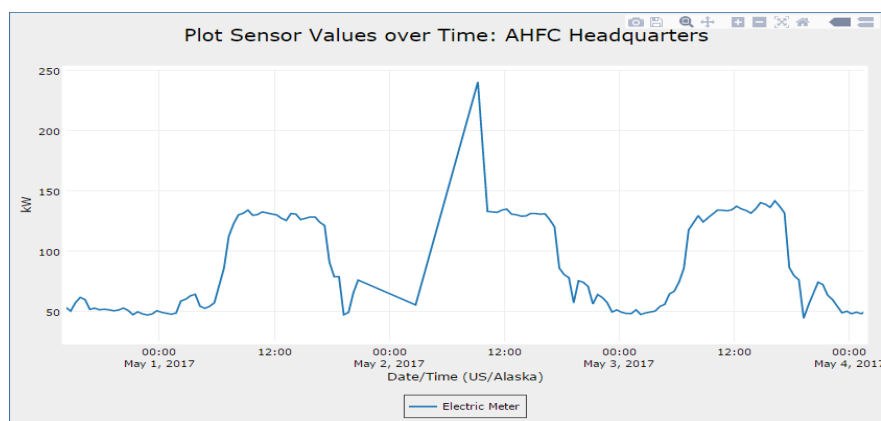
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Peak Demand Management Case Study

- 2 afternoons per summer setting ratchet
- No viable co-generation options
- Decided to load shed with a lighting retrofit
- Save 43 Watts per lamp
- 518 lamps in the building saves 27 kW

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Peak Demand Management



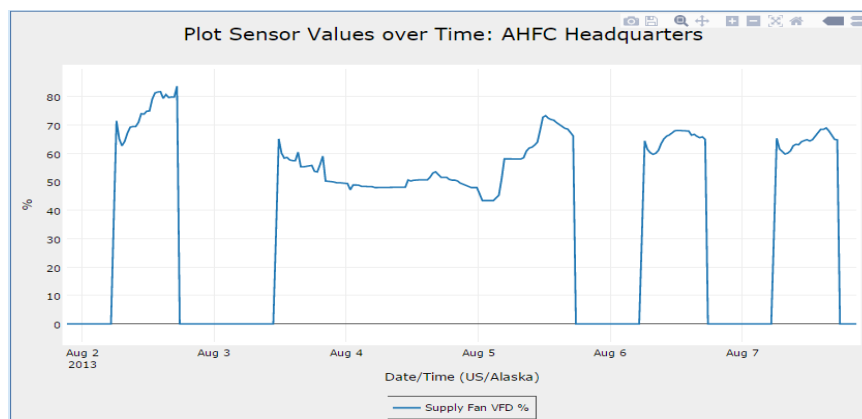
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Peak Demand Management Case Study

- Volumetric savings of \$9,180.02
- Demand savings of \$6,785.84 (27kW)
- Estimated yearly savings of \$15,965.86
- Hard project costs \$13,500
- Simple Pay Back 10 months
- Savings to Investment Ratio 6.8 to 1

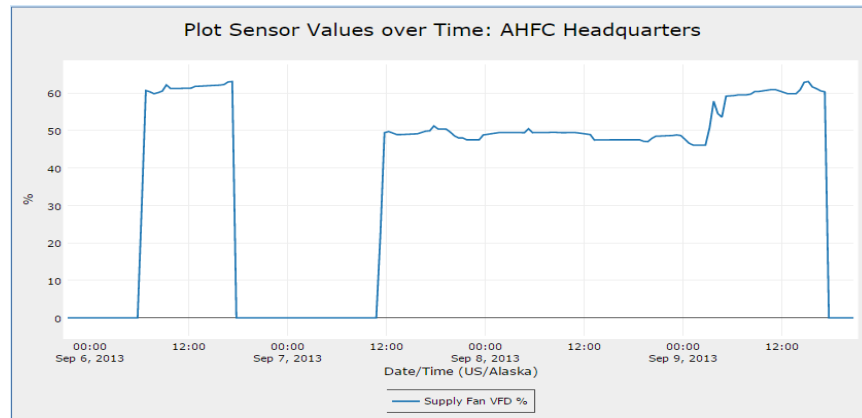
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Automation System Case Study



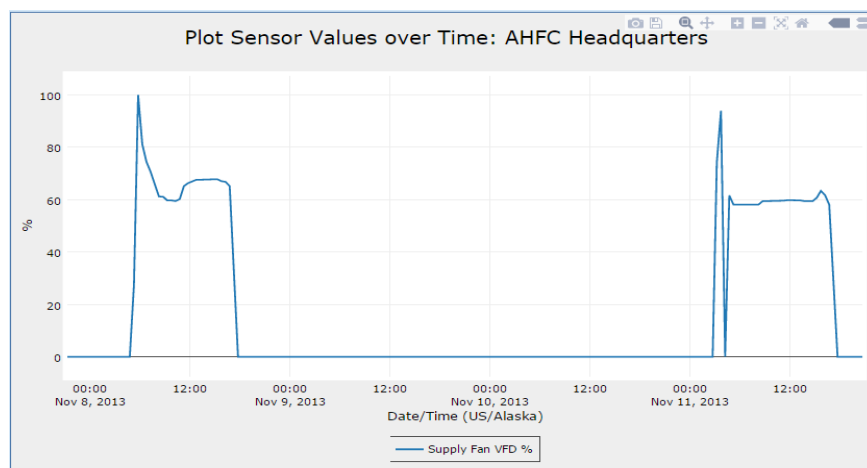
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Automation System Case Study



