Village End Use Energy Efficiency Measures Program

AEA Grant # 2195225 Administered by Alaska Building Science Network

Pedro Bay Final Report



Community Summary

5 community buildings and 3 teacher housing units received energy efficiency upgrades as follows:

PHOB Tribal Building, Lodge / Rental, Shop / Butler Building, Church, School Gym

Retrofits Completed: October 2008 – December 2008

Village-Wide Lighting Retrofit Summary:

- Installed 142 compact fluorescent light bulbs
- Retrofitted 81 light fixtures with electronic ballasts & T8 lamps
- Installed 15 T5 linear fluorescent fixtures in the School Gym
- Pre-retrofit energy use for all lighting: 19.756 Kilowatts
- Post-retrofit energy use for all lighting: 9.335 Kilowatts
- Energy savings projection: 10.421 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 53%

- Estimated Annual Savings:

kWh Rate (as of 10/01/08): $0.91 Fuel Cost (FY 2007 Ave): $4.05

Hours Per Day/ 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$9,483.11	755.69	$3,060.55
7 Hours/day	**$16,595.4**	1322.46	$5,355.97
10 Hours/day	$23,707.7	1889.23	$7,651.39

- Total project cost for all measures: $ 37,775
- Simple Payback (lighting measures only, using 7 hours/day lighting use run-time): 2.28 years
- Total village wide in-kind contribution: $ 6,764.92 (extended grant capacity by 17.9 %)

Additional Energy Efficiency Measures:

PHOB Tribal Building - attic air sealing and insulation measure

One programmable thermostat installed in PHOB Tribal building.

Pedro Bay Village Council Owned Buildings



3 buildings owned by the Pedro Bay Village Council received energy efficient lighting upgrades as follows:

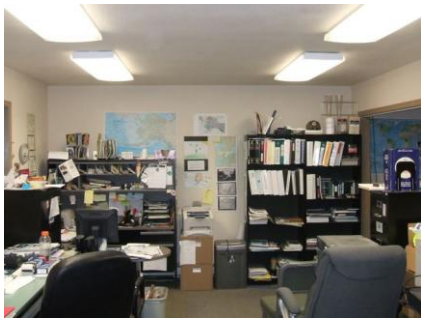
PHOB Tribal Building, Lodge / Rental, Shop / Butler Building

- Lighting upgrades completed in December 2008
- Retrofitted 77 light fixtures with electronic ballasts & T8 lamps
- Installed 112 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 13.836 Kilowatts
- Post-retrofit energy use for all lighting: 6.889 Kilowatts
- Energy savings projection: 6.947 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 50%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$6,321.77	503.77	$2,040.27
7 Hours/day	$11,063.1	881.60	$3,570.48
10 Hours/day	$15,804.4	1259.43	$5,100.68

PHOB Tribal Building



Lighting retrofits save energy while improving light levels in hallways and office spaces for a better working environment.

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	30
2-lamp electronic ballast, (2) 32 watt T8 lamps	7
4-lamp fixture (2) 2-lamp ballasts (4) 25 watt T8	24
CFL-11 W	4
CFL-14 W	15
CFL-27 W	4
CFL-9 W	16

- Pre-retrofit energy use: 8328 watts
- Post-retrofit energy use: 4544 watts
- Energy savings projection: 3784 watts
- Pre-retrofit to post retrofit energy reduction: 45%

- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
2000 Hours/year (Est.)	$6,886.88	548.80	$2,222.65
4 Hours/day	$3,443.44	274.40	$1,111.33
7 Hours/day	$6,026.02	480.20	$1,944.82
10 Hours/day	$8,608.60	686.00	$2,778.32



Kiska Shugak and Gillie Reeb install compact fluorescent light bulbs and retrofit fluorescent fixtures with energy efficient electronic ballasts and T-8 lamps.

PHOB Tribal Building – Attic Air Sealing Measure



Air sealing: Caulking was used on ceiling penetrations to prevent air leakage (heat loss) and transfer of moisture into the attic space.

PHOB Tribal Building Building attic: 28' x 60' (1680 sq. ft. plus an additional 300 sq. ft. for eve insulation). Existing insulation consisted of R30 fiberglass bats laid over ceiling joists on 24" inch centers.

Materials provided: 26 bales of R30 fiberglass insulation 24" x 48" bats (80 sq ft per bale), tyvek suits, dust/P100 particle respirators, 12 tubes of siliconized, paintable caulking and caulking guns.


