REPORT

COMPREHENSIVE ENERGY AUDIT

For

SOUTH NAKNEK WATER TREATMENT PLANT, SANITATION SYSTEM, TRIBAL OFFICE, CLINIC, AND COMMUNITY CENTER

South Naknek, Alaska

Prepared for

Village of South Naknek, Alaska

And

The Alaska Rural Utility Collaborative (ARUC)

August 2, 2011

Prepared by

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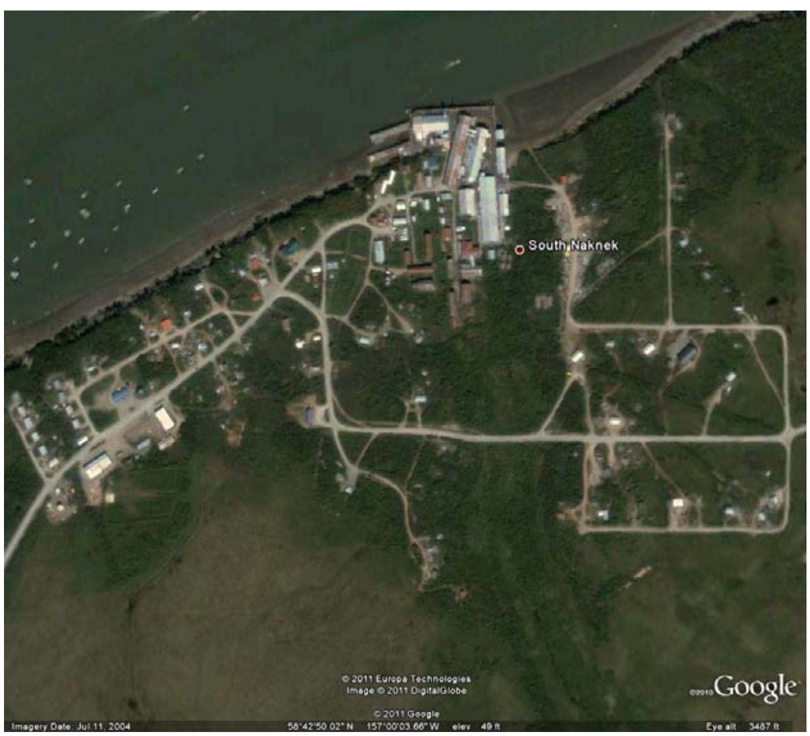
Preface

The Energy Projects Group at the Alaska Native Tribal health Consortium (ANTHC) prepared this document for The Tribal Council of South Naknek, Alaska and the Alaska Rural Utility Collaborative (ARUC). The authors of this report are Chris Mercer, PE and CEA, and Gavin Dixon.

The purpose of this report is to provide a comprehensive document of the findings and analysis that resulted from an energy audit conducted March 9, 2011 by the Energy Projects Group 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.

Acknowledgements

The ANTHC Energy Projects Group gratefully acknowledges the assistance of South Naknek Water Treatment Plant Operators Thomas Thaler, Carl Rawson, South Naknek Village Council Tribal Administrator Lorianne Rawson, and Alaska Rural Utility Collaborative Statewide Manager John Nichols.



Executive Summary

This report was prepared for the village of South Naknek, Alaska and the Alaska Rural Utility Collaborative. The audit focused on occupied tribal buildings, and water and sewer sanitation facilities. These included the tribal office, clinic, community center, water treatment plant (WTP) complex, and lift stations one and two. The scope of the report is a comprehensive energy study which includes all energy consuming aspects of the system.

Based on available electrical and fuel oil data, notable savings are available to the community of South Naknek. Recommendations are explained in detail below and in the recommended Energy Conservation Measures (ECM) section.

Twelve energy conservation measures are recommended as part of this study. These actions primarily deal with operations of existing infrastructure, but also involve minor repairs and improvements. These twelve recommendations have an estimated cost of roughly $8,000. The anticipated annual savings resulting from these changes are greater than $4,100 resulting in a combined simple payback of less than two years. It should be noted that several of the ECMs below will require no material cost and negligible time to implement.

Two areas have been identified for further study. Persons familiar with local construction should provide estimates for installation of a sealed combustion exhaust system on the existing clinic boiler. Also an in-depth review of space usage might identify where occupancy sensors may be warranted.

One item was evaluated and is not recommended at this time. A full lighting retrofit project could potentially save approximately $500 annually in electrical costs, but due to the high initial cost of this upgrade the simple payback would be over 17 years. In the future lower cost of materials, increasing electrical cost, or adjacent required work may make this project viable. Currently retrofitting the lighting in the clinic and exterior lighting fixtures are the only viable lighting retrofits.

As energy becomes an ever increasing concern accurate data and records will be vital to determining avenues for savings. We recommend that all electrical and oil use be metered and carefully recorded. This data should be tracked and analyzed on regular basis for the purpose of identifying waste or system problems.

Recommended Energy Conservation Measures

Table 1.1

Recommended Projects			
Description	**Cost**	**Annual Savings**	**Simple Payback**
Appliance Operations	$0	$1002	Immediate
Building Shell Improvements	$426	2% of fuel	2-5 Years
Lower Heating Set Point in Community Center	$0	$250	Immediate
Replace Toyo Stove igniter in WTP	$100	$250	5 months
Turn off Lift Station Heaters when unneeded	$0	$1152	Immediate
Reduce Hot Water temperature in clinic when not in use	$0	3% of fuel	Immediate
Insulate Hydronic Piping in Clinic and Community Center	$100	1% of fuel	1-6 months
Turn off Electric Hot Water Heater	$0	$560	Immediate
Occupancy Sensors/ Programmable Thermostats Installation	$820	2% of fuel + $30	6-8 months
Change Oil-Miser in the Clinic to sealed combustion unit	$3,224	$378	8.52 years
Replace Fluorescent Lighting in Clinic	$2,599	$221	11 years
Replace Exterior Lighting Fixtures	$755	$256	2.95 years
Total	$8024	$4100+	1.96 years

2. Audit and Analysis Background

2.1 Program Description

This audit effort comprised energy engineering services to identify, develop, and evaluate energy efficiency and conservation measures for the South Naknek water treatment plant, lift stations, tribal office, community center, and health clinic. Measures were selected such that an overall simple payback period of 10 years or less is achieved. Measures that were evaluated but had longer simple payback periods are included in the non-recommended measures section of this report in order to allow for re-evaluation of these projects should energy prices increase.

2.2 Audit Description and Methodology

On March 9th, 2011, the Energy Projects Group at ANTHC conducted an on-site audit of the above referenced facilities and systems. Complete facility surveys were conducted including a systematic inspection of the entire system, interviews with plant operators, observation of actual operating procedures, and data collection of all major equipment and structures including nameplate data for major equipment, operating hours of equipment, actual equipment loads over time, maintenance needs, condition of equipment, blower door test of each facility, and thermal imaging of each facility.

