AMERESCO
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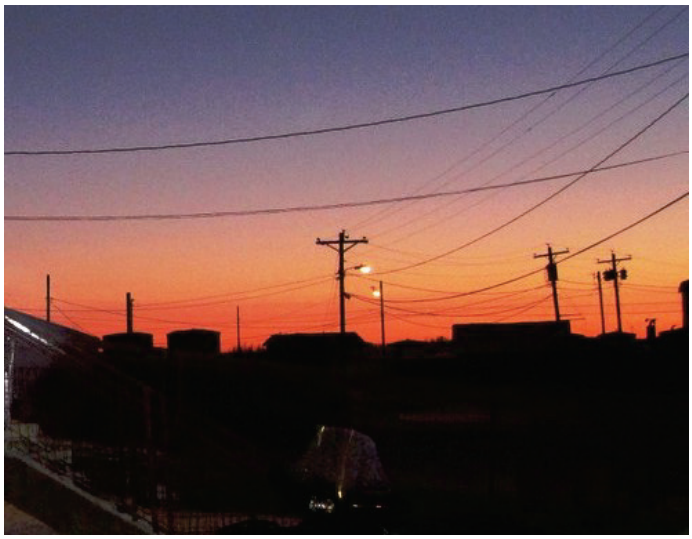
ENERGY AUDIT
POST INSTALLATION REPORT

Results and Recommendations from Energy Audit of Pilot Station

For VEEP Grants
City of Pilot Station, Alaska



June 20, 2012

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Alaska Energy Authority
City of Pilot Station

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APPENDICES

EXECUTIVE SUMMARY AND PREFACE

This Post Installation Report summarizes the results of an Ameresco Energy Audit of the City of Pilot Station, the initial energy savings measures identified and proposed, and any changes that may have occurred throughout the installation process. The City of Pilot Station is a recipient of an Alaska Energy Authority (AEA) Village Energy Efficiency Program (VEEP) grant of $150,000.

Ameresco engineers conducted an energy audit of the City of Pilot Station on December 15-16, 2010. The table below shows the buildings audited and their respective square footages.

City of Pilot Station - Building Summary

Building	Category	Square Footage
City Office (Public Safety)	Public Building	5,280
ATCO Building (Hotel)	Public Building	1,210
Garage/Maintenance Shop	Public Facility	2,016
Lift Station	Public Facility	128
Temporary Police Station	Public Building	1,600
School	School	36,150
Tutalgag Cablevision Office	Public Building	144
Water Treatment Plant	Public Facility	836

The audit identified existing types, conditions, operating modes, and energy consumption profiles for a variety of buildings, facilities and systems. The audit also identified all cost-effective system and facility modifications, adjustments, alterations, additions, and retrofits. Systems investigated during the audit included heating, ventilation, interior and exterior lighting, process exhaust, domestic hot water, motors, building envelopes, utility metering systems, and energy management control systems (EMCS).

The table below shows the actual project costs as well as expected savings, allocated by grant. See *Appendix A* for more detailed calculation results. Project costs include costs incurred from the site visit, engineering time, materials cost, and labor cost, as well as Ameresco's markup. It is important to note that the simple paybacks (SPBs) have been determined according to ECO type. For example, the SPB for an electrical ECO is calculated using only the annual kWh savings, even though the equivalent annual fuel gallon monetary savings is reported.

VEEP ECOS - PROJECT COSTS & EXPECTED SAVINGS

ECO	Cost	Savings	SPB
B01 - WEATHER-STRIPPING	$5,959.33	$ 774.81	7.69
B02 - THERMAL INSULATION UPGRADE	$17,545.23	$ 358.80	48.90
C01 - THERMOSTAT UPGRADE	$1,905.46	$ 800.89	2.38
E01 - T8 LIGHTING UPGRADE	$8,300.43	$ 120.36	68.96

VEEP ECOS - PROJECT COSTS & EXPECTED SAVINGS			
ECO	**Cost**	**Savings**	**SPB**
E02 - T5 LIGHTING UPGRADE	$4,043.10	$ 202.42	19.97
E03 - INSTALL OCCUPANCY SENSORS	$7,324.39	$ 1,507.65	4.86
E05 - CFL UPGRADE	$1,321.07	$ 237.69	5.56
E06 - STREETLIGHT UPGRADE	$56,326.43	$ 5,522.76	10.20
M01 - BOILER TUNE-UP	$7,700.13	$12,024.15	0.64
M02 - FURNACE UPGRADE	$19,620.18	$ 189.94	103.30
M04 - DOMESTIC WATER HEATER UPGRADE	$17,750.17	$ 538.75	32.95
AVAILABLE FUNDING	$2,204.08		
** Available funding allocated to Kotlik.*			
TOTAL	**$150,000.00**	**$22,278.22**	**6.63**

1.0 BUILDING DESCRIPTIONS

1.1 PILOT STATION CITY OFFICE

Description: The Pilot Station City Office is a relatively new building, constructed in 2008. Typical operating hours are 0900 to 1700 hours, Monday through Friday. This building also has a Community Hall used for special occasions such as native dancing and various ceremonies. During such occasions, additional operating hours are typically 1800 to 2200 hours.

General Conditions: The building is in good condition overall, but is still settling. If the soil does not compact properly, this could require additional action to maintain the structural integrity of the building.

Pictures of general conditions found during the field audit immediately follow this building description.

Building Envelope: The building is well constructed, and most building envelope components are in good condition – walls, windows, doors, and the roof. The exterior doors, however, could use a weather-stripping upgrade, as most have no weather-stripping at all. Because of this, the entry door is allowing warm air to escape the building; the entry door also freezes shut from time to time.

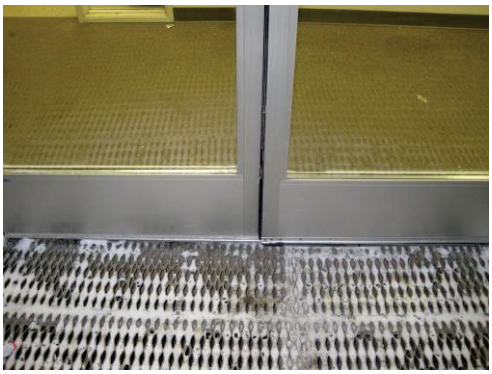
Heating: Three Toyotomi continuous water heaters provide the building with hydronic heating. There is also a Fantech heat recovery ventilator (HRV) to recycles the exhausted heat. The hydronic heating system has 6 zones, each with its own thermostat.

Controls: Building heating is controlled by programmable thermostats. The City clerk believes these thermostats are programmed correctly to have one setting during occupied hours and heating set backs during unoccupied hours.

Lighting: Interior lighting consists of T8 fluorescent fixtures with electronic ballasts. There are no occupancy sensors in the building.

Domestic Water: A Toyotomi Oil Miser instantaneous water heater provides the building with domestic hot water.

Building Photos: Pilot Station City Office



Entrance Door

Mechanical Room – Water Heaters

Toyostove Fuel Lifter Pump

Antifreeze Feeder

Fantech HRV

Uninsulated Pipes

1.2 PILOT STATION ATCO BUILDING (HOTEL)

Description: The ATCO building was Pilot Station's old city office, but is now used as a hotel or income property. This building is now only used occasionally and does not have standard operating hours.

General Conditions: The building is in fair condition, considering its age. No major defaults were found during the course of the audit walkthrough.

Pictures of general conditions found during the field audit immediately follow this building description.

Building Envelope: The building envelope of the building is in fair condition overall. The roof is not leaking, and there is no melted snow as evidence of poor insulation. This, however, could be due to the limited use of the building.

Heating: A Miller forced air furnace provides the building with space heating. A Monitor 2400 oil stove provides additional heat to one room in the building.

Controls: A mechanical thermostat controls building heating and is located in the kitchen. The Monitor 2400 has an internal thermostat which controls its output.

Lighting: Interior lighting consists of T12 fluorescent fixtures with magnetic ballasts. There are no occupancy sensors in the building. Several incandescent fixtures also light the facility and building exterior.

Domestic Water: An Amtrol Well-X-Trol well tank and Toyotomi instantaneous water heater provide the building with domestic hot water.

Building Photos: Pilot Station ATCO Building (Hotel)

Exterior Windows

Monitor Heater

Amtrol Well-X-Trol Well Tank

Toyotomi Instantaneous Water Heater

Furnace Stack

Miller Furnace

1.3 PILOT STATION GARAGE/MAINTENANCE SHOP

Description: The Pilot Station Garage and Maintenance Shop functions as the main maintenance facility for the village. Typical operating hours are 0900 to 1700 hours, Monday through Friday.

General Conditions: The garage is in fair condition overall, with no major faults or defects found over the course of the audit walkthrough.

Pictures of general conditions found during the field audit immediately follow this building description.

Building Envelope: The building is in fair condition overall. The roof is in fair condition, as are the structure walls and the exterior doors. Weather-stripping is in poor condition and is need of an upgrade.

Heating: Two oil-fired Modine POR145 unit heaters provide the building with heating. Installing two used oil furnaces would generate substantial energy savings.

Controls: Building heating is controlled by a mechanical thermostat.

Lighting: Interior lighting is provided by T12 fluorescent fixtures with magnetic ballasts in the workstation areas and high pressure sodium (HPS) high bay fixtures. There are no occupancy sensors in the building.

