Comprehensive Energy Audit
For
CMTRS Building

Prepared For

Chevak Native Village

December 21, 2011

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PREFACE

The Energy Projects Group at the Alaska Native Tribal Health Consortium (ANTHC) prepared this document for the Chevak Native Village. The authors of this report are Carl H. Remley, Certified Energy Auditor (CEA) and Certified Energy Manager (CEM) and Gavin Dixon.

The purpose of this report is to provide a comprehensive document that summarizes the findings and analysis that resulted from an energy audit conducted over the past couple months by the Energy Projects Group of ANTHC. This report analyzes historical energy use and identifies costs and savings of recommended energy efficiency measures. Discussions of site specific concerns and an Energy Efficiency Action Plan are also included in this report.

ACKNOWLEDGMENTS

The Energy Projects Group gratefully acknowledges the assistance of Tribal Administrator Angelique Anderson, and Nick Levi, Maintenance.

1. EXECUTIVE SUMMARY

This report was prepared for the YKHC. The scope of the audit focused on CMTRS Building. The scope of this report is a comprehensive energy study, which included an analysis of building shell, interior and exterior lighting systems, HVAC systems, and plug loads.

Based on electricity and fuel oil prices in effect at the time of the audit, the annual predicted energy costs for the buildings analyzed are $738 for Electricity, $5,679 for #1 Oil and total energy costs of $6,417 per year.

It should be noted that this facility received the power cost equalization (PCE) subsidy from the state of Alaska last year. If it had not received PCE, electricity costs would have been $1,357.

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

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Table 1.1 **PRIORITY LIST – ENERGY EFFICIENCY MEASURES**							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR[1]	Simple Payback (Years)[2]
1	Setback Thermostat: CMTRS Building	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the CMTRS Building space.	$1,158	$500	34.70	0.4
2	Air Tightening: Adjust front door, seal trim around front door, and insulate attic hatch.	Perform air sealing to reduce air leakage by 300 cfm at 50 Pascals.	$348	$200	17.86	0.6
3	Ceiling w/ Attic: CMTRS Building	Add R-38 fiberglass batts to attic with Standard Truss.	$767	$3,383	6.10	4.4
4	Window/Skylight: CMTRS Building	Remove existing glass and replace with triple pane, 2 low-E, argon glass.	$81	$590	2.66	7.2
5	Above-Grade Wall: CMTRS Building	Install R-30 rigid foam board to exterior and cover with T1-11 siding or equivalent.	$930	$14,006	1.78	15.1
	TOTAL, all measures		**$3,284**	**$18,678**	**3.65**	**5.7**

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 $3,284 per year, or 51.2% of the buildings' total energy costs. These measures are estimated to cost $18,678, for an overall simple payback period of 5.7 years.

Table 1.2 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 1.2 Annual Energy Cost Estimate											
Description	Space Heating	Space Cooling	Water Heating	Lighting	Refrigera tion	Other Electrical	Cooking	Clothes Drying	Ventilatio n Fans	Service Fees	Total Cost
Existing Building	$5,745	$0	$263	$126	$0	$278	$5	$0	$0	$0	$6,417
With All Proposed Retrofits	$2,462	$0	$263	$126	$0	$278	$5	$0	$0	$0	$3,133
SAVINGS	$3,284	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,284

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the CMTRS Building. The scope of this project included evaluating building shell, lighting and other electrical systems, and HVAC 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, ventilation, and air conditioning equipment (HVAC)

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- Lighting systems and controls
- Building-specific equipment

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 CMTRS Building 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.

CMTRS Building is classified as being made up of the following activity areas:

1) CMTRS Building: 920 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; HVAC; 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. CMTRS Building

3.1. Building Description

The 920 square foot CMTRS Building was constructed in 1980, with a normal occupancy of 1 people. This building is in operation 7 hours per day, Monday through Friday.

Description of Building Shell

The exterior walls are 2x4 construction with 3.5 inches of batt insulation.

The roof of the building is a cold roof with 3.5 inches of insulation.

The floor of the building is built on pilings with six inches of batt insulation.

Typical windows throughout the building are double paned operable windows with wood frames, though some windows have broken panes of glass.

Doors are metal urethane with no thermal break.

Description of Heating and Cooling Plants

The Heating Plants used in the building are:

Toyotomi Laser 73
Fuel Type:	#1 Oil
Input Rating:	40,000 BTU/hr
Steady State Efficiency:	87 %
Idle Loss:	0.5 %
Heat Distribution Type:	Air

Electric Hot Water Heater
Fuel Type:	Electricity
Input Rating:	0 BTU/hr
Steady State Efficiency:	98 %
Idle Loss:	0 %
Heat Distribution Type:	Water
Boiler Operation:	All Year

Space Heating Distribution Systems

The space heating system is currently a Toyotomi Laser 73 direct vent oil fired heater. A new ducted hot air furnace will carry the buildings heating load in the future.

