Comprehensive Energy Audit
For

Old Harbor Water Treatment Plant

Prepared For
City of Old Harbor

August 9, 2016

Prepared By:

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PREFACE

This energy audit was conducted using funds from the United States Department of Agriculture Rural Utilities Service as well as the State of Alaska Department of Environmental Conservation. Coordination with the State of Alaska Remote Maintenance Worker (RMW) Program and the associated RMW for each community has been undertaken to provide maximum accuracy in identifying audits and coordinating potential follow up retrofit activities.

The Rural Energy Initiative at the Alaska Native Tribal Health Consortium (ANTHC) prepared this document for The City of Old Harbor, Alaska. The authors of this report are Kevin Ulrich, Energy Manager-in-Training (EMIT); and Don Green, Senior Utility Operations Specialist.

The purpose of this report is to provide a comprehensive document of the findings and analysis that resulted from an energy audit conducted in July of 2016 by the Rural Energy Initiative of ANTHC. This report analyzes historical energy use and identifies costs and savings of recommended energy conservation measures. Discussions of site-specific concerns, non-recommended measures, and an energy conservation action plan are also included in this report.

ACKNOWLEDGMENTS

The ANTHC Rural Energy Initiative gratefully acknowledges the assistance of Water Treatment Plant Operator/Old Harbor City Treasurer Russell Fox.

1. EXECUTIVE SUMMARY

This report was prepared for the City of Old Harbor. The scope of the audit focused on Old Harbor Water Treatment Plant. The scope of this report is a comprehensive energy study, which included an analysis of building shell, interior and exterior lighting systems, heating and ventilation systems, and plug loads.

In the near future, a representative of ANTHC will be contacting the City of Old Harbor to follow up on the recommendations made in this report. Funding has been provided by to ANTHC through a Rural Alaska Village Grant to provide the community with assistance in understanding the report and implementing the recommendations. ANTHC will work to complete the recommendations within the 2016 calendar year.

The total predicted energy cost for the Old Harbor Water Treatment Plant is $45,989 per year. Electricity represents the largest portion with an annual cost of approximately $45,137. This includes $16,910 paid by the city and $28,227 paid by the Power Cost Equalization (PCE) program through the State of Alaska. Fuel oil represents the remaining portion with an annual cost of approximately $853.

The State of Alaska PCE program provides a subsidy to rural communities across the state to lower the electricity costs and make energy in rural Alaska affordable. In Old Harbor, the cost of electricity without PCE is $0.45/kWh, and the cost of electricity with PCE is $0.17/kWh. For the purposes of this report, electricity costs and savings are calculated using the $0.45/kWh rate.

The water treatment plant currently pumps approximately 70,956,000 gallons of raw water through the system annually, but the community of 285 people should have an average annual demand of approximately 10,950,000 and the water plant processes should have an average demand of approximately 5,298,000 gallons. That leads to an estimated 54,708,000 gallons being discharged through system leaks in the water distribution piping and other locations. Short-term repairs are recommended in this report and discussions about a system-wide water distribution replacement project are currently underway.

In addition to the water treatment plant, there is also an intake gallery and a water storage tank. The energy usage for these two sites are included in the bills for the water treatment plant and all associated energy efficiency measures are included in this report.

Table 1.1 lists the total usage of electricity and #1 heating oil in the water treatment plant before and after the proposed retrofits.

Table 1.1: Predicted Annual Fuel Usage for Each Fuel Type

Predicted Annual Fuel Use		
Fuel Use	**Existing Building**	**With Proposed Retrofits**
Electricity	100,303 kWh	71,867 kWh
#1 Oil	207 gallons	252 gallons

Benchmark figures facilitate comparing energy use between different buildings. Table 1.2 lists several benchmarks for the audited building. More details can be found in section 3.2.2.

Table 1.2: Building Benchmarks for the Old Harbor Water Treatment Plant

Building Benchmarks			
Description	**EUI (kBtu/Sq.Ft.)**	**EUI/HDD (Btu/Sq.Ft./HDD)**	**ECI ($/Sq.Ft.)**
Existing Building	262.5	30.48	$32.66
With Proposed Retrofits	197.9	22.97	$23.71
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 1.3 below summarizes the energy efficiency measures analyzed for the Old Harbor Water Treatment Plant. Listed are the estimates of the annual savings, installed costs, and two different financial measures of investment return.

Table 1.3: Summarized Priority List of All Energy Recommendations for the Old Harbor Water Treatment Plant

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	**Feature**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR[1]**	**Simple Payback (Years)[2]**	**CO_2 Savings**
1	Other Electrical: Water Supply Heat Tape	Shut off heat tape and use only for emergency purposes.	$1,578	$50	370.68	0.0	6,311.3
2	Lighting: Water Storage Tank	Replace with new energy-efficient, LED lighting.	$80	$100	9.45	1.2	321.8
3	Lighting: Infiltration Gallery	Replace with new energy-efficient, LED lighting.	$139	$300	5.42	2.2	554.1
4	Lighting: Entryway	Replace with new energy-efficient, LED lighting.	$37	$80	5.31	2.2	141.5
5	Lighting: Office	Replace with new energy-efficient, LED lighting.	$148	$320	5.29	2.2	563.2
6	Temperature Set Point: Process Room	Lower set point for Toyo stove to 50 deg. F.	$182	$500	4.73	2.7	868.0
7	Lighting: Process Room	Replace with new energy-efficient, LED lighting.	$233	$640	4.16	2.7	886.9

