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

Buckland Final Report



Community Summary

8 Community buildings and 12 teacher housing units received energy efficiency upgrades October ’06 - June ’07

City Building, City Shop, Community Building, Washeteria, City Bunk House, IRA Office, IRA Store, Buckland School gym, 12 Teacher Housing Units

Village-Wide Lighting Retrofit Summary:

- Retrofitted 180 light fixtures village-wide with electronic ballasts and T8 lamps
- Installed: 137 compact fluorescent light bulbs village-wide
- T5 Light fixtures were installed in School Gym
- Pre-retrofit energy use for all lighting: 44,377 watts
- Post-retrofit energy use for all lighting: 23,833 watts
- Energy savings projection: 20,544 watts (20.54 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	$8,834	1,438 Gallons	$3,508
7 Hours	$15,459	2,516 Gallons	$6,139
10 Hours	$22,085	3,594 Gallons	$8,770

- Total project cost for village lighting: $ 38,235
- Simple mean payback*: 2.47 Years
- Total village wide in-kind contribution: $ 9,466.50

*(Payback figured on total grant funds, using lighting savings only – based on 250 days/yr & 7 hrs/day).

Additional Energy Efficiency Measures:

(Budget Expense: $8,714 – splits expense for Selawik School heating system retofit).

- Boiler training for 4 local maintenance staff
- Cleaning and energy efficiency tuning for City community building boiler
- Outdoor temp boiler controls installed for community building boiler system
- Programmable thermostats installed in 4 locations

Buckland City Owned Buildings

Energy efficient lighting upgrades were completed in five buildings owned by the City of Buckland

City Owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in October, 2006
- Retrofitted 77 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 13 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 11,602 watts
- Post-retrofit energy use for all lighting: 8,317 watts
- Energy savings projection: 3,285 watts (3.29 kW)
- **Pre-retrofit to post retrofit energy reduction**: 28 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$1,413	230 Gallons	$561
7 Hours	$2,472	402 Gallons	$982
10 Hours	$3,531	575 Gallons	$1,402

City Building

Buckland City Offices

Village Maintenance Staff Retrofitting T8 fixtures

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 Offices	2	23	0	0	0	0	1	0	0

- Pre-retrofit energy use: 3,996 watts
- Post-retrofit energy use: 2,893 watts
- Energy savings projection: 1,103 watts (1.10 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 28 %

- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$474	77 Gallons	$188
7 Hours	$830	135 Gallons	$330
10 Hours	$1,186	193 Gallons	$471

City Shop

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 Shop	0	3	0	0	0	0	0	0	0

- Pre-retrofit energy use: 492 watts
- Post-retrofit energy use: 360 watts
- Energy savings projection: 132 (.13 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	$57	9 Gallons	$23
7 Hours	$99	16 Gallons	$39
10 Hours	$142	23 Gallons	$56

Buckland Community Building

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
	4	7	0	0	0	0	0	0	0

- Pre-retrofit energy use: 1,476 watts
- Post-retrofit energy use: 1,080 watts
- Energy savings projection: 396 watts (.40 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	$170	28 Gallons	$68
7 Hours	$298	48 Gallons	$118
10 Hours	$426	69 Gallons	$169

Washeteria

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
Washeteria	13	8	0	0	0	0	8	0	0

- Pre-retrofit energy use: 2,858 watts

- Post-retrofit energy use: 1,844 watts
- Energy savings projection: 1,014 watts (1.01 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	$436	71 Gallons	$173
7 Hours	$763	124 Gallons	$303
10 Hours	$1,090	177 Gallons	$433

Bunk House

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
Bunk House	0	17	0	0	0	0	0	0	4

- Pre-retrofit energy use: 2,780 watts
- Post-retrofit energy use: 2,140 watts
- Energy savings projection: 640 watts (.64 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 23 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$275	45 Gallons	$109
7 Hours	$482	78 Gallons	$191
10 Hours	$688	112 Gallons	$273

