Lighting Audit Results and Recommendations

City of Homer - City Hall
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Homer, AK 99603
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1. EXECUTIVE SUMMARY

This report was prepared for the City of Homer. The scope of the audit focused on Homer City Hall. The scope of this report is an energy study of the interior and exterior lighting systems.

Based on electricity and fuel oil prices in effect at the time of the audit, the total predicted energy costs are $25,317 per year and the breakdown of the annual predicted energy costs and fuel use for the buildings analyzed are as follows:

$18,769 for Electricity
$6,548 for Natural Gas

Predicted Annual Fuel Use		
Fuel Use	**Existing Building**	**With Proposed Retrofits**
Electricity	80,900 kWh	71,565 kWh
Natural Gas	6,357 ccf	6,554 ccf

Benchmark figures facilitate comparing energy use between different buildings. The table below lists several benchmarks for the audited building. More details can be found in section 3.2.2.

Building Benchmarks			
Description	**EUI (kBtu/Sq.Ft.)**	**EUI/HDD (Btu/Sq.Ft./HDD)**	**ECI ($/Sq.Ft.)**
Existing Building	69.9	6.92	$1.94
With Proposed Retrofits	69.0	6.83	$1.79
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. EUI/HDD: Energy Use Intensity per Heating Degree Day. ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.			

Table 1.1 below summarizes the energy efficiency measures analyzed for the Homer City Hall. Listed are the estimates of the annual savings, installed costs, and two different financial measures of investment return.

Table 1.1 PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	**Feature**	**Improvement Description**	**Annual Energy Savings**	**Materials Cost**	**Savings to Investment Ratio, SIR[1]**	**Simple Payback (Years)[2]**	**CO_2 Savings**
1	Lighting - Power Retrofit: Administration South Overlook Recessed Lights	Replace with 2 LED 14W Module StdElectronic	$16 / 0.1 MMBTU	$7	24.82	0.4	64.4
2	Lighting - Power Retrofit: Basement Entry Exterior Canopy, Southwest Corner	Replace with 2 LED 36W Module StdElectronic	$170 / 2.5 MMBTU	$100	15.51	0.6	808.0
3	Lighting - Power Retrofit: Administration Office Hallway	Replace with 3 LED 13W Module StdElectronic	$29 / 0.2 MMBTU	$30	10.16	1.0	119.1
4	Lighting - Power Retrofit: Top Floor North Entry Foyer Recessed Lighting	Replace with 4 LED 13W Module StdElectronic	$26 / 0.2 MMBTU	$40	6.75	1.5	105.4
5	Lighting - Power Retrofit: High Use T8 Fixtures	Replace with 350 LED 18W Module StdElectronic	$1,603 / 8.5 MMBTU	$3,542	4.98	2.2	6,405.4
6	Lighting - Power Retrofit: Elevator	Replace with 4 LED 8W Module StdElectronic	$42 / 0.0 MMBTU	$39	4.91	0.9	154.1
7	Lighting - Power Retrofit: Low Use T12 Fixtures	Replace with 22 LED 18W Module StdElectronic	$34 / 0.2 MMBTU	$223	2.18	6.6	133.2
8	Lighting - Power Retrofit: Exterior Small Wall Pack	Replace with 4 LED 24W Module StdElectronic	$39 / 0.6 MMBTU	$305	1.88	7.8	185.6
	TOTAL, cost-effective measures		**$1,960 / 12.2 MMBTU**	**$4,286**	**4.94**	**2.2**	**7,975.1**
The following measures were *not* found to be cost-effective:							
9	Lighting - Power Retrofit: Low Use T8 Fixtures	Replace with 8 LED 18W Module StdElectronic	$4 / 0.0 MMBTU	$81	0.64	22.3	14.2
10	Lighting - Power Retrofit: Low Use CFL	Replace with 3 LED 14W Module StdElectronic	$0 / 0.0 MMBTU	$10	-0.59	999.9	-1.6
	TOTAL, all measures		**$1,963 / 12.2 MMBTU**	**$4,377**	**4.85**	**2.2**	**7,987.7**

Table Notes:

[1] Savings to Investment Ratio (SIR) is a life-cycle cost measure calculated by dividing the total savings over the life of a project (expressed in today's dollars) by its investment costs. The SIR is an indication of the profitability of a measure; the higher the SIR, the more profitable the project. An SIR greater than 1.0 indicates a cost-effective project (i.e. more savings than cost). Remember that this profitability is based on the position of that Energy Efficiency Measure (EEM) in the overall list and assumes that the measures above it are implemented first.

