Village End Use Energy Efficiency Measures Program

AEA Grant # 2195225 Administered by Alaska Building Science Network

Chignik Lake Final Report

Community Summary

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

SUB Building, Old Clinic, New Clinic, Washeteria, Church, Main School Building including new addition, Shop, Generator Plant

Village-Wide Lighting Retrofit Summary:

- Installed 85 compact fluorescent light bulbs
- Retrofitted 240 light fixtures with electronic ballasts & T8 lamps
- Pre-retrofit energy use for all lighting: 30.302 Kilowatts
- Post-retrofit energy use for all lighting: 16.405 Kilowatts
- Energy savings projection: 13.897 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 46%

- Estimated Annual Savings:

kWh Rate (as of): $0.58 Fuel Cost (FY 2007 Ave): $3.51

Hours Per Day/ 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$8,082.50	1545.83	$5,425.86
7 Hours/day	$14,144.3	2705.20	$9,495.25
10 Hours/day	$20,206.2	3864.57	$13,564.6

- Total project cost for all measures: $37,775
- Simple Payback (lighting measures only, using 7 hours/day lighting use run-time): 1.87 years
- Total village wide in-kind contribution: $ 4,768.00 (extended grant capacity by 12.6%)

Additional Energy Efficiency Measures:

- Completed air sealing and addition of R-30 attic insulation in Sub building
- Completed air sealing in Old Clinic

IRA/TC Owned Buildings



4 buildings owned by the IRA/TC received energy efficient lighting upgrades as follows:

SUB Building, Old Clinic, New Clinic, Washeteria,

- Lighting upgrades completed in October 2008
- Installed 45 compact fluorescent light bulbs
- Installed 29 light fixtures with electronic ballasts & T8 lamps
- Pre-retrofit energy use for all lighting: 4.388 Kilowatts
- Post-retrofit energy use for all lighting: 2.369 Kilowatts
- Energy savings projection: 2.019 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 46%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$1,174.25	224.58	$788.29
7 Hours/day	$2,054.94	393.02	$1,379.50
10 Hours/day	$2,935.63	561.46	$1,970.71

SUB Building

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	3
2-Lamp Fixture (w/existing electronic ballast) re-lamped with (2)25 watt T8 Lamps	8
3-Lamp Fixture (w/existing electronic ballast) re-lamped with (3)25 watt T8 Lamps	8
CFL-14 W	4
CFL-27 W	2

- Pre-retrofit energy use: 1817 watts
- Post-retrofit energy use: 1219 watts
- Energy savings projection: 598 watts
- Pre-retrofit to post retrofit energy reduction: 33%

- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$347.80	66.52	$233.48
7 Hours/day	$608.64	116.41	$408.59
10 Hours/day	$869.49	166.30	$583.70

SUB Building – Air Sealing and Insulation Measure

Maintenance workers prepare for insulation job.

Existing R-19 fiber glass attic insulation placed between ceiling joists on 24 inch centers.

New R-30 fiberglass bats installed on top of existing R-19 insulation.

SUB Building attic: 56’ x 36’ (2016 sq. ft.). Existing insulation consists of R-19 fiberglass bats between ceiling joists on 24” inch centers.

Materials provided: 28 bales of R-30 fiber glass insulation 24” x 48” bats (80 sq ft ea. bale), 3 tyvek suits, dusk masks, dust particle respirators and 12 tubes of siliconized, paintable caulking and caulking guns.

Work Completed:

1. Removed stored items from attic area to avoid compressing batt insulation.

2. Installed one layer of new R-30 fiberglass bats perpendicular, over the top of existing layer of R19 fiberglass insulation. This will add to thermal retention by reducing air movement through seams of existing insulation.

3. Attic insulation increased from R-19 to R-49.

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.