Buckland IRA Owned Buildings

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

IRA Owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in October, 2006
- Retrofitted 48 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 2 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 9,496 watts
- Post-retrofit energy use for all lighting: 6,147 watts
- Energy savings projection: 3,349 watts (3.35 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	$1,440	234 Gallons	$572
7 Hours	$2,520	410 Gallons	$1,001
10 Hours	$3,600	586 Gallons	$1,430

IRA Office

IRA maint staff reading power for light fixture wattage test

T8 retrofits in IRA Meeting Hall

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts (3) 32w lamps	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
IRA Office	22	0	0	0	0	0	0	1

- Pre-retrofit energy use: 1,904 watts
- Post-retrofit energy use: 1,345 watts
- Energy savings projection: 559 watts (.56 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 29 %

- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$240	39 Gallons	$95
7 Hours	$421	68 Gallons	$167
10 Hours	$601	98 Gallons	$239

IRA Store

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts (3) 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 Store	0	48	0	0	0	0	0	0	2

- Pre-retrofit energy use: 7,592 watts
- Post-retrofit energy use: 4,802 watts
- Energy savings projection: 2,790 watts (2.79 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 37 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$1,200	195 Gallons	$476
7 Hours	$2,099	342 Gallons	$834
10 Hours	$2,999	488 Gallons	$1,191

Notes: Significant savings achieved through de-lamping existing dual ballast 4-lamp fixtures. We replaced this system with a single 4-lamp ballast using only 3, 32 watt lamps per fixture. Pre to post energy use per fixture went from 164 watts down to 99 watts.

Buckland School Owned Buildings

Energy efficient lighting upgrades were completed in 12 teacher housing units. T5 light fixtures will be installed in the Buckland school gym in June, 2007.

School Owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in October, 2006
- Retrofitted 33 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 121 compact fluorescent light bulbs
- T5 lighting fixtures were installed in the School Gym
- Pre-retrofit energy use for all lighting: 23,279 watts
- Post-retrofit energy use for all lighting: 9,369 watts
- Energy savings projection: 13,910 watts (13.91 kW)
- **Pre-retrofit to post retrofit energy reduction**: 60 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$5,981	973 Gallons	$2,375
7 Hours	$10,467	1,703 Gallons	$4,156
10 Hours	$14,953	2,434 Gallons	$5,938

Teacher Housing

Materials Installed	2-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	23w CFL	25w CFL
Teacher Housing	0	30	3	62	32	27

- Pre-retrofit energy use: 11,334 watts
- Post-retrofit energy use: 3,897 watts
- Energy savings projection: 7,437 watts (7.44 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 66 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$3,198	520 Gallons	$1,270
7 Hours	$5,596	911 Gallons	$2,222
10 Hours	$7,995	1,301 Gallons	$3,175

Notes: For ceiling heights of 8' or less we have found 25w T8 lamps with standard electronic ballasts can replace whatever magnetic ballast and T12 lamp combination exists – while providing great savings and plenty of light.

High Output T5 Lighting Upgrades for the Buckland Gym

Existing 400 watt Multi-vapor lighting in the Buckland Gym

Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$2,783	453 Gallons	$1,105
7 Hours	$4,871	793 Gallons	$1,934
10 Hours	$6,958	1,132 Gallons	$2,763

Notes: It's always good news when we find a gym that has 400 watt multi-vapor bulbs for existing lighting. T5 lighting can produce huge savings and better quality light over these existing systems. The Buckland school gym existing lighting is also supplemented by 8' fluorescent light fixtures. When the new T5 fixtures are installed during the summer recess of '07, the new energy use will be reduced by 54% overall. Switching options will provide opportunity to achieve even more savings by choosing to power partial lighting. The following page details this lighting upgrade that will be installed entirely by in-kind labor provided by the Northwest Arctic Borough School district.

Buckland School, T5 Lighting Upgrade Details - ABSN Energy Efficiency Projects '05-'06

These retrofits will be completed in June, 2007, per Northwest Arctic Borough School District Maintenance.