Lighting audits were also completed for each facility including complete physical counts of all the fixtures and a determination of fixture configuration.

Some of the major tools used to facilitate the audit included:

- Energy Conservatory Blower Door Test System
- FLIR b50 Infrared Camera
- Extech Video Boroscope
- Bacharach Fyrite Insight Combustion Gas Analyzer
- Dranetz/BMI EP1 Power Monitor

In addition to the physical inspection, the following sources of information were used to obtain the level of detail necessary to accurately understand and analyze the buildings energy use.

- As-built architectural, mechanical and electrical drawings
- Operation and Maintenance manuals for both facilities
- Fiscal years 2009 and 2010 fuel and electricity use data

2.3 Analysis Methodology

This section describes the main analysis methods used to identify baseline building energy usage and to evaluate energy conservation measures (ECMs).

2.3.1 Energy Engineering Analysis

Following the site visit, energy balances were calculated to determine the distribution of energy use as given in the historical bills. The significant number of separate meters combined with the equipment monitoring done made analyzing the electrical usage easier. Electrical and oil consumption were prorated to the end use categories based on a combination of monitoring and calculations of consumption by the system components. This analysis confirms the understanding of how systems are operated. For example, it is a check on the assumed load, cycling factor, or length of operation of the various systems or individual pieces of equipment.

After the balances were completed, potential energy efficiency measures were analyzed and annual savings calculated. Savings calculations are based on reduction in run time of an existing system, improved control of an existing system, or conversion to more efficient equipment. Due to partially limited access to the community building, assumptions were made concerning the electrical load usage of a single locked office.

Cost estimates are provided for the proposed conversions or improvements. These are budget estimates based on a combination of quotations and the experience of the auditors on similar projects completed in rural Alaska.

2.3.2 Thermal Imaging

An infrared thermal imaging analysis of the buildings was conducted using a FLIR b50 infrared camera. Several areas of large losses were identified and each are included in the list of energy conservation measures.

2.4 Limitations of Study

The information presented herein is an energy efficiency and conservation study to identify potential energy conservation measures and estimate their costs and savings. In some cases, several methods may achieve the identified savings. This report does not include specific design instructions. It is not intended as a final design document and projects have not been developed to construction design level. The design professional or other persons following the recommendations shall accept responsibility and liability for the results. Budget for engineering and design of these projects is included in the cost estimate for each measure as needed.

2.5 Water System

2.5.1 Water Treatment Plant Complex

The water treatment facilities in South Naknek consist of the water treatment plant, 150,000 gallon water storage tank (WST), maintenance facility, and two wells. Water lines currently serve approximately 6 homes in the winter, but this number increases 10 or more homes in summer months. The system is designed to pump water from two wells, and store the water in the WST after chlorine and fluoride is added. In the design configuration two alternating pressure pumps would build pressure in two parallel bladder-type pressure vessels and supply water to the distribution lines.

Current Operations

The water treatment system in South Naknek is currently being as operated without the use of the WST. In this configuration water is pumped directly from the wells into the bladder-type pressure vessels. This configuration allows for the pressure pumps, the High Capacity pump, and the associated controls to remain inactive. The community is not currently adding either chlorine or fluoride to the water.

WTP

The water treatment plant facility is approximately 320 square feet in size, and is heated by one electric wall heater. Electric heat tapes are installed on the well lines, but are not used as part of regular operations. Electric and fuel usage for the facility is summarized in the table below.

Table 2.1

	Quantity	Kwh	
Well pumps	2	625	Unknown type 1Φ 118V @ 17.2A 1.7kw
Pressure pumps	2	0	1.5Hp w/ Goulds1BF21534 $5^1/_8$ imp.
High capacity pump	1	0	15Hp w/ Goulds 3656 $9^3/_4$ imp.
Dosing pump	2	0	LMI A752
Lighting	6	350	T12 Fluorescent Bulbs
Electric heater	1	700	Emergency use only
Elec. Heat tape	1	0	Varries between 8.7A and 2.2A
Other	n/a		Tool, work lights, vehicle heaters etc.

An itemized table of well pumps starts and hours can be found in the appendices.

Other includes the minor loads such as flow meters, control circuits, voltage monitors, telephones, and the fuel heater fan.

2.5.2 Mechanical Building

The maintenance facility receives minimal use under normal operations. Currently the structure is being used as heated storage for an adjacent construction project.

2.6 Sewer System

2.6.1 Lift Station 1

Lift station 1 consists of a single divided facility. As sewage flows into the wet well the level rises to a point where one of two suction lift Hydromatic 30MP pumps are activated. The sewage is then pumped via a force main to the transition manhole. The building is heated electrically, which along with pump use is responsible for the majority of the buildings energy costs.

2.6.2 Lift Station 2

Lift station 2 consists of a single divided facility. As sewage flows into the wet well the level rises to a point where one of two suction lift hydromatic 30MP pumps are activated. The sewage is then pumped via force main to the transition manhole. The building is heated electrically, which along with pump use is responsible for the majority of the buildings energy costs.

2.7 Health Clinic

The health clinic is used on a semi-regular basis. The village does not maintain a year long health aide, but instead will host an aide at the clinic for two week periods once a month. The aide lives in the clinic, and operates the clinic four days a week, six hours a day. The building is 2x6 construction with above grade floors, and roughly 800 square feet.

2.8 Community Center

The community center is used primarily by one tribal employee who works 5 days a week 8 hours a day in the summer, and 2 or 3 days week in the winter 8 hours a day. She maintains a small office. Three other offices in the building are being renovated for eventual usage as the tribal office. The main floor area of the building is used only three times a year on average, for funerals and community events. The square footage of the main facility is roughly 2450 square feet, and the back offices under construction add an additional 450 square feet The building is 2x6 construction with above grade floors and has been added onto recently.

In terms of electrical load, the primary contributors in this building are appliances such as computers, coffee pots, and radios, as well as fluorescent lighting fixtures.

2.9 Tribal Office

The Tribal Office in its current state is very rarely used. The active office has been relocated to a remote site in Wasilla, Alaska. The operators for the treatment plant and sewage system use the building sparingly, less than an hour per day. Offices are being renovated in the community center to accommodate a move from the current Tribal Office. The building is 2x6 construction with above grade floors.

2.10 Additional Unoccupied Tribal Facilities:

Old Fire Station

The Old Fire Station is in use only as a cold storage facility. All fire safety vehicles are now located at the Borough fire station. The building uses no electricity or fuel electrical and service is not connected to the facility.

Youth Center

The youth center is utilized only as a cold storage facility. The building uses no electricity or fuel. The Electrical connection has been disconnected at the meter base.

