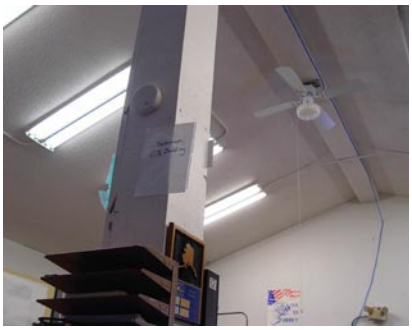
Village End Use Energy Efficiency Measures Program '05 – '06
AEA Grant # 2195225 Administered by Alaska Building Science Network

Selawik Final Report





Community Summary

5 Community buildings and 12 teacher housing units received energy efficiency upgrades January '05 - April '07

Boys & Girls Club, Community Hall, City Hall, IRA Office, IRA Housing, 12 Teacher Housing Units

Village-Wide Lighting Retrofit Summary:

- Retrofitted 102 light fixtures village-wide with electronic ballasts and T8 lamps
- Installed: 21 compact fluorescent light bulbs village-wide
- T5 light fixtures were installed in the Boys and Girls Club
- Pre-retrofit energy use for all lighting: 20,522 watts
- Post-retrofit energy use for all lighting: 10,689 watts
- Energy savings projection: 9,833 watts (9.83 kW)
- **Pre-retrofit to post retrofit energy reduction**: 48 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$5,113	731 Gallons	$1,761
7 Hours	$8,948	1,278 Gallons	$3,081
10 Hours	$12,783	1,826 Gallons	$4,401

- Total project cost for all measures: $ 38,235
- Simple mean payback* 4.27 Years
  *(All grant funds, but accounting for lighting savings only)
- Total village wide in-kind contribution: $ 21,287

Additional Energy Efficiency Measures: (Budget Expense: $ 8,355)

- Northwest Arctic Borough School District, Selawik Davis-Raymoth School:
  Partial materials for school-wide, fuel efficiency boiler system retrofit.
- 16 hour energy efficiency boiler training for 2 local maintenance staff – at Nome regional Boiler training in November, 2005 (Provided in-kind by ABSN).

Selawik City Owned Buildings

Energy efficient lighting upgrades were completed in 3 buildings owned by the City of Selawik.

City owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in multi-purpose and community buildings completed in April, 2007. City building was completed in January 2006
- Retrofitted 10 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 32 compact fluorescent light bulbs
- T5 light fixtures were installed in the Boys and Girls Club
- Pre-retrofit energy use for all lighting: 11,960 watts
- Post-retrofit energy use for all lighting: 5,614 watts
- Energy savings projection: 6,346 watts (6.35 kW)
- **Pre-retrofit to post retrofit energy reduction**: 53 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$3,300	471 Gallons	$1,136
7 Hours	$5,775	825 Gallons	$1988
10 Hours	$8,250	1,179 Gallons	$2,841

Community Building

Community Building main room

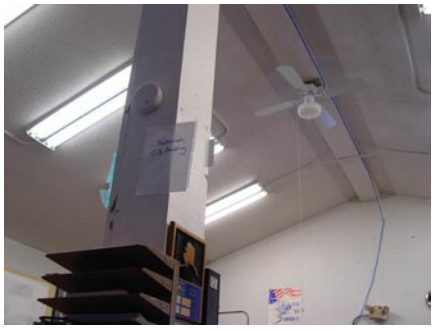
Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL	8ft 2-Lamp Fixtures 59 lamps
Community Building Totals	2	4	0	0	0	0	0	0	0	2

- Pre-retrofit energy use: 1,152 watts
- Post-Retrofit Energy Use: 836 watts
- Energy savings projection: 316 watts (.32 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 27 %

- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$164	23 Gallons	$57
7 Hours	$288	41 Gallons	$99
10 Hours	$411	59 Gallons	$141

City Hall



Main Room T8 Lighting

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
City Hall Totals	0	8	11	0	1	0	2	0	0

- Pre-retrofit energy use: 2,366 watts
- Post-Retrofit Energy Use: 1,578 watts
- Energy savings projection: 788 watts (.79 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 33 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$410	59 Gallons	$141
7 Hours	$717	102 Gallons	$247
10 Hours	$1,024	146 Gallons	$353

Multi Purpose Building / Boys & Girls Club

Upstairs office T8 lighting

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL	8ft 2-Lamp Fixtures 59 lamps
Boys & Girls Club Totals	2	2	0	0	0	8	0	0	0

- Pre-retrofit energy use: 972 watts
- Post-Retrofit Energy Use: 464 watts
- Energy savings projection: 508 watts (.51 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 52 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$264	38 Gallons	$91
7 Hours	$462	66 Gallons	$159
10 Hours	$660	94 Gallons	$227

High Output T5 Lighting Upgrades for the City of Selawik
Multi-Purpose Bldg / Boys and Girls Club

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$2,462	352 Gallons	$848
7 Hours	$4,308	615 Gallons	$1,483
10 Hours	$6,154	879 Gallons	$2,119

Notes: The multi-purpose gym had been off-line intermittently since early 2004. A village wide effort has been on-going to bring this building up to a useable standard for the community which is happening during the spring and summer of '07. The savings illustrated in the following spreadsheet are calculated based on the City of Selawik using the new T5 lighting verses the existing high-wattage lighting. Actual electrical use tracking for existing lighting would have to begin prior to 2004.