Old Clinic

Materials Installed **Quantity**

CFL-27 W 4

- Pre-retrofit energy use: 350 watts
- Post-retrofit energy use: 108 watts
- Energy savings projection: 242 watts
- Pre-retrofit to post retrofit energy reduction: 69%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$140.75	26.92	$94.48
7 Hours/day	$246.31	47.11	$165.35
10 Hours/day	$351.87	67.30	$236.21

Old Clinic – Air Sealing and Insulation Measure

Existing light fixture. Large gaps allowed substantial air leakage through thermal boundary

Before air sealing. Large gaps in plywood seams allowed substantial air leakage through thermal boundary

After air sealing. Substantial gaps in plywood seams sealed to prevent air leakage through thermal boundary

Old Clinic attic: 28' x 20' (560sq. ft.). Existing insulation consists of R-19 fiberglass bats between ceiling joists on 24" inch centers

Work completed: Air sealing/caulking of all seams and gaps in ceiling to reduce air leakage from interior of building into attic. One bundle of R-30 fiberglass insulation added along eves over existing R-19 insulation.

New Clinic

Fixtures in clinic lobby re-lamped with 25 watt T-8 lamps for additional savings.

Materials Installed	**Quantity**
2-Lamp Fixture (w/existing electronic ballast) re-lamped with (2)25 watt T8 Lamps	8

- Pre-retrofit energy use: 480 watts
- Post-retrofit energy use: 376 watts
- Energy savings projection: 104 watts
- Pre-retrofit to post retrofit energy reduction: 22%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$60.49	11.57	$40.61
7 Hours/day	$105.85	20.24	$71.06
10 Hours/day	$151.22	28.92	$101.51

Note: building consists of existing electronic ballasts and 32 watt T-8 lamps installed previously. Eight fixtures we're re-lamped with 25 watt T-8 lamps for added savings.

Washeteria

Materials Installed	**Quantity**
3-lamp electronic ballast, (3) 32 watt T8 lamps	2
CFL-14 W	2
CFL-20 W	3
CFL-27 W	3

- Pre-retrofit energy use: 646 watts
- Post-retrofit energy use: 349 watts
- Energy savings projection: 297 watts
- Pre-retrofit to post retrofit energy reduction: 46%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$172.74	33.04	$115.96
7 Hours/day	$302.29	57.81	$202.93
10 Hours/day	$431.84	82.59	$289.90

Church

Candelabra style 9 watt CFLs installed in chandelier and ceiling fixtures.

Pre to post retrofit his fixture went from 160 watts down to 36 watts.

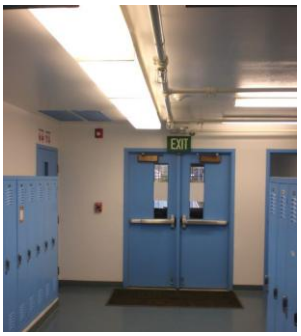
Materials Installed	**Quantity**
CFL-14 W	4
CFL-27 W	3
CFL-9 W	20
• Pre-retrofit energy use:	1095 watts
• Post-retrofit energy use:	317 watts
• Energy savings projection:	778 watts
• Pre-retrofit to post retrofit energy reduction:	71%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$452.48	86.54	$303.76
7 Hours/day	$791.85	151.45	$531.58
10 Hours/day	$1,131.21	216.35	$759.39

Notes: The church in Chignik Lake 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.

School District Owned Buildings



3 buildings and 5 teacher housing units owned by the School District received energy efficient lighting upgrades as follows:

Main School Building including new addition, School Shop, Generator Plant, 2-Bedroom Duplex (A), 2-Bedroom Duplex (B), 1-Bedroom Duplex (A), 1-Bedroom Duplex (B), 3-Bedroom Apartment

- Lighting upgrades completed in October 2008
- Installed 40 compact fluorescent light bulbs
- Installed 211 light fixtures with electronic ballasts & t8 lamps
- De-lamped 2 T5 linear fluorescent fixtures
- Pre-retrofit energy use for all lighting: 25.914 Kilowatts
- Post-retrofit energy use for all lighting: 14.036 Kilowatts
- Energy savings projection: 11.878 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 46%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$6,908.24	1321.25	$4,637.57
7 Hours/day	$12,089.4	2312.18	$8,115.75
10 Hours/day	$17,270.6	3303.11	$11,593.9

Main School Building

New addition being added to old school building.

Martin Kiley works on a fixture at the school.

4-lamp fixtures de-lamped to three 25 watt T-8 lamps each for additional savings.

Existing electronic ballasts and 32 watt T-8 lamps in new school addition.

T-5 fixture taken offline in over-lit bathroom.