3. Summary of Energy Use

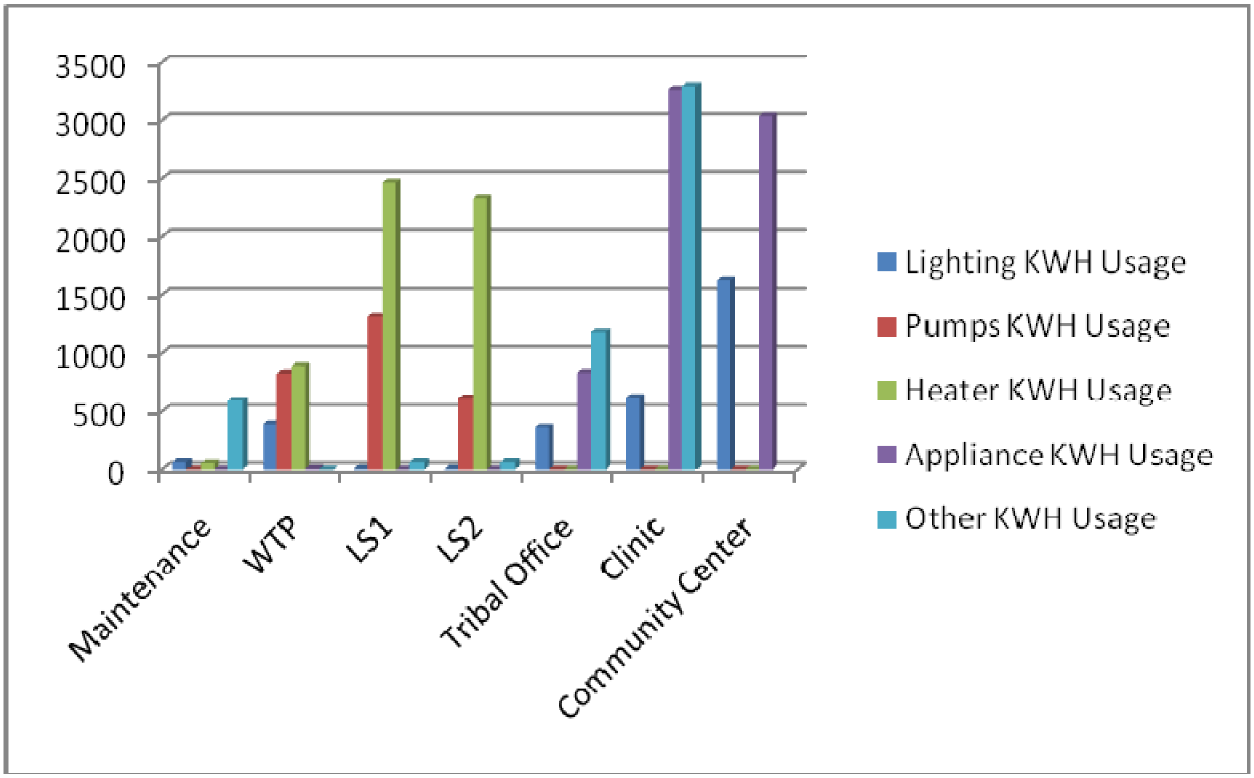


Figure 1.1*

*In the above figure other refers to the electric water heater in the tribal office, the usage of medical equipment in the clinic, and extension chords for maintenance in the maintnence buildings and lift stations.

The electricitiy in South Naknek is provided by Naknek Electrical Association in Naknek; power is provided through transmission lines over the Naknek river. Naknek uses diesel fuel and is working to add geothermal production to its mix. South Naknek is on PCE for some of its community buildings, including all water and sewer services and the clinic.

For the most part South Naknek has low usage of its community building. The annual electricity use by tribal buildings is 23,946 kwh. The highest electrical use building is the clinic, due mostly to the use of medical equipment and general operations. Heating the lift stations with electric heat is an additional large expense.

4. Summary of Fuel Usage

Fuel usage data was mostly unavailable for the community. The water and sewer operations had the following fuel usage data for fiscal year 2010. The vast majority of this was used by the water treatment plant, though some was used to heat the maintenance building.

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
35	35	45	30	40	40	30	30	10	0	5	15

For other buildings fuel data was unavailable, three other tribal facilities are heated with fuel oil. The community center and clinic likely have elevated fuel usage and costs, due to the additional usage and higher maintained inside room temperature.

Currently fuel is purchased from a private tank held by a fish processing company. Recently however the fuel tank has been deemed unfit for storage due to environmental concerns, and the community will acquire its fuel from Naknek across the river, making fuel both more expensive and less convenient.

5. ENERGY CONSERVATION MEASURES

Many energy conservation measures (ECMs) have been identified that if implemented will have an impact on the operating costs of the water and sanitation systems in the Native Village of South Naknek. These measures are described on the following pages.

The recommendations, savings calculations and estimated implementation costs are derived from design information obtained from the original drawings and specifications, observations made during the on-site audit, discussions with plant operators, detailed measurements and monitoring done during the audit, review of historical consumption data, quotations and historical knowledge of both energy engineering, lift stations and water treatment plants.

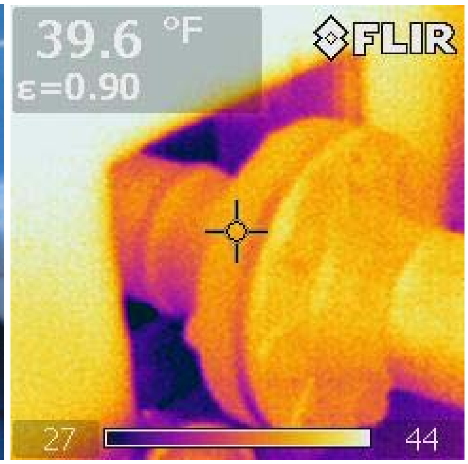
It should be noted that this report does not include specific design instructions. It is not intended as a final design document and projects have not been developed to construction design level. The design professional or other persons following the recommendations shall accept responsibility and liability for the results. Budget for engineering and design of these projects is included in the cost estimate for each measure as needed. For labor costs assume local water plant operator rate of $17.50/hour.

ECM: Building Shell Heating Improvements

WTP

The water treatment plant is a tightly constructed building. In terms of air leakage in the building there were very few leaks. Seal air infiltration leaks around doors, and line penetrations. Arctic hoods for well lines should be sealed, but not closed to the heated interior of the facility. Arctic hoods for water storage tank could be sealed completely until such time as the WST should be reactivated.

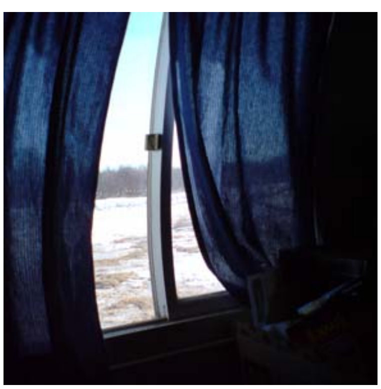
The primary leak is around the raw water intake from the unused water tank. Using spray foam or some other form of insulation around this area would minimize heat loss in the building. Assume one hour and $20 cost in materials, and a 1% drop in yearly heating bill.