Domestic Water: There is not a domestic water system in place at the Garage and Maintenance Shop.

Building Photos: Pilot Station Garage/Maintenance Shop

Overhead Doors not Flush with Floor

High Bay Fixtures

Modine Oil-Fired Unit Heater

Workstation Area

1.4 PILOT STATION TEMPORARY POLICE STATION

Description: The current Police Station in Pilot Station is just a temporary facility while the long-term Police Station is being renovated. This facility operates 24 hours a day, 7 days a week.

General Conditions: The building was originally constructed in the 1970's and is in fair condition overall. This building has many opportunities for improvement; however, Ameresco does not suggest any energy improvements at this facility at this time. This is due to the temporary occupancy of the building and limited funding available.

Pictures of general conditions found during the field audit immediately follow this building description.

Building Envelope: The building is showing many signs of weathering and age. The roof is in fair condition, but shows no signs of water leakage. Windows have been boarded up, and the exterior doors are in poor condition. Existing weather-stripping is deteriorating and inadequate.

Heating: A Nordine fuel oil furnace provides the building with space heating. This furnace is an older model and is quite run down because of age. A newer, more efficient model would generate substantial energy savings with the building's current use.

Controls: Space heating is controlled by a single mechanical thermostat.

Lighting: Interior lighting is primarily T8 fluorescent fixtures with electronic ballasts. There are also several incandescent fixtures in the facility. There are no occupancy sensors.

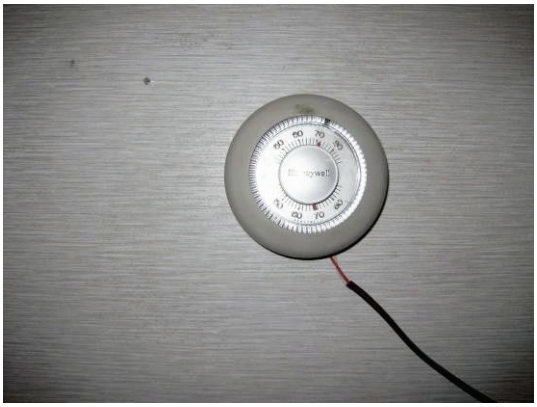
Domestic Water: An American water heater provides the building with domestic hot water.

Building Photos: Pilot Station Temporary Police Station

Interior Lighting

Nordine Furnace

Furnace Interior



Honeywell Thermostat

1.5 PILOT STATION SCHOOL

Description: The Pilot Station school houses elementary through high school students from the village. Typical operating hours for the school are 0800 to 1700 hours, Monday through Friday, but the building is also used for after school activities and events.

General Conditions: The building is in good condition overall. There is some room for improvement with the controls system and set point, but no major faults or defects were noticed during the course of the audit walkthrough.

Pictures of general conditions found during the field audit immediately follow this building description.

Building Envelope: The building is in good condition and is well-maintained. The roof is in good condition and shows no signs of leakage or inadequate insulation. Windows are in good condition. Exterior doors are in good condition, though the weather-stripping needs to be replaced.

Heating: Normally, two Weil-McLain model 788 oil-fired boilers provide the building with space heating. At the time of the audit, only one of these boilers was operational. These boilers are rated at 82% thermal efficiency and 84% combustion efficiency. A combustion analysis showed the operational boiler to be 80.8% efficient.

Controls: There are several mechanical thermostats in the facility, though not all of them function properly. The current set point temperature throughout much of the facility is 80°F.

Lighting: The building is primarily lit by T8 fluorescent fixtures with electronic ballasts. The classrooms are the only rooms with occupancy sensors. The high bay gym lighting appears to be in good condition; due to the short nature of the audit, exact wattages and lamp types are not available at this time.

Domestic Water: A point-of-use electric water heater provides the building with domestic hot water.

Building Photos: Pilot Station School

Gym High Bay Lighting

Weil-McLain Boilers

Fuel Oil Day Tank

Circulating Pumps

Amtrol Well Tank

Fire Suppression System

1.6 TUTALGAG CABLEVISION OFFICE

Description: The Tutalgag Cablevision Office houses all of the GCI cable services equipment for the village. This building does not have typical operational hours, as it is not staffed regularly. A single operator maintains the facility whenever there is need for him.

General Conditions: The building is in fair condition overall and is showing signs of weathering and age, having been constructed in the 1970's. All of the equipment in the facility is run by uninterruptible power supplies (UPS's).

Pictures of general conditions found during the field audit immediately follow this building description.

Building Envelope: The building is in fair condition. Exterior doors are in poor condition and need to be replaced, as well as need new weather-stripping. The roof is in fair condition and could use a thermal insulation upgrade. There are no windows in the facility.

Heating: Two oil stoves provide the building with space heating; one is a Toyostove Laser 56, and the other is a Monitor 2400. The Toyostove runs constantly, and the Monitor is used as a backup in case the Toyostove fails. At the time of the audit, the Monitor stove was not on.

Controls: There are no additional building controls for this facility.

Lighting: Interior lighting is provided by T12 fluorescent fixtures with magnetic ballasts. There are no occupancy sensors in the building.

Domestic Water: There is not a domestic water system in the building.

Photos: Tutalgag Cablevision Office

Toyostove Laser 56 Heater

Monitor 2400 Heater - Off

GCI Equipment

Attic Insulation

No Weather-stripping on Doors

1.7 PILOT STATION WATER TREATMENT PLANT

Description: The Pilot Station Water Treatment Plant provides clean water to the entire city. The plant has a single operator, but receives extra maintenance help when needed. The building is in good condition. Most of the equipment housed at the facility has been well-maintained, though there are several outdated pumps and motors that could be replaced with more efficient models. The building is typically staffed 3 hours a day, 7 days a week.

General Conditions: The water treatment plant is in good condition overall, having been built in 2005. No major defects were noticed during the audit walkthrough.

Pictures of general conditions found during the field audit immediately follow this building description.

Building Envelope: The building is in good condition, as expected because of its youth. The roof is in good condition and shows no signs of leakage or poor insulation. Windows and doors are in good condition, though the existing weather-stripping could be upgraded.

Heating: Two oil-fired Weil-McLain Gold Oil boilers provide the building with heating. A combustion analysis at the time of the audit showed B-1 to be operating at 84.8% combustion efficiency, and B-2 was operating at 83.4% combustion efficiency. These boilers are rated at 85% thermal efficiency.

Controls: Building heating is controlled by mechanical thermostats.

Lighting: Interior lighting consists mainly of T12 fluorescent fixtures with magnetic ballasts. There are no occupancy sensors in the building.

Domestic Water: A 19-gallon electric American water heater provides the building with domestic hot water.

Building Photos: Pilot Station Water Treatment Plant

Weil-McLain Boilers

Circulating Pumps

Circulating Pumps

Perkins Generator

American Water Heater

1.8 OTHER BUILDINGS VISITED

Lift Station: The Pilot Station Lift Station is a new facility built in 2008 and is in good condition overall. This building does not have operational shift hours and is just used as needed. The structure, roof, walls, and doors are all in good condition; exterior doors have adequate weather-stripping. There is no heating equipment at this building. Lighting is T8 fluorescent fixtures with electronic ballasts, but there are no occupancy sensors in the building.

2.0 UTILITIES

2.1 ELECTRICITY

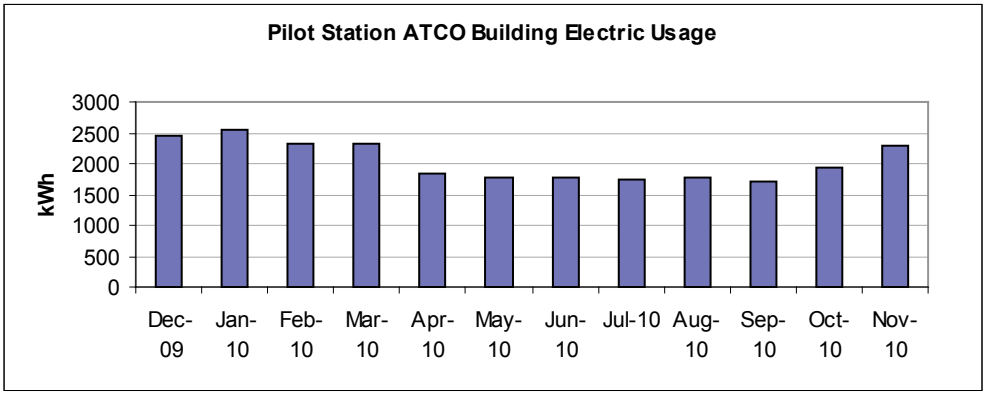
The City of Pilot Station purchases its electricity from the Alaskan Village Electric Cooperative (AVEC). Village facilities are billed on an electric use and fuel use to provide the electricity. Some facilities may also qualify for a Power Cost Equalization (PCE) incentive. All buildings audited receive PCE assistance, with the exception of the Pilot Station School. The AVEC rates for the City of Pilot Station are listed below.