Domestic Hot Water System

The building has a six gallon electric hot water heater that uses roughly 5 gallons of hot water per day.

Lighting

Typical lighting throughout the building is made up of T8 electronic fluorescent ballasts. Exterior lighting is made up of a pair of metal halide bulbs. The bathroom has a single compact fluorescent bulb.

Plug Loads

Most of the plug loads are a computer and printer, as well as a portable electric heater which is rarely used.

Major Equipment

A water circulation pump and an electric heat tape for the sewer that is used only in the winter time make up the major equipment in the facility.

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).

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

      Electricity: AVEC-Chevak - Commercial - Sm

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	$ 0.25/kWh
#1 Oil	$ 6.15/gallons

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, YKHC pays approximately $6,417 annually for electricity and other fuel costs for the CMTRS Building.

Figure 3.1 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 3.1
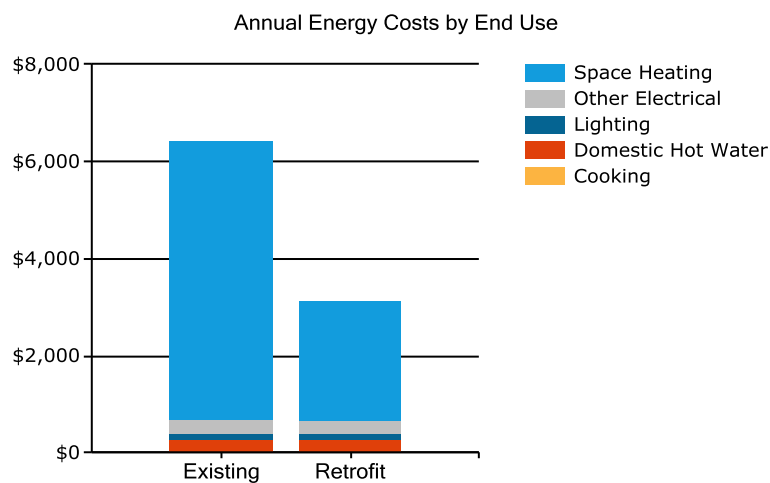**Annual Energy Costs by End Use**

Annual Energy Costs by End Use

Legend:
- Space Heating
- Other Electrical
- Lighting
- Domestic Hot Water
- Cooking

(Bars: Existing, Retrofit)

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

Annual Energy Costs by Fuel
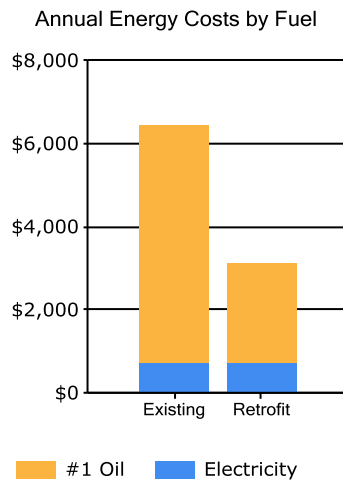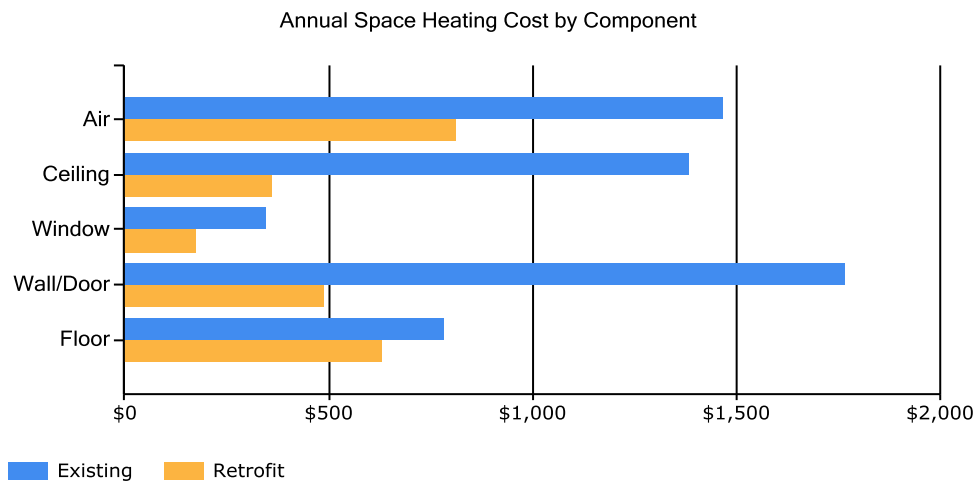

Legend: #1 Oil, Electricity

Figure 3.3 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 3.3
Annual Space Heating Cost by Component

Annual Space Heating Cost by Component

Legend: Existing, Retrofit

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.