[2] Simple Payback (SP) is a measure of the length of time required for the savings from an EEM to payback the investment cost, not counting interest on the investment and any future changes in energy prices. It is calculated by dividing the investment cost by the expected first-year savings of the EEM.

With all of these energy efficiency measures in place, the annual utility cost can be reduced by $1,963 per year, or 7.8% of the buildings' total energy costs. These measures are estimated to cost $4,376, for an overall simple payback period of 2.2 years. If only the cost-effective measures are implemented, the annual utility cost can be reduced by $1,960 per year, or 7.7% of the buildings' total energy costs. These measures are estimated to cost $4,286, for an overall simple payback period of 2.2 years.

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the Homer City Hall. The scope of this project included evaluating interior and exterior lighting. Measures were analyzed based on life-cycle-cost techniques, which include the initial cost of the equipment, life of the equipment, annual energy cost, annual maintenance cost, and a discount rate of 3.0%/year in excess of general inflation.

2.2 Audit Description

Preliminary audit information was gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is used and what opportunities exist within a building. The entire site was surveyed to inventory the following to gain an understanding of how each building operates:

- Lighting systems and controls

Details collected from Homer City Hall enable a model of the building's energy usage to be developed, highlighting the building's total energy consumption, energy consumption by specific building component, and equivalent energy cost. The analysis involves distinguishing the different fuels used on site, and analyzing their consumption in different activity areas of the building.

Homer City Hall is classified as being made up of the following activity areas:

1) Office Space: 13,047 square feet

In addition, the methodology involves taking into account a wide range of factors specific to the building. These factors are used in the construction of the model of energy used. The factors include:

- Occupancy hours
- Local climate conditions
- Prices paid for energy

2.3. Method of Analysis

Data collected was processed using AkWarm© Energy Use Software to estimate energy savings for each of the proposed energy efficiency measures (EEMs).

EEMs are evaluated based on building use and processes, local climate conditions, building construction type, function, operational schedule, existing conditions, and foreseen future plans. Energy savings are calculated based on industry standard methods and engineering estimations.

Our analysis provides a number of tools for assessing the cost effectiveness of various improvement options. These tools utilize **Life-Cycle Costing**, which is defined in this context as a method of cost analysis that estimates the total cost of a project over the period of time that includes both the construction cost and ongoing maintenance and operating costs.

Savings to Investment Ratio (SIR) = **Savings** divided by **Investment**

Savings includes the total discounted dollar savings considered over the life of the improvement. When these savings are added up, changes in future fuel prices as projected by the Department of Energy are included. Future savings are discounted to the present to account for the time-value of money (i.e. money's ability to earn interest over time). The **Investment** in the SIR calculation includes the labor and materials required to install the measure. An SIR value of at least 1.0 indicates that the project is cost-effective—total savings exceed the investment costs.

Simple payback is a cost analysis method whereby the investment cost of a project is divided by the first year's savings of the project to give the number of years required to recover the cost of the investment. This may be compared to the expected time before replacement of the system or component will be required. For example, if a boiler costs $12,000 and results in a savings of $1,000 in the first year, the payback time is 12 years. If the boiler has an expected life to replacement of 10 years, it would not be financially viable to make the investment since the payback period of 12 years is greater than the project life.

The Simple Payback calculation does not consider likely increases in future annual savings due to energy price increases. As an offsetting simplification, simple payback does not consider the need to earn interest on the investment (i.e. it does not consider the time-value of money). Because of these simplifications, the SIR figure is considered to be a better financial investment indicator than the Simple Payback measure.

Measures are implemented in order of cost-effectiveness. The program first calculates individual SIRs, and ranks all measures by SIR, higher SIRs at the top of the list. An individual measure must have an individual SIR>=1 to make the cut. Next the building is modified and re-simulated with the highest ranked measure included. Now all remaining measures are re-evaluated and ranked, and the next most cost-effective measure is implemented. AkWarm goes through this iterative process until all appropriate measures have been evaluated and installed.