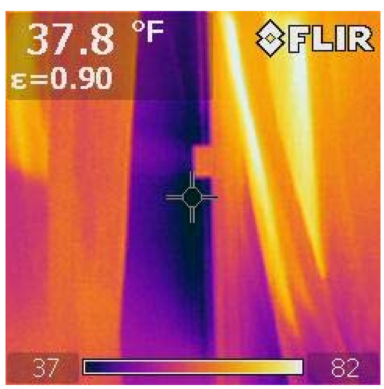


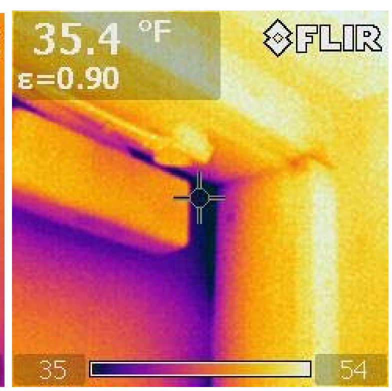
Measure	Cost	Savings/year	Simple Payback
Insulate Raw Water Line	$37.50	$12.50	3 years

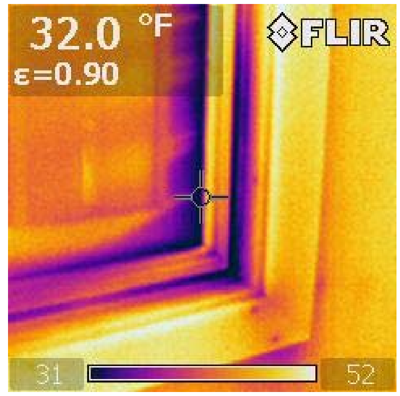
Tribal Office

After performing a blower door test, the tribal office was revealed to be a very leaky building. Many of the windows have significant air leakages, including one window that cannot close all the way in the back office. Given that the building is soon to be unused, it would not be sensible to replace the poor quality windows, but instead to seal them with 2 inch board stock insulation when not used for ventilation or lighting.







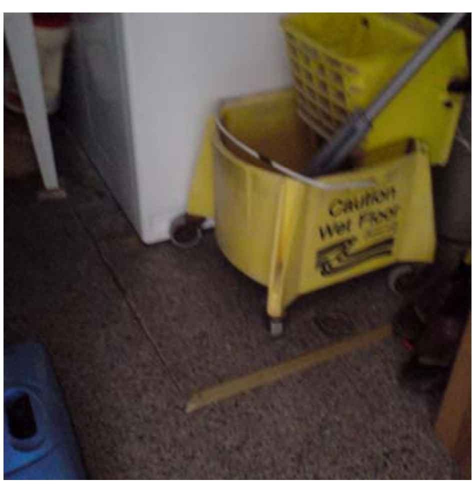


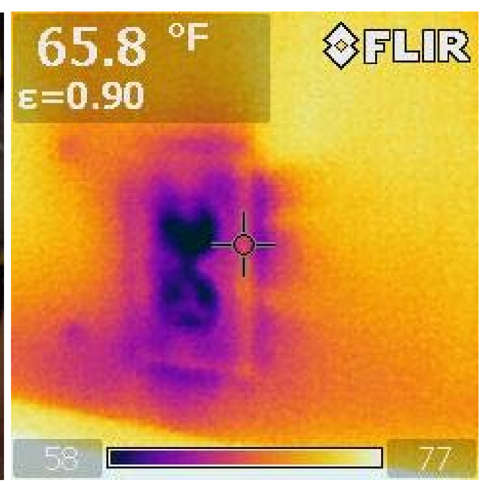
Additionally, the crawl space was fairly leaky in the front office, and should be covered to prevent leakage. Filling electrical outlets to prevent further leakage, as in all buildings is recommended to prevent heat losses. Assume $20/window materials, 30 minutes/window labor, and an hour each for insulation of outlets and the attic door. Assume 10% heat loss savings from windows, 1% from electrical outlets, and 5% from the attic door.

Measure	Cost	Savings/year	Simple Payback
Insulate/Fix Windows	$277.50	10%	2-5 years
Electrical Outlet Insulation	$27.50	1%	2-5 years
Attic Door Insulation	$27.50	5%	2-5 years

Clinic

The clinic is a fairly tight building as well, with good windows and relatively little leakage. The crawl space should be better insulated, as this is the primary air leak location in the building. Additionally all electrical outlets should be back insulated to prevent heat losses. Assume an hour to install electric outlet insulation, half an hour for board stock insulation for the crawl space.





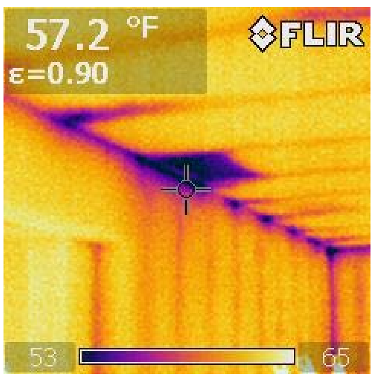
Measure	Cost	Savings/year	Simple Payback

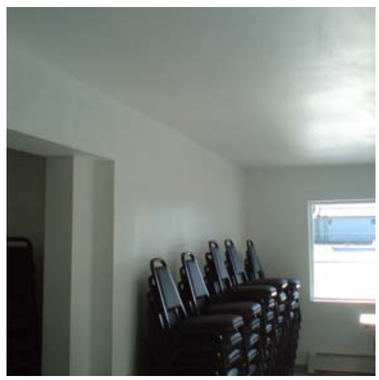
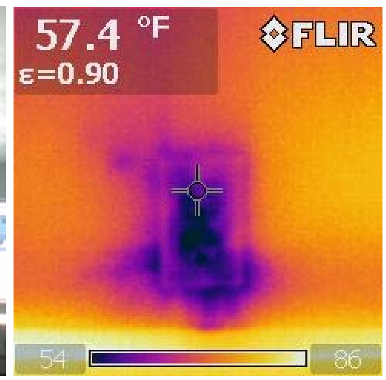
Electrical Outlet Insulation	$27.50	1%	3-5 years
Crawl Space Insulation	$28.75	3%	2-5 years

Community Center

While the community center is fairly new, there are a few areas to prevent leakage. As in all the buildings in South Naknek, exterior electrical outlets were drafty and causing a noticeable leakage of heat. It takes about 5 minutes and .50/outlet to put in outlet insulation. There are about 12 exterior outlets in the community center.

Some spray in foam for around the doors would reduce the slight draftiness caused by separation in the door framing. There also appears to be a serious cold spot in the ceiling where the new community center expansion connects to the old community center.