New school addition re-lamped with 25 watt T-8 lamps.

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	28
2-Lamp Fixture (w/existing electronic ballast) re-lamped with (2)25 watt T8 Lamps	32
3-lamp electronic ballast, (3) 25 watt T8 lamps	9
3-Lamp Fixture (w/existing electronic ballast) re-lamped with (3)25 watt T8 Lamps	3
4-lamp electronic ballast, (3) 25 watt T8 lamps	32
4-Lamp Fixture (w/existing electronic ballast) re-lamped with (3) 25 watt T8 Lamps	66
De-lamped T5 fixture, electronic ballast, (2) 54 watt T5 HO	2
CFL-20 W	1

- Pre-retrofit energy use: 19158 watts
- Post-retrofit energy use: 11534 watts
- Energy savings projection: 7624 watts
- Pre-retrofit to post retrofit energy reduction: 40%

- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$4,434.12	848.05	$2,976.67
7 Hours/day	$7,759.71	1484.09	$5,209.17
10 Hours/day	$11,085.3	2120.13	$7,441.67

Notes: All fixtures in old portion of school updated with electronic ballast and 25 watt T-8 lamps. Re-lamping occurred in the new portion of school to replace newly installed 32 watt T-8 lamps with 25 watt T-8 lamps for additional savings. All 4-lamp fixtures throughout the building were de-lamped from four to three lamps for added savings.

School Shop

Materials Installed **Quantity**

2-lamp electronic ballast, (2) 25 watt T8 lamps 13

- Pre-retrofit energy use: 1872 watts
- Post-retrofit energy use: 1222 watts
- Energy savings projection: 650 watts
- Pre-retrofit to post retrofit energy reduction: 35%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$733.40	140.27	$492.34
7 Hours/day	$1,283.45	245.47	$861.59
10 Hours/day	$1,833.49	350.67	$1,230.84

Notes: Every other fixture taken offline reducing 26 fixtures to 13 fixtures for additional savings.

Generator Plant

Materials Installed **Quantity**

2-lamp electronic ballast, (2) 25 watt T8 lamps 12

- Pre-retrofit energy use: 864 watts
- Post-retrofit energy use: 564 watts
- Energy savings projection: 300 watts
- Pre-retrofit to post retrofit energy reduction: 35%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$174.48	33.37	$117.13
7 Hours/day	$305.34	58.40	$204.98
10 Hours/day	$436.20	83.43	$292.83

2-Bed duplex (A)

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	3
CFL-11 W	2
CFL-14 W	4
CFL-9 W	1

- Pre-retrofit energy use: 575 watts
- Post-retrofit energy use: 228 watts
- Energy savings projection: 347 watts
- Pre-retrofit to post retrofit energy reduction: 60%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$201.82	38.60	$135.48
7 Hours/day	$353.18	67.55	$237.09
10 Hours/day	$504.54	96.50	$338.70

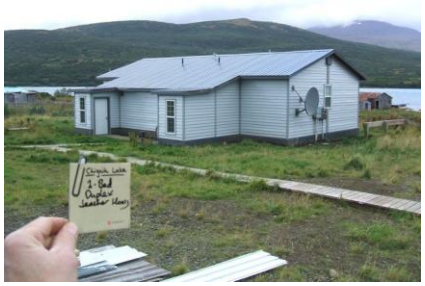
2-Bed Duplex (B)

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	1
CFL-11 W	2
CFL-14 W	5
CFL-20 W	2
CFL-9 W	1

- Pre-retrofit energy use: 625 watts
- Post-retrofit energy use: 188 watts
- Energy savings projection: 437 watts
- Pre-retrofit to post retrofit energy reduction: 70%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$254.16	48.61	$170.62
7 Hours/day	$444.78	85.07	$298.58
10 Hours/day	$635.40	121.52	$426.55

Duplex 1-Bedroom (A)