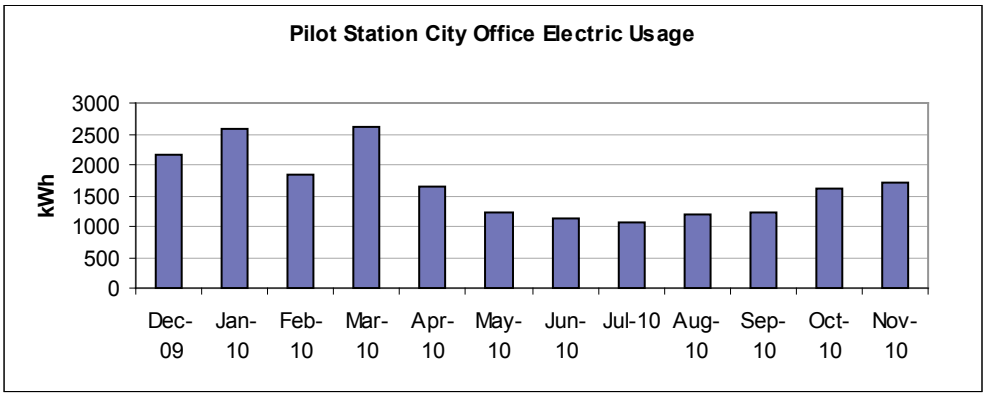
Current Rates as of January 2011		
AVEC Cost of Fuel (Added to Customer Electric Bill)	$	0.2291
Rate Per kWh, Fuel Cost Included (1-700 kWh)	$	0.5291
Rate Per kWh, Fuel Cost Included (Over 700 kWh)	$	0.4291
PCE Rate (1-700 kWh)	$	0.3138
PCE Rate (Over 700 kWh)	$	0.2858
Rates August 2010 - December 2010		
AVEC Cost of Fuel (Added to Customer Electric Bill)	$	0.2258
Rate Per kWh, Fuel Cost Included (1-700 kWh)	$	0.5258
Rate Per kWh, Fuel Cost Included (Over 700 kWh)	$	0.4258
PCE Rate (1-700 kWh)	$	0.3107
PCE Rate (Over 700 kWh)	$	0.2827
Rates for Calculations, Including Fuel Cost and PCE Incentive		
Rate for Calcs (1-700 kWh)	$	0.2153
Rate for Calcs (700+ kWh)	$	0.1433

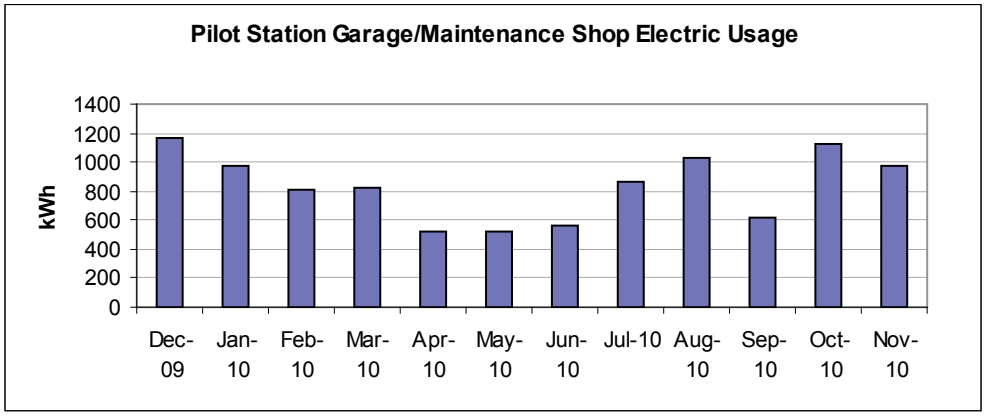
The Lower Yukon School District (LYSD) has its own contract with AVEC to provide electricity to the school. Rates are listed below.

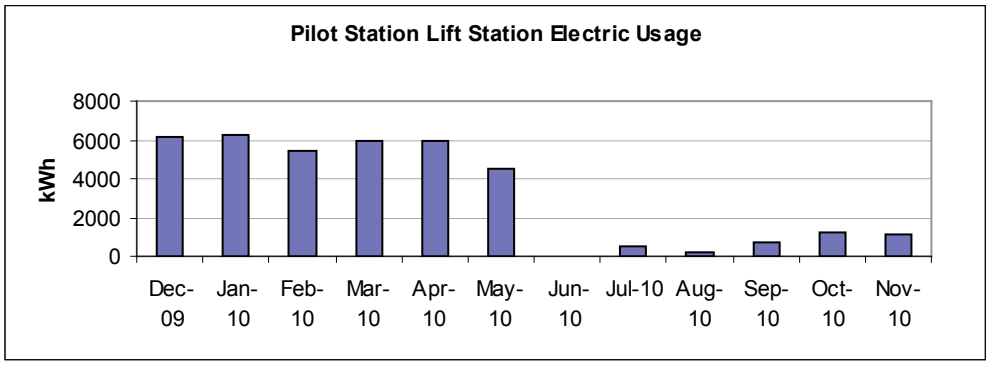
AVEC Average Cost of Fuel	$	0.2194
Demand Cost, Per kW	$	45.00
Rate Per kWh, Fuel Cost Included (1-1,500 kWh)	$	0.3394
Rate Per kWh, Fuel Cost Included (Over 1,500 kWh)	$	0.2594

