Village End Use Energy Efficiency Measures Program

AEA Grant # 2195234 Administered by Alaska Building Science Network

Atmautluak Final Report



Community Summary

12 community buildings and 6 teacher housing units received energy efficiency upgrades as follows:

New Office Building, Old Office Building, Washeteria, Jail/Public Safety, Post Office Building, Clinic, Council Shop, Power House, Village Corp Store & Office Building, Elementary School Building, School Shop/Preschool and School Gym

Retrofits Completed: May - June 2007

Village-Wide Lighting Retrofit Summary:

- Retrofitted 139 light fixtures with electronic ballasts & T8 lamps
- Installed 73 compact fluorescent light bulbs
- Installed 12 T5 linear fluorescent fixtures in the School Gym
- Pre-retrofit energy use for all lighting: 24.649 Kilowatts
- Post-retrofit energy use for all lighting: 12.616 Kilowatts
- Energy savings projection: 12.033 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 49%

- Estimated Annual Savings:

kWh Rate (as of 11/20/08): $0.64 Fuel Cost (FY 2007 Ave): $3.22

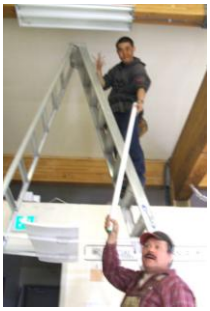
Hours Per Day/ 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated	$13,705.95	2449.05	$7,885.94
4 Hours/day	$7,701.12	1376.08	$4,430.96
7 Hours/day	**$13,476.9**	2408.13	$7,754.18
10 Hours/day	$19,252.8	3440.19	$11,077.4

- Total project cost for all measures: $37,775
- Simple Payback (lighting measures only, using 7 hours/day lighting use run-time): **2.80 years**
- Total village wide in-kind contribution: **$6,943.00** (increased grant funds by 18.3%)

Additional Energy Efficiency Measures:

- 2 Programmable Thermostats were installed in LKSD teacher housing units.

Atmautluak Traditional Council Owned Buildings



8 buildings owned by the Atmautluak Traditional Council received energy efficient lighting upgrades as follows:

New Office Building, Old Office Building, Washeteria, Jail/Public Safety, Post Office Building, Clinic, Council Shop, Power House

- Lighting upgrades were completed in May 2007
- Retrofitted 103 light fixtures with electronic ballasts & T8 lamps
- Installed 27 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 13.159 Kilowatts
- Post-retrofit energy use for all lighting: 7.341 Kilowatts
- Energy savings projection: 5.818 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 44%
- Estimated Annual Savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated	$6,986.50	1248.38	$4,019.79
4 Hours/day	$3,723.52	665.34	$2,142.39
7 Hours/day	$6,516.16	1164.34	$3,749.18
10 Hours/day	$9,308.80	1663.34	$5,355.97

New Office Building



Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	3
3-lamp electronic ballast, (3) 25 watt T8 lamps	12
4-lamp electronic ballast, (3) 25 watt T8 lamps	18

- Pre-retrofit energy use: 4140 watts
- Post-retrofit energy use: 2379 watts
- Energy savings projection: 1761 watts
- Pre-retrofit to post retrofit energy reduction: 43%
- 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.)	$2,254.08	402.77	$1,296.92
4 Hours/day	$1,127.04	201.39	$648.46
7 Hours/day	$1,972.32	352.42	$1,134.81
10 Hours/day	$2,817.60	503.46	$1,621.15

Notes: 40 original 4-lamp fixtures in this building were de-lamped to 3-lamp fixtures achieving excellent savings and improved light levels over existing 34w T12s.

Old Office Building



Materials Installed	Quantity
1-lamp electronic ballast, (1) 25 watt T8 lamp	2
2-lamp electronic ballast, (2) 25 watt T8 lamps	18
CFL-14 W	4

- Pre-retrofit energy use: 1562 watts
- Post-retrofit energy use: 950 watts
- Energy savings projection: 612 watts
- Pre-retrofit to post retrofit energy reduction: 39%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
2400 Hours/year (Est.)	$940.03	167.97	$540.86
4 Hours/day	$391.68	69.99	$225.36
7 Hours/day	$685.44	122.48	$394.38
10 Hours/day	$979.20	174.97	$563.40

Washeteria

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	2
4-lamp fixture (2) 2-lamp ballasts (4) 25 watt T8	9
4-lamp fixture 2, 2-Lamp Ballasts (2) 32 watt	11
CFL-14 W	2

- Pre-retrofit energy use: 3104 watts
- Post-retrofit energy use: 2105 watts
- Energy savings projection: 999 watts
- Pre-retrofit to post retrofit energy reduction: 32%
- 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.)	$1,278.72	228.49	$735.73
4 Hours/day	$639.36	114.24	$367.87
7 Hours/day	$1,118.88	199.93	$643.77
10 Hours/day	$1,598.40	285.61	$919.66

Notes: 11 fixtures in water treatment area were 4-lamp fixtures using two, 2-lamp magnetic ballast to power four T12 lamps/fixture. Two switches controlled either inside or outside pair of exiting lamps. Dual switching control options were maintained in retrofit. 32w T8s were installed for outside pair of lamps and 25w T8 lamps were installed for inside pair of lamps – achieving additional savings over all 32w T8s.