Existing layer of R30 insulation bats were laid perpendicular to truss members – allowing large voids between ceiling and insulation bats

Existing layer of R30 – reinstalled parallel with truss members with carefully adjusted, tight seams

Work Completed:

Before installing insulation bats, a local maintenance crew air sealed by caulking around ceiling penetrations wherever possible. Existing layer of R30 insulation was laid perpendicular to truss members which maintained large voids between sheet rocked ceiling and insulation bats, thus diminishing insulation R value. After a brief training on insulation safety and installation procedures, local maintenance staff removed existing layer of R30 insulation and re-laid it parallel with truss members.



Pedro Bay Village Council maint. staff David Sanner works on insulation retrofit

New layer of R30 insulation installed carefully over existing layer of R30

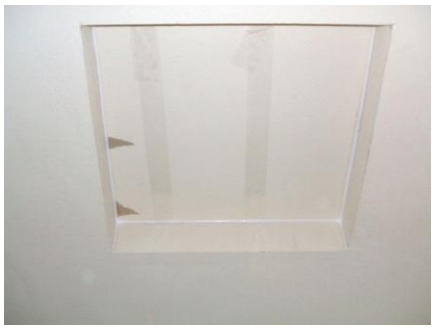
PHOB Tribal Building – Attic Insulation Measure (Cont'd)

The local crew then installed the new layer of R30 insulation bats perpendicular to the 1st layer to bridge seams between insulation bats. This double layer method will add to thermal retention by reducing heat transfer through seams of existing insulation. Attic insulation R-value doubled from R30 to R60. Air sealing the attic and correctly installing greater levels of insulation will substantially reduce heat loss for the PHOB building. From recent AKWarm runs, at fuel prices of at least $6.00 / gallon which was current for the fall of 2008, payback on air sealing and adding attic insulation would come in at 2 to 4 years.

Completed installation – two layers of R30 fiberglass insulation

R60 insulation custom-cut and taped to attic access cover.

Insulation covered access hatch will fit snuggly into insulation field forming a uniform R60 layer.



Attic access hatch sealed closed to prevent air leakage and heat transfer into attic space.

R3.2 per inch x 18" yields a total of ~ R60

The following section details insulation measure procedures for adding fiberglass bats. This is excerpt from ABSN's: Attic Insulation and Air Sealing Procedure and Release Form which is read and signed by each village maint staff person working with fiberglass bat insulation measures.

Safety Protocols:

ABSN provides the following safety equipment which shall be worn by each worker involved in installing attic insulation:

- Respirator face masks with nose/mouth, flexible rubber seal and P-100 particle filter cartridges.
- Wrap-around safety goggles for full eye protection from exposure to fiberglass fibers.
- Tyvek suits with hoods.
- Gloves (cloth and rubber).

Quality Control Rules of Thumb:

- Spray foam, and/or caulking for air-seal around electrical boxes, wiring and other ceiling penetrations will be done wherever possible - before installing insulation. Appropriate color, quantity and placement of caulking will be applied to result in a professional seal and finish.
- Insulation will make light contact with ceiling (not roof).
- A 2" - 3" gap, of air space will be allowed between insulation and roof - especially at eve for proper ventilation and cooling of roof.
- Insulation will not be compressed, and will be worked to allow full expansion of its loft.
- There will be no gaps between bats of insulation or between insulation and framing members.
- There will be no surface level changes among same R-value bats of insulation,
- Insulation will be cut and worked to fit snugly around framing members.
- Insulation will be cut and worked to fit around electrical wiring, cable and vacuum lines - and to make light contact with ceiling sheet rock and vapor barrier.
- Insulation level will be continuous across attic access hatch. This will be accomplished by taping bats of insulation on the hatch-cover without compressing insulation.
- Access hatches will be caulked shut for air sealing.

These rules of thumb are important, because a sloppy insulation job that results in 3% voids or gaps between fiberglass bats looses 30% of its insulation capacity! For example R-30 can end up R-20 or less if care is not taken for quality installation.

Pedro Bay Council Tribal Administrator John Balke in March 2009:

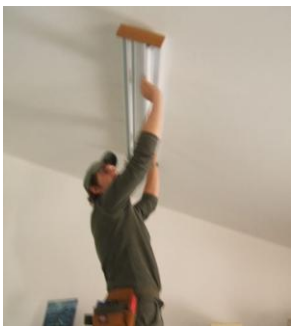
"It seems like the heater is coming on a lot less, and it seems warmer in here during the cold spells. I can't imagine that it wouldn't help, knowing what we had in there and knowing what we have now."