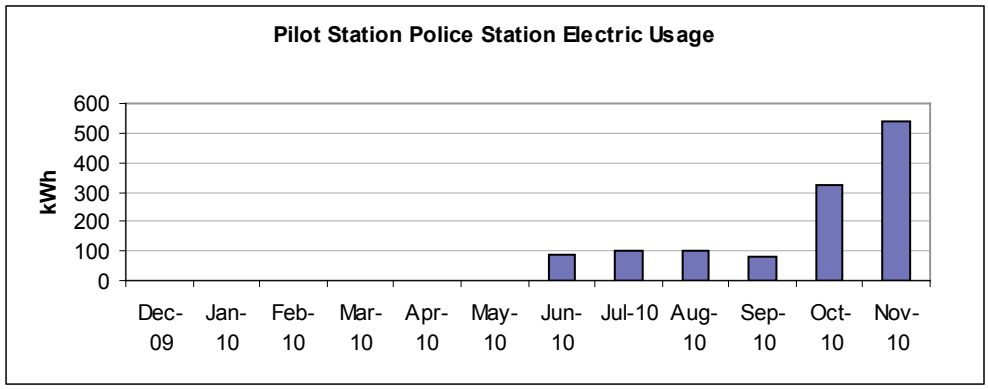
2.1.1 Electricity Usage Profiles

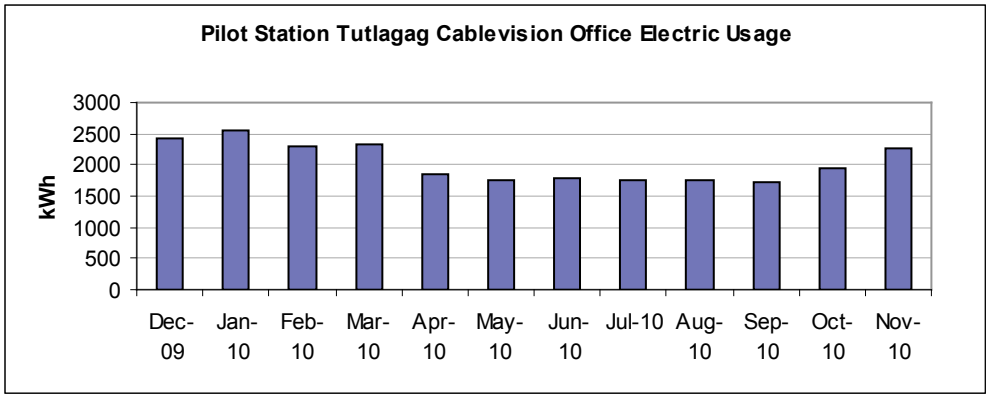


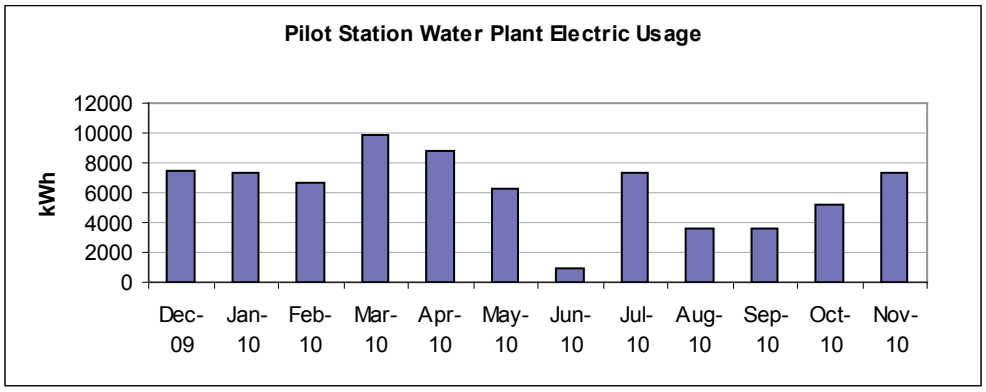


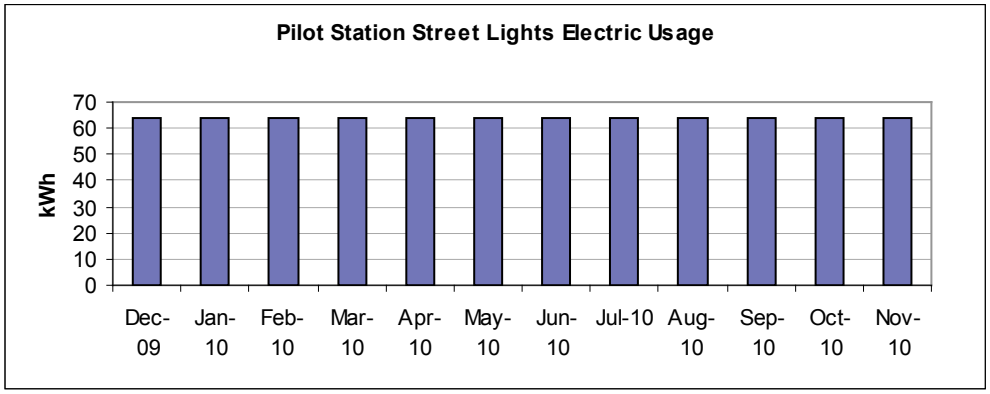


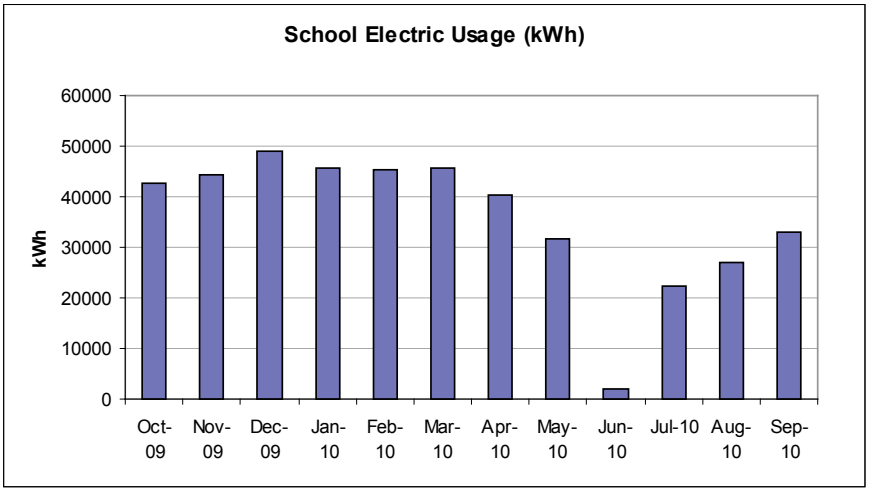

Pilot Station Lift Station Electric Usage
kWh
8000
6000
4000
2000
0
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10

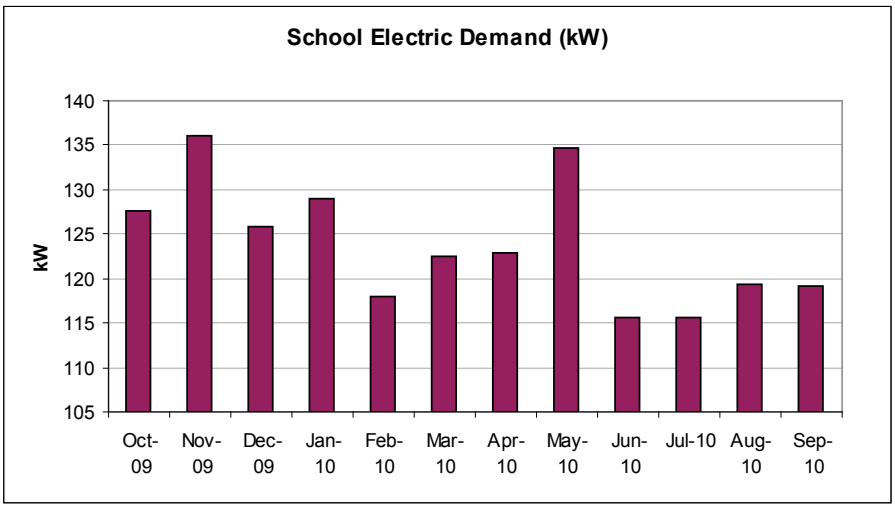

Pilot Station Police Station Electric Usage
kWh
600
500
400
300
200
100
0
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10


Pilot Station Tutlagag Cablevision Office Electric Usage
kWh
3000
2500
2000
1500
1000
500
0
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10


Pilot Station Water Plant Electric Usage
kWh
12000
10000
8000
6000
4000
2000
0
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10


Pilot Station Street Lights Electric Usage
kWh
70
60
50
40
30
20
10
0
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10


School Electric Usage (kWh)
kWh
60000
50000
40000
30000
20000
10000
0
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10

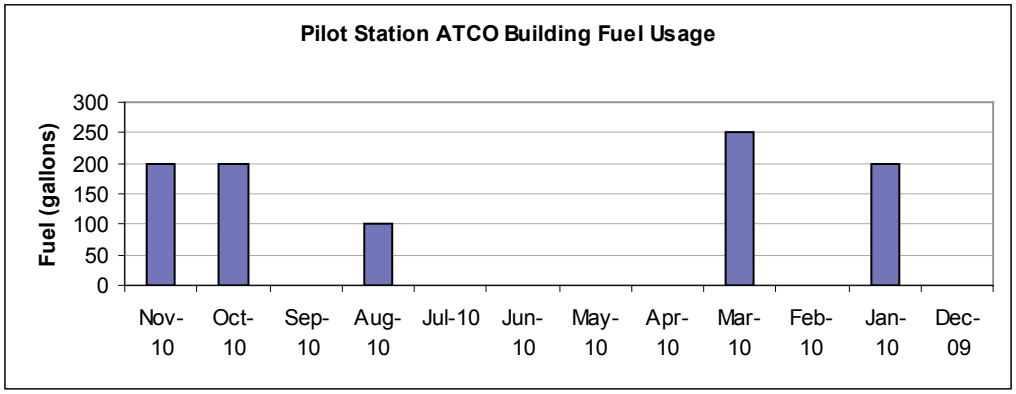


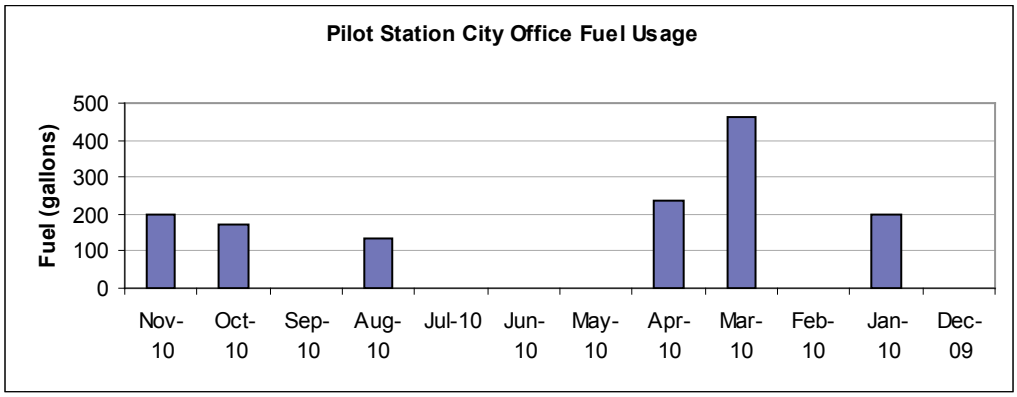
2.2 FUEL

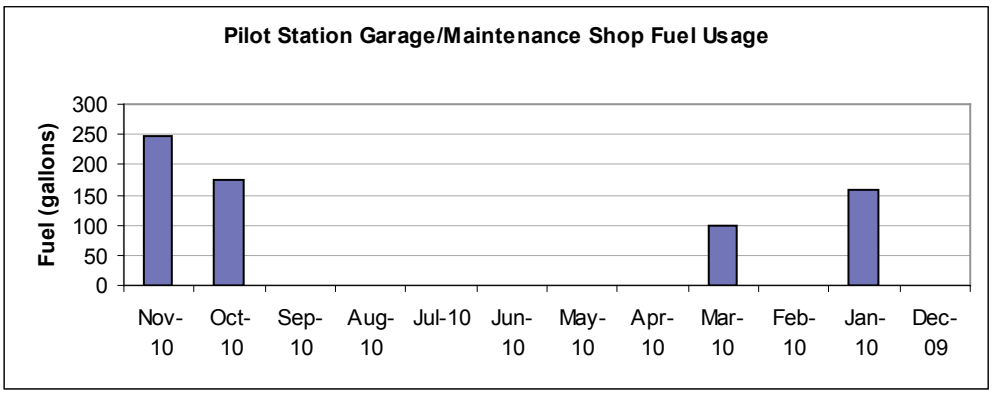
The City of Pilot Station purchases its fuel from Crowley Petroleum Distribution, Inc. at a rate of $3.2537/gallon.

