Village End Use Energy Efficiency Measures Program
AEA Grant # 2195234 Administered by Alaska Building Science Network

Kwethluk Final Report

Community Summary

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

City Offices, Fire Station, Head Start / Inn, Washeteria & Water Plant, Public Safety Building, IRA Office, Health & Human Services, IRA Boardroom, KTRC Office, Kwethluk Native Store, Old Community Hall, Post Office - Old Clinic, Social Services Building, Kwethluk Inc. Offices, Kwethluk Inc Warehouse, Kwethluk Inc. Sports Store, Utility Building, School Gym, Moravian Church, Russian Orthodox Church, Orthodox Quarters

Retrofits Completed: Primary lighting retrofits completed in January, 2009

Village-Wide Lighting Retrofit Summary:

- Retrofitted 303 light fixtures with electronic ballasts & T8 lamps
- Installed 253 compact fluorescent light bulbs
- Installed 8 T5 linear fluorescent fixtures in the School Gym
- Pre-retrofit energy use for all lighting: 61.23 Kilowatts
- Post-retrofit energy use for all lighting: 26.19 Kilowatts
- Energy savings projection: 35.04 Kilowatts
- Pre-retrofit to post retrofit energy reduction: 57%
- Estimated Annual Savings:

kWh Rate (FY 2009 AVE): $0.52 Fuel Cost (FY 2009 Ave): $2.69

Hours Per Day/ 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
Locally Estimated Use	$32,799	5829	$15,681
4 Hours/day	$18,223	3238	$8,712
7 Hours/day	**$31,890**	5668	$15,247
10 Hours/day	$45,558	8097	$21,781

- Total project cost for all measures: $46,500

- Simple Payback (lighting measures only, using 7 hours/day lighting use run-time): 1.46 Years

- Total village wide in-kind contribution: $ 8,993 (expanded grant capacity by 19%)

City Of Kwethluk Owned Buildings

5 buildings owned by the City Of Kwethluk received energy efficient lighting upgrades as follows:

City Offices, Fire Station, Head Start / Inn, Washeteria & Water Plant, Public Safety Building

- Lighting upgrades completed in January, 2009
- Retrofitted 111 light fixtures with electronic ballasts & T8 lamps
- Installed 27 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 18.001 Kilowatts
- Post-retrofit energy use for all lighting: 7.271 Kilowatts
- Energy savings projection: 10.73 Kilowatts
- 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
Locally Estimated	$10,464.40	1859.89	$5,003.10
4 Hours/day	$5,579.60	991.68	$2,667.62
7 Hours/day	$9,764.30	1735.44	$4,668.34
10 Hours/day	$13,949.00	2479.21	$6,669.06

Kwethluk City Offices - Old Clinic

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	15
3-lamp electronic ballast, (3) 25 watt T8 lamps	8
4-lamp electronic ballast, (3) 25 watt T8 lamps	4
CFL-14 W	7
CFL-23 W	1

- Pre-retrofit energy use: 4132 watts
- Post-retrofit energy use: 1703 watts
- Energy savings projection: 2429 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	$1,263.08	224.49	$603.88
7 Hours/day	$2,210.39	392.86	$1,056.79
10 Hours/day	$3,157.70	561.23	$1,509.71
1800 Hours/year (Est.)	$2,273.54	404.09	$1,086.99

Note: Reduced 4 4-lamp fixtures to 2-lamp fixtures, Reduced 8 4-lamp fixtures to 2-lamp fixtures, De-lamped 4 4-lamp fixtures to 3-lamp fixtures.