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	**Feature**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR[1]**	**Simple Payback (Years)[2]**	**CO_2 Savings**
8	Other Electrical: Well Pumps	Repair leaks in water distribution system. This assumes a leak reduction of approximately 10%.	$8,434 + $1,500 Maint. Savings	$35,000	4.16	3.5	33,735.1
9	Temperature Set Point: Office	Lower set point for Monitor stove to 50 deg. F.	$145	$500	3.77	3.4	692.3
10	Heating, Ventilation, and Domestic Hot Water	Replace existing hot water heater with on-demand Toyo unit. Downsize electric heater in chlorine room.	$1,573	$20,000	1.10	12.7	5,899.7
11	Lighting: Chlorine Room	Replace with new energy-efficient, LED lighting.	$7	$160	0.53	22.1	28.9
12	Weatherization: Exterior Wall Surface	Add caulking to exterior wall between panels to improve protection against water infiltration.	$15	$500	0.27	32.9	72.3
13	Lighting: Restrooms	Replace with new energy-efficient, LED lighting.	$2	$80	0.27	41.8	7.3
14	Exterior Door: Sand Filter Door	Insulate the sand filter door space when not in use.	$4	$456	0.20	113.6	19.1
15	Lighting: Exterior	Replace with new energy-efficient, LED lighting.	$29	$1,800	0.19	61.5	117.1
16	Lighting: Attic	Replace with new energy-efficient, LED lighting.	$3	$320	0.11	106.4	11.4
	TOTAL, all measures		**$12,610 + $1,500 Maintenance Savings**	**$60,806**	**3.26**	**4.3**	**50,229.9**

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 $12,610 per year, or 27.4% of the buildings' total energy costs. These measures are estimated to cost $60,806, for an overall simple payback period of 4.3 years.

Table 1.4 below is a breakdown of the annual energy cost across various energy end use types, such as Space Heating and Water Heating. The first row in the table shows the breakdown for the building as it is now. The second row shows the expected breakdown of energy cost for the building assuming all of the retrofits in this report are implemented. Finally, the last row shows the annual energy savings that will be achieved from the retrofits.

Table 1.4: Annual Energy Cost Estimate Broken Down by Category

Annual Energy Cost Estimate						
Description	**Space Heating**	**Water Heating**	**Ventilation Fans**	**Lighting**	**Other Electrical**	**Total Cost**
Existing Building	$1,249	$1,965	$163	$1,201	$41,411	**$45,989**
With Proposed Retrofits	$1,140	$263	$163	$415	$31,400	**$33,379**
Savings	$109	$1,703	$0	$787	$10,012	**$12,610**

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the Old Harbor Water Treatment Plant. The scope of this project included evaluating building shell, lighting and other electrical systems, and heating and ventilation equipment, motors and pumps. 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:

- Building envelope (roof, windows, etc.)
- Heating and ventilation equipment
- Lighting systems and controls
- Building-specific equipment

- Water consumption, treatment & disposal

The building site visit was performed to survey all major building components and systems. The site visit included detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager were collected along with the system and components to determine a more accurate impact on energy consumption.

Details collected from Old Harbor Water Treatment Plant 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.

The Old Harbor Water Treatment Plant has an area of approximately 1,408 square feet. Within the plant there is a process room with an area of approximately 864 square feet and the office area (including the chlorine room) with an area of approximately 544 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). The recommendations focus on the building envelope; heating and ventilation; lighting, plug load, and other electrical improvements; and motor and pump systems that will reduce annual energy consumption.

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. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers.

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. Old Harbor Water Treatment Plant

3.1. Building Description

The 1,408 square foot Old Harbor Water Treatment Plant was constructed in 2012, with a normal occupancy of one person for approximately two hours per day on weekdays and one hour per day on weekends.

The Old Harbor Water Treatment Plant serves as the water intake, filtration, and distribution center for the community. Water is pumped from a well approximately 1,100 feet from the water treatment plant by two well pumps, each of which is rated for 7.5 HP. Both pumps run simultaneously for the majority of the time. The water source is a groundwater well under the influence of the nearby Dog Creek, which flows into the Old Harbor Estuary. The plant has two large sand filters that process the intake water from the well pumps. Polymer is injected into the water prior to the filters and chlorine is injected in the water after the filters before leaving the building. The filtered water is stored in a 287,000 gallon water storage tank before getting transported to the city distribution system.

Figure 3.1: Infiltration Gallery Site

Figure 3.2: The 287,000 Water Storage Tank

<u>Description of Building Shell</u>

The exterior walls are constructed with single stud construction and 2 x 8 lumber with 24-inch spacing. There is approximately 7.5 inches of blue foam insulation within the walls and the walls have an average height of 15 ft. There is approximately 2,192 square feet of wall space in the building.

The roof of the building has a cathedral ceiling with an attic covering approximately half of the building. The roof is constructed with standard 2 x 8 lumber framing and 7.5 inches of blue foam insulation. There is approximately 1,484 square feet of roof space in the building.

The building is constructed on a gravel pad with a concrete slab and no insulation. There is approximately 1,408 square feet of floor space in the building.

There are nine total windows in the building. Eight of the windows are 16.125”x 46.25” with double pane glass and vinyl framing. There are six of these windows in the process room and two of these windows in the office. Two of the windows in the process room are on the south-facing wall. The office also has a large window with the same construction that is 34.25” x 46.25”.

The main entrance has a single insulated metal door with a quarter-lite window that is 6’8” x 3’. The chlorine room has a single insulated metal door with no glass that is 6’8” x 3’. There is a small half door in the sand filter corner that is only used when the filters are being cleaned. The door is an insulated metal door with no glass that is 36.25” x 36.125”.