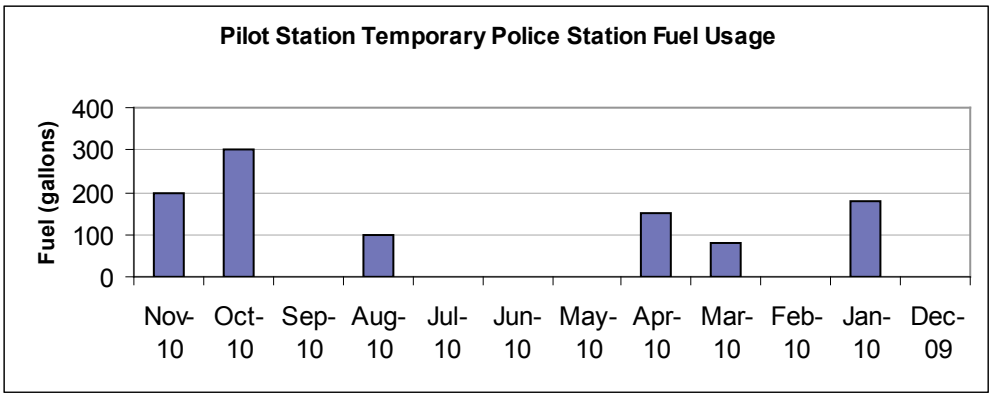
The Pilot Station School has its own fuel contract with Crowley Petroleum Distribution, Inc. The school purchases its fuel from Crowley at a rate of $2.99705/gallon.

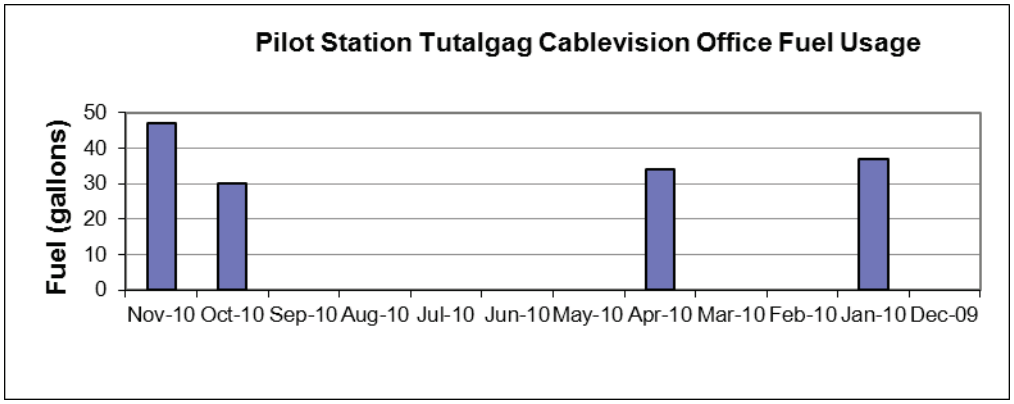
2.2.1 Fuel Usage Profiles

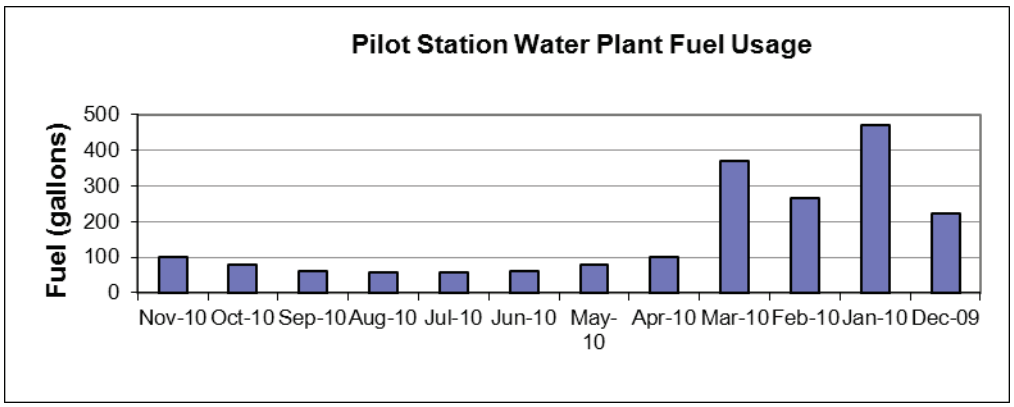



Pilot Station City Office Fuel Usage
Fuel (gallons)
500
400
300
200
100
0
Nov-10
Oct-10
Sep-10
Aug-10
Jul-10
Jun-10
May-10
Apr-10
Mar-10
Feb-10
Jan-10
Dec-09


Pilot Station Garage/Maintenance Shop Fuel Usage
Fuel (gallons)
300
250
200
150
100
50
0
Nov-10
Oct-10
Sep-10
Aug-10
Jul-10
Jun-10
May-10
Apr-10
Mar-10
Feb-10
Jan-10
Dec-09


Pilot Station Temporary Police Station Fuel Usage
Fuel (gallons)
400
300
200
100
0
Nov-10
Oct-10
Sep-10
Aug-10
Jul-10
Jun-10
May-10
Apr-10
Mar-10
Feb-10
Jan-10
Dec-09


Pilot Station Tutalgag Cablevision Office Fuel Usage
Fuel (gallons)
50
40
30
20
10
0
Nov-10
Oct-10
Sep-10
Aug-10
Jul-10
Jun-10
May-10
Apr-10
Mar-10
Feb-10
Jan-10
Dec-09


Pilot Station Water Plant Fuel Usage
Fuel (gallons)
500
400
300
200
100
0
Nov-10
Oct-10
Sep-10
Aug-10
Jul-10
Jun-10
May-10
Apr-10
Mar-10
Feb-10
Jan-10
Dec-09

3.0 OPERATIONS/MAINTENANCE PRACTICES

The village has a number of designated maintenance personnel that seem to possess the basic skills required to clean and maintain selected equipment. From Ameresco's observations, if the equipment should fall into disrepair, the staff does not have the training or experience to repair the equipment per the manufacturer's requirements and tends to piece together the equipment to maintain operation. Over time, the systems no longer function as required, which currently appears to be the case of most equipment and systems with in the village.

Operations and maintenance is one area in energy services where improvement and training costs are lower than equipment replacement costs, and the energy efficiency return is high. During the site audit, Ameresco found that outside of general cleaning, most of the equipment is not maintained to meet standard manufacturers' recommendations. Dirty filters, boilers in disrepair, systems altered, and control systems disconnected are a result of limited funding and lack of system training. This results in excessive energy use, premature equipment failure, and employee and resident discomfort. An annual system check by a qualified burner service technician to perform services such as boiler cleaning, boiler tune ups, system check out, and control system reviews will not only extend the overall life of the equipment, but improve occupant comfort as well as increase and maintain long term energy efficiency.

4.0 ENERGY CONSERVATION OPPORTUNITIES

The ECO matrix below summarizes the energy conservation opportunities identified during the site survey and baseline analysis. A description of each energy conservation opportunity follows the matrix.

Please Note: This matrix applies to the initial proposal and the ECOs identified during that stage of the Pilot Station project. There are some ECOs included in this section that were not performed, or the scope of work may have changed. *Section 4* is for reference only. See *Section 5* for updated project information.

ECO No.	ECO Description B=Building Envelope; C=Controls; E=Electrical; M=Mechanical; W=Water/Wastewater; R=Renewable	ORIGINAL ECO MATRIX PILOT STATION					
		ATCO Building	City Office	Garage Shop	School	TV Cable Building	Water Treatment
Building Envelope							
B01	Door Weather-stripping Upgrade			X	X	X	
B02	Insulation Upgrade		X	X		X	
Controls							
C01	Thermostat Upgrade	X			X		X
Electrical							
E01	T-8 Lighting Upgrade			X		X	X
E02	T-5 Lighting Upgrade			X			
E03	Occupancy Sensors	X	X	X		X	X
E04	Premium Efficiency Motors						X
E05	CFL Upgrade	X	X				X
Mechanical							
M01	Boiler Tune-Up				X		X
M02	Furnace Upgrade	X					
M03	Unit Heater Upgrade			X			
M04	DHW Upgrade						X

VEEP – INITIAL PROPOSAL (FINAL AUDIT REPORT)				
ECO		**Cost**	**Savings**	**SPB**
B01 - WEATHERSTRIPPING	$	10,000.00	$ 1,147.94	8.71
B02 - THERMAL INSULATION UPGRADE	$	9,500.00	$ 358.80	26.48
C01 - THERMOSTAT UPGRADE	$	3,000.00	$ 14,870.46	0.20
E01 - T8 LIGHTING UPGRADE	$	6,000.00	$ 168.63	35.58
E02 - T5 LIGHTING UPGRADE	$	4,000.00	$ 202.42	19.76
E03 - INSTALL OCCUPANCY SENSORS	$	11,500.00	$ 1,780.31	6.46
E04 - PREMIUM EFFICIENCY MOTORS UPGRADE	$	8,000.00	$ 253.11	31.61
E05 - CFL LIGHTING UPGRADE	$	1,500.00	$ 237.69	6.31
M01 - BOILER TUNE-UP	$	10,000.00	$ 25,150.23	0.40
M02 - FURNACE UPGRADE	$	15,260.00	$ 189.94	80.34
M03 - UNIT HEATER UPGRADE	$	21,000.00	$ 191.06	109.91
M04 - DOMESTIC WATER HEATER UPGRADE	$	3,000.00	$ 538.75	5.57
DESIGN/AUDIT	$	2,500.00		
AVAILABLE FUNDING	$	44,740.00		
** Available funding allocated for travel expenses, shipping, additional labor, etc*				
TOTAL	**$**	**150,000.00**	**$ 44,550.59**	**3.37**

4.1 ECO DESCRIPTIONS

Below are the descriptions of the Energy Conservation Opportunities (ECOs) that Ameresco analyzed for the Village of Pilot Station. These include Ameresco's initial project recommendations for the village.