Fire Station

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	2
4-lamp electronic ballast, (4) 32 watt T8 lamps	5
CFL-14 W	2

- Pre-retrofit energy use: 1128 watts
- Post-retrofit energy use: 720 watts
- Energy savings projection: 408 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
4 Hours/day	$212.16	37.71	$101.43
7 Hours/day	$371.28	65.99	$177.51
10 Hours/day	$530.40	94.27	$253.59
1500 Hours/year (Est.)	$318.24	56.56	$152.15

Head Start / Inn

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	35
3-lamp electronic ballast, (3) 25 watt T8 lamps	13
CFL-14 W	3
• Pre-retrofit energy use:	7488 watts
• Post-retrofit energy use:	2614 watts
• Energy savings projection:	4874 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	$2,534.48	450.46	$1,211.74
7 Hours/day	$4,435.34	788.31	$2,120.55
10 Hours/day	$6,336.20	1126.16	$3,029.36
1800 Hours/year (Est.)	$4,562.06	810.83	$2,181.14

Note: Reduced 13 4-lamp fixtures to 3-lamp fixtures, and 26 4-lamp fixtures to 2-lamp fixtures.

Washeteria & Water Plant

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	15
2-lamp electronic ballast, (2) 32 watt T8 lamps	6
4-lamp electronic ballast, (4) 25 watt T8 lamps	1
4-lamp electronic ballast, (4) 32 watt T8 lamps	7
CFL-14 W	1
CFL-23 W	3
• Pre-retrofit energy use:	4653 watts
• Post-retrofit energy use:	2063 watts
• Energy savings projection:	2590 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
4 Hours/day	$1,346.80	239.37	$643.91
7 Hours/day	$2,356.90	418.90	$1,126.84
10 Hours/day	$3,367.00	598.43	$1,609.77
2160 Hours/year (Est.)	$2,909.09	517.04	$1,390.84

Note: Reduced 15 4-lamp fixtures to 2-lamp fixtures

Public Safety Building

Materials Installed	**Quantity**
CFL-14 W	7
CFL-23 W	2
CFL-27 W	1
• Pre-retrofit energy use:	600 watts
• Post-retrofit energy use:	171 watts
• Energy savings projection:	429 watts
• Pre-retrofit to post retrofit energy reduction:	72%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$223.08	39.65	$106.66
7 Hours/day	$390.39	69.39	$186.65
10 Hours/day	$557.70	99.12	$266.64
1800 Hours/year (Est.)	$401.54	71.37	$191.98

IRA/TC Owned Buildings

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

IRA Office, Health & Human Services, IRA Boardroom, KTRC Office, Kwethluk Native Store, Old Community Hall, Post Office - Old Clinic, Social Services Building

- Lighting upgrades completed in
- Retrofitted 126 light fixtures with electronic ballasts & T8 lamps
- Installed 23 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 19.053 Kilowatts
- Post-retrofit energy use for all lighting: 8.401 Kilowatts
- Energy savings projection: 10.652 Kilowatts
- 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
Locally Estimated	$12,737.80	2263.93	$6,089.98
4 Hours/day	$5,539.04	984.47	$2,648.23
7 Hours/day	$9,693.32	1722.83	$4,634.41
10 Hours/day	$13,847.60	2461.18	$6,620.58

Health & Human Services Dept. - Old, Old Clinic

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

- Pre-retrofit energy use: 2088 watts
- Post-retrofit energy use: 1013 watts
- Energy savings projection: 1075 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
4 Hours/day	$559.00	99.35	$267.26
7 Hours/day	$978.25	173.87	$467.70
10 Hours/day	$1,397.50	248.38	$668.15
1800 Hours/year (Est.)	$1,006.20	178.84	$481.07

Note: De-lamped 4 fixtures from 4-Lamp Fixtures to 3-lamp fixtures.