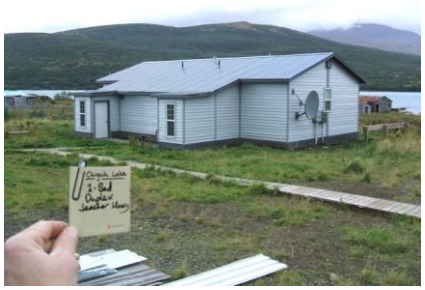


Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	4
CFL-14 W	6
CFL-20 W	1

- Pre-retrofit energy use: 729 watts
- Post-retrofit energy use: 292 watts
- Energy savings projection: 437 watts
- Pre-retrofit to post retrofit energy reduction: 60%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$254.16	48.61	$170.62
7 Hours/day	$444.78	85.07	$298.58
10 Hours/day	$635.40	121.52	$426.55

Duplex 1-Bedroom (B)



Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	2
CFL-14 W	5

- Pre-retrofit energy use: 504 watts
- Post-retrofit energy use: 164 watts
- Energy savings projection: 340 watts
- Pre-retrofit to post retrofit energy reduction: 67%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$197.74	37.82	$132.75
7 Hours/day	$346.05	66.18	$232.31
10 Hours/day	$494.36	94.55	$331.87

3 Bedroom Apartment

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	6
CFL-14 W	5
CFL-20 W	4
CFL-23 W	1

- Pre-retrofit energy use: 1587 watts
- Post-retrofit energy use: 455 watts
- Energy savings projection: 1132 watts
- Pre-retrofit to post retrofit energy reduction: 71%

- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$658.37	125.92	$441.97
7 Hours/day	$1,152.15	220.36	$773.45
10 Hours/day	$1,645.93	314.79	$1,104.93

Lamp and ballast disposal

Existing lamps and magnetic ballasts await ship-out for recycling and disposal in lower-48 facilities.

ADDITIONAL CONSULTING

In addition to completing the for-mentioned lighting upgrades and additional measures, Dan Lung with consulted the Lake and Peninsula School District on additional measures they could take to reduce their energy loads. The following recommendations were made:

Recommendations for further savings (not covered by this project)

Old boys and girls bathrooms:
Each bathroom has three, T-5, 2-lamp fixtures (at 115 watts each) that were installed during the school remodeling. Since T-5 fixtures are designed for lighting spaces with high ceilings (greater than 8ft), I took one fixture off-line in each bathroom as a short term strategy to reduce wattage due to over-lighting. With that, I recommend actually removing those T-5 fixtures and replacing with two standard 2-lamp T-8 fixtures with 25 watt lamps. Those run at 46 watts each and will provide more than adequate light levels for those spaces. Long-term savings will add up, , especially since those lights are on for approx 10-12 hrs per day. (please see photos under school above).

New boys and girls bathrooms:
Each bathroom has two, T-5, 2-lamp fixtures (at 115 watts each) currently installed in the shower spaces. I recommend replacing those with two moisture proof 2-lamp, T-8 fixtures with 32 watt T-8 lamps. These are the same style fixtures currently installed in the old bathroom shower with sealed plastic covers (see photos under school above). Similarly, these lights are on 10-12 hrs per day which is costly.

Student store/storage (old side):
replace existing T-5 fixtures (x3) with a 2 or 3-lamp T-8 fixture.
new janitor and sports equip storage (near gym):
replace existing T-5 fixtures (1 ea.) with a 2-lamp T-8 fixture.

In summary, the T-5 fixtures in the spaces mentioned above are severely over-lighting those spaces and are costing more than what is necessary especially considering the number of hours these lights are on during the day.

Chignik Lake, 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)		3	$15.00	$45.00	list number of entities
Staff time for Attending teleconference (TC/IRA)		2	$15.00	$30.00	list # of staff and wages if possible ($15/hr is an average wage designated for village entity staff).
Staff time for Attending teleconference (School)		1	$15.00	$15.00	"
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			$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.
Lodging for ABSN Field Managers - 1st assessment site visit	4			$260	4 nights at $65/night
Transportation and fuel costs - 1st assessment site-visit	2			$100	school district truck rental and TC 4-wheeler rental for moving supplies and field manager transportation.
Lodging for ABSN Field Managers - 2nd site visit	3			$150.00	
School-wide T8 and cfl lighting upgrades, including main school, shop, generator shed and teacher housing.	Sept-Nov '08	130	$18.00	$2,340.00	Est time in school post tally sheet tab is around 130 hours. Wage estimated at $18/hr, which including fringe paid by SD is likely fairly low.
	TOTAL			$4,768.00	