Measure	Cost	Savings/year	Simple Payback
Electrical Outlet Insulation	$27.50	1%	
Door Frame Foam	$66.25	2%	

ECM: Replace Igniter for Toyo stove

The toyo stove in the water treatment plant has broken igniter and is in need of replacement. The water treatment plant has been running the electric wall heater visible in the picture to the right. This change in usage is equivalent to 700 kilowatt hours a month, or $210/month (winter time). This cost of running the Toyo stove at the same rate would be about 30 gallons a month of fuel oil, or $165/month. Replacing the igniter would cost about $100.

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Measure	Cost	Savings/year	Simple Payback
Replace Igniter	$100	$250	5 months

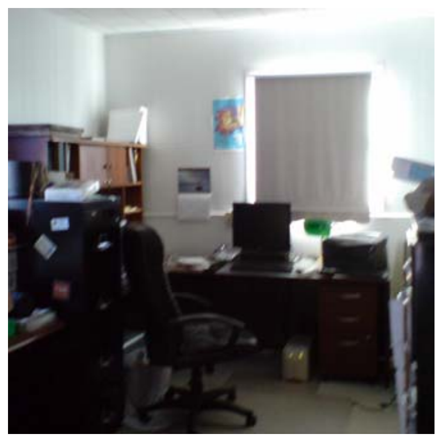
ECM: Appliances by Building

Tribal Office

Most appliances in the tribal office are shut down. There are a few that are plugged in on a constant basis however which are drawing unneeded electricity.

Appliance	KWH Savings	Cost Savings w/ PCE	Cost Savings w/o PCE
Microwave	47.06	$ 14.11	$37.65
SB 7.0 Dataport	17.398	$5.22	$13.92
Paper Shredder	17.398	$5.22	$13.92
Copy/Fax Machine	43.495	$13.05	$34.79

By keeping all of these appliances unplugged when not in use, the above savings can be realized.



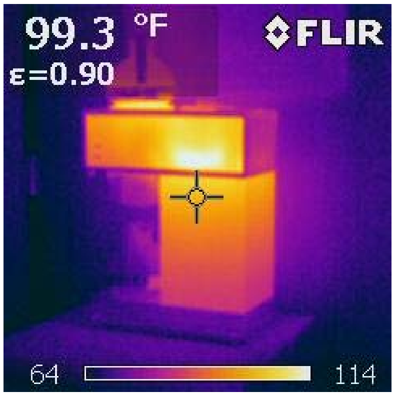
Community Center

The community center is one of the most used buildings in South Naknek, and has a significant appliance load. Several smaller appliances such as the radio and microwave are on all the time. Unplugging these items when not in use would save a noticeable amount of electricity per year.

The most energy intensive appliance in the building is the BUNN coffee maker. Just to run this machine costs almost $1800 a year; the electricity required to heat this appliance is significant. By turning off the coffee maker when not immediately heating or brewing a pot of coffee over $1,600 dollars per year would be saved. This assumes 3 hours of use per day, 4 days a week, 52 weeks a year. If the use is less the savings would be even greater. Further reduction could be had by using a more standard pot style brewing coffee machine, which would be more appropriate for the usage level in South Naknek.

Additionally the refrigerator is in use 24/7 despite very limited usage. Turning the refrigerator off would save all of those costs.

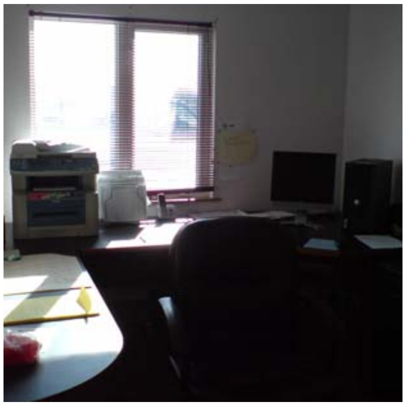
Appliance	KWH Savings	Cost Savings w/PCE	Cost Savings w/o PCE
BUNN Coffee Maker	2034	$610.2	$1627
Microwave	43.75	$13.125	$35
Stereo	85.15	$25.54	$51.09
Refrigerator	318	$95.4	$254.4



Clinic

Unplugging many of these items while not in use would save a fair amount of electricity. The coffee maker is again the biggest energy user. Other significant electricity users were the electric stove and two refrigerators. It was determined there were no actions to save energy with these appliances.

Appliance	KWH Savings	Cost Savings w/ PCE	Cost Savings w/o PCE
Hamilton Beach Coffee Maker	687	$206.1	$549.60
Microwave	19.01	$5.70	$15.21
Toaster	5.88	$1.76	$4.70
Paper Shredder	13.14	$3.942	$10.51
Addressograph	8.76	$2.628	$7.008



ECM: Turn off Lift Station Heats when unneeded

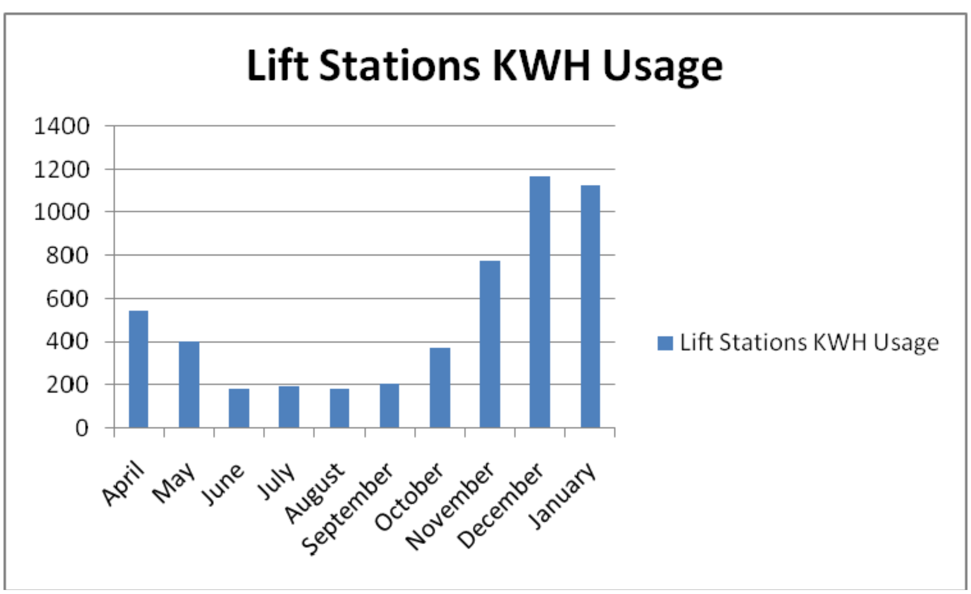
The heater in the wet wells of the lift stations are unnecessary and could be turned off year round. This would result in a savings of 35% of the total heating costs in the lift stations or $1008/year.