Description of Heating Plants

The heating plants used in the building are:

Monitor 2200

Fuel Type:	#1 Oil
Input Rating:	22,000 BTU/hr
Steady State Efficiency:	95 %
Idle Loss:	0.2 %
Heat Distribution Type:	Air

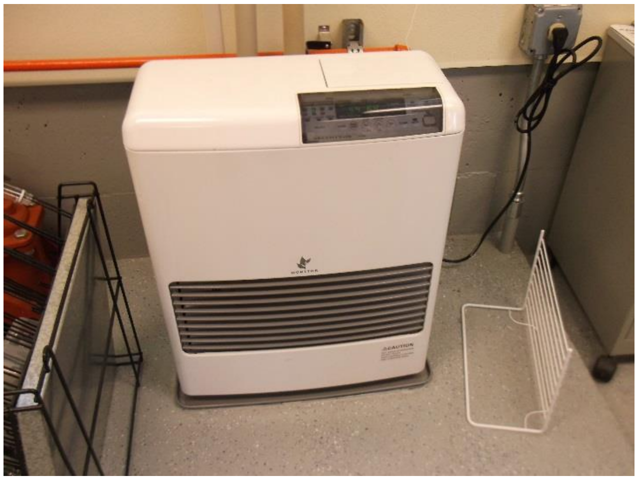


Figure 3.3: Monitor Stove in the Office

Toyo 73

Fuel Type:	#1 Oil
Input Rating:	40,000 BTU/hr
Steady State Efficiency:	95 %
Idle Loss:	0.2 %
Heat Distribution Type:	Air

Figure 3.4: Toyo 73 Stove in the Process Room

Hot Water Heater

Nameplate Information:	State P64020T4W
Fuel Type:	Electricity
Input Rating:	0 BTU/hr
Steady State Efficiency:	95 %
Idle Loss:	1 %
Heat Distribution Type:	Water
Boiler Operation:	All Year

Figure 3.5: State Model Hot Water Heater in the Restroom

Chlorine Room Heater

Fuel Type:	Electricity
Input Rating:	0 BTU/hr
Steady State Efficiency:	95 %
Idle Loss:	0 %
Heat Distribution Type:	Air

Figure 3.6: Electric Heater in the Chlorine Room

Space Heating Distribution Systems

The process room is heated by a Toyo 73 oil-fired stove that provides space heat to the room. It is rated for 40,000 BTU/hr and has a set point of 53 deg. F. This room is difficult to maintain at a constant temperature because of the water process equipment including the two large sand filters. Sunlight through the exterior windows also is a contributing factor to the space heating. During the site visit the room temperature ranged from 49 to 60 degrees.

The office and entryway is heated by a Monitor 2200 oil-fired stove with a rating of 22,000 BTU/hr. The stove has a set point of 54 deg. F.

The chlorine room has a dedicated electric space heater that has an input rating of 3.3 kW. The room has a total area of approximately 80 square feet. The heater is a large unit for the small space and a retrofit to downsize the unit is included in the recommendations.

Domestic Hot Water System

The building has a State model hot water heater that runs off an electricity input of 6.0 kW. The hot water heater has a 40 gallon tank that is maintained at 120 deg. F. The heater provides hot water for a lab sink, restroom sink, and chemical room sink as well as for the toiler in the restroom. A retrofit to change this unit for a Toyo oil-fired on-demand unit is included in the recommendations.

Description of Building Ventilation System

The process room has a mechanical ventilation system including an air damper on the west wall and a mechanical exhaust fan on the south wall with a rating of 500 CFM. The fan is used to cycle air through the building to prevent a rise in humidity, which can have detrimental effects to the water process equipment. The ventilation fan operates whenever the operator is present and occasionally during the evenings of humid days.

The chemical room has an exhaust fan that operates off a manual switch. The fan is a Greenheck model SQ-70-D-X rated for 170 CFM.

The restroom has a small exhaust fan that is used when occupied. It has a rating of 90 CFM.

Lighting

The entryway to the building has one fixture with four T8 4ft. fluorescent light bulbs in the fixture. The lights are on for approximately two hours per day when the operator is present and they consume approximately 162 kWh annually.

The office has four fixtures with four T8 4ft. fluorescent light bulbs in each fixture. The lights are on for approximately two hours per day when the operator is present and they consume approximately 649 kWh annually.

The process room has eight fixtures with four T8 4ft. fluorescent light bulbs in each fixture. The lights are on for approximately two hours per day when the operator is present, but the operator commonly operates half of the lights using a manual switch. They consume approximately 1,016 kWh annually.

The restroom has one fixture with two T8 4ft. fluorescent light bulbs in the fixture. The lights are on when the room is occupied and they consume approximately 18 kWh annually.

The attic has four fixtures with two T8 4ft. fluorescent light bulbs in each fixture. The space is used for storage of tools and equipment and the lights consume approximately 29 kWh annually.

The chlorine room has two fixtures with two T8 4ft. fluorescent light bulbs in each fixture. The lights are on for approximately 50% of the time when the operator is present and they consume approximately 55 kWh annually.

The exterior of the building has six fixtures with a single spiral CFL 26 Watt bulb in each fixture. The lights are manually controlled by the operator when he is present during the winter months and they consume approximately 161 kWh annually.

The infiltration gallery has a single fixture with a high pressure sodium 150 Watt light bulb that is rarely used and consumes approximately 339 kWh annually.

The water storage tank has a single fixture with an incandescent 60 Watt light bulb that consumes approximately 241 kWh annually.

Plug Loads

The water treatment plant has a variety of power tools, a telephone, and some other miscellaneous loads that require a plug into an electrical outlet. The use of these items is infrequent and consumes a small portion of the total energy demand of the building.

Major Equipment

There are two pumps and a motor associated with the addition of polymer into the water. There is a polymer adding pump that pumps polymer from a storage container into the mixing tank whenever a new batch of polymer is needed that consumes approximately 48 kWh annually. There is a polymer mixing motor that is used to mix the polymer into a proper solution prior to injection. The pump consumes approximately 81 kWh annually. There is a polymer injection pump that operates constantly to inject polymer into the water before filtration. The injection pump is a Leeson Model C6T17WC25C and consumes approximately 3,103 kWh annually.

There is a pump and motor associated with the addition of chlorine into the water. There is a chlorine mixing motor that is used to mix each batch of chlorine into a proper solution that consumes approximately 81 kWh annually. There is a chlorine injection pump that operates by pumping chlorine into the water in doses approximately 23-25 seconds apart. The pump consumes approximately 193 kWh annually.