It is important to note that the savings for each recommendation is calculated based on implementing the most cost effective measure first, and then cycling through the list to find the next most cost effective measure. Implementation of more than one EEM often affects the savings of other EEMs. The savings may in some cases be relatively higher if an individual EEM is implemented in lieu of multiple recommended EEMs. For example implementing a reduced operating schedule for inefficient lighting will result in relatively high savings. Implementing a reduced operating schedule for newly installed efficient lighting will result in lower relative savings, because the efficient lighting system uses less energy during each hour of operation. If multiple EEM's are recommended to be implemented, AkWarm calculates the combined savings appropriately.

Cost savings are calculated based on estimated initial costs for each measure.

2.4 Limitations of Study

All results are dependent on the quality of input data provided, and can only act as an approximation. In some instances, several methods may achieve the identified savings. This report is not intended as a final design document. The design professional or other persons following the recommendations shall accept responsibility and liability for the results.

3. Homer City Hall

3.1. Building Description

The 13,047 square foot Homer City Hall was constructed in 1980, with a normal occupancy of 20 people. The number of hours of operation for this building averages 7.1 hours per day, considering all seven days of the week.

3.2 Predicted Energy Use

3.2.1 Energy Usage / Tariffs

The electric usage profile charts (below) represents the predicted electrical usage for the building. If actual electricity usage records were available, the model used to predict usage was calibrated to approximately match actual usage. The electric utility measures consumption in kilowatt-hours (kWh) and maximum demand in kilowatts (kW). One kWh usage is equivalent to 1,000 watts running for one hour. One KW of electric demand is equivalent to 1,000 watts running at a particular moment. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges.

The natural gas usage profile shows the predicted natural gas energy usage for the building. If actual gas usage records were available, the model used to predict usage was calibrated to approximately match actual usage. Natural gas is sold to the customer in units of 100 cubic feet (CCF), which contains approximately 100,000 BTUs of energy.

The following is a list of the utility companies providing energy to the building and the class of service provided:

Electricity: Homer Electric Assn - Commercial - Sm

Natural Gas: Enstar Natural Gas - G3

The average cost for each type of fuel used in this building is shown below in Table 3.1. This figure includes all surcharges, subsidies, and utility customer charges:

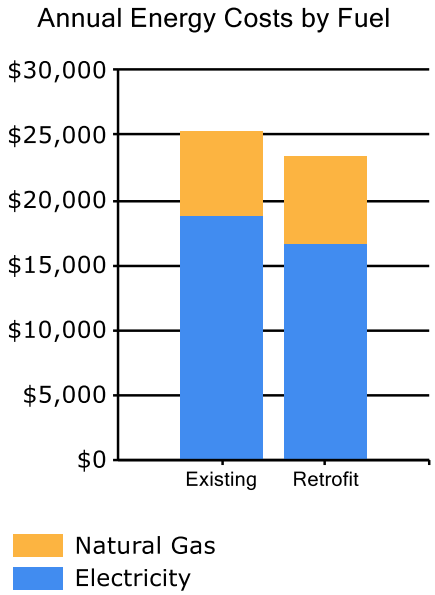
Table 3.1 – Average Energy Cost

Description	Average Energy Cost
Electricity	$ 0.2320/kWh
Natural Gas	$ 1.03/ccf

3.2.1.1 Total Energy Use and Cost Breakdown

Figure 3.2 below shows how the annual energy cost of the building splits between the different fuels used by the building. The "Existing" bar shows the breakdown for the building as it is now; the "Retrofit" bar shows the predicted costs if all of the energy efficiency measures in this report are implemented.

Figure 3.2
Annual Energy Costs by Fuel Type



3.2.2 Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (Btu) or kBtu, and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.
The site and source EUIs for this building are calculated as follows. (See Table 3.4 for details):

$$\textit{Building Site EUI} = \frac{(\textit{Electric Usage in kBtu + Gas Usage in kBtu + similar for other fuels})}{\textit{Building Square Footage}}$$

$$\textit{Building Source EUI} = \frac{(\textit{Electric Usage in kBtu X SS Ratio + Gas Usage in kBtu X SS Ratio + similar for other fuels})}{\textit{Building Square Footage}}$$

where "SS Ratio" is the Source Energy to Site Energy ratio for the particular fuel.