4.1.1 Building Envelope Opportunities

B01 – Door Weather-stripping Upgrade

This ECO proposes applying weather stripping to exterior door perimeters to reduce air infiltration into the buildings. Many building doors have existing weather stripping material which is worn or missing.

B02 – Thermal Insulation Upgrade

This ECO proposes installing blown-in roof insulation on existing building envelopes to reduce energy consumption. Insulation can be added to roofs to increase or renew their insulating ratings (R-value).

4.1.2 Controls Opportunities

C01 – Thermostat Upgrade

This ECO proposes replacing the outdated mechanical thermostats with 7-day programmable thermostats. The programmable thermostats would allow a building's HVAC system to be scheduled to operate in comfortable conditions while occupied and allow for night set-backs.

4.1.3 Electrical Opportunities

E01 – T8 Lighting Upgrade

This ECO proposes replacing current T-12 fluorescent lighting and magnetic ballast with T-8 lamps and electronic ballasts. Post-light levels will be nearly equal or better to that of the existing lighting systems.

E02 – T5 Lighting Upgrade

This ECO proposes replacing high intensity discharge (HID) lighting systems in the medium and high bay areas such as the water treatment plant, maintenance shops, school, etc., with T5 fluorescent fixtures. HID lighting is often used in areas with high ceilings or roof structures. The fixtures generate high luminous flux, are reasonably energy efficient, and are long lasting. Such systems often remain illuminated continuously since the re-strike times make periodic switching in irregularly occupied spaces a nuisance. Continuous operation of HID fixtures reduces the overall energy efficiency of lighting systems designed around their use. Newer, high output fluorescent sources, characterized by quick warm-up, with instant light output and improved efficiency, are now being used in place of many medium wattage HID fixtures in low and high bay applications. Post-light levels will be nearly equal to that of the existing lighting systems

E03 – Occupancy Sensors

Lighting systems are often left energized in unoccupied areas. This ECO proposes to install sensors to shut off lighting in unoccupied spaces. Common sensing technologies include infrared, ultrasonic, and audible sound, often combining multiple types of sensing in one unit to avoid shutting off lights in an occupied area.

E04 – Premium Efficiency Motors

This ECO proposes installing National Electrical Manufacturers Association (NEMA) premium efficiency motors to replace standard and high efficiency motors. There are various mechanical systems operating with inefficient motors throughout the base. Premium efficiency motors typically increase energy efficiency by 2-3%.

E05 – CFL Lighting Upgrade

This ECO proposes replacing current incandescent bulbs in audited village buildings with compact fluorescent (CFL) lamps. This is a simple and effective retrofit with easy installation. Additional lamps have been provided in calculations apart from the buildings specified in the matrix. Most city buildings have incandescent fixtures and could be retrofit, such as the Lift Station and the dome-shaped building.

4.1.4 Mechanical Opportunities

M01 – Boiler Tune-Up

This ECO proposes a comprehensive re-commissioning of the boilers in each building to optimize system operations. Such efforts include:

- Replace, repair, calibrate or install sensors or switches
- Repair air linkages
- Conduct combustion efficiency test services
- Clean combustion chambers and stacks

M02 – Furnace Upgrade

This ECO proposes replacing existing fuel oil furnaces with more energy efficient units. Many of the existing units in the village are original to the buildings they serve and have reached the end of their useful service life. Furnaces employing modern technology can be installed to reduce energy consumption, improve system operations, and reduce maintenance costs.

M03 – Unit Heater Upgrade

The current fuel oil burners are Modine model POR145B with a heating capacity of 145MBH each. More efficient Reznor models have been chosen as the replacements.

M04 – Domestic Hot Water Heater Upgrade

This ECO proposes replacing existing electric or fuel oil tank-type water heaters with fuel oil instantaneous Toyotomi OM-128 models. Standby losses will be eliminated, as there is no need to continuously heat tanks of water until they are needed. Where electric water heaters are replaced, additional savings will come from the cost of generating electricity.

5.0 FINAL COSTING AND CHANGES FROM INITIAL REPORTING

Due to the brief nature of these contracts and the high cost of travel to and from the villages, audits were conducted a quickly and efficiently as possible. Once engineers have left the villages, communication is strained at best, and gathering additional information is difficult. Because of this, assumptions must be made during the initial ECO assessments and project cost estimates. Occasionally, Ameresco engineers have found that previously identified projects have been externally funded from another source, but this information usually comes too late in the process. As a result of all these factors, some previously identified projects have been modified or abandoned. Final project costs and expected annual savings can be found in *Appendix A* and *Section 5.2*.

5.1 CHANGES FROM INITIAL REPORTING

B01 – Door Weather-stripping Upgrade

Installed as planned at the Garage/Maintenance Shop. This ECO was abandoned at the School and Tutlgag Cablevision buildings during the construction phase due to lack of funding; material was not purchased or installed at these buildings.

B02 – Thermal Insulation Upgrade

The thermal insulation upgrade was installed as planned in the Tutalgag Cablevision building. An insulation upgrade was performed on the City Office building instead of the Garage/Maintenance Shop. Upon further investigation, the Garage/Maintenance Shop was found to be unsuitable for an insulation upgrade, so this ECO was redirected to the City Office building.

C01 – Programmable Thermostat Upgrade

Installed as planned in the ATCO building. The thermostats were not installed at the school due to communication issues; construction occurred during the summer holiday, and Ameresco was unable to make contact with a school maintenance representative. This ECO has been abandoned at the school. A programmable thermostat was installed in the Police Station instead of the Water Treatment Plant due to compatibility issues; the Water Treatment Plant requires a line voltage thermostat, but the model ordered was low voltage. Because the building operates 24/7, however, there are no savings associated with this ECO at the Police Station building.

E01 – T-8 Lighting Upgrade

Installed as planned in the Tutalgag Cablevision building as well as the Water Treatment Plant. T12 task lighting was not retrofit in the Garage/Maintenance shop because this task lighting was found to be high output (HO) during the construction phase. Typical T8 lighting fixtures are not a suitable replacement for the existing fixtures. In this case, the fixtures were delivered but not installed.

E02 – T-5 Lighting Upgrade

Installed as planned.

E03 – Occupancy Sensors

Installed as planned, though some quantities were transferred between buildings. See *Appendix A* for details.

E04 – Premium Efficiency Motors Upgrade

This ECO has been abandoned due to lack of funding and limited availability of premium efficiency motors.

E05 – CFL Lighting Upgrade

Installed as planned.

E06 – LED Street Lighting Upgrade

Newly added ECO. After the initial proposal was submitted, Ameresco and AVEC came to an agreement on installing new street lighting fixtures. The village will need to work with AVEC to ensure that new utility bills reflect the decreased energy usage.

M01 – Boiler Tune-Up

Performed as planned.

M02 – Furnace Upgrade

The furnace in the Police Station was upgraded instead of the ATCO Building. The replacement model that was purchased fit the needs of the Police Station better than the ATCO Building, so the furnace in the Police Station was upgraded instead.

M03 – Unit Heater Upgrade

This ECO has been abandoned due to lack of funding.

M04 – Domestic Water Heater Upgrade

Installed as planned.

5.2 FUNDING ALLOCATION SUMMARY TABLES

VEEP ECOS - PROJECT COSTS & EXPECTED SAVINGS			
ECO	**Cost**	**Savings**	**SPB**
B01 - WEATHER-STRIPPING	$5,959.33	$ 774.81	7.69
B02 - THERMAL INSULATION UPGRADE	$17,545.23	$ 358.80	48.90
C01 - THERMOSTAT UPGRADE	$1,905.46	$ 800.89	2.38
E01 - T8 LIGHTING UPGRADE	$8,300.43	$ 120.36	68.96
E02 - T5 LIGHTING UPGRADE	$4,043.10	$ 202.42	19.97
E03 - INSTALL OCCUPANCY SENSORS	$7,324.39	$ 1,507.65	4.86
E05 - CFL UPGRADE	$1,321.07	$ 237.69	5.56
E06 - STREETLIGHT UPGRADE	$56,326.43	$ 5,522.76	10.20
M01 - BOILER TUNE-UP	$7,700.13	$12,024.15	0.64
M02 - FURNACE UPGRADE	$19,620.18	$ 189.94	103.30
M04 - DOMESTIC WATER HEATER UPGRADE	$17,750.17	$ 538.75	32.95
AVAILABLE FUNDING	$2,204.08		
** Available funding allocated to Kotlik.*			
TOTAL	**$150,000.00**	**$22,278.22**	**6.63**

ECOS NOT FUNDED - REJECTED IN CONSTRUCTION PHASE			
ECO	**Cost**	**Savings**	**SPB**
B01 - WEATHER-STRIPPING	$ 6,000.00	$ 373.13	16.08
C01 - THERMOSTAT UPGRADE	$ 2,100.00	$ 14,069.57	0.15
E04 - PREMIUM EFFICIENCY MOTORS UPGRADE	$ 8,000.00	$ 253.11	31.61
M02 - FURNACE UPGRADE	$ 15,260.00	$ 189.94	80.34
M03 - UNIT HEATER UPGRADE	$ 21,000.00	$ 191.06	109.91
TOTAL	**$ 52,360.00**	**$ 15,076.81**	**3.47**

**Note: C01 pricing would most likely increase from this initial projection as seen at the buildings the ECO was completed in.*

APPENDIX A

VEEP PROJECT COSTS & EXPECTED SAVINGS

APPENDIX A - VEEP PROJECT COSTS & EXPECTED SAVINGS - PILOT STATION

Note: The reported simple paybacks are based on the type of ECO listed. For example, electrical ECOs only use the Annual kWh Cost Savings column to calculate the SPB, even though the Annual Equivalent Fuel Cost Savings is still reported.