There are two well pumps that are used to pump water from the infiltration gallery through the water filtration and distribution system. Both of the pumps are VFD smart pumps and are rated for 10 HP each. One of the pumps runs constantly while the other pump runs an estimated 35% of the time to meet the water demand of the community and overcome the known leaks in the water distribution system. The water is pumped at a flow rate of approximately 130-140 GPM on average, which is the equivalent of 5-10 times the minimum community demand requirement. The two pumps combine to consume approximately 85,013 kWh annually.

There is a heat tape on the water supply line from the distribution main to the water treatment plant that is used to heat the water for drinking and washing purposes in the building. The heat tape is estimated to be 50 ft. long and was in constant operation before being shut off during a site visit in July 2016. Prior to being shut off, the heat tape was consuming approximately 3,506 kWh annually. This is reflected in the modeled usage totals.

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 fuel oil usage profile shows the fuel oil usage for the building. Fuel oil consumption is measured in gallons. One gallon of #1 Fuel Oil provides approximately 132,000 BTUs of energy.

The Alaska Village Electric Cooperative (AVEC) provides electricity to the residents of Old Harbor as well as all commercial and public facilities.

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 Rates by Fuel Type

Average Energy Cost	
Description	**Average Energy Cost**
Electricity	$ 0.4500/kWh
#1 Oil	$ 4.12/gallons

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, City of Old Harbor pays approximately $45,989 annually for electricity and other fuel costs for the Old Harbor Water Treatment Plant.

Figure 3.7 below reflects the estimated distribution of costs across the primary end uses of energy based on the AkWarm© computer simulation. Comparing the “Retrofit” bar in the figure to the “Existing” bar shows the potential savings from implementing all of the energy efficiency measures shown in this report.

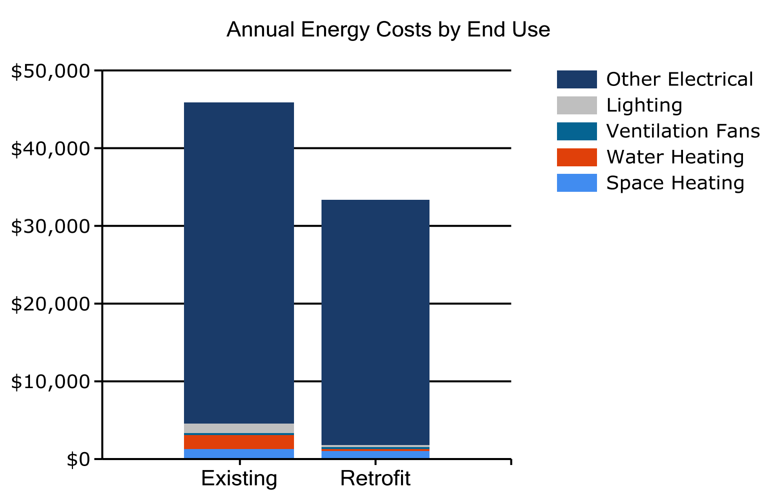


Figure 3.7: Average Energy Costs by Building Category

Figure 3.8 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.

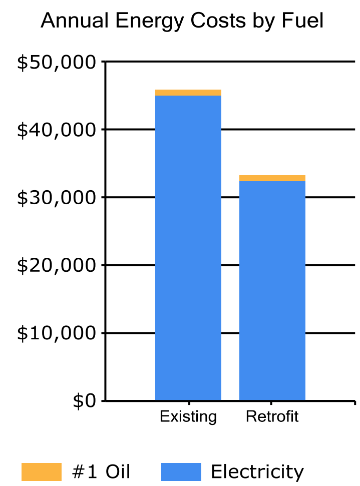


Figure 3.8: Average Energy Costs by Fuel Type

Figure 3.9 below addresses only Space Heating costs. The figure shows how each heat loss component contributes to those costs; for example, the figure shows how much annual space heating cost is caused by the heat loss through the Walls/Doors. For each component, the space heating cost for the Existing building is shown (blue bar) and the space heating cost assuming all retrofits are implemented (yellow bar) are shown.

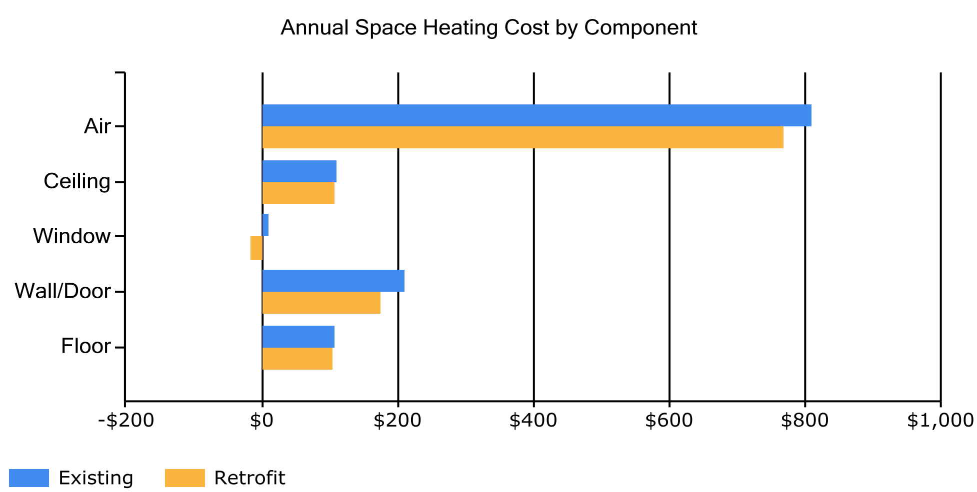


Figure 3.9: Annual Space Heating Cost by Component

The tables below show AkWarm's estimate of the monthly fuel use for each of the fuels used in the building. For each fuel, the fuel use is broken down across the energy end uses. Note, in the tables below "DHW" refers to Domestic Hot Water heating.

