Village End Use Energy Efficiency Measures Program

AEA Grant # 2195225 Administered by Alaska Building Science Network

Lower Kalskag Final Report



Community Summary

8 community buildings and 3 teacher housing units received energy efficiency upgrades:

City Office/Bingo Hall, Water Treatment plant, Health Clinic, Tribal Office, Zackar Levi Elementary School (Lower School) and Gymnasium, School Generator Shed, KSD Bunkhouse/library, three teacher housing units.

Retrofits Completed: December 2007- January 2008
Lower School Gym Will Be Completed Summer 2009

Village-Wide Lighting Retrofit Summary:

- Retrofitted 244 light fixtures with electronic ballasts & T8 lamps
- Installed 51 compact fluorescent light bulbs
- Installed 16 T-5 linear fluorescent fixtures in the School Gym
- Pre-retrofit energy use for all lighting: 29.452 Kilowatts
- Post-retrofit energy use for all lighting: 17.284 Kilowatts
- Energy savings projection: 12.168 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 41%
- Estimated Annual Savings:

kWh Rate (as of 11/13/08): $0.64 Fuel Cost (FY 2007 Ave): $1.89
(The Fuel Rate is taken from the FY 2007 PCE data for Upper Kalskag)

Hours Per Day/ 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated	$14,298.4	1621.28	$3,064.21
4 Hours/day	$7,804.56	884.95	$1,672.55
7 Hours/day	**$13,657.90**	1548.65	$2,926.96
10 Hours/day	$19,511.30	2212.36	$4,181.37

- Total project cost for all measures: $37,775
- Simple Payback (lighting measures only, using 7 hours/day lighting use run-time): 3.5 years
- Total village wide in-kind contribution: $ 6,818.00 (extended grant capacity by 18%)

Additional Energy Efficiency Measures:

- The clinic received a programmable thermostat.
- 16 hr. Boiler maintenance & efficiency training

City of Lower Kalskag Owned Buildings

ABSN Field Manager Harry Morgan
during maintenance worker training.

2 buildings owned by the City of Lower Kalskag received energy efficient lighting upgrades as follows:

City Office/Bingo Hall, Water Treatment

- Lighting upgrades completed in: December 2007
- Retrofitted 63 light fixtures with electronic ballasts & T8 lamps
- Pre-retrofit energy use for all lighting: 5.628 Kilowatts
- Post-retrofit energy use for all lighting: 3.562 Kilowatts
- Energy savings projection: 2.066 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 37%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated	$2,913.33	330.34	$624.34
4 Hours/day	$1,325.13	150.25	$283.98
7 Hours/day	$2,318.98	262.95	$496.97
10 Hours/day	$3,312.83	375.64	$709.95

City Office/Bingo Hall



Mickey Nicolai helps with lighting assessments.

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	26
4-lamp electronic ballast, (4) 25 watt T8 lamps	4
• Pre-retrofit energy use:	2856 watts
• Post-retrofit energy use:	1582 watts
• Energy savings projection:	1274 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
1750 Hours/year (Est.)	$1,430.00	162.15	$306.45
4 Hours/day	$817.14	92.65	$175.12
7 Hours/day	$1,430.00	162.15	$306.45
10 Hours/day	$2,042.86	231.64	$437.79

Water Treatment plant



Andrew Wise upgrades a fixture in the water treatment plant.

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 32 watt T8 lamps	33
• Pre-retrofit energy use:	2772 watts
• Post-retrofit energy use:	1980 watts
• Energy savings projection:	792 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
2920 Hours/year (Est.)	$1,483.33	168.19	$317.88
4 Hours/day	$507.99	57.60	$108.86
7 Hours/day	$888.98	100.80	$190.51
10 Hours/day	$1,269.97	144.00	$272.16

Village of Lower Kalskag Owned Buildings



2 buildings owned by the Village of Lower Kalskag received energy efficient lighting upgrades as follows:

Health Clinic, Tribal Office

- Lighting upgrades completed in: December 2007
- Retrofitted 35 light fixtures with electronic ballasts & T8 lamps
- Installed 2 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 2.31 Kilowatts
- Post-retrofit energy use for all lighting: 1.92 Kilowatts
- Energy savings projection: 0.39 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 17%

- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated	$498.62	56.54	$106.86
4 Hours/day	$250.15	28.36	$53.61
7 Hours/day	$437.76	49.64	$93.81
10 Hours/day	$625.37	70.91	$134.02

Additional Energy Efficiency Measures:

The clinic received a programmable thermostat.