Buckland Gym	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**
Gym	97	63	32	23	415	9,545	27	44	16	6	342	5,472
				12	200	2,400	New T5 wattage = 57 watts / lamp, which includes ballast wattage					
				Total Existing Watts		11,945						

Total New wattage for gym = 54% savings

Savings & Payback Calculation for Gym:

Assume 1800 hrs / year for 250 days/year of use

Full cost of electricity: $0.50 /kWh

Watts of existing lighting: 11,945

New wattage for T5 fixtures: 5,472

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

Existing Cost: $10,751

Retrofitted Cost: $4,925

Annual Savings: $ $5,826

Material & shipping cost of Gym retrofit: $4,109.25

Simple Payback: Materials cost / annual savings = **0.71** years (for retrofit to pay for itself in materials)

Buckland Energy Efficiency Boiler Maintenance and Training activities

Charlie Deer's Buckland Boiler Training

Class training with Bacharak Kit

From Dec 5 – 7, 2006, ABSN's boiler specialist Charlie Deer gave a two-day course to five village maintenance staff on boiler energy efficiency and maintenance. Following the course, Charlie spent another full day working with the maintenance staff on heating system energy efficiency and retrofit activities.

During the 16-hour course Charlie instructed the Buckland maintenance staff in the fundamentals of boiler and fuel energy efficiency. This training benefit to the grant came through an in-kind contribution of $2,100 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.

Additional Heating Energy Efficiency Activities

The following is a trip report excerpt by Charlie Deer - detailing his energy efficiency heating training and maintenance activities with Buckland maintenance staff:

"I had the class visit the clinic as their maintenance man was one of the students. He had one boiler down and we were able to trouble shoot it to find the problem but he did not have authority to fix anything. It was a good experience for the class. As many of the over engineered, over built buildings being built in rural Alaska, the circulating pump was running 24/7 and the building was over heating. The maintenance man programmed a thermostat for one of the zones in the clinic and will install it as soon as he can get permission from Kotzebue. We replaced two thermostats in the city building with seven day, programmable, ones. There was no more opening the windows to control the heat. The maintenance staff wire brushed the boiler in the community building and tuned up the burner using the FGA Kit provided by AEA. We installed an out side reset to control the boiler temperature and save fuel. Maintenance staff also installed two programmable thermostats in the community building."

Buckland, 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, etc.
Staff time for Attending teleconference village-wide		4.5	$15.00	$67.50	Hrs contributed column indicates length of telecon multiplied by # of village telecon participants
Tribal Maint. Staff time to assist Field Manager on building assessments - 1st site visit		3	$12.00	$36.00	list hrs of in-kind staff assisting FM on building assessments.
CityMaint. Staff time to assist Field Manager on building assessments - 1st site visit		5	$12.00	$60.00	
School Maint. Staff time to assist Field Manager on building assessments - 1st site visit		3	$12.00	$36.00	
Maint. Staff time to attend ABSN training		6	$12.00	$72.00	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 = $38,235/village - (our admin percentage , (around 9%) Approx: $3,440) = $34,795 x 5% = $1,740 (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.	Jan '05 - Jan '07			$1,740.00	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.
Lodging for ABSN Field Managers - 1st & 2nd site visits	June '05			$360.00	6 nights x $60/night
Transportation and fuel costs - 1st assessmenet site-visit	June '05			$300.00	6 days x $50/day
City of Buckland In-kind labor for lighting upgrades,	spring '06	30	15	$450.00	Total fixtures were around 160 which translates to around 98 hours. But they only could produce back-up and invoicing for about 60 hours, so ~ 30 were in-kind
Buckland School T5s	June '07			$4,700.00	Job to complete sumer '07 l- Estimate total inkind from NWABSD: $4,700
Buckland School Teacher Housing lighting upgrades	June '07			$1,600.00	Job to complete sumer '07 l- Estimate total inkind from NWABSD: $2,000
	TOTAL			$9,466.50	