Table 3.2: Electrical Consumption by Category

Electrical Consumption (kWh)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space Heating	161	166	129	60	11	0	0	0	0	42	121	190
DHW	371	338	371	359	371	359	371	371	359	371	359	371
Ventilation Fans	31	28	31	30	31	30	31	31	30	31	30	31
Lighting	227	206	227	219	227	219	227	227	219	227	219	227
Other Electrical	7811	7118	7811	7559	7811	7559	7811	7811	7559	7811	7559	7811

Table 3.3: Fuel Oil Consumption by Category

Fuel Oil #1 Consumption (Gallons)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space Heating	37	38	30	14	3	1	1	1	1	10	28	44

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):

$$\text{Building Site EUI} = \frac{(\text{Electric Usage in kBtu} + \text{Fuel Oil Usage in kBtu})}{\text{Building Square Footage}}$$

$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu X SS Ratio} + \text{Fuel Oil Usage in kBtu})}{\text{Building Square Footage}}$$

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

Table 3.4: Old Harbor Water Treatment Plant 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	100,303 kWh	342,336	3.340	1,143,401
#1 Oil	207 gallons	27,325	1.010	27,598
Total		**369,661**		**1,170,999**
BUILDING AREA		1,408	Square Feet	
BUILDING SITE EUI		263	kBTU/Ft²/Yr	
BUILDING SOURCE EUI		832	**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: Old Harbor Water Treatment Plant Building Benchmarks

Building Benchmarks			
Description	**EUI (kBtu/Sq.Ft.)**	**EUI/HDD (Btu/Sq.Ft./HDD)**	**ECI ($/Sq.Ft.)**
Existing Building	262.5	30.48	$32.66
With Proposed Retrofits	197.9	22.97	$23.71
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

An accurate model of the building performance can be created by simulating the thermal performance of the walls, roof, windows and floors of the building. The heating and ventilation systems and central plant are modeled as well, accounting for the outside air ventilation required by the building and the heat recovery equipment in place.

The model uses local weather data and is trued up to historical energy use to ensure its accuracy. The model can be used now and in the future to measure the utility bill impact of all types of energy projects, including improving building insulation, modifying glazing, changing air handler schedules, increasing heat recovery, installing high efficiency boilers, using variable air volume air handlers, adjusting outside air ventilation and adding cogeneration systems.

For the purposes of this study, the Old Harbor Water Treatment Plant was modeled using AkWarm© energy use software to establish a baseline space heating energy usage. Climate data from Old Harbor 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 Old Harbor. This data represents the average ambient weather profile as observed over approximately 30 years. As such, the electric profile 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 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 heating loads across different parts of the building.

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.

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	**Feature**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR**	**Simple Payback (Years)**	**CO_2 Savings**
1	Other Electrical: Water Supply Heat Tape	Shut off heat tape and use only for emergency purposes.	$1,578	$50	370.68	0.0	6,311.3
2	Lighting: Water Storage Tank	Replace with new energy-efficient, LED lighting.	$80	$100	9.45	1.2	321.8
3	Lighting: Infiltration Gallery	Replace with new energy-efficient, LED lighting.	$139	$300	5.42	2.2	554.1
4	Lighting: Entryway	Replace with new energy-efficient, LED lighting.	$37	$80	5.31	2.2	141.5
5	Lighting: Office	Replace with new energy-efficient, LED lighting.	$148	$320	5.29	2.2	563.2
6	Temperature Set Point: Process Room	Lower set point for Toyo stove to 50 deg. F.	$182	$500	4.73	2.7	868.0
7	Lighting: Process Room	Replace with new energy-efficient, LED lighting.	$233	$640	4.16	2.7	886.9
8	Other Electrical: Well Pumps	Repair leaks in water distribution system. This assumes a leak reduction of approximately 10%.	$8,434 + $1,500 Maint. Savings	$35,000	4.16	3.5	33,735.1

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	**Feature**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR**	**Simple Payback (Years)**	**CO_2 Savings**
9	Temperature Set Point: Office	Lower set point for Monitor stove to 50 deg. F.	$145	$500	3.77	3.4	692.3
10	Heating, Ventilation, and Domestic Hot Water	Replace existing hot water heater with on-demand Toyo unit. Downsize electric heater in chlorine room.	$1,573	$20,000	1.10	12.7	5,899.7
11	Lighting: Chlorine Room	Replace with new energy-efficient, LED lighting.	$7	$160	0.53	22.1	28.9
12	Weatherization: Exterior Wall Surface	Add caulking to exterior wall between panels to improve protection against water infiltration.	$15	$500	0.27	32.9	72.3
13	Lighting: Restrooms	Replace with new energy-efficient, LED lighting.	$2	$80	0.27	41.8	7.3
14	Exterior Door: Sand Filter Door	Insulate the sand filter door space when not in use.	$4	$456	0.20	113.6	19.1
15	Lighting: Exterior	Replace with new energy-efficient, LED lighting.	$29	$1,800	0.19	61.5	117.1
16	Lighting: Attic	Replace with new energy-efficient, LED lighting.	$3	$320	0.11	106.4	11.4
	TOTAL, all measures		**$12,610 + $1,500 Maintenance Savings**	**$60,806**	**3.26**	**4.3**	**50,229.9**

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. Lighting efficiency improvements are anticipated to slightly increase heating requirements. Heating penalties were included in the lighting project analysis.

4.3 Building Shell Measures

4.3.1 Door Measures

Rank	**Location**	**Size/Type, Condition**		**Recommendation**	
14	Exterior Door: Sand Filter	Door Type: Entrance, Metal, EPS core, metal edge, no glass Modeled R-Value: 2.7		Insulate the sand filter door space when not in use.	
Installation Cost	$456	**Estimated Life of Measure (yrs)**	30	**Energy Savings (/yr)**	$4
Breakeven Cost	$89	**Savings-to-Investment Ratio**	0.2	**Simple Payback yrs**	114
Auditors Notes: There is a door in the back corner by the sand filters that is used to discard of waste when cleaning the sand filters. The door is about half the size of a standard door and is only used for this purpose on a limited basis while the rest of the year it is not used at all. This can be a hole in the insulation barrier. Adding some form of insulation or cover across the space will reduce heat loss through the door when not in use.					