B01 - WEATHER-STRIPPING

Building	# of Doors	Price Per Door	Total Cost	Electric kWh Savings	Fuel mmBtu Savings	Total mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Total Annual Savings	Simple Payback
Garage/Maintenance	3	Varies w/Size	$5,959.33	0.00	33.34	33.34	238.13	$0.00	$774.81	$774.81	7.69

B02 - THERMAL INSULATION UPGRADE

Building	Current Insulation	Proposed Insulation	Total Cost	Electric kWh Savings	Fuel mmBtu Savings	Total mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Total Annual Savings	Simple Payback
City Office	R-22	R-40	$15,592.75	0.00	7.71	7.71	55.05	$0.00	$335.91	$335.91	46.42
Cable TV Building	R-20	R-38	$1,952.48	0.00	0.98	0.98	7.04	$0.00	$22.89	$22.89	85.30

C01 - THERMOSTAT UPGRADE

Building	# of Thermo-stats Installed	Cost Per Thermostat	Total Cost	Electric kWh Savings	Fuel mmBtu Savings	Total mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Total Annual Savings	Simple Payback
ATCO Building	1	$952.73	$952.73	0.00	34.46	34.46	246.15	$0.00	$800.89	$800.89	1.19
Police Station*	1	$952.73	$952.73	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

E01 - T8 LIGHTING UPGRADE

Building	# of Fixtures	Price Per Fixture	Total Cost	Electric kWh Savings	Electric kW Savings	Equivalent mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Total Annual Savings	Simple Payback
Garage/Maintenance	7	$415.02	$2,905.15	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Tutlgag Cablevision	2	$415.02	$830.04	22.42	0.53	0.08	1.63	$4.83	$5.29	$10.12	171.94
Water Treatment	11	$415.02	$4,565.23	536.61	8.42	1.83	38.94	$115.53	$126.70	$242.23	39.51

E02 - T5 LIGHTING UPGRADE

Building	# of Fixtures	Price Per Fixture	Total Cost	Electric kWh Savings	Electric kW Savings	Equivalent mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Total Annual Savings	Simple Payback
Garage/Maintenance	4	$1,010.78	$4,043.10	940.16	5.42	3.21	68.23	$202.42	$204.48	$406.89	19.97

E03 - INSTALL OCCUPANCY SENSORS

Building	# of Fixtures	Price Per Fixture	Total Cost	Electric kWh Savings	Electric kW Savings	Equivalent mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Total Annual Savings	Simple Payback
ATCO Building	8	$292.98	$2,343.80	438.02	0.00	1.49	31.79	$94.31	$103.42	$98.86	24.85
City Office	13	$292.98	$3,808.68	4,827.61	0.00	16.48	350.33	$1,039.38	$1,139.88	$2,849.81	3.66
Garage/Maintenance	1	$292.98	$292.98	655.20	0.00	2.24	47.55	$141.06	$141.06	$282.13	2.08
Tutalgag Cablevision	1	$292.98	$292.98	57.66	0.00	0.20	4.18	$12.41	$13.61	$26.03	23.60
Water Treatment	2	$292.98	$585.95	1,024.08	0.00	3.50	74.32	$220.48	$241.80	$462.29	2.66

E05 - CFL LIGHTING UPGRADE											
Building	**# of Incans to be Replaced**	**Wattages to be Replaced**	**Total Cost**	**Electric kWh Savings**	**Electric kW Savings**	**Equivalent mmBtu Savings**	**Equivalent Fuel Gallons Savings**	**Annual kWh Cost Savings**	**Annual Equivalent Fuel Cost Savings**	**Total Annual Savings**	**Simple Payback**
Scattered	40	75, 100	$1,321.07	1,104.00	16.56	3.77	80.12	$237.69	$260.67	$498.36	5.56

E06 - LED STREET LIGHTING UPGRADE - QTY 53											
Building	**Existing Fixture**	**Retrofit Fixture**	**Total Cost**	**Electric kWh Savings**	**Electric kW Savings**	**Equivalent mmBtu Savings**	**Equivalent Fuel Gallons Savings**	**Annual kWh Cost Savings**	**Annual Equivalent Fuel Cost Savings**	**Total Annual Savings**	**Simple Payback**
Whole Village	150W HPS	47W LED	$56,326.43	25,651.47	70.28	87.55	1,861.50	$5,522.76	$6,057.32	$11,580.08	10.20

M01 - BOILER TUNE-UP											
Building	**Number of Boilers**	**Increase in Efficiency**	**Total Cost**	**Electric kWh Savings**	**Fuel mmBtu Savings**	**Total mmBtu Savings**	**Equivalent Fuel Gallons Savings**	**Annual kWh Cost Savings**	**Annual Equivalent Fuel Cost Savings**	**Total Annual Savings**	**Simple Payback**
School	2	~3%	$3,850.06	0.00	528.92	528.92	3,777.98	$0.00	$11,322.79	$11,322.79	0.34
Water Treatment	2	~1%	$3,850.06	0.00	30.18	30.18	215.56	$0.00	$701.36	$701.36	5.49

M02 - FURNACE UPGRADE											
Building	**# of Furnaces to Replace**	**New Furnace Efficiency (AFUE)**	**Total Cost**	**Electric kWh Savings**	**Fuel mmBtu Savings**	**Total mmBtu Savings**	**Equivalent Fuel Gallons Savings**	**Annual kWh Cost Savings**	**Annual Equivalent Fuel Cost Savings**	**Total Annual Savings**	**Simple Payback**
Police Station	1	85.00%	$19,620.18	0.00	8.17	8.17	58.38	$0.00	$189.94	$189.94	103.30

M04 - DOMESTIC WATER HEATER UPGRADE											
Building	**# of Water Heaters to Replace**	**New Water Heater Efficiency (AFUE)**	**Total Cost**	**Electric kWh Savings**	**Equivalent Fuel mmBtu Savings**	**New Fuel mmBtu Use**	**Equivalent Fuel Gallons Savings**	**Annual kWh Cost Savings**	**Annual Equivalent Fuel Cost Savings**	**Total Annual Savings**	**Simple Payback**
Water Treatment	1	88.00%	$17,750.17	3,475.33	11.86	12.13	165.58	$0.00	$538.75	$538.75	32.95

APPENDIX B

ECO CALCULATION RESULTS – NOT FUNDED

APPENDIX B - ECO CALCULATION RESULTS - NOT FUNDED - PILOT STATION

Note: The reported simple paybacks are based on the type of ECO listed. For example, electrical ECOs only use the Annual kWh Cost Savings column to calculate the SPB, even though the Annual Equivalent Fuel Cost Savings is still reported.

B01 - WEATHER-STRIPPING

Building	# of Doors	Price Per Door	Total Cost	Electric kWh Savings	Fuel mmBtu Savings	Total mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Simple Payback
School	6	Varies w/Size	$5,000.00	0.00	13.82	13.82	98.71	$0.00	$321.19	15.57
Tutlgag Cablevision	1	Varies w/Size	$1,000.00	0.00	2.23	2.23	15.96	$0.00	$51.94	19.25

C01 - THERMOSTAT UPGRADE

Building	# of Thermo-stats Installed	Cost Per Thermostat	Total Cost	Electric kWh Savings	Fuel mmBtu Savings	Total mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Simple Payback
School	2	$290.00	$1,200.00	0.00	521.22	521.22	3,722.99	$0.00	$12,113.50	0.10
Water Treatment	1	$290.00	$900.00	0.00	84.17	84.17	601.18	$0.00	$1,956.08	0.46

E04 - PREMIUM EFFICIENCY MOTORS UPGRADE

Building	# of Motors	Price Per Motor	Total Cost	Electric kWh Savings	Electric kW Savings	Equivalent mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Simple Payback
Water Treatment	6	Varies w/HP	$8,000.00	1,175.60	0.42	4.01	85.31	$253.11	$277.58	31.61

M02 - FURNACE UPGRADE

Building	# of Furnaces to Replace	New Furnace Efficiency (AFUE)	Total Cost	Electric kWh Savings	Fuel mmBtu Savings	Total mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Simple Payback
ATCO Building	1	85.00%	$15,260.00	0.00	8.17	8.17	58.38	$0.00	$189.94	80.34

M03 - UNIT HEATER UPGRADE

Building	# of Heaters to Replace	Heater Price	Total Cost	Electric kWh Savings	Fuel mmBtu Savings	Total mmBtu Savings	Equivalent Fuel Gallons Savings	Annual kWh Cost Savings	Annual Equivalent Fuel Cost Savings	Simple Payback
Garage/Maintenance	2	$7,500.00	$21,000.00	0.00	8.22	8.22	58.72	$0.00	$191.06	109.91

APPENDIX C

EQUATIONS USED IN CALCULATIONS

APPENDIX C - EQUATIONS USED IN CALCULATIONS - PILOT STATION

ECO ***Equations***

B01 1. Door Leakage Area (in2) = Door Area x Door Leakage Factor
2. Specific Infiltration (CFM/in2) = [(Stack Coefficient x ΔT) + (Wind Coefficient x [Wind Speed]2)]1/2
3. ΔT = Heating Setpoint Temp - Bin Temp
4. Air Infiltration (CFM) = Specific Infiltration x Door Leakage Area
5. Heat Loss Rate (Btu/hr) = 1.08 x Air Infiltration x ΔT
6. Heating Load (mmBtu) = Heat Loss Rate x Bin Hours / 1,000,000
7. Energy Savings = Baseline - Proposed

Note: This ECO was completed using the RETscreen program.