IRA Boardroom

Materials Installed	Quantity
CFL-27 W	2

- Pre-retrofit energy use: 200 watts
- Post-retrofit energy use: 54 watts
- Energy savings projection: 146 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
4 Hours/day	$75.92	13.49	$36.30
7 Hours/day	$132.86	23.61	$63.52
10 Hours/day	$189.80	33.73	$90.74
1500 Hours/year (Est.)	$113.88	20.24	$54.45

IRA Office

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	5
CFL-27 W	1
• Pre-retrofit energy use:	520 watts
• Post-retrofit energy use:	257 watts
• Energy savings projection:	263 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
4 Hours/day	$136.76	24.31	$65.39
7 Hours/day	$239.33	42.54	$114.42
10 Hours/day	$341.90	60.77	$163.46
1900 Hours/year (Est.)	$259.84	46.18	$124.23

KTRC Office

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	11
4-lamp electronic ballast, (3) 25 watt T8 lamps	1
CFL-20 W	3
• Pre-retrofit energy use:	1275 watts
• Post-retrofit energy use:	641 watts
• Energy savings projection:	634 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	$329.68	58.60	$157.62
7 Hours/day	$576.94	102.54	$275.84
10 Hours/day	$824.20	146.49	$394.05
1900 Hours/year (Est.)	$626.39	111.33	$299.48

Kwethluk Native Store

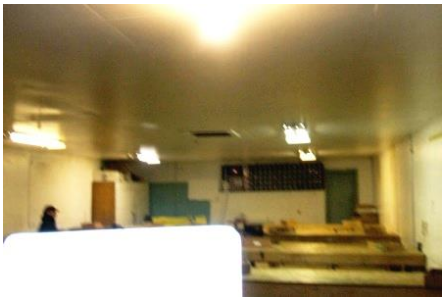
Materials Installed **Quantity**

3-lamp electronic ballast, (2) 25 watt T8 lamps	5
3-lamp electronic ballast, (3) 25 watt T8 lamps	56
• Pre-retrofit energy use:	10248 watts
• Post-retrofit energy use:	4404 watts
• Energy savings projection:	5844 watts
• Pre-retrofit to post retrofit energy reduction:	57%
• Estimated annual savings:	

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$3,038.88	540.11	$1,452.90
7 Hours/day	$5,318.04	945.19	$2,542.57
10 Hours/day	$7,597.20	1350.28	$3,632.25
2808 Hours/year (Est.)	$8,533.18	1516.63	$4,079.74

Note: Reduced 5, 4-lamp fixtures to 2-lamp fixtures, and 56, 4-lamp fixtures to 3-lamp fixtures.

Old Community Hall



Materials Installed **Quantity**

4-lamp electronic ballast, (4) 32 watt T8 lamps	5
CFL-20 W	3
CFL-27 W	1
• Pre-retrofit energy use:	1165 watts
• Post-retrofit energy use:	687 watts
• Energy savings projection:	478 watts
• Pre-retrofit to post retrofit energy reduction:	41%
• Estimated annual savings:	

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$248.56	44.18	$118.84
7 Hours/day	$434.98	77.31	$207.97
10 Hours/day	$621.40	110.44	$297.09
1440 Hours/year (Est.)	$357.93	63.62	$171.13

Post Office - Old Clinic

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	9
CFL-20 W	3

- Pre-retrofit energy use: 981 watts
- Post-retrofit energy use: 474 watts
- Energy savings projection: 507 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
4 Hours/day	$263.64	46.86	$126.05
7 Hours/day	$461.37	82.00	$220.58
10 Hours/day	$659.10	117.14	$315.12
1600 Hours/year (Est.)	$421.82	74.97	$201.68

Social Services Building

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	16
CFL-14 W	1
CFL-20 W	2
CFL-27 W	3

- Pre-retrofit energy use: 2576 watts
- Post-retrofit energy use: 871 watts
- Energy savings projection: 1705 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	$886.60	157.58	$423.89
7 Hours/day	$1,551.55	275.76	$741.80
10 Hours/day	$2,216.50	393.95	$1,059.72
1600 Hours/year (Est.)	$1,418.56	252.13	$678.22

Note: Took 8, 2-lamp fixtures off-line.

