Village End Use Energy Efficiency Measures Program

AEA Grant # 2195225 Administered by Alaska Building Science Network

Levelock Final Report



Community Summary

8 community buildings and 4 teacher housing units received energy efficiency upgrades as follows:

Multiuse: Offices, Old Store & Fish Plant, Rainbow Hall, TC Shop, Future VPSO, Main Corporation Office, Russian Orthodox Church, Levelock School, School Gym and Teacher Housing 4-Plex

Retrofits Completed: October 2009 – January 2010
ABSN Field Management by: Harry Morgan and Anna Hilbruner.
Trained 6 local maintenance staff who were employed by village entities to complete lighting retrofits

Village-Wide Lighting Retrofit Summary:

- Retrofitted 252 light fixtures with electronic ballasts & T8 lamps
- Installed 85 compact fluorescent light bulbs
- Installed 16 T5 linear fluorescent fixtures
- Pre-retrofit energy use for all lighting: 39.94 Kilowatts
- Post-retrofit energy use for all lighting: 19.66 Kilowatts
- Energy savings projection: 20.28 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 51%

- Estimated Annual Savings:

kWh Rate (FY 2009 AVE): $0.70 Fuel Cost (FY 2009 Ave): $7.44

Hours Per Day/ 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated Use	$26,664	3,517	$26,168
4 Hours/day	$14,203	1,873	$13,938
7 Hours/day	**$24,855**	3,278	$24,392
10 Hours/day	$35,507	4683	$34,847

- Total project cost for all measures: $33,700 (Allocated according to number of lighting retrofits and tracked grant expense)
- Simple Payback (lighting measures only, using 7 hours/day lighting use run-time): 1.36 years
- Total village wide in-kind contribution: $ 8,921

Levelock Village Council Owned Buildings



5 buildings owned by the Levelock Village Council received energy efficient lighting upgrades as follows:

Multiuse: Offices, Old Store & Fish Plant, Rainbow Hall, TC Shop, Future VPSO

- Lighting upgrades completed in January 2010
- Retrofitted 114 light fixtures with electronic ballasts & T8 lamps
- Installed 6 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 14.223 Kilowatts
- Post-retrofit energy use for all lighting: 7.436 Kilowatts
- Energy savings projection: 6.787 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 48%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated	$11,338.8	1495.69	$11,127.90
4 Hours/day	$4,750.90	626.69	$4,662.54
7 Hours/day	$8,314.08	1096.70	$8,159.44
10 Hours/day	$11,877.2	1566.71	$11,656.30

"The light levels have been really good, they haven't even been blinking like our old ones"

~ Glendora Nelson – Administrator's Assistant

Multiuse: Offices, Clinic & Fire Hall



Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	39
8 ft fixture, 2 lamp electronic ballast, (2) 59 watt T8	6
CFL-23 W	3
CFL-27 W	3

- Pre-retrofit energy use: 6495 watts
- Post-retrofit energy use: 2652 watts
- Energy savings projection: 3843 watts
- 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
4 Hours/day	$2,690.10	354.85	$2,640.07
7 Hours/day	$4,707.68	620.98	$4,620.12
10 Hours/day	$6,725.25	887.12	$6,600.17
1875 Hours/year (Est.)	$5,043.94	665.34	$4,950.12

Old Store & Fish Plant



Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	32
4-lamp electronic ballast, (4) 25 watt T8 lamps	4

- Pre-retrofit energy use: 3360 watts
- Post-retrofit energy use: 1832 watts
- Energy savings projection: 1528 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
4 Hours/day	$1,069.60	141.09	$1,049.71
7 Hours/day	$1,871.80	246.91	$1,836.99
10 Hours/day	$2,674.00	352.72	$2,624.27
3240 Hours/year (Est.)	$3,465.50	457.13	$3,401.05

Rainbow Hall



Materials Installed	Quantity	
4-lamp electronic ballast, (3) 32 watt T8 lamps	4	De-lamping from 4 to 3 lamps saved additional wattage.
4-lamp electronic ballast, (4) 32 watt T8 lamps	15	

- Pre-retrofit energy use: 3192 watts
- Post-retrofit energy use: 2196 watts
- Energy savings projection: 996 watts
- Pre-retrofit to post retrofit energy reduction: 31%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$697.20	91.97	$684.23
7 Hours/day	$1,220.10	160.94	$1,197.41
10 Hours/day	$1,743.00	229.92	$1,710.58
3504 Hours/year (Est.)	$2,442.99	322.25	$2,397.55

TC Shop


Materials Installed	Quantity
2-lamp electronic ballast, (2) 32 watt T8 lamps	8

- Pre-retrofit energy use: 672 watts
- Post-retrofit energy use: 480 watts
- Energy savings projection: 192 watts
- Pre-retrofit to post retrofit energy reduction: 29%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$134.40	17.73	$131.90
7 Hours/day	$235.20	31.02	$230.83
10 Hours/day	$336.00	44.32	$329.75
500 Hours/year (Est.)	$67.20	8.86	$65.95