B02 *Note: This ECO was completed using the RETscreen program.*
Inputs are R-values reported in the appendices as well as the insulation square footage

C01 *Note: This ECO is based on bin data, occupancy, heating peak loads, boiler efficiency, and an assumed night setback*
Baseline Usage = (Peak Load x Occupied Load Profile x All Hours) / Boiler Eff.
ECM Usage = [(Peak Load x Occupied Load Profile x Occupied Hours)
+ (Peak Load x Unoccupied Load Profile x Unoccupied Hours)] / Boiler Eff
mmBtu Saved = Baseline Usage - ECM Usage

E01 1. Baseline Demand (kW) = (Existing Fixture Wattage) x (Qty) X (12 Months) / (1,000)
2. Baseline Usage (kWh) = (Baseline Demand) x (Fixture Hours)
3. Proposed Demand (kW) = (Proposed Fixture Wattage) x (Qty) X (12 Months) / (1,000)
4. Proposed Usage (kWh) = (Proposed Demand) x (Fixture Hours)
5. Annual Energy Savings = (Baseline Energy Usage) - (Proposed Energy Usage)
6. Annual Cost Savings = (Energy Savings) x (Energy Cost)

E02 1. Baseline Demand (kW) = (Existing Fixture Wattage) x (Qty) X (12 Months) / (1,000)
2. Baseline Usage (kWh) = (Baseline Demand) x (Fixture Hours)
3. Proposed Demand (kW) = (Proposed Fixture Wattage) x (Qty) X (12 Months) / (1,000)
4. Proposed Usage (kWh) = (Proposed Demand) x (Fixture Hours)
5. Annual Energy Savings = (Baseline Energy Usage) - (Proposed Energy Usage)
6. Annual Cost Savings = (Energy Savings) x (Energy Cost)

E03 1. Baseline Usage (kWh) = (Existing Fixture Wattage) x (Qty) x (Existing Hours) / (1,000)
2. Proposed Usage (kWh) = (Existing Fixture Wattage) x (Qty) x [(Existing Hours) - (Hours Reduced)] / (1,000)
3. Annual Energy Savings = (Baseline Energy Usage) - (Proposed Energy Usage)
4. Annual Cost Savings = (Energy Savings) x (Energy Cost)

E04 1. Existing/Proposed Motor Demand (kW) = (Motor HP) x (Load Factor) x (0.746 kW/HP)/ Motor Efficiency
2. Existing/Proposed Motor Consumption (kWh) = (Motor Demand) x (Diversity Factor) x (Annual Hours)
3. kW Savings = [(Baseline kW) - (Proposed kW)] x (12 Months)
4. kWh Savings = (Baseline kWh) - (Proposed kWh)
5. Energy Cost Savings = Energy Savings (kW or kWh) x (Energy Unit Cost)

E05 1. Baseline Demand (kW) = (Existing Fixture Wattage) x (Qty) X (12 Months) / (1,000)
2. Baseline Usage (kWh) = (Baseline Demand) x (Fixture Hours)
3. Proposed Demand (kW) = (Proposed Fixture Wattage) x (Qty) X (12 Months) / (1,000)
4. Proposed Usage (kWh) = (Proposed Demand) x (Fixture Hours)
5. Annual Energy Savings = (Baseline Energy Usage) - (Proposed Energy Usage)
6. Annual Cost Savings = (Energy Savings) x (Energy Cost)

E06 1. Baseline Demand (kW) = (Existing Fixture Wattage) x (Qty) X (12 Months) / (1,000)
2. Baseline Usage (kWh) = (Baseline Demand) x (Fixture Hours)
3. Proposed Demand (kW) = (Proposed Fixture Wattage) x (Qty) X (12 Months) / (1,000)
4. Proposed Usage (kWh) = (Proposed Demand) x (Fixture Hours)
5. Annual Energy Savings = (Baseline Energy Usage) - (Proposed Energy Usage)
6. Annual Cost Savings = (Energy Savings) x (Energy Cost)

M01 Savings (MBtu) = (Boiler Input Rating) x ((1/Tested Efficiency)-(1/Desired Efficiency)) x (Hours per Year)
Savings ($) = (MBtu Savings) x (Energy Cost)

M02 1. Heat Loss Rate (mmBtu/hr) = MBLC x (Heating Temp Setpoint - Mean Bin Temp)
2. Heat Load (MBH) = Heat Loss Rate x 1000
3. MBH-hr = Heat Load x Bin Heating Hours / (kW/ton)
4. Fuel Used (mmBtu) =[(MBH-hr) / Efficiency] / 1000
5. mmBtu Saved = (mmBtu)Existing - (mmBtu)Proposed

M03 *Note: This ECO is based on bin data, occupancy, heating peak loads, heater efficiency, and an assumed night setback*
Baseline Usage = (Peak Load x Occupied Load Profile x All Hours) / (Old Heater Efficiency)
ECM Usage = (Peak Load x Occupied Load Profile x All Hours) / (New Heater Efficiency)
mmBtu Saved = Baseline Usage - ECM Usage

M04 1. Annual Energy Usage (mmBtu) = (41,045 Btu/Day) x (Total Days/Yr) x (Total Heaters) / (Energy Factor or Thermal Efficiency)
2. Annual Energy Usage (kWh) = (12.03 kWh/Day) x (Total Days/Yr) x (Total Heaters) / (Energy Factor or Thermal Efficiency)
3. (Commercial Type Heaters) Annual Standby Losses (mmBtu) = (Btu/Hr) x (24 Hrs/Day) x (Total Days/Yr) x (Total Heaters) / (1,000,000)
4. (Electric Type Heaters) Annual kW Use = System kW x 12
5. (Commercial Type Heaters) Total Annual Energy Usage (mmBtu) = Annual Energy Usage + Annual Standby Losses
6. Annual Savings = Baseline Conditions - Proposed Conditions

FOR E03 - Hours Reduced

From the Energy Management Handbook, Turner, 4th Edition Table 13.8 p361
Savings from installing occupancy sensors are as follows

Offices (Private)	25-50%
Offices (Open Spaces)	20-25%
Rest Rooms	30-75%
Corridors	30-40%
Storage Areas	45-65%
Meeting Rooms	45-65%
Conference Rooms	45-65%
Warehouses	50-75%

FOR E04

Load factor assumed to be 80% except in some cases. Vacuum pumps assumed 100% load factor.
Diversity factor assumed to be 95%.

Tables 2A and 2B - 1995 Commercial Building Energy Consumption
2003 ASHRAE Applications Handbook, Chapter 35

	Energy End-Use (1,000 Btu/ft^2-yr)		
Building Characteristics	**Space Heat**	**Cool**	**Ventilation**
Education	32.8	4.8	1.6
Food sales	27.5	13.4	4.4
Food service	30.9	19.5	5.3
Health care	55.2	9.9	7.2
Lodging	22.7	8.1	1.7
Mercantile and service	30.6	5.8	2.5
Office	24.3	9.1	5.2
Public assembly	53.6	6.3	3.5
Public order and safety	27.8	6.1	2.3
Religious worship	23.7	1.9	0.9
Storage/Warehouse	15.7	0.9	0.3
Vacant	11.9	0.6	0.3

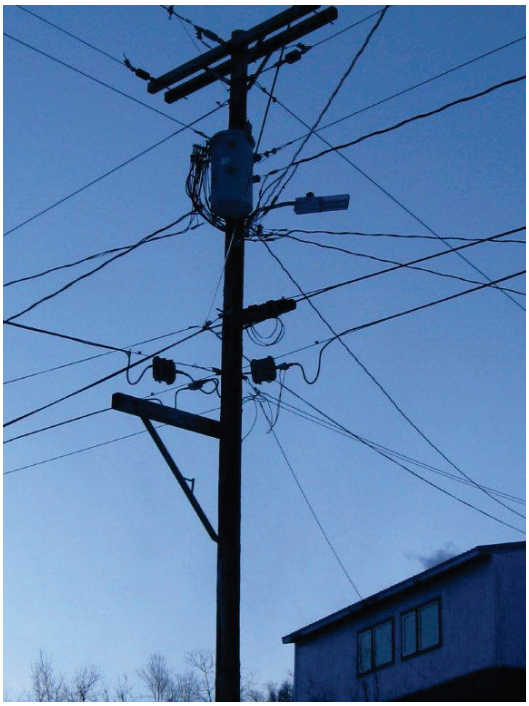
APPENDIX D

POST INSTALLATION PHOTOS

APPENDIX D – POST INSTALLATION PHOTOS – PILOT STATION

Completed Domestic Water Heater Upgrade

Completed Insulation Upgrade – Tutalgag Cablevision



New Street Light Installation

Furnace Upgrade – Police Department