Table 3.4
Homer City Hall EUI Calculations

Energy Type	Building Fuel Use per Year	Site Energy Use per Year, kBTU	Source/Site Ratio	Source Energy Use per Year, kBTU
Electricity	80,900 kWh	276,112	3.340	922,215
Natural Gas	6,357 ccf	635,727	1.047	665,607
Total		**911,840**		**1,587,822**
BUILDING AREA		13,047	Square Feet	
BUILDING SITE EUI		70	kBTU/Ft²/Yr	
BUILDING SOURCE EUI		122	**kBTU/Ft²/Yr**	
* Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued March 2011.				

Table 3.5

Building Benchmarks			
Description	**EUI (kBtu/Sq.Ft.)**	**EUI/HDD (Btu/Sq.Ft./HDD)**	**ECI ($/Sq.Ft.)**
Existing Building	**69.9**	**6.92**	**$1.94**
With Proposed Retrofits	**69.0**	**6.83**	**$1.79**
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. **EUI/HDD: Energy Use Intensity per Heating Degree Day.** **ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.**			

3.3 AkWarm© Building Simulation

For the purposes of this study, the Homer City Hall was modeled using AkWarm© energy use software to establish a baseline space heating and cooling energy usage. Climate data from Homer was used for analysis. From this, the model was be calibrated to predict the impact of theoretical energy savings measures. Once annual energy savings from a particular measure were predicted and the initial capital cost was estimated, payback scenarios were approximated.

Limitations of AkWarm© Models

• The model is based on typical mean year weather data for Homer. This data represents the average ambient weather profile as observed over approximately 30 years. As such, the gas and electric profiles generated will not likely compare perfectly with actual energy billing information from any single year. This is especially true for years with extreme warm or cold periods, or even years with unexpectedly moderate weather.
• The heating and cooling load model is a simple two-zone model consisting of the building's core interior spaces and the building's perimeter spaces. This simplified approach loses accuracy for buildings that have large variations in cooling/heating loads across different parts of the building.
• The model does not model HVAC systems that simultaneously provide both heating and cooling to the same building space (typically done as a means of providing temperature control in the space).

The energy balances shown in Section 3.1 were derived from the output generated by the AkWarm© simulations.

4. ENERGY COST SAVING MEASURES

4.1 Summary of Results

The energy saving measures are summarized in Table 4.1. Please refer to the individual measure descriptions later in this report for more detail.

Table 4.1
Homer City Hall, Homer, Alaska
PRIORITY LIST – ENERGY EFFICIENCY MEASURES

Rank	Feature	Improvement Description	Annual Energy Savings	Materials Cost	Savings to Investment Ratio, SIR	Simple Payback (Years)	CO_2 Savings
1	Lighting - Power Retrofit: Administration South Overlook Recessed Lights	Replace with 2 LED 14W Module StdElectronic	$16 / 0.1 MMBTU	$7	24.82	0.4	64.4
2	Lighting - Power Retrofit: Basement Entry Exterior Canopy, Southwest Corner	Replace with 2 LED 36W Module StdElectronic	$170 / 2.5 MMBTU	$100	15.51	0.6	808.0
3	Lighting - Power Retrofit: Administration Office Hallway	Replace with 3 LED 13W Module StdElectronic	$29 / 0.2 MMBTU	$30	10.16	1.0	119.1
4	Lighting - Power Retrofit: Top Floor North Entry Foyer Recessed Lighting	Replace with 4 LED 13W Module StdElectronic	$26 / 0.2 MMBTU	$40	6.75	1.5	105.4
5	Lighting - Power Retrofit: High Use T8 Fixtures	Replace with 350 LED 18W Module StdElectronic	$1,603 / 8.5 MMBTU	$3,542	4.98	2.2	6,405.4
6	Lighting - Power Retrofit: Elevator	Replace with 4 LED 8W Module StdElectronic	$42 / 0.0 MMBTU	$39	4.91	0.9	154.1
7	Lighting - Power Retrofit: Low Use T12 Fixtures	Replace with 22 LED 18W Module StdElectronic	$34 / 0.2 MMBTU	$223	2.18	6.6	133.2
8	Lighting - Power Retrofit: Exterior Small Wall Pack	Replace with 4 LED 24W Module StdElectronic	$39 / 0.6 MMBTU	$305	1.88	7.8	185.6
	TOTAL, cost-effective measures		**$1,960 / 12.2 MMBTU**	**$4,286**	**4.94**	**2.2**	**7,975.1**
The following measures were *not* found to be cost-effective:							
9	Lighting - Power Retrofit: Low Use T8 Fixtures	Replace with 8 LED 18W Module StdElectronic	$4 / 0.0 MMBTU	$81	0.64	22.3	14.2
10	Lighting - Power Retrofit: Low Use CFL	Replace with 3 LED 14W Module StdElectronic	$0 / 0.0 MMBTU	$10	-0.59	999.9	-1.6
	TOTAL, all measures		**$1,963 / 12.2 MMBTU**	**$4,377**	**4.85**	**2.2**	**7,987.7**