4.3.2 Air Sealing Measures

Rank	**Location**	**Existing Air Leakage Level (cfm@50/75 Pa)**		**Recommended Air Leakage Reduction (cfm@50/75 Pa)**	
12	Exterior Wall Surface	Air Tightness estimated as: 1750 cfm at 50 Pascals		Add caulking to exterior wall between panels to improve protection against water infiltration.	
Installation Cost	$500	**Estimated Life of Measure (yrs)**	10	**Energy Savings (/yr)**	$15
Breakeven Cost	$137	**Savings-to-Investment Ratio**	0.3	**Simple Payback yrs**	33
Auditors Notes: The exterior walls on the southern and western sides of the building have caulking between the wall boards that has dried, cracked, and broken due to constant exposure to the sun and other weather pattern. Repairing this with new caulking will seal the wall for water damage and air penetration better and preserve the life of the building shell.					

4.4 Mechanical Equipment Measures

4.4.1 Heating/ Domestic Hot Water Measure

Rank	**Recommendation**				
10	Replace existing hot water heater with on-demand toyo unit. Downsize electric heater in chlorine room.				
Installation Cost	$20,000	**Estimated Life of Measure (yrs)**	20	**Energy Savings (/yr)**	$1,573
Breakeven Cost	$22,002	**Savings-to-Investment Ratio**	1.1	**Simple Payback yrs**	13
Auditors Notes: The current hot water heater is constantly keeping 40 gallons of hot water, which is not needed because of the sparse use of hot water in the building. Replacing the heater with an on-demand, oil-fired unit will reduce the wasted electricity when water is not in use and will convert the heating to the cheaper fuel oil. The electric heater in the chlorine is oversized for the small space that it occupies. Downsizing the unit to a heater rated at approximately 1.7 kW (half the size) will allow for more appropriate heating usage.					

4.4.2 Night Setback Thermostat Measures

Rank	Building Space			Recommendation	
6	Process Room			Lower set point for Toyo stove to 50 deg. F.	
Installation Cost	$500	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$182
Breakeven Cost	$2,367	**Savings-to-Investment Ratio**	4.7	**Simple Payback yrs**	3
Auditors Notes: The operator described how he had kept the operational set points previously at 50 degrees until a power outage changed the programming of the two stoves. Reducing the temperature set point will reduce fuel usage. The operator is not concerned about working in cooler temperatures because of his short hours in the plant each day.					

Rank	Building Space			Recommendation	
9	Office			Lower set point for Monitor stove to 50 deg. F.	
Installation Cost	$500	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$145
Breakeven Cost	$1,887	**Savings-to-Investment Ratio**	3.8	**Simple Payback yrs**	3
Auditors Notes: The operator described how he had kept the operational set points previously at 50 degrees until a power outage changed the programming of the two stoves. Reducing the temperature set point will reduce fuel usage. The operator is not concerned about working in cooler temperatures because of his short hours in the plant each day.					

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	
2	Water Storage Tank	INCAN A Lamp, Std 60W		Replace with new energy-efficient, LED lighting.	
Installation Cost	$100	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$80
Breakeven Cost	$945	**Savings-to-Investment Ratio**	9.5	**Simple Payback yrs**	1
Auditors Notes: The water storage tank has one fixture with one single incandescent 60 Watt light bulb to be replaced.					

Rank	Location	Existing Condition		Recommendation	
3	Infiltration Gallery	HPS 150 Watt StdElectronic		Replace with new energy-efficient, LED lighting.	
Installation Cost	$300	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$139
Breakeven Cost	$1,627	**Savings-to-Investment Ratio**	5.4	**Simple Payback yrs**	2
Auditors Notes: The infiltration gallery has one fixture with one HPS 150 Watt light bulb to be replaced.					

Rank	Location	Existing Condition	Recommendation
4	Entryway	FLUOR (4) T8 4' F32T8 32W Standard Instant StdElectronic	Replace with new energy-efficient, LED lighting.

Installation Cost	$80	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$37
Breakeven Cost	$425	**Savings-to-Investment Ratio**	5.3	**Simple Payback yrs**	2

Auditors Notes: The space has one fixture with four light bulbs to be replaced with two light bulbs for a total of two light bulbs to be replaced.

Rank	Location	Existing Condition	Recommendation
5	Office	4 FLUOR (4) T8 4' F32T8 32W Standard Instant StdElectronic	Replace with new energy-efficient, LED lighting.

Installation Cost	$320	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$148
Breakeven Cost	$1,692	**Savings-to-Investment Ratio**	5.3	**Simple Payback yrs**	2

Auditors Notes: The room has four fixtures with four light bulbs in each fixture to be replaced with two new light bulbs in each fixture for a total of eight light bulbs to be replaced.

Rank	Location	Existing Condition	Recommendation
7	Process Room	8 FLUOR (4) T8 4' F32T8 32W Standard Instant StdElectronic	Replace with new energy-efficient, LED lighting.

Installation Cost	$640	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$233
Breakeven Cost	$2,663	**Savings-to-Investment Ratio**	4.2	**Simple Payback yrs**	3

Auditors Notes: The room has eight fixtures with four light bulbs in each fixture to be replaced with two new light bulbs in each fixture for a total of 16 light bulbs to be replaced.

Rank	Location	Existing Condition	Recommendation
11	Chlorine Room	2 FLUOR (2) T8 4' F32T8 32W Standard Instant StdElectronic	Replace with new energy-efficient, LED lighting.

Installation Cost	$160	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$7
Breakeven Cost	$85	**Savings-to-Investment Ratio**	0.5	**Simple Payback yrs**	22

Auditors Notes: The infiltration gallery has one fixture with one HPS 35 Watt light bulb to be replaced.

Rank	Location	Existing Condition	Recommendation
13	Restroom	FLUOR (2) T8 4' F32T8 32W Standard Instant StdElectronic	Replace with new energy-efficient, LED lighting.