Kwethluk Incorporated Owned Buildings


3 buildings owned by the Kwethluk Incorporated received energy efficient lighting upgrades as follows:

Kwethluk Inc. Offices, Kwethluk Inc Warehouse, Kwethluk Inc. Sports Store

- Lighting upgrades completed in
- Retrofitted 52 light fixtures with electronic ballasts & T8 lamps
- Installed 39 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 6.921 Kilowatts
- Post-retrofit energy use for all lighting: 3.374 Kilowatts
- Energy savings projection: 3.547 Kilowatts
- 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
Locally Estimated	$3,662.51	650.95	$1,751.06
4 Hours/day	$1,844.44	327.82	$881.83
7 Hours/day	$3,227.77	573.68	$1,543.21
10 Hours/day	$4,611.10	819.55	$2,204.58

Kwethluk Inc. Offices

Materials Installed	**Quantity**
CFL-14 W	14
CFL-20 W	15
CFL-27 W	10
• Pre-retrofit energy use:	2340 watts
• Post-retrofit energy use:	766 watts
• Energy savings projection:	1574 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	$818.48	145.47	$391.32
7 Hours/day	$1,432.34	254.57	$684.81
10 Hours/day	$2,046.20	363.68	$978.29
1920 Hours/year (Est.)	$1,571.48	279.30	$751.33

Kwethluk Inc Warehouse

Materials Installed	**Quantity**
8 ft fixture, 2 lamp electronic ballast, (2) 59 watt T8	3
• Pre-retrofit energy use:	465 watts
• Post-retrofit energy use:	354 watts
• Energy savings projection:	111 watts
• Pre-retrofit to post retrofit energy reduction:	24%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$57.72	10.26	$27.60
7 Hours/day	$101.01	17.95	$48.29
10 Hours/day	$144.30	25.65	$68.99
1000 Hours/year (Est.)	$57.72	10.26	$27.60

Kwethluk Inc. Sports Store

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	49
• Pre-retrofit energy use:	4116 watts
• Post-retrofit energy use:	2254 watts
• Energy savings projection:	1862 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	$968.24	172.09	$462.92
7 Hours/day	$1,694.42	301.16	$810.11
10 Hours/day	$2,420.60	430.22	$1,157.30
2100 Hours/year (Est.)	$2,033.30	361.39	$972.13

Lower Kuskokwim School District Owned Buildings



2 buildings and 8 teacher housing units owned by the Lower Kuskokwim School District received energy efficient lighting upgrades as follows: Ket'acik/Aapalluk Memorial School

Utility Building, School Gym, KW09 – Teacher, KW11 – Teacher, KW12 – Teacher, KW13 – Teacher, KW14 – Teacher, KW18 – Teacher, KW19 – Teacher, KW20 – Teacher, School Gym, Utility Building Totals

- Lighting upgrades completed in
- Retrofitted 4 light fixtures with electronic ballasts & T8 lamps
- Installed 118 compact fluorescent light bulbs
- Installed 8 T5 linear fluorescent fixtures in the Gym
- Pre-retrofit energy use for all lighting: 12.068 Kilowatts
- Post-retrofit energy use for all lighting: 5.278 Kilowatts
- Energy savings projection: 6.79 Kilowatts
- 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
Locally Estimated	$4,551.04	808.87	$2,175.87
4 Hours/day	$3,530.80	627.54	$1,688.09
7 Hours/day	$6,178.90	1098.20	$2,954.15
10 Hours/day	$8,827.00	1568.85	$4,220.22

Utility Building Totals

Materials Installed	Quantity
CFL-27 W	6
CFL-40 W	8
• Pre-retrofit energy use:	1400 watts
• Post-retrofit energy use:	482 watts
• Energy savings projection:	918 watts
• Pre-retrofit to post retrofit energy reduction:	66%