4.2 Interactive Effects of Projects

The savings for a particular measure are calculated assuming all recommended EEMs coming before that measure in the list are implemented. If some EEMs are not implemented, savings for the remaining EEMs will be affected. For example, if ceiling insulation is not added, then savings from a project to replace the heating system will be increased, because the heating system for the building supplies a larger load.

In general, all projects are evaluated sequentially so energy savings associated with one EEM would not also be attributed to another EEM. By modeling the recommended project sequentially, the analysis accounts for interactive affects among the EEMs and does not "double count" savings.

Interior lighting, plug loads, facility equipment, and occupants generate heat within the building. When the building is in cooling mode, these items contribute to the overall cooling demands of the building; therefore, lighting efficiency improvements will reduce cooling requirements in air-conditioned buildings. Conversely, lighting-efficiency improvements are anticipated to slightly increase heating requirements. Heating penalties and cooling benefits were included in the lighting project analysis.

4.5 Electrical & Appliance Measures

4.5.1 Lighting Measures

The goal of this section is to present any lighting energy conservation measures that may also be cost beneficial. It should be noted that replacing current bulbs with more energy-efficient equivalents will have a small effect on the building heating and cooling loads. The building cooling load will see a small decrease from an upgrade to more efficient bulbs and the heating load will see a small increase, as the more energy efficient bulbs give off less heat.

4.5.1a Lighting Measures – Replace Existing Fixtures/Bulbs

Rank	Location	Existing Condition	Recommendation
1	Administration South Overlook Recessed Lights	2 FLUOR CFL, Spiral 32 W with Manual Switching	Replace with 2 LED 14W Module StdElectronic

Installation Cost	$7	**Estimated Life of Measure (yrs)**	13	**Energy Savings ($/yr)**	$16
Breakeven Cost	$165	**Simple Payback (yrs)**	0	**Energy Savings (MMBTU/yr)**	0.1 MMBTU
		Savings-to-Investment Ratio	24.8		

Auditors Notes: Replace lamps at the administration office south overlook area in southwest corner.
https://www.amazon.com/dp/B074PJ4RM4/?colid=1FR7FQ9MTA4IS&coliid=I2EKUI7WR4MVQO&ref_=lv_ov_lig_pab

Rank	Location	Existing Condition	Recommendation
2	Basement Entry Exterior Canopy, Southwest Corner	2 MH 100 Watt Magnetic with Manual Switching	Replace with 2 LED 36W Module StdElectronic

Installation Cost	$100	**Estimated Life of Measure (yrs)**	11	**Energy Savings ($/yr)**	$170
Breakeven Cost	$1,555	**Simple Payback (yrs)**	1	**Energy Savings (MMBTU/yr)**	2.5 MMBTU
		Savings-to-Investment Ratio	15.5		

Auditors Notes: Replace all existing lamps at exterior recessed lighting fixtures. Bypass existing ballasts. Verify new lamps will fit existing fixtures before purchase.
https://www.1000bulbs.com/product/192005/PLT-5103B.html

Rank	Location	Existing Condition	Recommendation
3	Administration Office Hallway	3 FLUOR CFL, Plug-in 32W Six Tube with Manual Switching	Replace with 3 LED 13W Module StdElectronic

Installation Cost	$30	**Estimated Life of Measure (yrs)**	13	**Energy Savings ($/yr)**	$29
Breakeven Cost	$305	**Simple Payback (yrs)**	1	**Energy Savings (MMBTU/yr)**	0.2 MMBTU
		Savings-to-Investment Ratio	10.2		