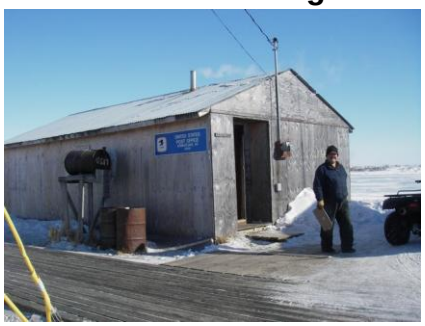
Jail/Public Safety

Materials Installed	Quantity
CFL-20 W	6
CFL-27 W	2

- Pre-retrofit energy use: 600 watts
- Post-retrofit energy use: 174 watts
- Energy savings projection: 426 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
1250 Hours/year (Est.)	$340.80	60.90	$196.08
4 Hours/day	$272.64	48.72	$156.87
7 Hours/day	$477.12	85.25	$274.52
10 Hours/day	$681.60	121.79	$392.17

Post Office Building



Materials Installed	**Quantity**
CFL-20 W	1
CFL-27 W	4

- Pre-retrofit energy use: 475 watts
- Post-retrofit energy use: 128 watts
- Energy savings projection: 347 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
1800 Hours/year (Est.)	$399.74	71.43	$230.00
4 Hours/day	$222.08	39.68	$127.78
7 Hours/day	$388.64	69.44	$223.61
10 Hours/day	$555.20	99.21	$319.44

Clinic

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	15
4-lamp electronic ballast, (4) 25 watt T8 lamps	2
CFL-14 W	1
CFL-27 W	1

- Pre-retrofit energy use: 1886 watts
- Post-retrofit energy use: 926 watts
- Energy savings projection: 960 watts
- Pre-retrofit to post retrofit energy reduction: 51%
- 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.)	$1,228.80	219.57	$707.01
4 Hours/day	$614.40	109.78	$353.50
7 Hours/day	$1,075.20	192.12	$618.63
10 Hours/day	$1,536.00	274.46	$883.76

Notes: 9 of 11 original 4-lamp fixtures in this building were de-lamped to 2-lamp fixtures achieving excellent savings and improved light levels over existing mixed wattage T12s, many of which were out of service.

Council Shop

Materials Installed **Quantity**

CFL-27 W 6

- Pre-retrofit energy use: 600 watts
- Post-retrofit energy use: 162 watts
- Energy savings projection: 438 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
1000 Hours/year (Est.)	$280.32	50.09	$161.29
4 Hours/day	$280.32	50.09	$161.29
7 Hours/day	$490.56	87.66	$282.25
10 Hours/day	$700.80	125.22	$403.22

Power House

Materials Installed **Quantity**

2-lamp electronic ballast, (2) 25 watt T8 lamps 11

- Pre-retrofit energy use: 792 watts
- Post-retrofit energy use: 517 watts
- Energy savings projection: 275 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
1500 Hours/year (Est.)	$264.00	47.17	$151.90
4 Hours/day	$176.00	31.45	$101.26
7 Hours/day	$308.00	55.04	$177.21
10 Hours/day	$440.00	78.62	$253.16

Atmautluak Limited Owned Buildings

1 building owned by the Atmautluak Limited received energy efficient lighting upgrades as follows:

Store Office Building

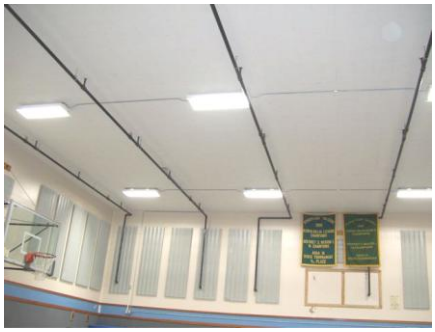
Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	12
CFL-27 W	4

- Lighting upgrades completed in June 2007
- Retrofitted 12 light fixtures with electronic ballasts & T8 lamps
- Installed 4 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 1.239 Kilowatts
- Post-retrofit energy use for all lighting: 0.672 Kilowatts
- Energy savings projection: 0.567 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
Locally Estimated	$1,088.64	194.52	$626.37
4 Hours/day	$362.88	64.84	$208.79
7 Hours/day	$635.04	113.47	$365.38
10 Hours/day	$907.20	162.10	$521.97