Pedro Bay Village Council Maintenance Crew: Kiska Shugak, David Sanner, Allen Wasuli,

Pedro Bay Village Council Maintenance Crew Mascot

Our mascot knew the value of good insulation

Lodge / Rental


Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	3
2-lamp electronic ballast, (2) 32 watt T8 lamps	3
CFL-11 W	10
CFL-14 W	18
CFL-20 W	14
CFL-27 W	5

- Pre-retrofit energy use: 3179 watts
- Post-retrofit energy use: 1098 watts
- Energy savings projection: 2081 watts
- Pre-retrofit to post retrofit energy reduction: 65%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$1,893.71	150.91	$611.17
7 Hours/day	$3,313.99	264.09	$1,069.55
10 Hours/day	$4,734.28	377.27	$1,527.93

Shop / Butler Building



Materials Installed	Quantity
3-lamp electronic ballast, (2) 32 watt T8 lamps	6
4-lamp fixture 2, 3-lamp ballasts & (4) 32 watt T8	4

- Pre-retrofit energy use: 1084 watts
- Post-retrofit energy use: 910 watts
- Energy savings projection: 174 watts
- Pre-retrofit to post retrofit energy reduction: 16%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1200 Hours/year (Est.)	$190.01	15.14	$61.32
4 Hours/day	$158.34	12.62	$51.10
7 Hours/day	$277.10	22.08	$89.43
10 Hours/day	$395.85	31.54	$127.76

New Church

9 -watt compact fluorescent light bulbs replace 15-watt incandescent lights.

Materials Installed	**Quantity**	
CFL-14 W	17	
CFL-27 W	1	
CFL-9 W	8	
• Pre-retrofit energy use:	1245	watts
• Post-retrofit energy use:	337	watts
• Energy savings projection:	908	watts
• Pre-retrofit to post retrofit energy reduction:	73%	

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
900 Hours/year (Est.)	$743.65	59.26	$240.00
4 Hours/day	$826.28	65.84	$266.67
7 Hours/day	$1,445.99	115.23	$466.68
10 Hours/day	$2,065.70	164.61	$666.68

Notes: The church in Pedro Bay was maintained through volunteer labor with no maintenance funds coming from outside the community. This is the criteria used to determine if a church qualifies for energy upgrades to community buildings.

Lake & Peninsula Borough School Owned Buildings



1 building and 3 teacher housing units owned by the Lake & Peninsula Borough School District received energy efficient lighting upgrades as follows:

Dena'ina School Gym, Teacher Housing #1, Teacher Housing #3, Interim Teacher Housing

- Lighting upgrades completed in November 2008
- Retrofitted 4 light fixtures with electronic ballasts & T8 lamps
- Installed 30 compact fluorescent light bulbs
- Installed 15 T5 linear fluorescent fixtures
- Pre-retrofit energy use for all lighting: 5.92 Kilowatts
- Post-retrofit energy use for all lighting: 2.446 Kilowatts
- Energy savings projection: 3.474 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 59%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated	$5,062.24	403.40	$1,633.77
4 Hours/day	$3,161.34	251.92	$1,020.28
7 Hours/day	$5,532.35	440.86	$1,785.49
10 Hours/day	$7,903.35	629.80	$2,550.71

Interim Teacher Housing (Middle)

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	2
CFL-14 W	4
CFL-20 W	2

- Pre-retrofit energy use: 516 watts
- Post-retrofit energy use: 190 watts
- Energy savings projection: 326 watts
- Pre-retrofit to post retrofit energy reduction: 63%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
900 Hours/year (Est.)	$266.99	21.28	$86.17
4 Hours/day	$296.66	23.64	$95.74
7 Hours/day	$519.16	41.37	$167.55
10 Hours/day	$741.65	59.10	$239.36

Teacher Housing #1

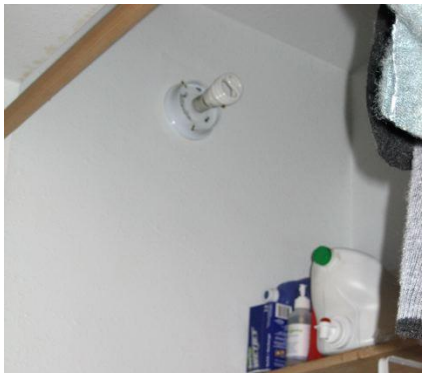
Compact fluorescent light bulbs are a great strategy for reducing wattage use in teacher housing units.