Selawik City Boys & Girls Club, T5 Lighting Upgrade - ABSN Energy Efficiency Projects '05-'06

These retrofits were completed in May, 2007, per City of Selawik (building owner)

All labor is in-kind through City of Selawik.

Selawik Multi-purpose Building / Boys & Girls Club, Gym Area	Length (feet)	Width (feet)	Ceiling Hieght (feet)	# of Existing Fixtures	Existing Fixture Wattage	**Total Existing Wattage**	Existing Foot-candles	New Foot-Candles	# of New Fixtures	lamps / fixture	New Fixture Wattage	**Total New Wattage**
	70	44	25	18	415	**7,470**		42	12	4	228	**2736**

New T5 wattage = 57 watts / lamp, which includes ballast wattage	**Total New wattage for gym = 63 % savings** (This is actually an avoided electrical cost. - see notes below):

Gym - UTILITY TRACKING NOTE: The multi-purpose gym had been off-line intermittently since early 2004. A village wide effort has been on-going to bring this building up to a useable standard for the community which will happen during the summer of '07

We have a print-out of AVEC electric billing data provided by City of Selawik for this building, (meter # 80571741 - should be verified). AVEC billing Print-out runs from Jan '98 - Feb '05. Electric was disconnected, 2-17-04, and reconected at various t

Savings & Payback Calculation for Gym:

Assume 500 hrs / year for 250 days/year of use

Full cost of electricity: $ 0.52 /kWh

Watts of existing lighting: 7,470

New wattage for T5 fixtures: 2,736

Calculation: (Watts) x (hrs/year) / (1000w/kw) x (cost of electricity) = (cost / year)

Existing Cost: $ 1,942

Retrofitted Cost: $ 711

Annual Savings: $ $ 1,231

Material & shipping cost of Gym retrofit: $ 3,241.11

Labor: $18/hr for about 40 hours work: $ 720.00

Simple Payback: Materials & labor cost / annual savings = **3.22** years for retrofit to pay for itself.
(does not include coordination time to set up job)

Selawik IRA Owned Buildings

Energy efficient lighting upgrades were completed in two buildings owned by the Selawik IRA.

IRA owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in January, 2006
- Retrofitted 28 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 2 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 4,074 watts
- Post-retrofit energy use for all lighting: 2,659 watts
- Energy savings projection: 1,415 watts (1.42 kW)
- **Pre-retrofit to post retrofit energy reduction**: 35 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$736	105 Gallons	$253
7 Hours	$1,288	184 Gallons	$443
10 Hours	$1,840	263 Gallons	$633

IRA Office

Maintenance staff putting up Christmas decorations (and installing electronic ballasts)

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL	8ft 2-Lamp Fixtures 59 watt lamps
IRA Office Totals	0	0	2	0	0	7	1	1	0	9

- Pre-retrofit energy use: 2,926 watts
- Post-Retrofit Energy Use: 1,819 watts
- Energy savings projection: 1,107 watts (1.11 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 38 %

- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$576	82 Gallons	$198
7 Hours	$1,007	144 Gallons	$347
10 Hours	$1,439	206 Gallons	$496

IRA Housing

T8 lighting retrofits

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
IRA Housing	6	4	0	0	0	0	0	0	0

- Pre-retrofit energy use: 1,148 watts
- Post-Retrofit Energy Use: 840 watts
- Energy savings projection: 308 watts (.31 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 27 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$160	23 Gallons	$55
7 Hours	$280	40 Gallons	$97
10 Hours	$400	57 Gallons	$138

Selawik School Owned Buildings

Energy efficient lighting upgrades were completed in 12 teacher housing units owned by the Northwest Arctic Borough School District

Teacher Housing - Lighting Retrofit Summary:

- Lighting upgrades completed in January, 2007
- Retrofitted 42 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 9 compact fluorescent light bulbs

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts, (3) 25w lamps	13w CFL	20w CFL	25w CFL
Teacher Housing	0	0	0	37	0	5	9	0	0

- Pre-retrofit energy use for all lighting: 4,488 watts
- Post-retrofit energy use for all lighting: 2,416 watts
- Energy savings projection: 2,072 watts (2.07 kW)
- **Pre-retrofit to post retrofit energy reduction**: 46 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$1,077	154 Gallons	$371
7 Hours	$1,886	269 Gallons	$649
10 Hours	$2,694	385 Gallons	$927

Selawik Davis-Raymoth School - Facility-wide heating system retrofit
Scheduled for installation July, 2007

Existing Boiler system.
All 3 boilers have to maintain temperature at all times

Notes:
The Selawik School existing boiler system has 3 boilers that are all on the same heating loop and therefore all have to constantly maintain temperature – thus using more fuel than necessary. ABSN utilized ~ $13,000 of VEUEEM grant funds to purchase piping, welding, components, circ pumps and other equipment for the retrofit. The NWABSD will provide all in-kind labor to fabricate and install retrofit components. The re-built boiler system will isolate each boiler with it's own heating loop and circ pump. Boilers may then operate independently of each other to meet heating loads in different parts of the school, thus allowing some boilers to remain cool. Fuel savings is expected to be substantial – in the range of 25% – 30% annual fuel savings. A similar boiler retrofit was completed by the Northwest Arctic Borough School District for the Buckland School in the summer of 2004. According to NWABSD records, without accounting for annual heating and cooling data, straight annual fuel use declined by 30% during the first year and by 50% during the second year compared with pre-retrofit fuel use, school-wide. The difference between 30% and 50% is likely due to one winter being colder than the other.