Auditors Notes: Replace existing lamps.
https://www.amazon.com/dp/B01A0CIUXG/?coliid=IBMZBQ6GTQABY&colid=1FR7FQ9MTA4IS&psc=0&ref_=lv_ov_lig_dp_it

Rank	Location	Existing Condition	Recommendation
4	Top Floor North Entry Foyer Recessed Lighting	4 FLUOR CFL, Plug-in 26W Quad Tube StdElectronic with Manual Switching	Replace with 4 LED 13W Module StdElectronic

Installation Cost	$40	**Estimated Life of Measure (yrs)**	13	**Energy Savings ($/yr)**	$26
Breakeven Cost	$270	**Simple Payback (yrs)**	2	**Energy Savings (MMBTU/yr)**	0.2 MMBTU
		Savings-to-Investment Ratio	6.7		

Auditors Notes: Replace existing lamps.
https://www.amazon.com/dp/B01A0CIUXG/?coliid=IBMZBQ6GTQABY&colid=1FR7FQ9MTA4IS&psc=0&ref_=lv_ov_lig_dp_it

Rank	Location	Existing Condition	Recommendation
5	High Use T8 Fixtures	350 FLUOR T8 4' F32T8 32W Standard Instant StdElectronic with Manual Switching	Replace with 350 LED 18W Module StdElectronic

Installation Cost	$3,542	**Estimated Life of Measure (yrs)**	14	**Energy Savings ($/yr)**	$1,603
Breakeven Cost	$17,636	**Simple Payback (yrs)**	2	**Energy Savings (MMBTU/yr)**	8.5 MMBTU
		Savings-to-Investment Ratio	5.0		

Auditors Notes: Replace all T8 lamps in areas not otherwise specified in the low use improvement option. Bypass existing ballasts.
https://www.amazon.com/dp/B01G4GWHCW/?coliid=I2R7MD0JXZZCC5&colid=1FR7FQ9MTA4IS&psc=0&ref_=lv_ov_lig_dp_it

Rank	Location	Existing Condition	Recommendation
6	Elevator	4 FLUOR T8 2' F17T8 17W Standard with Manual Switching	Replace with 4 LED 8W Module StdElectronic

Installation Cost	$39	**Estimated Life of Measure (yrs)**	5	**Energy Savings ($/yr)**	$42
Breakeven Cost	$194	**Simple Payback (yrs)**	1	**Energy Savings (MMBTU/yr)**	0.0 MMBTU
		Savings-to-Investment Ratio	4.9		

Auditors Notes: Replace lighting in elevator. Bypass ballast.
https://www.amazon.com/dp/B00R8SJ7UG/ref=twister_B00R8SJ41S?_encoding=UTF8&psc=1

Rank	Location	Existing Condition	Recommendation
7	Low Use T12 Fixtures	22 FLUOR T12 4' F40T12 40W Standard Magnetic with Manual Switching	Replace with 22 LED 18W Module StdElectronic

Installation Cost	$223	**Estimated Life of Measure (yrs)**	20	**Energy Savings ($/yr)**	$34
Breakeven Cost	$486	**Simple Payback (yrs)**	7	**Energy Savings (MMBTU/yr)**	0.2 MMBTU
		Savings-to-Investment Ratio	2.2		

Auditors Notes: Replace existing T12 lamps in Server Room, Elevator Room, Basement Telephone Room, and Basement Vault. Bypass existing ballasts.
https://www.amazon.com/dp/B01G4GWHCW/?coliid=I2R7MD0JXZZCC5&colid=1FR7FQ9MTA4IS&psc=0&ref_=lv_ov_lig_dp_it

Rank	Location	Existing Condition	Recommendation
8	Exterior Small Wall Pack	4 INDUCT Sylvania Icetron 40W System with Manual Switching	Replace with 4 LED 24W Module StdElectronic

Installation Cost	$305	**Estimated Life of Measure (yrs)**	20	**Energy Savings ($/yr)**	$39
Breakeven Cost	$572	**Simple Payback (yrs)**	8	**Energy Savings (MMBTU/yr)**	0.6 MMBTU
		Savings-to-Investment Ratio	1.9		