Future VPSO

Materials Installed **Quantity**

2-lamp electronic ballast, (2) 25 watt T8 lamps 6

- Pre-retrofit energy use: 504 watts
- Post-retrofit energy use: 276 watts
- Energy savings projection: 228 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
4 Hours/day	$159.60	21.05	$156.63
7 Hours/day	$279.30	36.84	$274.11
10 Hours/day	$399.00	52.63	$391.58
2000 Hours/year (Est.)	$319.20	42.11	$313.26

Levelock Natives Ltd Owned Buildings



1 building owned by the Levelock Natives Ltd received energy efficient lighting upgrades as follows:

Main Corporation Office

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	3
CFL-20 W	4
CFL-27 W	1

- Lighting upgrades completed in January 2010
- Retrofitted 3 light fixtures with electronic ballasts & T8 lamps
- Installed 5 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 0.752 Kilowatts
- Post-retrofit energy use for all lighting: 0.245 Kilowatts
- Energy savings projection: 0.507 Kilowatts
- 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	$354.90	46.81	$348.30
7 Hours/day	$621.08	81.93	$609.52
10 Hours/day	$887.25	117.04	$870.75
1000 Hours/year (Est.)	$354.90	46.81	$348.30

Russian Orthodox Church Owned Buildings



1 building owned by the community supported Russian Orthodox Church received energy efficient lighting upgrades as follows:

Russian Orthodox Church

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	3
CFL-27 W	2

- Lighting upgrades completed in January 2010
- Retrofitted 3 light fixtures with electronic ballasts & T8 lamps
- Installed 2 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 0.452 Kilowatts
- Post-retrofit energy use for all lighting: 0.192 Kilowatts
- Energy savings projection: 0.26 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 58%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$182.00	24.01	$178.61
7 Hours/day	$318.50	42.01	$312.58
10 Hours/day	$455.00	60.02	$446.54
100 Hours/year (Est.)	$18.20	2.40	$17.86

Lake and Peninsula Borough School District Owned Buildings



1 building and 4 Teacher Housing Units owned by the Lake and Peninsula Borough School District received energy efficient lighting upgrades as follows:

Levelock School, 4-Plex Teacher Housing, School Gym

- Lighting upgrades completed in January 2010
- Retrofitted 132 light fixtures with electronic ballasts & T8 lamps
- Installed 72 compact fluorescent light bulbs
- Installed 16 T5 linear fluorescent fixtures
- Pre-retrofit energy use for all lighting: 24.521 Kilowatts
- Post-retrofit energy use for all lighting: 11.788 Kilowatts
- Energy savings projection: 12.733 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 52%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated	$14,952.90	1972.43	$14,674.80
4 Hours/day	$8,915.20	1175.99	$8,749.39
7 Hours/day	$15,601.60	2057.99	$15,311.40
10 Hours/day	$22,288.00	2939.98	$21,873.40

The Levelock School contained 132 4-foot linear fluorescent fixtures all burning old 40-watt T12 lamps. Most schools had already switched to 34-watt T12s as an energy saving measure within the last several years. By retrofitting with 25-watt T8s and replacing 72 incandescent light bulbs with compact fluorescents, this school achieved a substantial overall energy cost reduction exceeding 50%.

In-kind Labor: Southwest Region School District generously provided all maintenance staff labor in-kind to the grant to complete school facility, teacher housing and Gym T5 lighting retrofits - resulting in substantial direct cost savings to the grant.

School



Materials Installed	Quantity
2 ft fixture, 2-lamp electronic ballast, (2) 17 watt T8	1
2-lamp electronic ballast, (1) 25 watt T8 lamp	5
2-lamp electronic ballast, (2) 25 watt T8 lamps	55
2-lamp electronic ballast, (2) 32 watt T8 lamps	6
4-lamp electronic ballast, (4) 25 watt T8 lamps	49
CFL-20 W	1
CFL-23 W	2
CFL-27 W	24

- Pre-retrofit energy use: 16228 watts
- Post-retrofit energy use: 8176 watts
- Energy savings projection: 8052 watts
- 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	$5,638.50	743.77	$5,533.63
7 Hours/day	$9,867.38	1301.59	$9,683.85
10 Hours/day	$14,096.2	1859.42	$13,834.0
1800 Hours/year (Est.)	$10,149.3	1338.78	$9,960.53

4-Plex Teacher Housing

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	16
CFL-20 W	1
CFL-23 W	39
CFL-27 W	5