Additionally the minimum temperature setting in the rest of the lift station is unknown, and though it is set to heat to "minimum", this temperature is really only necessary to keep the lines from freezing. When the temperature is not expected to be below freezing for more than half the day for long stretches (early fall, and late spring) the entire heating unit could be turned off, saving 5% of the heating for a savings of $144/year.

(Wet well heater)

(main heater)

Measure	Cost	Savings/year	Simple Payback
Turn off Heaters when unnecessary	0	$1,152	Immediate



ECM: General Recommendations

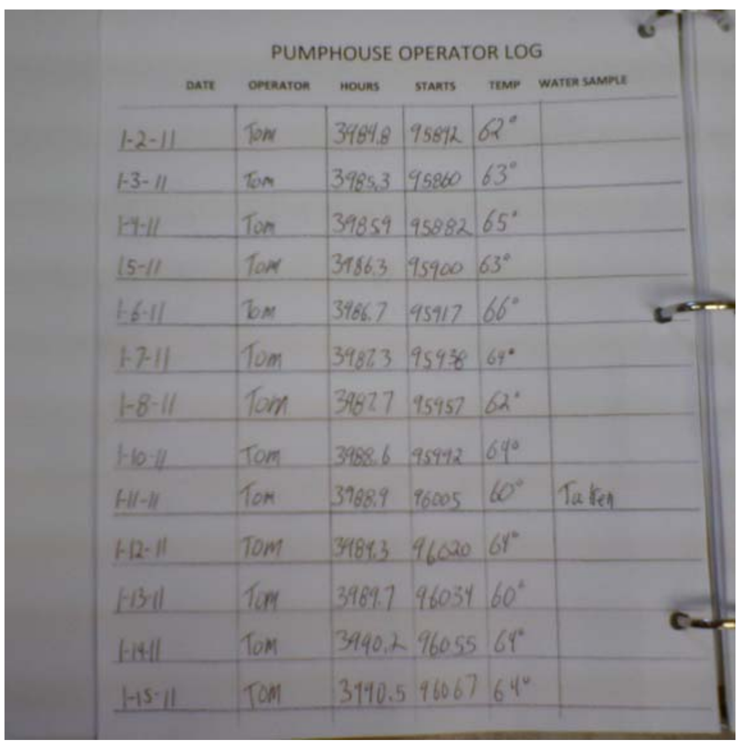
Hydromatic 30MP pumps

Retro-commissioning; the efficiency of suction-lift, high-solids, self-priming pumps is closely tied to adjustment and tuning. This should be performed on a re-occurring maintenance schedule set either calendar or pump run time. The manufactures literature for these pumps carefully defines tolerances and procedures for adjusting the impeller/wear-plate clearances, adjusting the self-prime bypass lines, and setting belt tension. It is recommended that the pumps be re-commissioned, and that a re-occurring maintenance schedule be developed.

Some efficiency may be gained by adjusting the lead-lag-off controls for the lift station. As part of retro-commissioning a wet-well water audit, should be performed to determine whether the float levels are operating at calculated set points.

Fuel Meters and Records

As energy becomes an ever increasing concern accurate data and records will be vital to determining avenues for savings. We recommend that all electrical and oil use be metered and carefully recorded. This data should be tracked and analyzed on a regular basis for the purpose of identifying wastes or system problems.



PUMPHOUSE OPERATOR LOG

DATE	OPERATOR	HOURS	STARTS	TEMP	WATER SAMPLE
1-2-11	Tom	3984.8	95842	62°	
1-3-11	Tom	3985.3	95860	63°	
1-4-11	Tom	3985.9	95882	65°	
1-5-11	Tom	3986.3	95900	63°	
1-6-11	Tom	3986.7	95917	66°	
1-7-11	Tom	3987.3	95938	64°	
1-8-11	Tom	3987.7	95957	62°	
1-10-11	Tom	3988.6	95992	64°	
1-11-11	Tom	3988.9	96005	60°	Taken
1-12-11	Tom	3989.3	96020	64°	
1-13-11	Tom	3989.7	96034	60°	
1-14-11	Tom	3990.2	96055	64°	
1-15-11	Tom	3990.5	96067	64°	

(Pump Logs)

ECM: Insulate Hydronic Piping in Clinic and Community Center

Heat generated by the boiler system is being dissipated through the primary and secondary heating loop piping. Insulation should be installed on this piping to ensure that heat is being retained for its intended use. Losses from piping will increase the temperature in the boiler room, and increase the energy that must be supplied to the system. In the clinic this piping is being exposed to cold outside air causing additional heating losses. Insulating this piping could save $50 per year in fuel costs.

(Community Center Piping)

(Clinic Piping)

Measure	Cost	Savings/year	Simple Payback
Insulate Hydronic Piping in Clinic and Community Center	Labor: $208 Materials: $50 Total:$258	$48	5.375 years

ECM: Turn off the electric water heater in the tribal office

Currently the electric water heater in the tribal office is heating water that is never used. The bathroom in the tribal office is rarely needed, as the building is essentially unused. By flipping the breaker to the off position for the electric water heater, this needless electricity usage of 800 kwh could be eliminated.

Measure	Cost	Savings/year	Simple Payback
Turn off electric hot water heater	0	$560	Immediate

ECM: Install Occupancy Sensors/ Programmable Thermostats

Currently all community lighting is controlled via manual switches, likewise facility heating set points are controlled manually via standard wall thermostats. Installation of occupancy sensors will allow for lighting to be turned on only when the space is occupied. Installation of programmable thermostats will provide the opportunity to automatically set back the heating set point when the less heat it required. Savings will be dependent on usage, but will reduce losses which occur when manual set-back is ignored or forgotten.

Measure	Cost	Savings/year	Simple Payback
Occupancy Sensors/ Programmable Thermostats Installation	820	2% of fuel + $30	6-8 months

ECM: Reduce Hot Water temperature in clinic when not in use

Currently the hot water heater in the clinic is ready for use at all times, despite the clinic's intermittent use. While this hot water heater also serves the community center, there is very little need for hot water in the community center with only two bathrooms without showers.

Turning down the hot water heater when the clinic is not in operation, which is roughly half the year would result in significant fuel usage savings.

Measure	Cost	Savings/year	Simple Payback
Turn off electric hot water heater	0	$560	Immediate

ECM: Convert Clinic to sealed combustion

Change clinic Oil-Miser boiler intake and seal vents in room.

Currently the health clinic boiler utilizes inside combustion air and natural draft ventilation. This set-up requires that excessive outside air be available in the boiler room to ensure adequate combustion air, and prevent hazardous carbon dioxide levels. This also increases the energy losses from the exposed heating hydronic components and domestic hot water systems. Additionally heat from inside the facility will be lost to the boiler room through leaks and conduction.

Changing the existing boiler to a sealed combustion unit similar to the unit in the community center will reduce heating loads in the clinic, and save almost $400 in fuel costs per year.