Notes: For programmable thermostats in community buildings we work with local maintenance staff. Our goal is to set thermostats to a night-time and weekend set-back of 62 - 64 degrees and a daytime temp of 68-70 degrees. Programmable thermostats used and maintained as programmed are known to achieve an overall fuel savings of between 5 and 10% over non-programmed thermostats.

Health Clinic

Programmable thermostat installed in the Clinic.

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	15
3-lamp electronic ballast, (2) 25 watt T8 lamps	4
4-lamp electronic ballast, (4) 25 watt T8 lamps	5
CFL-20 W	2

- Pre-retrofit energy use: 1650 watts
- Post-retrofit energy use: 1403 watts
- Energy savings projection: 247 watts
- Pre-retrofit to post retrofit energy reduction: 15%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1700 Hours/year (Est.)	$269.32	30.54	$57.72
4 Hours/day	$158.43	17.96	$33.95
7 Hours/day	$277.25	31.44	$59.41
10 Hours/day	$396.06	44.91	$84.88

Additional Energy Efficiency Measures: The clinic received a programmable thermostat.

Tribal Office

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

Community computer lab.

Materials Installed	**Quantity**
2-Lamp Fixture (w/existing electronic ballast) re-lamped with (2)25 watt T8 Lamps	11

- Pre-retrofit energy use: 660 watts
- Post-retrofit energy use: 517 watts
- Energy savings projection: 143 watts
- Pre-retrofit to post retrofit energy reduction: 22%
- Estimated annual savings:

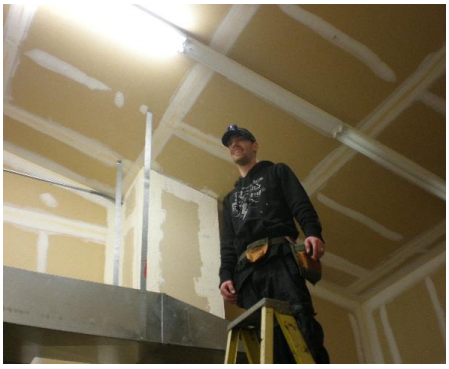
Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
2500 Hours/year (Est.)	$229.30	26.00	$49.14
4 Hours/day	$91.72	10.40	$19.66
7 Hours/day	$160.51	18.20	$34.40
10 Hours/day	$229.30	26.00	$49.14

Note: Fixtures contained existing electronic ballast & 32 watt T-8 lamps installed previously. All fixtures were re-lamped 25 watt T-8 lamps.

Kuspuk School District Owned Buildings

Maintenance workers practice lighting retrofits.

Earl Morgan packs up used fluorescent lamps.



Jeromy Hoeldt works on a fixture at Lower Kalskag Elementary school.

6 buildings owned by the School District received energy efficient lighting upgrades as follows:

Zackar Levi Elementary School and gymnasium (Lower School), School Generator Shed, KSD Bunkhouse/library, KSD leased teacher housing (1 unit), KSD owned teacher housing (2 units).

- Lighting upgrades completed in January 2008, Lower School Gymnasium will be completed Summer 2009
- Installed 49 compact fluorescent light bulbs
- Retrofitted 146 light fixtures with electronic ballasts & T8 lamps
- Installed 16 T-5 linear fluorescent fixtures
- Pre-retrofit energy use for all lighting: 21.514 Kilowatts
- Post-retrofit energy use for all lighting: 11.802 Kilowatts
- Energy savings projection: 9.712 Kilowatts
- 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
Locally Estimated	$10,886.4	1234.40	$2,333.02
4 Hours/day	$6,229.28	706.33	$1,334.96
7 Hours/day	$10,901.2	1236.07	$2,336.18
10 Hours/day	$15,573.1	1765.82	$3,337.40

Zackar Levi Elementary

T-8 strip fixtures replace inefficient High Output T-12 fixtures saving approx 1000 watts in the school hallway.

25 watt T-8 lamps save energy while improving over-all light levels in school classrooms for a better learning environment.

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	11
3-lamp electronic ballast, (2) 25 watt T8 lamps	5
4-Lamp Fixture (w/existing electronic ballast) re-	27
4-lamp fixture 3-lamp ballast (3) 25 watt T8 lamps	27
8 ft strip fixture, 4-lamp electronic ballast (4) 32	9

- Pre-retrofit energy use: 9927 watts
- Post-retrofit energy use: 5880 watts
- Energy savings projection: 4047 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
2500 Hours/year (Est.)	$6,489.36	735.82	$1,390.70
4 Hours/day	$2,595.75	294.33	$556.28
7 Hours/day	$4,542.56	515.07	$973.49
10 Hours/day	$6,489.36	735.82	$1,390.70

Note: Some fixtures contained existing electronic ballast and 32 watt T-8 lamps installed previously. All 4-lamp fixtures (54 total) were de-lamped to three 25 watt T-8 lamps each.