ABSN will be monitoring the installation process and contact AEA with relevant updates. NWABSD facilities and maintenance department has indicated they keep careful records of fuel use in their facilities. ABSN and NWABSD will stay in contact and appraise AEA of fuel savings when a winter's season of comparative data is available.

Nome Boiler Training

In November, 2005 ABSN partnered with Kawerak Housing Authority based in Nome to provide ABSN's 16 hour boiler training course to 15 rural maintenance staff. AEA VEUEEM grant funds were used to cover air fair and lodging in Nome for the following maintenance staff from this grant's villages: Selawik: Daniel, Harry Foxglove; Savoonga: Cedric Toolie; Buckland: Jonny Hadley.

Using a flu analyzer to test boiler efficiency

Charlie Deer covering Boiler Controls

Checking CO2 content of flu gases with Bacharak test kit

During this 16-hour course ABSN's boiler specialist Charlie Deer instructed Old Harbor maintenance staff in the fundamentals of boiler and fuel energy efficiency. This benefit to the grant came through an in-kind contribution of $2,100 overall provided by ABSN . Training topics covered: fuel, proper heating system sizing, testing boiler efficiency with a flu gas analyzer kit, cleaning and tuning boilers for energy efficiency, control options and proper control function, burner and nozzle components and function, outdoor temperature boiler controls, programmable thermostats, etc.

Selawik, In-Kind Contribution Tracking Record - ABSN Energy Efficiency Projects:
Village entities worked with: Tribe, City, School District.

In-Kind Item	Dates	Hours Contri-buted	Hourly Wage	Value / Amount	Notes
Staff time for project contact, introduction, and reviewof intro materials (Number of entities x 1 hour each)		3	$15.00	$45.00	# of entities we worked with in the village is indicated in the Hrs contributed column. $15 / hr is our generic estimated average wage for local village staff: Tribal Administrators, City Clerks,
Staff time for Attending teleconference village-wide		3	$15.00	$45.00	Hrs contributed column indicates length of telecon multiplied by # of village telecon participants
Tribal and City Maint. Staff time to assist Field Manager on varifying building assessments - 1st site visit		6	$15.00	$90.00	list hrs of in-kind staff assisting FM on building assessments.
Native Village of Selawik Labor to attend Nome Boiler Training				$1,130.00	For 2 Maint staff. In-kind of $100/day per diem for both maint staff & for wages for Harry - IRA maint staff
School Maint. Staff time to assist Field Manager on teacher housing assessments - 2nd site visit		4	$15.00	$60.00	
Maint. Staff time to attend ABSN training		9	$15.00	$135.00	Hrs contributed column indicates length of training multiplied by # of in-kind training participants
Village office administrative percentage of total project cost less ABSN Admin %. Total project cost = $37,775/village - (our admin percentage , (around 9%) Approx: $3,400) = $34,375 x 5% = $1,718 (this 5% village admin cost estimate is spread across all entities we work with for the course of the grant for completing all energy efficiency measures. These are primarily for cumulative, otherwise unaccounted time expense for project support.	Feb, '07 through			$1,718.00	Each time we call, email, or fax a village entity, someone has to receive the communication, review and/or foward the information, follow-up on requests, etc. Wether it is to set-up a teleconference, verify maintenance staff participation in lighting or boiler trainings, set-up in-kind lodging and transportation, lighting trainings, track a shipment, verify completion of lighting in a given building, ship lamps and ballasts out of the village, request a labor reimbursement agreement, or invoice etc, etc. Village expenses for phone charges, copying and fax costs, office supplies, etc are part of this ammount.
Tribal Council - Labor charges for electrical repair				$500.00	TC paid half of transpo and labor charges for Danny McKonnell to fix electrical problem
Electrical Labor - T5 installations		40	18	$720.00	City paid ~40 hrs labor to local electrician @$18/hr
Lodging for ABSN Field Managers - all site visits				$420.00	7 nights @ $60/night
Transportation and fuel costs - 1st assessmenet site-visit				$320.00	4-wheeler rental $40/day x 8 days
School Teacher Housing Lighting upgrades	Jan '06			$2,284.08	documented back-up of cost breakdowns from BSSD in Selawik file. This was for 42, 2-lamp fixtures.
Selawik, School wide boiler heating system retrofit		200	50	$10,000.00	Estimate 200 hours labor @ $50/hr
	TOTAL			$17,287.08	