Measure	Cost	Savings/year	Simple Payback
Convert Clinic to sealed combustion	Labor: $2,024 Materials:$1,200 Total: $3,224	$378	8.52 years

ECM: Retrofit all clinic lights to LEDs

Replacing the T8 and T12 fluorescent lights in the Clinic with high efficiency LED fluorescent replacement bulbs could yield savings of over $200 per year, with a simple payback period of 11 years, assuming no increase in electric rates.

Non Recommended ECM: Fluorescent Lighting Replacement

Given the relatively low usage rates of the buildings, and the high cost of LED lighting alternatives, it is not cost effective to install new fluorescent lighting in any of the other buildings. Replacing all 40W T12 fluorescent bulbs and 32W T8 bulbs with the appropriate LED bulb would cost around $5,826 to install, with an annual savings of $272.65 at the PCE rate of electricity of $0.30, for a payback period of just over 21 years.

Replace T8s, T12s with LEDs

Measure	Cost	Savings/year	Simple Payback
Replace Clinic lights with LEDs	$2,599	$221.35	11 years
Replace all T8s, T12s with LEDs	$5,826	$272.65	21.38 years

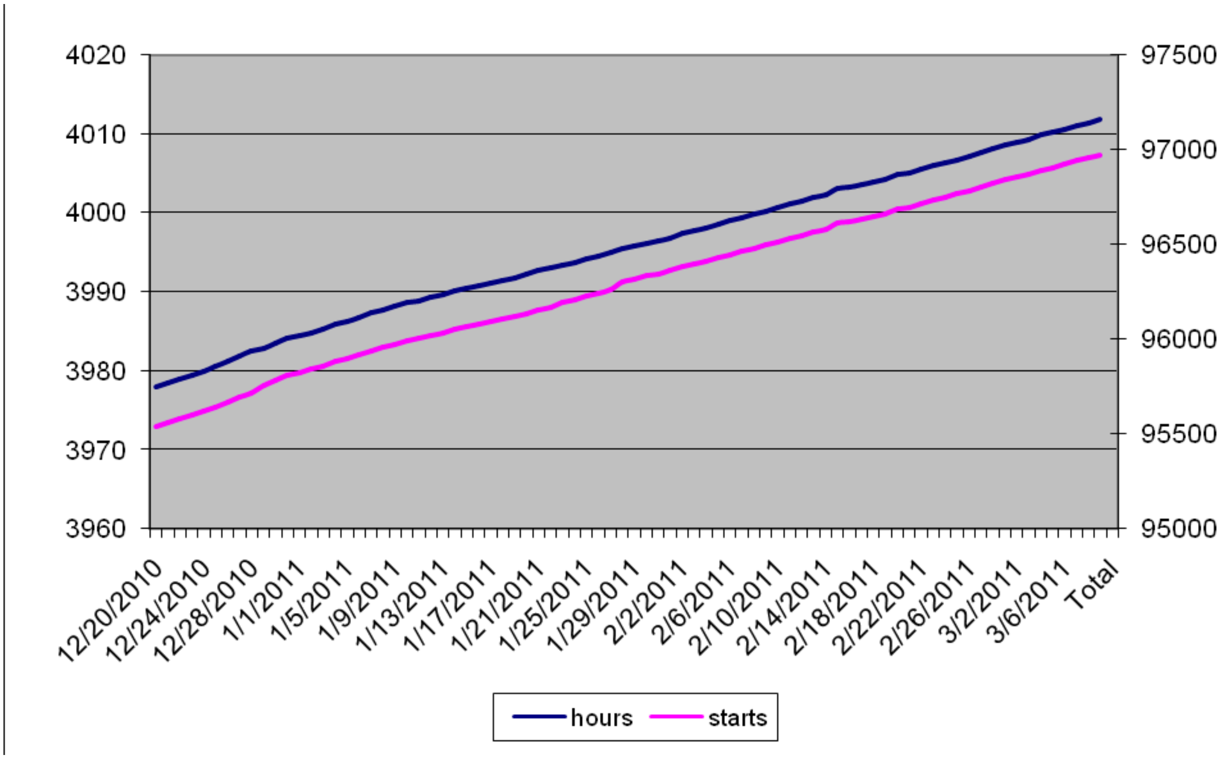
ECM: Replace Exterior Lighting Fixtures on the Clinic, Community Center, WTP, and Lift Stations with LEDS

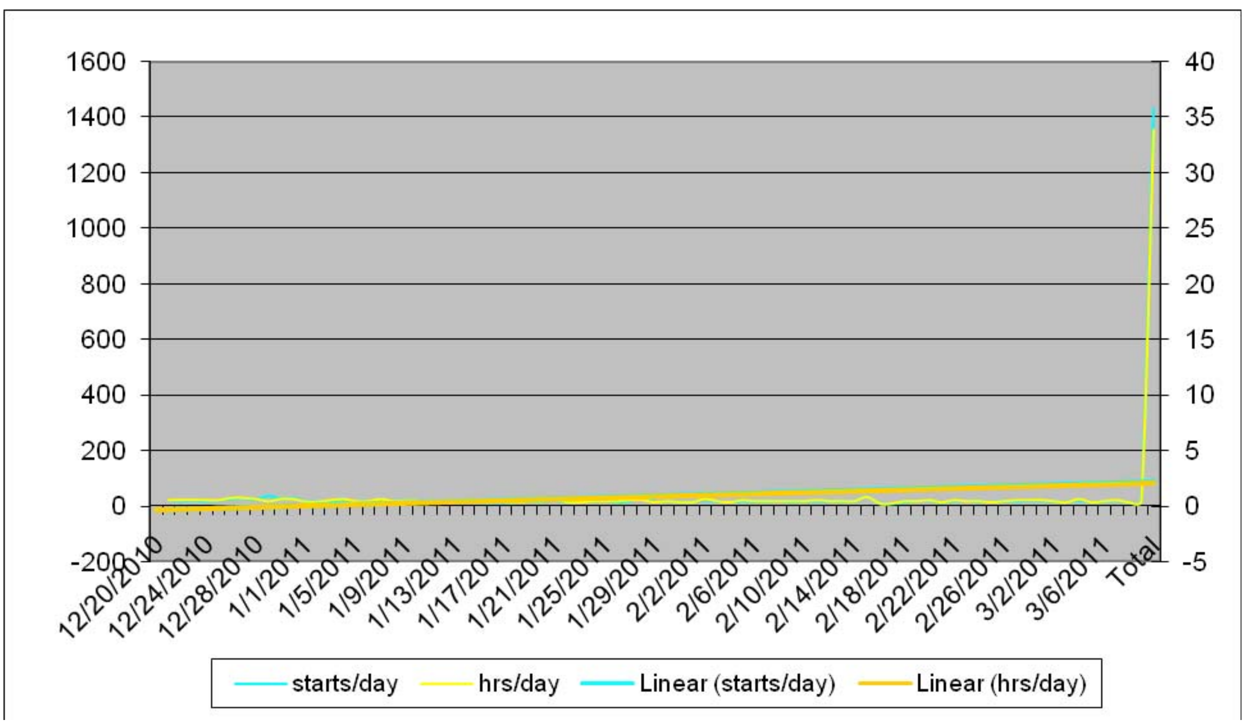
Replacing exterior lighting with highly efficient LED wall packs which perform well in cold temperatures would represent a significant savings. There are 4 wall packs worth replacing, three on the clinic/community center, and one on the water plant. There are 3 sets of motion sensor emergency lights to replace on the community center/tribal building.