School Generator shed

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	1
4-lamp electronic ballast, (4) 25 watt T8 lamps	1
CFL-14 W	7

- Pre-retrofit energy use: 672 watts
- Post-retrofit energy use: 235 watts
- Energy savings projection: 437 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
500 Hours/year (Est.)	$140.15	15.89	$30.03
4 Hours/day	$280.29	31.78	$60.07
7 Hours/day	$490.51	55.62	$105.12
10 Hours/day	$700.73	79.45	$150.17

KSD Bunkhouse/library

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	56
CFL-20 W	4
CFL-23 W	1

- Pre-retrofit energy use: 4432 watts
- Post-retrofit energy use: 2735 watts
- Energy savings projection: 1697 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
500 Hours/year (Est.)	$544.23	61.71	$116.63
4 Hours/day	$1,088.46	123.42	$233.26
7 Hours/day	$1,904.80	215.98	$408.21
10 Hours/day	$2,721.14	308.55	$583.15

KSD leased teacher housing

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	1
CFL-14 W	4
CFL-20 W	8
CFL-27 W	3

- Pre-retrofit energy use: 1204 watts
- Post-retrofit energy use: 344 watts
- Energy savings projection: 860 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
1500 Hours/year (Est.)	$827.41	93.82	$177.32
4 Hours/day	$551.60	62.55	$118.21
7 Hours/day	$965.31	109.45	$206.87
10 Hours/day	$1,379.01	156.36	$295.53

KSD owned teacher housing

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	6
CFL-14 W	8
CFL-23 W	3

- Pre-retrofit energy use: 1035 watts
- Post-retrofit energy use: 463 watts
- Energy savings projection: 572 watts
- Pre-retrofit to post retrofit energy reduction: 55%
- 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.)	$550.32	62.40	$117.94
4 Hours/day	$366.88	41.60	$78.62
7 Hours/day	$642.04	72.80	$137.59
10 Hours/day	$917.20	104.00	$196.56

KSD owned teacher housing

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	1
4-lamp electronic ballast, (3) 25 watt T8 lamps	1
CFL-14 W	4
CFL-20 W	6
CFL-23 W	1

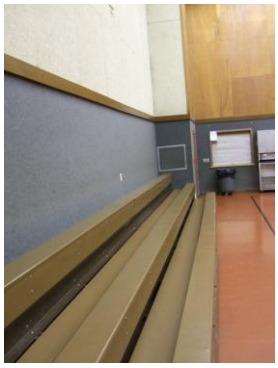
- Pre-retrofit energy use: 452 watts
- Post-retrofit energy use: 321 watts
- Energy savings projection: 131 watts
- Pre-retrofit to post retrofit energy reduction: 29%

- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1500 Hours/year (Est.)	$126.04	14.29	$27.01
4 Hours/day	$84.02	9.53	$18.01
7 Hours/day	$147.04	16.67	$31.51
10 Hours/day	$210.06	23.82	$45.02

School Gym

Existing High Output magnetic ballast and T-12 lamps are inefficient and provide poor lighting.



T-5 energy efficient lighting replaces high output fluorescent light fixtures in school gymnasium.

T-5 fixtures save energy while improving light levels in large spaces.

Materials Installed	**Quantity**
T-5 fixture, electronic ballast, (2) 54 watt T-5 HO	16
• Pre-retrofit energy use:	3792 watts
• Post-retrofit energy use:	1824 watts
• Energy savings projection:	1968 watts
• 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
1750 Hours/year (Est.)	$2,208.98	250.47	$473.39
4 Hours/day	$1,262.28	143.13	$270.51
7 Hours/day	$2,208.98	250.47	$473.39
10 Hours/day	$3,155.69	357.82	$676.28

KUSPUK SCHOOL DISTRICT

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Brad Allen
SUPERINTENDENT OF SCHOOLS
(907) 675-4250, Ext. #103

Dan,

We just wanted to say "Thank You" to you for all your work in our district for helping out with the lighting upgrades as well as the environmental education programs that you've assisted with in Kalskag.

Your efforts are very appreciated by the students, staff and village in our district. The Kuspuk School District Board of Education also wanted to say thanks to you too – hence the enclosed certificate.

Thanks again for all your efforts on behalf of our kids!