Electrical Consumption (kWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Other_Electrical	125	114	125	121	51	49	51	51	49	125	121	125
Lighting	43	39	43	41	43	41	43	43	41	43	41	43
Cooking	2	2	2	2	2	2	2	2	2	2	2	2
DHW	89	81	89	86	89	86	89	89	86	89	86	89
Space_Heating	36	32	31	23	15	10	9	10	13	22	28	36

Fuel Oil #1 Consumption (Gallons)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
DHW	0	0	0	0	0	0	0	0	0	0	0	0
Space_Heating	134	119	115	81	49	27	21	26	41	76	101	134

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):

Building Site EUI = $\dfrac{\text{(Electric Usage in kBtu + Fuel Oil Usage in kBtu + similar for other fuels)}}{\text{Building Square Footage}}$

Building Source EUI = $\dfrac{\text{(Electric Usage in kBtu X SS Ratio + Fuel Oil Usage in kBtu X SS Ratio + similar for other fuels)}}{\text{Building Square Footage}}$

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

Table 3.4
CMTRS Building 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	2,951 kWh	10,072	3.340	33,639
#1 Oil	923 gallons	121,896	1.010	123,115
Total		**131,967**		**156,754**

BUILDING AREA	920	Square Feet
BUILDING SITE EUI	143	kBTU/Ft²/Yr
BUILDING SOURCE EUI	**170**	**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.

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 HVAC system 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 CMTRS Building was modeled using AkWarm© energy use software to establish a baseline space heating and cooling energy usage. Climate data from Chevak 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. Equipment cost estimate calculations are provided in Appendix D.

Limitations of AkWarm© Models

• The model is based on typical mean year weather data for Chevak. 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. Calculations and cost estimates for analyzed measures are provided in Appendix C.

Table 4.1 **CMTRS Building, Chevak, Alaska** **PRIORITY LIST – ENERGY EFFICIENCY MEASURES**						
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR	Simple Payback (Years)
1	Setback Thermostat: CMTRS Building	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the CMTRS Building space.	$1,158	$500	34.70	0.4
2	Air Tightening: Adjust front door, seal trim around front door, and insulate attic hatch.	Perform air sealing to reduce air leakage by 300 cfm at 50 Pascals.	$348	$200	17.86	0.6
3	Ceiling w/ Attic: CMTRS Building	Add R-38 fiberglass batts to attic with Standard Truss.	$767	$3,383	6.10	4.4
4	Window/Skylight: CMTRS Building	Remove existing glass and replace with triple pane, 2 low-E, argon glass.	$81	$590	2.66	7.2
5	Above-Grade Wall: CMTRS Building	Install R-30 rigid foam board to exterior and cover with T1-11 siding or equivalent.	$930	$14,006	1.78	15.1
	TOTAL, all measures		**$3,284**	**$18,678**	**3.65**	**5.7**

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.

4.3 Building Shell Measures

4.3.1 Insulation Measures

Rank	Location	Existing Type/R-Value	Recommendation Type/R-Value
5	Above-Grade Wall: CMTRS Building	Wall Type: Single Stud Siding Configuration: Just Siding Insul. Sheathing: None Structural Wall: 2 x 4, 16 inches on center R-11 Batt:FG or RW, 3.5 inches Window and door headers: Not Insulated Insulation Quality: Damaged Modeled R-Value: 10.1	Install R-30 rigid foam board to exterior and cover with T1-11 siding or equivalent.

Installation Cost	$14,006	Estimated Life of Measure (yrs)	30	Energy Savings (/yr)	$930
Breakeven Cost	$24,998	Savings-to-Investment Ratio	1.8	Simple Payback yrs	15

Auditors Notes: Increasing insulation in the building will yield an excellent payback, so long as the facility is intended to be used for many more years.

Rank	Location	Existing Type/R-Value	Recommendation Type/R-Value
3	Ceiling w/ Attic: CMTRS Building	Framing Type: Standard Framing Spacing: 24 inches Insulated Sheathing: None Bottom Insulation Layer: R-11 Batt:FG or RW, 3.5 inches Top Insulation Layer: None Insulation Quality: Damaged Modeled R-Value: 12.4	Add R-38 fiberglass batts to attic with Standard Truss.

Installation Cost	$3,383	Estimated Life of Measure (yrs)	30	Energy Savings (/yr)	$767
Breakeven Cost	$20,621	Savings-to-Investment Ratio	6.1	Simple Payback yrs	4

Auditors Notes: Increasing insulation in the building will yield an excellent payback, so long as the facility is intended to be used for many more years.