Auditors Notes: This type of fixture cannot be re-lamped. Replaces existing induction fixture with new fixture mounted on exterior vertical walls.
https://www.homedepot.com/p/Halco-Lighting-Technologies-ProLED-Mini-Wallpack-24-Watt-Bronze-Outdoor-Integrated-LED-Dimmable-Dusk-to-Dawn-Large-Wall-Pack-Light-Cool-White-MWP24-U40BZ-PC-10172/306826290

Rank	Location	Existing Condition	Recommendation
9	Low Use T8 Fixtures	8 FLUOR T8 4' F32T8 32W Standard Instant StdElectronic with Manual Switching	Replace with 8 LED 18W Module StdElectronic

Installation Cost	$81	**Estimated Life of Measure (yrs)**	20	**Energy Savings ($/yr)**	$4
Breakeven Cost	$52	**Simple Payback (yrs)**	22	**Energy Savings (MMBTU/yr)**	0.0 MMBTU
		Savings-to-Investment Ratio	0.6		

Auditors Notes: Replace existing T8 lamps in Boiler Room and Basement Storage Rooms. Bypass existing ballasts. Not cost effective for immediate replacement. Replace when existing lamp burns out.
https://www.amazon.com/dp/B01G4GWHCW/?coliid=I2R7MD0JXZZCC5&colid=1FR7FQ9MTA4IS&psc=0&ref_=lv_ov_lig_dp_it

Rank	Location	Existing Condition	Recommendation
10	Low Use CFL	3 FLUOR CFL, Spiral 15 W with Manual Switching	Replace with 3 LED 14W Module StdElectronic

Installation Cost	$10	**Estimated Life of Measure (yrs)**	20	**Energy Savings ($/yr)**	$
Breakeven Cost	-$6	**Simple Payback (yrs)**	1000	**Energy Savings (MMBTU/yr)**	0.0 MMBTU
		Savings-to-Investment Ratio	-0.6		

Auditors Notes: Replace compact fluorescent lamps in Basement Custodial Rooms and Basement Copy Bathroom. Not cost effective for immediate replacement. Replace when existing lamp burns out.
https://www.amazon.com/dp/B01N8P5M6K/?coliid=I2AZR08QXF4AX2&colid=1FR7FQ9MTA4IS&psc=0&ref_=lv_ov_lig_dp_it

Appendix A – Energy Audit Report – Project Summary

ENERGY AUDIT REPORT – PROJECT SUMMARY	
General Project Information	
PROJECT INFORMATION	**AUDITOR INFORMATION**
Building: Homer City Hall	**Auditor Company:** Wisdom and Associates, Inc.
Address: 491 East Pioneer Ave	**Auditor Name:** Robert Moss
City: Homer	**Auditor Address:** 7984 Kenai Spur Highway Kenai, AK 99611
Client Name: Carey Meyer	
Client Address: 3575 Heath Street Homer, AK 99603	**Auditor Phone:** (907) 283-0629
	Auditor FAX:
Client Phone: (907) 235-3145	**Auditor Comment:**
Client FAX:	
Design Data	
Building Area: 13,047 square feet	**Design Space Heating Load:** Design Loss at Space: 97,195 Btu/hour with Distribution Losses: 97,195 Btu/hour Plant Input Rating assuming 82.0% Plant Efficiency and 25% Safety Margin: 148,164 Btu/hour Note: Additional Capacity should be added for DHW and other plant loads, if served.
Typical Occupancy: 20 people	**Design Indoor Temperature:** 70 deg F (building average)
Actual City: Homer	**Design Outdoor Temperature:** 0 deg F
Weather/Fuel City: Homer	**Heating Degree Days:** 10,097 deg F-days
Utility Information	
Electric Utility: Homer Electric Assn - Commercial - Sm	**Natural Gas Provider:** Enstar Natural Gas - G3
Average Annual Cost/kWh: $0.232/kWh	**Average Annual Cost/ccf:** $1.030/ccf