Best Wishes,

Brad Allen
Superintendent – Kuspuk School District

SchoolGymPre&Post

These retrofits will be completed Summer 2009

Lower Kalskag Elementary School 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**
	44.833	33.833	22.5	HPS 150 watt		160	**0**	47 direct,	59	16	T-5 2 lamps	114	**1824**
sloping ceiling: 20' 5" low to 24'3" at peak				HPS 250 watt		260	**0**	30 indirect			T-5 3 lamps	171	**0**
Existing watts per False Pass and Craig from AK Lighting				8' T12 2-lamp HO	16	237	**3,792**				T-5 6 lamps	342	**0**
					Total Existing Watts		3,792				Total New Watts		1824

6, 4-lamp fixtures is the same light output as 12, 2-lamp fixtures. (Which is an average of 47 foot candles at floor level). To simplify and achieve fixture - for fixture exchange we can go with 16, 2-lamp fixtures, which is 32 lamps - the same as 8, 4-lamp fixtures which will give an average foot candle spread of

Percent Savings Pre to Post Retrofit:	**51.90%**

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: 0.6414 /kWh Cost of Elect is **$0.6414/kWh** as of **11/13/08**. Request rates from AVEC

Watts of existing lighting: 3,792

New wattage for T5 fixtures: 1,824

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

Existing Cost: $4,256

Retrofitted Cost: $2,047

Annual Savings: $2,209

Est material & shipping cost of Gym retrofit: $3,057

Simple Payback: Materials cost / annual savings = **1.38** years (for retrofit to pay for itself in materials)

Lower Kalskag, 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 (Number of entities x 1 hour each)		3.00	$ 15.00	$ 45.00	list number of entities
Staff time for Attending teleconference (TC/IRA)		1.00	$ 15.00	$ 15.00	list # of staff & wages if possible ($15/hr is an average wage for village entity staff).
Staff time for Attending teleconference (City)		1.00	$ 15.00	$15.00	"
Staff time for Attending teleconference (School)		1.00	$ 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 Dec '08			$ 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	Dec 17-20 2007			$100	Lodging at KSD Lower School x 4 days and at Aniak vocational school 1 day
Lodging for ABSN Field Managers - 2nd site visit	Jan 21-23 2008			$75	Lodging at KSD Lower School 3 days
School T8 lighting upgrades		125.00	$ 25.00	$ 3,125.00	Best guestimate on wage and hours
Lower School T5s, etc . .		80.00	$ 25.00	$ 2,000.00	Install 16, T-5 fixtures in HS gym (Best guestimate on wage and hours)
KSD-labor support for T5 and T8 lighting upgrades - Earl Morgan, local KSD Maint staff		30.00	$20.00	$ 600.00	Various lighting retrofit support
KSD notes:				$(1,000.00)	KSD is providing all labor In-Kind for their **full time** maintenance staff however they invoiced us for $1,000.00 (66.6 hrs) in Nov '08 financial reporting for their on-call maint staff they had to hire specifically for the projects.
	TOTAL			$ 6,818.00	

Bethel Boiler Trainings at Yuut Elitnaurviat Learning Center, October 7-8 & 15-16, 2008

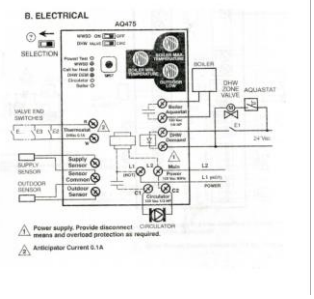
ABSN Master Boiler Technician Charlie Deer presents at Bethel area boiler training -Yuut Elitnaurviat, the Learning Center Shop in Bethel, October, 2008.

Training on oil burner combustion efficiency and maintenance.

The Native Village of Lower Kalskag maintenance staff Micky Nicolai traveled to Bethel October 7 and 8, 2008 to participate in this training. ABSN partnered with Association of Village Council Presidents Housing Authority and YKHC's Yuut Elitnaurviat Learning Center to provide ABSN's 16-hour boiler training course to 4 rural maintenance staff from '07-'08 villages covered under this VEUEEM grant. Additionally 11 AVCP Housing maintenance staff from Bethel and surrounding western villages attended this training. Charlie Deer's training hours were covered by matching funds from ABSN. AEA VEUEEM grant funds were used to cover training coordination, air fare, meals and lodging in Bethel for VEUEEM grant village maintenance staff.

Components of a Bacharach Flu Gas Analyzing Kit used in boiler efficiency training and left with capable maint staff for use in their villages.

Smoke-test kit for analyzing flu gases for boiler efficiency



Schematic of outdoor temperature sensing boiler control

During this 16-hour course ABSN's boiler specialist Charlie Deer instructed maintenance staff in the fundamentals of boiler and fuel energy efficiency. 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.