4.3.2 Window Measures

Rank	Location	Size/Type, Condition	Recommendation
4	Window/Skylight: CMTRS Building	Glass: Single, Glass Frame: Wood\Vinyl Spacing Between Layers: Half Inch Gas Fill Type: Air Modeled U-Value: 0.94 Solar Heat Gain Coefficient including Window Coverings: 0.52	Remove existing glass and replace with triple pane, 2 low-E, argon glass.

Installation Cost	$590	Estimated Life of Measure (yrs)	20	Energy Savings (/yr)	$81
Breakeven Cost	$1,568	Savings-to-Investment Ratio	2.7	Simple Payback yrs	7

Auditors Notes: Broken windows and single paned windows should be replaced with double or triple paned glass or boarded up with board stock insulation to reduce heat loss.

4.3.3 Air Sealing Measures

Rank	Location	Existing Air Leakage Level (cfm@50/75 Pa)	Recommended Air Leakage Reduction (cfm@50/75 Pa)
2	Adjust front door, seal trim around front door, and insulate attic hatch.	Air Tightness from Blower Door Test: 1020 cfm at 50 Pascals	Perform air sealing to reduce air leakage by 300 cfm at 50 Pascals.

Installation Cost	$200	Estimated Life of Measure (yrs)	10	Energy Savings (/yr)	$348
Breakeven Cost	$3,572	Savings-to-Investment Ratio	17.9	Simple Payback yrs	1

Auditors Notes: Door is not mounted square and trim leaks very bad on right side of door. Remounting the door and using weather stripping would be a large savings. Sealing other small leaks around windows and drafty locations in the facility would provide further savings.

4.4 Mechanical Equipment Measures

4.4.1 Night Setback Thermostat Measures

Rank	Building Space	Recommendation
1	CMTRS Building	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the CMTRS Building space.

Installation Cost	$500	Estimated Life of Measure (yrs)	15	Energy Savings (/yr)	$1,158
Breakeven Cost	$17,349	Savings-to-Investment Ratio	34.7	Simple Payback yrs	0

Auditors Notes: A setback thermostat should be installed in conjunction with the new furnace. At times when the building is not occupied the furnace could be programmed to heat the building only to 60 degrees, such as on nights or weekends. The current Toyotomi Laser 73 has a built in capability for this, and it should be taken advantage of immediately.

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.

Appendix A – Listing of Energy Conservation and Renewable Energy Websites

Lighting
Illumination Engineering Society - http://www.iesna.org/

Energy Star Compact Fluorescent Lighting Program - www.energystar.gov/index.cfm?c=cfls.pr_cfls

DOE Solid State Lighting Program - http://www1.eere.energy.gov/buildings/ssl/

DOE office of Energy Efficiency and Renewable Energy - http://apps1.eere.energy.gov/consumer/your_workplace/

Energy Star – http://www.energystar.gov/index.cfm?c=lighting.pr_lighting

Hot Water Heaters

Heat Pump Water Heaters - http://apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12840

Solar Water Heating

FEMP Federal Technology Alerts – http://www.eere.energy.gov/femp/pdfs/FTA_solwat_heat.pdf

Solar Radiation Data Manual – http://rredc.nrel.gov/solar/pubs/redbook

Plug Loads

DOE office of Energy Efficiency and Renewable Energy – http:apps1.eere.energy.gov/consumer/your_workplace/

Energy Star – http://www.energystar.gov/index.cfm?fuseaction=find_a_product

The Greenest Desktop Computers of 2008 - http://www.metaefficient.com/computers/the-greenest-pcs-of-2008.html

Wind

AWEA Web Site – http://www.awea.org

National Wind Coordinating Collaborative – http:www.nationalwind.org

Utility Wind Interest Group site: http://www.uwig.org

WPA Web Site – http://www.windpoweringamerica.gov

Homepower Web Site: http://homepower.com

Windustry Project: http://www.windustry.com

Solar

NREL – http://www.nrel.gov/rredc/

Firstlook – http://firstlook.3tiergroup.com

TMY or Weather Data – http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/

State and Utility Incentives and Utility Policies - http://www.dsireusa.org

Appendix B – Direct Vent Oil Heater Programming

Using the temperature setbacks built into most direct vent oil heaters, such as Toyotomi Lasers and Monitor MPIs is a simple, cost effective way to save energy. We recommend setback temperatures of 60 degrees for nights and weekends in offices and other frequently occupied facilities. In buildings that are occupied intermittently, such as Bingo Halls, we recommend a setback of 50 or 55 degrees. Facilities that are never occupied, such as lift stations and well houses, should be setback to 40 degrees, to prevent freezeups. Check the following websites for tips on programming the built in temperature setback capabilities of your specific direct vent oil heater.

http://www.toyotomiusa.com/ownersManuals_ventedHeaters.php

http://www.monitorproducts.com/customer-support/manuals