Building Benchmarks

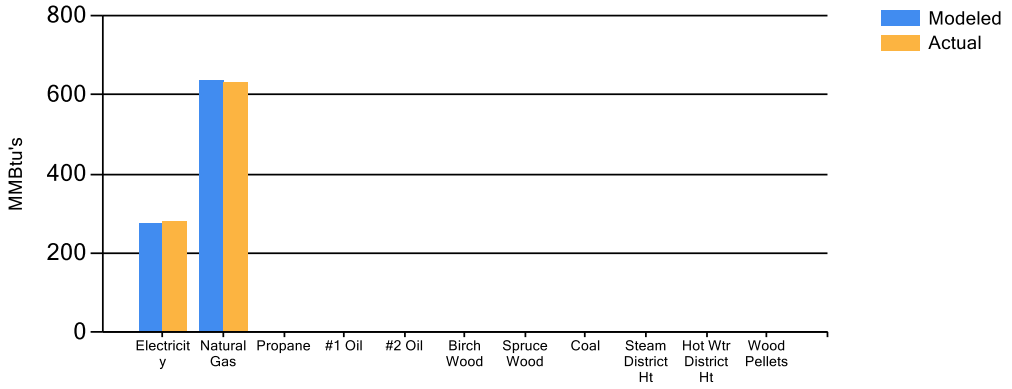
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI ($/Sq.Ft.)
Existing Building	69.9	6.92	$1.94
With Proposed Retrofits	69.0	6.83	$1.79

EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area.
EUI/HDD: Energy Use Intensity per Heating Degree Day.
ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.

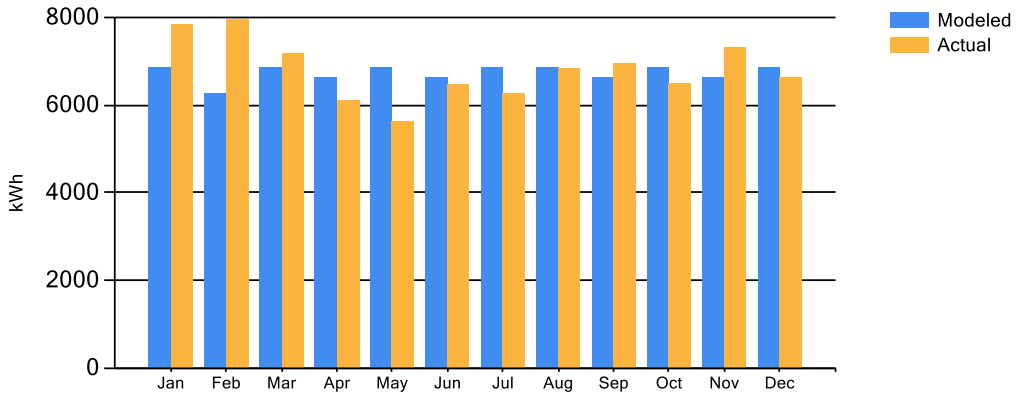
Appendix B – Actual Fuel Use versus Modeled Fuel Use

The Orange bars show Actual fuel use, and the Blue bars are AkWarm's prediction of fuel use.

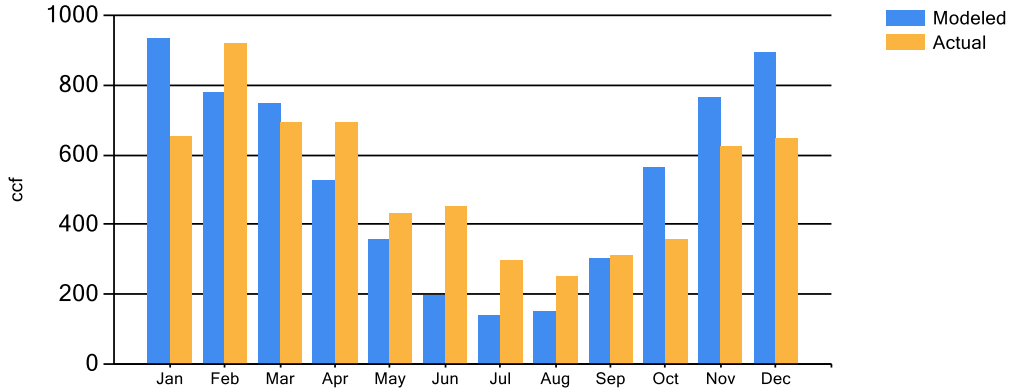
Annual Fuel Use



Electricity Fuel Use



Natural Gas Fuel Use



Appendix C - Electrical Demands

Estimated Peak Electrical Demand (kW)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Current	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4
As Proposed	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6

Estimated Demand Charges (at $0.00/kW)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Current	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
As Proposed	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

AkWarmCalc Ver 2.9.0.0, Energy Lib 9/27/2018