Measure	Cost	Savings/year	Simple Payback
Replace 4Wall Packs with LEDs	$500	$236	2.12 years
Replace 3 Emergency Lights with LED's	$255	$20	12.75 years
Total	$755	$256	2.95 years

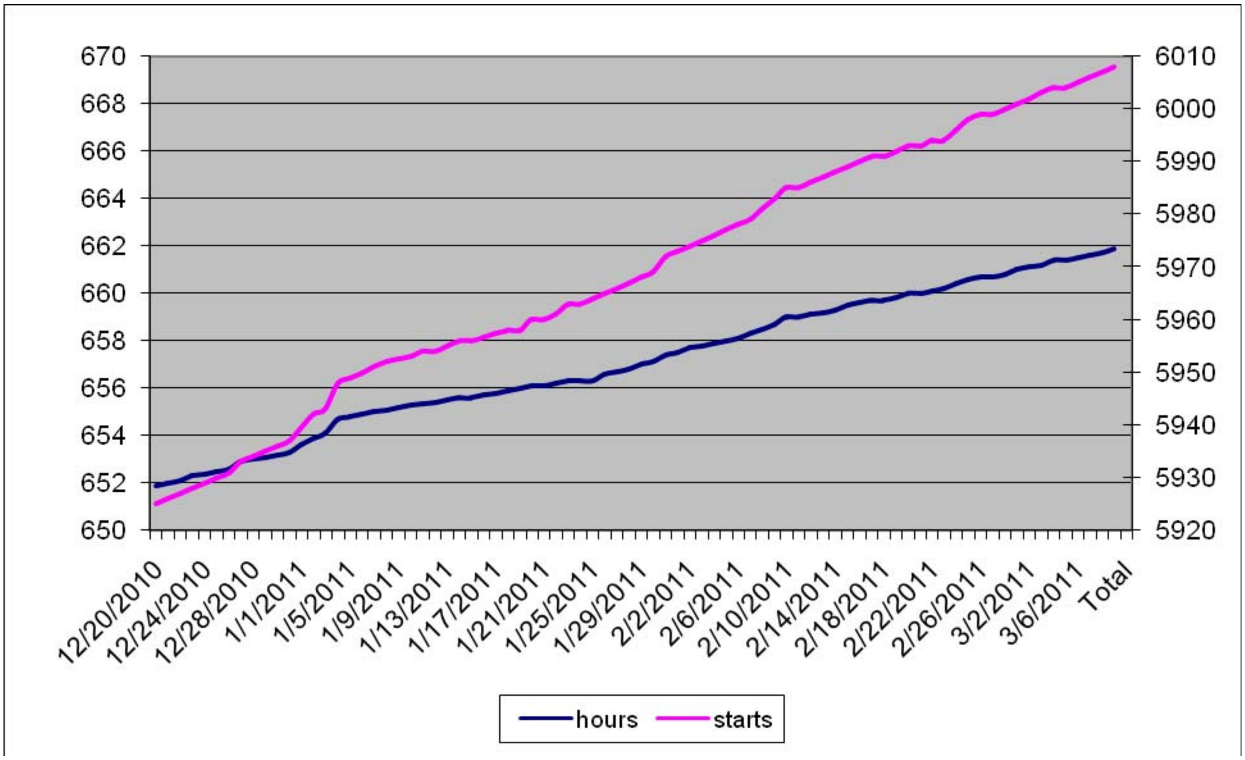
Appendices

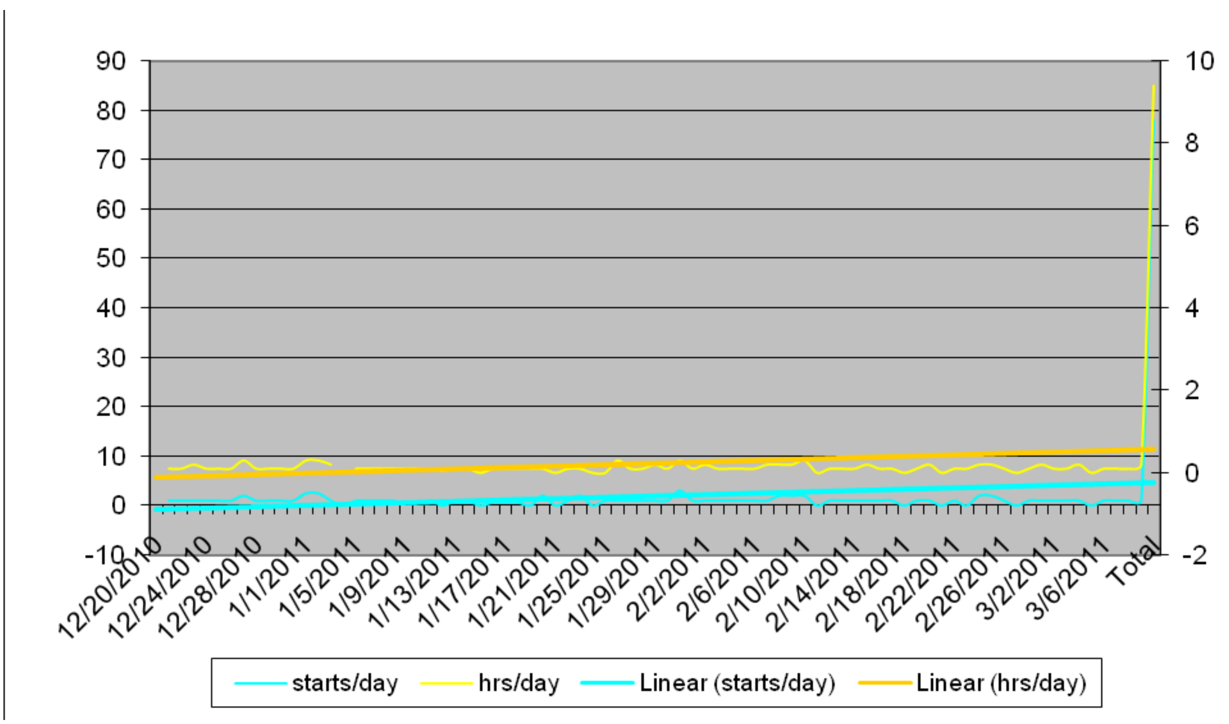
LS 2 Pump Logs





LS 1 Pump Logs





Well Pump Logs