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	1
CFL-11 W	5
CFL-20 W	2
CFL-23 W	1
CFL-27 W	4

- Pre-retrofit energy use: 752 watts
- Post-retrofit energy use: 273 watts
- Energy savings projection: 479 watts
- Pre-retrofit to post retrofit energy reduction: 64%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1500 Hours/year (Est.)	$653.84	52.10	$211.02
4 Hours/day	$435.89	34.74	$140.68
7 Hours/day	$762.81	60.79	$246.19
10 Hours/day	$1,089.73	86.84	$351.70

Teacher Housing #3



Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	1
CFL-11 W	5
CFL-20 W	2
CFL-23 W	1
CFL-27 W	4

- Pre-retrofit energy use: 752 watts
- Post-retrofit energy use: 273 watts
- Energy savings projection: 479 watts
- Pre-retrofit to post retrofit energy reduction: 64%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1500 Hours/year (Est.)	$653.84	52.10	$211.02
4 Hours/day	$435.89	34.74	$140.68
7 Hours/day	$762.81	60.79	$246.19
10 Hours/day	$1,089.73	86.84	$351.70

School Gym

T-5 lighting upgrades save energy and increase light levels in gymnasium. For additional savings Pedro Bay L&PSD staff generally switch on only half the T5 light fixtures, reducing energy use beyond the reported 56%.

Materials Installed	Quantity
T5 fixture, electronic ballast, (2) 54 watt T5 HO	15

- Pre-retrofit energy use: 3900 watts
- Post-retrofit energy use: 1710 watts
- Energy savings projection: 2190 watts
- Pre-retrofit to post retrofit energy reduction: 56%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1750 Hours/year (Est.)	$3,487.58	277.92	$1,125.57
4 Hours/day	$1,992.90	158.81	$643.18
7 Hours/day	$3,487.58	277.92	$1,125.57
10 Hours/day	$4,982.25	397.03	$1,607.96

Pedro Bay - Alaska Building Science Network - T5 Lighting Upgrade Details

These retrofits were completed in January 2008.

Pedro Bay Gym	Length (feet)	Width (feet)	Ceiling Height (feet)	Type of Existing Fixture	# of Existing Fixtures	Existing Fixture Wattage	**Total Existing Wattage**	Existing Foot-candles	New Foot-Candles	# of New Fixtures	New fixtures	New Fixture Wattage	**Total New Wattage**
	64	45.5	21	HPS 150 watt		160	**0**		38	15	T-5 2 lamps	114	**1710**
Color shade of walls				HPS 250 watt	15	260	**3,900**				T-5 3 lamps	171	**0**
Color shade of floor				Multi-Vapor 400 watt		415	**0**				T-5 4 lamps	228	**0**
					Total Existing Watts		3,900				Total New Watts		1710

Percent Savings Pre to Post Retrofit:	**56.15%**

Savings & Payback Calculation for Gym:

1750

New watts / old watts

Assume 1750 hrs / year for 250 days/year of use

neg 1 (New watts / Old watts x 100 - 100) / 100

Full cost of electricity:	$ 0.91	/kWh
Watts of existing lighting:	3,900	
New wattage for T5 fixtures:	1,710	

# Lamps	Lumins/ lamp	Total Lumins	Av. Foot-candles
30	5000	150000	30
38	5000	190000	38.01
		40000	
		40050	
		8.01	

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

Existing Cost: $6,211

26.7% of 150,000 lumins

Retrofitted Cost: $2,723

T5 Materials costs $ 2,654

Annual Savings: $3,488

T5 shipping costs $ 300

Material & shipping cost of Gym retrofit: $2,954

Simple Payback: Materials cost / annual savings = **0.85** years (for retrofit to pay for itself in materials)

Pedro Bay, In-Kind Contribution Tracking Record - ABSN Energy Efficiency Projects:

In-Kind Item	Dates	Hours Contri -buted	Hourly Wage	Value / Amount	Notes
Staff time for project contact, introduction, and review of intro materials (Number of entities x 1 hour each)	fall '07	2	$15.00	$ 30.00	list number of entities
Staff time for Attending teleconference (TC/IRA)	8/24/2007	4	$15.00	$ 60.00	list # of staff and wages if possible ($15/hr is an average wage designated for village entity staff).
Conservative village office administrative percentage of total project cost less ABSN Admin %. Total project cost = $37,775/village - (our admin percentage , (around 12%) Approx: $4,533) = $33,242 x 5.5% = $1,828 (this 5.5% 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 village- based project support.	Feb, '07 through end of grant work			$1,828.00	Each time we call, email, or fax a village entity, someone has to receive the communication, review and/or forward the information, follow-up on requests, etc. Whether 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 amount.
School T5s, etc . .	12-07 & 1-08			$4,666.92	Vince's 1-25-08 email: 60 man/hours @ $35.00/hr = $2100.00 $140.00 per diem $1200.00 travel $500.00 shipping (King Salmon to Pedro Bay) $200.00 misc parts $526.92 replaced 3 of the 7 fixtures lost.
Teacher Housing lighting - local Lake and Pen SD labor hours	12-07 & 1-08	10	18	$ 180.00	Estimate 10 hours x $18/hr
	TOTAL			$6,764.92	