Lower Kuskokwim School District Owned Buildings


3 buildings, and 6 teacher housing units owned by the Lower Kuskokwim School District received energy efficient lighting upgrades as follows:

Joann A. Alexie Memorial School: Elementary School Building, Shop/Preschool, Teacher Housing units: AT #8, AT #9, AT #10, AT #13, AT #17, Principal's House, School Gym,

- Lighting upgrades completed in June 2007
- Retrofitted 24 light fixtures with electronic ballasts & T8 lamps
- Installed 42 compact fluorescent light bulbs
- Installed 12 T5 linear fluorescent fixtures
- Pre-retrofit energy use for all lighting: 10.251 Kilowatts
- Post-retrofit energy use for all lighting: 4.603 Kilowatts
- Energy savings projection: 5.648 Kilowatts
- 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
Locally Estimated	$5,636.96	1007.24	$3,243.31
4 Hours/day	$3,614.72	645.90	$2,079.79
7 Hours/day	$6,325.76	1130.32	$3,639.63
10 Hours/day	$9,036.80	1614.74	$5,199.47

Additional Energy Efficiency Measures:

Programmable Thermostats were installed in LKSD teacher housing units AT #9 and AT #10.

Both these housing units are heated with oil-fired Burnham boilers.

Notes: For programmable thermostats in teacher housing units we work with local maintenance staff. Our goal is to generally set thermostats to a night time set-back of 62 - 64 degrees and a daytime / evening / weekend temp of 68-70 degrees. If occupants are interested and willing to go beyond that, maintenance staff work with them to program the thermostat to 62 degrees during the weekdays when teachers are away working. Programmable thermostats used and maintained as programmed are known to achieve an overall fuel savings of between 5 and 15% over non-programmed thermostats.

Elem. School Building



Materials Installed	**Quantity**
CFL-20 W	4
CFL-27 W	2

- Pre-retrofit energy use: 500 watts
- Post-retrofit energy use: 134 watts
- Energy savings projection: 366 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
1750 Hours/year (Est.)	$409.92	73.25	$235.85
4 Hours/day	$234.24	41.86	$134.77
7 Hours/day	$409.92	73.25	$235.85
10 Hours/day	$585.60	104.64	$336.93

Shop/Preschool



Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	17
CFL-14 W	1

- Pre-retrofit energy use: 1264 watts
- Post-retrofit energy use: 813 watts
- Energy savings projection: 451 watts
- Pre-retrofit to post retrofit energy reduction: 36%
- 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.)	$432.96	77.36	$249.11
4 Hours/day	$288.64	51.58	$166.07
7 Hours/day	$505.12	90.26	$290.63
10 Hours/day	$721.60	128.94	$415.18

Teacher Housing Units

Notes: Teacher Housing, #'s 8, 13, 17 and the Principals Home were already retrofitted with T8s for their linear fluorescent lighting. The ABSN program coordinated installation of cfls in these units to replace existing incandescent lighting wherever possible as indicated below:

Teacher Housing, AT #8

Materials Installed	**Quantity**
CFL-14 W	7

- Pre-retrofit energy use: 420 watts
- Post-retrofit energy use: 98 watts
- Energy savings projection: 322 watts
- Pre-retrofit to post retrofit energy reduction: 77%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1250 Hours/year (Est.)	$257.60	46.03	$148.21
4 Hours/day	$206.08	36.82	$118.57
7 Hours/day	$360.64	64.44	$207.50
10 Hours/day	$515.20	92.06	$296.43

Teacher Housing, AT #9

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

- Pre-retrofit energy use: 666 watts
- Post-retrofit energy use: 262 watts
- Energy savings projection: 404 watts
- Pre-retrofit to post retrofit energy reduction: 61%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1250 Hours/year (Est.)	$323.20	57.75	$185.96
4 Hours/day	$258.56	46.20	$148.77
7 Hours/day	$452.48	80.85	$260.34
10 Hours/day	$646.40	115.50	$371.92

Teacher Housing, AT #10

Atmautluak School teacher housing unit AT # 10

Typical linear fluorescent lighting retrofit

Programmable Thermostats Installed in units AT #9 and AT # 10

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

- Pre-retrofit energy use: 828 watts
- Post-retrofit energy use: 336 watts
- Energy savings projection: 492 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
1250 Hours/year (Est.)	$393.60	70.33	$226.46
4 Hours/day	$314.88	56.26	$181.17
7 Hours/day	$551.04	98.46	$317.05
10 Hours/day	$787.20	140.66	$452.93

Teacher Housing, AT #13

Materials Installed	**Quantity**
CFL-14 W	4

- Pre-retrofit energy use: 213 watts
- Post-retrofit energy use: 56 watts
- Energy savings projection: 157 watts
- Pre-retrofit to post retrofit energy reduction: 74%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1250 Hours/year (Est.)	$125.60	22.44	$72.27
4 Hours/day	$100.48	17.95	$57.81
7 Hours/day	$175.84	31.42	$101.17
10 Hours/day	$251.20	44.89	$144.53