47

Automation System Case Study



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Alaska Energy Efficiency Revolving Loan Program (AEERLP)

Open to public facilities including;

School, City and Borough buildings

State Agency and University of Alaska buildings

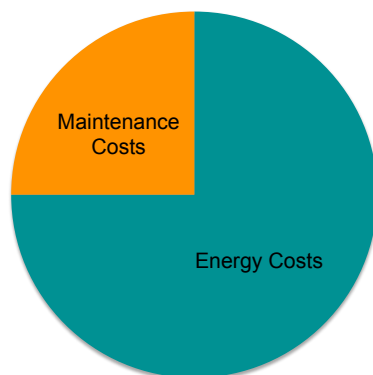
Loans can be repaid by energy savings



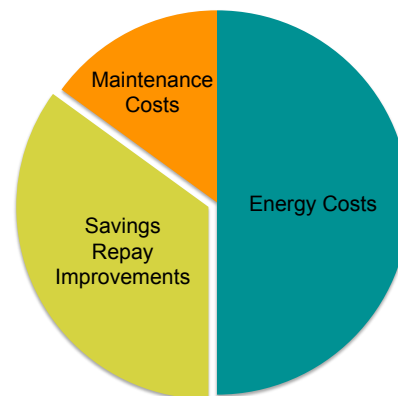
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Finances

Before Improvements



After Improvements



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Source: Energy Services Coalition

Impact of Priorities – Cost of Delay

Cash Flow Calculator

INPUTS & OUTPUTS					
Pre-Retrofit Annual Energy Expenditure	\$460,000	Cost for Improvements	\$ 563,000	Loan Term (yrs.)	6
Post-Retrofit Annual Energy Expenditure	\$317,000	Design/Engineering	\$ 84,450	Interest Rate	2.500%
Post Retrofit Annual Energy Cost Savings	\$143,000	Project Management	\$ 16,890	Number of Payments per year	12
Post Retrofit Annual Energy Savings %	31%	Contingency	\$ 56,300	Down Payment	\$ -
Energy Cost Annual Escalation Rate	2.0%	Project Costs - Down Payment	\$ 720,640	Discount Rate	8.0%
Assumed Project Life	15				

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Impact of Priorities – Cost of Delay

INVESTMENT ANALYSIS		
Project Cost	\$ 720,640	<i>Includes applicable incentives or down payment of \$0</i>
Internal Rate of Return (IRR)	21%	<i>Assumes 2.0% annual utility cost increase</i>
Simple Payback	5.04	<i>Only applicable if using internal funds</i>
Cost of Delay (6 Months)	\$ 84,081	<i>Lost incremental cash flow from waiting to implement project</i>
Life Cycle Savings	\$1,739,051	<i>Assumes loan and immediate action, with 15 year equipment life</i>
Annual Savings		
With loan payment	\$ 22,789	<i>Represents average energy cost savings - loan payments</i>
No loan payment	\$ 168,161	<i>Represents increased cash flow from energy cost savings, in scenarios where no loan is taken, or where loan is paid off</i>

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RESOURCES

1. Introduction and History to Green Building
2. Understanding Building Energy Use
3. The Economics of Energy Efficiency
4. Policy and Codes that Support Efficiency
5. High Performance Envelope Design
6. Climate Responsive Design in Cold Climates
7. Energy Modeling as a Design Tool
8. Building for Efficiency: The Role of Contractors & Trades
9. Energy Efficient Retrofits of Existing Buildings
10. Commissioning and Retro-commissioning

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“You *either* pay for energy waste...
or for energy *improvements*.”

Coffman Engineers



Thank You



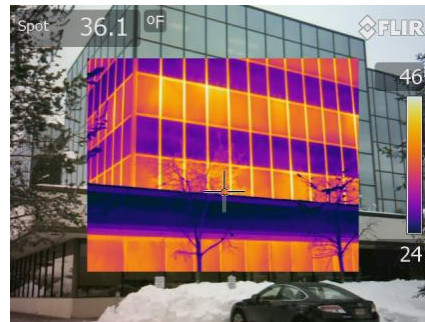
Alaska Housing Finance Corporation

<https://www.ahfc.us/efficiency/>

Energy Efficiency Technical Assistance Center

eetac@ahfc.us

1-877-257-3228



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