Installation Cost	$80	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$2
Breakeven Cost	$22	**Savings-to-Investment Ratio**	0.3	**Simple Payback yrs**	42

Auditors Notes: The room has a single fixture with two light bulbs in the fixture for a total of two light bulbs to be replaced.

Rank	Location	Existing Condition		Recommendation	
15	Exterior	6 FLUOR CFL, Spiral 26 W		Replace with new energy-efficient, LED lighting.	
Installation Cost	$1,800	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$29
Breakeven Cost	$344	**Savings-to-Investment Ratio**	0.2	**Simple Payback yrs**	61
Auditors Notes: The exterior of the building has six fixtures with a single light bulb in each fixture for a total of six light bulbs to be replaced. Four fixtures are mounted on the exterior wall while two fixtures are installed in the pavilion cover by the entrance and are difficult to access.					

Rank	Location	Existing Condition		Recommendation	
16	Attic	4 FLUOR (2) T8 4' F32T8 32W Standard Instant StdElectronic		Replace with new energy-efficient, LED lighting.	
Installation Cost	$320	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$3
Breakeven Cost	$34	**Savings-to-Investment Ratio**	0.1	**Simple Payback yrs**	106
Auditors Notes: The room has four fixtures with two light bulbs in each fixture for a total of eight light bulbs to be replaced.					

4.5.2 Other Electrical Measures

Rank	Location	Description of Existing		Efficiency Recommendation	
1	Water Supply Heat Tape	Heat Tape		Shut off heat tape and use only for emergency thaw purposes.	
Installation Cost	$50	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$1,578
Breakeven Cost	$18,534	**Savings-to-Investment Ratio**	370.7	**Simple Payback yrs**	0
Auditors Notes: Already completed					

Rank	Location	Description of Existing		Efficiency Recommendation	
8	Well Pumps	2 Well Pump		Repair leaks in water distribution system. This assumes a leak reduction of approximately 10%.	
Installation Cost	$35,000	**Estimated Life of Measure (yrs)**	20	**Energy Savings (/yr)**	$8,434
				Maintenance Savings (/yr)	$1,500
Breakeven Cost	$145,535	**Savings-to-Investment Ratio**	4.2	**Simple Payback yrs**	4
Auditors Notes: The water plant pumps approximately 5-10 times the amount of water necessary for the estimated community demand. Many leaks are present in the distribution system and a system-wide replacement is needed in the long term. Repairing leaks in the short term will reduce the water usage, lowering the pumping and treatment costs. With both well pumps operating almost constantly, there is no backup option in case one pump is not functional, and this is a key item for plant operational stability. Current raw water usage is approximately 70,956,000 gallons annually. Community demand is estimated 10,950,000 gallons annually, water sampling, treatment, and backwashing procedures uses 5,298,000 gallons annually. That means 54,708,000 gallons are leaving through leaks in the distribution system. This assumes that the average person uses 100 gallons of water per day, the average water intake flow rate is 135 GPM with some water used in the plant and backwash procedures. The retrofit estimates an approximate 10% reduction in leaks from minor fixes.					

5. ENERGY EFFICIENCY ACTION PLAN

Through inspection of the energy-using equipment on-site and discussions with site facilities personnel, this energy audit has identified several energy-saving measures. The measures will reduce the amount of fuel burned and electricity used at the site. The projects will not degrade the performance of the building and, in some cases, will improve it.

Several types of EEMs can be implemented immediately by building staff, and others will require various amounts of lead time for engineering and equipment acquisition. In some cases, there are logical advantages to implementing EEMs concurrently. For example, if the same electrical contractor is used to install both lighting equipment and motors, implementation of these measures should be scheduled to occur simultaneously.

In the near future, a representative of ANTHC will be contacting the City of Old Harbor to follow up on the recommendations made in this report. Funding has been provided by to ANTHC through a Rural Alaska Village Grant to provide the community with assistance in understanding the report and implementing the recommendations. ANTHC will work to complete the recommendations within the 2016 calendar year.

APPENDICES

Appendix A – Energy Audit Report – Project Summary

ENERGY AUDIT REPORT – PROJECT SUMMARY	
General Project Information	
PROJECT INFORMATION	**AUDITOR INFORMATION**
Building: Old Harbor Water Treatment Plant	**Auditor Company:** ANTHC-DEHE
Address: Water Treatment Plant	**Auditor Name:** Kevin Ulrich and Don Green
City: Old Harbor	**Auditor Address:** 4500 Diplomacy Dr. Anchorage, AK 99508
Client Name: Russell Fox	
Client Address: P.O. Box 109 Old Harbor, AK 99643	**Auditor Phone:** (907) 729-3237
	Auditor FAX:
Client Phone: (907) 286-2204	**Auditor Comment:**
Client FAX:	
Design Data	
Building Area: 1,408 square feet	**Design Space Heating Load:** Design Loss at Space: 34,127 Btu/hour with Distribution Losses: 34,127 Btu/hour Plant Input Rating assuming 82.0% Plant Efficiency and 25% Safety Margin: 52,024 Btu/hour Note: Additional Capacity should be added for DHW and other plant loads, if served.
Typical Occupancy: 0 people	**Design Indoor Temperature:** 53.4 deg F (building average)
Actual City: Old Harbor	**Design Outdoor Temperature:** 13 deg F
Weather/Fuel City: Old Harbor	**Heating Degree Days:** 8,614 deg F-days
Utility Information	
Electric Utility: Alaska Village Electric Cooperative (AVEC)	**Average Annual Cost/kWh:** $0.450/kWh

Annual Energy Cost Estimate						
Description	**Space Heating**	**Water Heating**	**Ventilation Fans**	**Lighting**	**Other Electrical**	**Total Cost**
Existing Building	$1,249	$1,965	$163	$1,201	$41,411	**$45,989**
With Proposed Retrofits	$1,140	$263	$163	$415	$31,400	**$33,379**
Savings	$109	$1,703	$0	$787	$10,012	**$12,610**