- Pre-retrofit energy use: 5333 watts
- Post-retrofit energy use: 1788 watts
- Energy savings projection: 3545 watts
- Pre-retrofit to post retrofit energy reduction: 66%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$2,481.50	327.33	$2,435.35
7 Hours/day	$4,342.63	572.83	$4,261.86
10 Hours/day	$6,203.75	818.33	$6,088.37
1375 Hours/year (Est.)	$3,412.06	450.08	$3,348.60

School Gym

Materials Installed	**Quantity**
T5 fixture, electronic ballast, (2) 54 watt T5 HO	16
• Pre-retrofit energy use:	2960 watts
• Post-retrofit energy use:	1824 watts
• Energy savings projection:	1136 watts
• Pre-retrofit to post retrofit energy reduction:	38%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$795.20	104.89	$780.41
7 Hours/day	$1,391.60	183.56	$1,365.72
10 Hours/day	$1,988.00	262.23	$1,951.02
1750 Hours/year (Est.)	$1,391.60	183.56	$1,365.72

ABSN T5 Lighting plans are designed to increase the average light levels throughout the area when all fixtures are switched on - in comparison with former existing light output. Existing switching controls are normally retained - allowing users to choose the appropriate number of light fixtures / rows of light fixtures needed for various use patterns. In many cases school staff will choose not to use all fixtures available, thereby achieving more electrical savings than is shown above. Considering light quality, ABSN T5 lighting plans employ 54-watt, high output T5 lamps with a color-rendering index (CRI) of 85. Existing light fixtures in rural high ceiling areas typically have a CRI ranging from 30 to 70. With the T5 retrofits, the boost in CRI greatly improves light quality – resulting in objects appearing much closer to their true color as seen under sunlight. This increased light quality can result in less light needed to illuminate a given space - for example fewer rows of fixtures selected to light the space.

Levelock - Alaska Building Science Network - T5 Lighting Upgrade Details

These retrofits were completed in October, 2009

Levelock 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**
	80	50	20	HPS 150 watt		160	**0**	22	32	16	T-5 2 lamps	114	**1824**
Color shade of walls				HPS 250 watt		260	**0**				T-5 3 lamps	171	**0**
Color shade of floor				Multi-Vapor 400 watt		415	**0**				T-5 4 lamps	228	**0**
				HPS 175 watt	16	185	**2,960**				T-5 6 lamps	342	**0**
					Total Existing Watts		2,960				Total New Watts		1824

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

Percent Savings Pre to Post Retrofit:	**38.38%**

1750 New watts / old watts

Savings & Payback Calculation for Gym:

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

Full cost of electricity: $ 0.7000 /kWh

Watts of existing lighting: 2,960

New wattage for T5 fixtures: 1,824

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

Existing Cost: $ 3,626

Retrofitted Cost: $ 2,234

T5 Materials cost, PO 212: $ 2,806.96

Annual Savings: $ $ 1,392

Shipping cost: $ 171.25 U.S.P.S. Priority

Material & shipping cost of Gym retrofit: $2,978.21

Simple Payback: Materials cost / annual savings = **2.14** years (for retrofit to pay for itself in materials)

Levelock, 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 & review of intro materials		3	$ 20.00	$ 60.00	Number of entities x 1 hour each
Staff time for Attending teleconference		4	$ 20.00	$ 80.00	TC/IRA
Staff time for Attending teleconference		1	$ 20.00	$ 20.00	Village Corp
Staff time for Attending teleconference		1	$ 20.00	$ 20.00	School
Maint. Staff time to accompany Field Manager on building assessments		24	$ 15.00	$ 360.00	Estimated Hours Contributed by School & Village Council on First Site Visit
Conservative village office administrative percentage of total project cost less ABSN Admin %. Total project cost = $33,700/village - (our admin percentage , (around 12%) Approx: $4,044) = $29,656 x 5.5% = $1,631 (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			$1,631.00	Each time we call, email, or fax a village entity, someone receives the communication, reviews and/or forwards the information, follows-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 for recycling, request a labor reimbursement agreement, or invoice 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	Jan-10	3	$150	$ 450.00	$150 Per Night - School Contribution
Lodging for ABSN Field Managers - 2nd site visit	Jan-10	4	$150	$ 600.00	$150 Per Night - Village Council Contribution
School In-Kind Labor		100	$20	$2,000.00	Estimated School In-Kind Labor
School In-Kind Labor - Gym T5s				$3,700.00	Conservative estimate for total labor contributed including travel and fringe costs.
	TOTAL			$8,921.00	

The capacity of ABSN's scope of work was greatly increased by the response of local communities to work in partnership with ABSN and provide in-kind services of project coordination, paid labor for lighting retrofits, transportation and lodging for ABSN field staff, and other valuable contributions. This allowed ABSN and the community of Levelock to deliver 26% more energy savings measures beyond the original grant funding.