Teacher Housing, AT #17

Materials Installed	**Quantity**
CFL-14 W	6
• Pre-retrofit energy use:	360 watts
• Post-retrofit energy use:	84 watts
• Energy savings projection:	276 watts
• Pre-retrofit to post retrofit energy reduction:	77%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1250 Hours/year (Est.)	$220.80	39.45	$127.04
4 Hours/day	$176.64	31.56	$101.63
7 Hours/day	$309.12	55.24	$177.86
10 Hours/day	$441.60	78.91	$254.08

Teacher Housing, Principal's House

Materials Installed	**Quantity**
CFL-14 W	6
• Pre-retrofit energy use:	360 watts
• Post-retrofit energy use:	84 watts
• Energy savings projection:	276 watts
• Pre-retrofit to post retrofit energy reduction:	77%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
1250 Hours/year (Est.)	$220.80	39.45	$127.04
4 Hours/day	$176.64	31.56	$101.63
7 Hours/day	$309.12	55.24	$177.86
10 Hours/day	$441.60	78.91	$254.08

School Gym

Joann A. Alexie Memorial School Gym

Principal Larry Strunk, (center, standing, at school potluck)

New , 4-lampT5 light fixtures

Materials Installed **Quantity**

T5 fixtures electronic ballasts, (4) 54 watt T5 HO lamps 12

- Pre-retrofit energy use: 5640 watts
- Post-retrofit energy use: 2736 watts
- Energy savings projection: 2904 watts
- Pre-retrofit to post retrofit energy reduction: 51%
- 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.)	$3252.48	581.17	$1,871.37
4 Hours/day	$1,858.56	332.10	$1,069.35
7 Hours/day	$3,252.48	581.17	$1,871.37
10 Hours/day	$4,646.40	830.24	$2,673.38

Notes: LKSD contracted with third party electrical contractor: Quality Electric and installed T5 lighting in the Atmautluak gym. Labor costs for this upgrade were provided in-kind by LKSD.

Existing lighting consisted of 24, 235w HO T12 linear fluorescent fixtures. Light quality for the gym increased significantly going from an existing color rendering index, CRI of around 60 to a CRI of 85 with the new T5 lighting.

"*The staff members all like the fact that the gym is much brighter than it used to be. We are also very appreciative that it uses less electricity now. The community members that play basketball and at the potluck were impressed by the improvement and being able to see in the corner areas much better*".

- Atmautluak School Principal Larry Strunk, Oct. '07

Atmautluak, Joann A. Alexie Memorial School - Alaska Building Science Network - T5 Lighting Upgrade Details

These retrofits were completed in July, 2007.

Atmautluak 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**
	55	51	20	HPS 150 watt		160	**0**	27 av	55		T-5 2 lamps	114	**0**
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**			12	T-5 4 lamps	228	**2736**
				Other School Gym (A)	24	235	**5,640**				T-5 6 lamps	342	**0**
				Other School Gym (B)			**0**				Other fixtures (A)		**0**
					Total Existing Watts		5,640				Total New Watts		2736

Percent Savings Pre to Post Retrofit:	**51.49%**

1750

New watts / old watts

Savings & Payback Calculation for Gym:

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

Full cost of electricity: $0.64 /kWh

Watts of existing lighting: 5,640

New wattage for T5 fixtures: 2,736

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

Existing Cost: $6,317

Retrofitted Cost: $3,064

Annual Savings: $ $3,252

T5 Materials costs $2,656.04

T5 shipping costs $300.00

Material & shipping cost of Gym retrofit: $2,956.04

Labor was paid by LKSD as in-kind contribution

Simple Payback: Materials cost / annual savings = **0.91** years (for retrofit to pay for itself in materials)

Atmautluak, 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)	Feb, 2007	3	$15.00	$45.00	list number of entities
Staff time for Attending teleconference (TC/IRA)	2-27-07	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 (Village Corp)	2-27-07	2	$15.00	$30.00	"
Staff time for Attending teleconference (School)	2-27-07	2	$15.00	$30.00	"
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	3/12/07	2	$60.00	$120.00	Geoff Butler and Harry Morgan for 2 nights at the school
Transportation and fuel costs - 1st assessment site-visit					
School teacher housing - mainly cfl upgrades	summer '07	20	$18.00	$360.00	School post tally sheet tabs indicate around 20 hours of in-kind time. $18/hr wage is a conservative estimate considering fringe costs.
LKSD cert. electrician maint labor for T5 retrofits				$4,500.00	Comparable estimate - In-kind labor, provided by school district - includes airfare & per diem and lodging.
	TOTAL			$6,943.00	