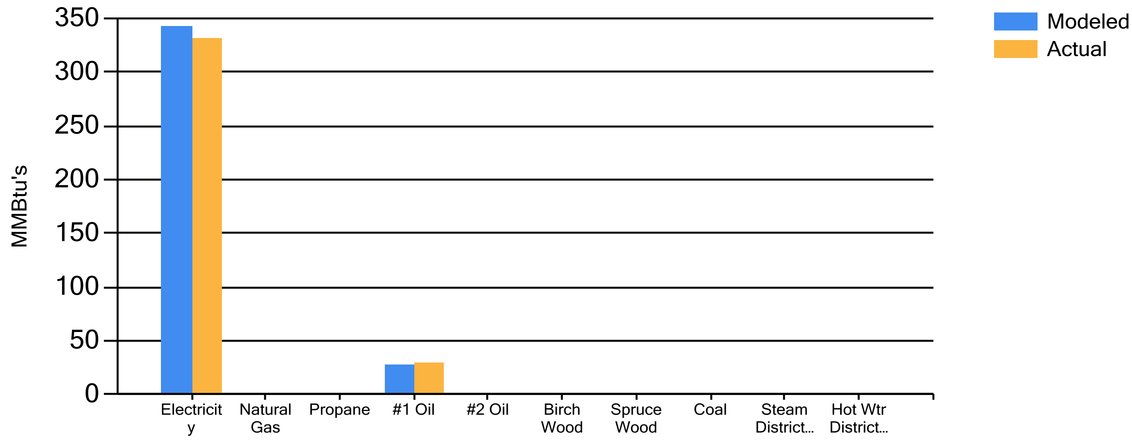
Building Benchmarks			
Description	**EUI (kBtu/Sq.Ft.)**	**EUI/HDD (Btu/Sq.Ft./HDD)**	**ECI ($/Sq.Ft.)**
Existing Building	262.5	30.48	$32.66
With Proposed Retrofits	197.9	22.97	$23.71

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.

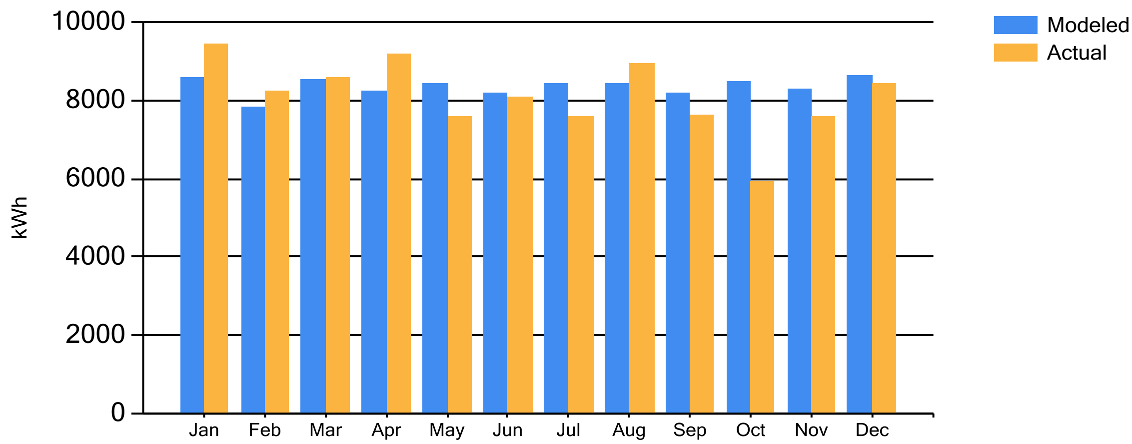
Appendix B – Actual Fuel Use versus Modeled Fuel Use

The graphs below show the modeled energy usage results of the energy audit process compared to the actual energy usage report data. The model was completed using AkWarm modeling software. The orange bars show actual fuel use, and the blue bars are AkWarm's prediction of fuel use.

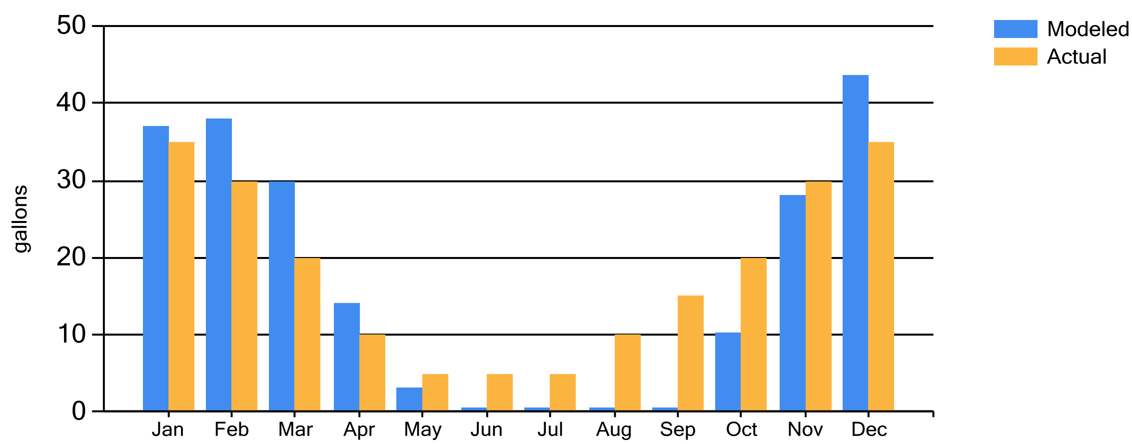
Annual Fuel Use



Electricity Fuel Use



#1 Fuel Oil Fuel Use



Appendix C - Electrical Demands

Estimated Peak Electrical Demand (kW)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Current	21.5	20.5	19.5	18.6	17.9	17.2	16.5	15.9	15.2	14.5	13.8	12.9
As Proposed	10.1	9.8	9.5	9.3	9.2	9.2	9.2	9.2	9.2	9.2	9.1	8.9

AkWarmCalc Ver 2.5.3.0, Energy Lib 3/7/2016