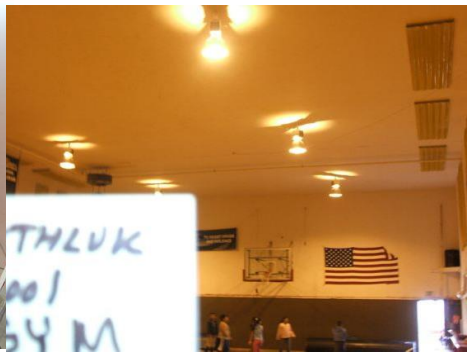
• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$477.36	84.84	$228.23
7 Hours/day	$835.38	148.48	$399.40
10 Hours/day	$1,193.40	212.11	$570.57
500 Hours/year (Est.)	$238.68	42.42	$114.11

School Gym

Kwethluk, Ket'acik/Aapalluk Memorial School Gym

New T5 Fluorescent Lighting, 27 – 30 Ave foot candles and CRI of 85



Former 400w HID Lighting, 5 - 10 Ave foot candles and CRI of 30 - 40

Materials Installed	**Quantity**
T5 fixture, electronic ballast, (6) 54 watt T5 HO	8
• Pre-retrofit energy use:	3320 watts
• Post-retrofit energy use:	2736 watts
• Energy savings projection:	584 watts
• Pre-retrofit to post retrofit energy reduction:	18%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$303.68	53.97	$145.19
7 Hours/day	$531.44	94.45	$254.08
10 Hours/day	$759.20	134.94	$362.98
1750 Hours/year (Est.)	$531.44	94.45	$254.08

Note on energy reduction for the Kwethluk School gym:

Generally we see a larger savings percentage pre to post retrofit with our T5 lighting projects. In the case of the Kwethluk School gym however, the original lighting design for the space provided extremely low light levels – an average of 5 to 10 existing foot-candles. Bringing light levels up to an acceptable standard of ~30 foot-candles resulted in reduced but still substantial pre to post savings. We pursued the measure considering all labor was provided in-kind by the Lower Kuskokwim School District, and due to the substantial community benefit achieved.

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.

Kwethluk - Alaska Building Science Network - T5 Lighting Upgrade Details

These retrofits were completed in (June, 2009).

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**
Late 70' mid	84	49.5	21	HPS 150 watt		160	**0**	5 to 10	27-30		T-5 2 lamps	114	**0**
Color shade of walls	dirty white, off-green			HPS 250 watt		260	**0**	Mid (of) 58 gym			T-5 3 lamps	171	**0**
Color shade of floor	yellow		HPS ballast 551	LU400 400 watt	8	415	**3,320**	End027, Mid-End 27			T-5 4 lamps	228	**0**
				Other School Gym (A)			**0**			8	T-5 6 lamps	342	**2736**
					Total Existing Watts		3,320				Total New Watts		2736

Percent Savings Pre to Post Retrofit:	**17.59%**

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: $ 0.52 /kWh

Watts of existing lighting: 3,320

New wattage for T5 fixtures: 2,736

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

Existing Cost: $3,021

Retrofitted Cost: $2,490

Annual Savings: $ $531

T5 Materials costs $1,800.00

T5 shipping costs $200.00

Material & shipping cost of Gym retrofit: $ 2,000.00

Simple Payback: Materials cost / annual savings = **3.76** years (for retrofit to pay for itself in materials)

KW09 - Teacher Housing

Materials Installed	Quantity
CFL-14 W	4
CFL-20 W	9
CFL-23 W	8
CFL-27 W	2

- Pre-retrofit energy use: 1825 watts
- Post-retrofit energy use: 474 watts
- Energy savings projection: 1351 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
4 Hours/day	$702.52	124.86	$335.88
7 Hours/day	$1,229.41	218.51	$587.78
10 Hours/day	$1,756.30	312.15	$839.69
1375 Hours/year (Est.)	$965.97	171.68	$461.83

KW11 - Teacher Housing

Materials Installed	Quantity
CFL-14 W	9
CFL-23 W	1
CFL-27 W	3
CFL-9 W	5

- Pre-retrofit energy use: 1035 watts
- Post-retrofit energy use: 275 watts
- Energy savings projection: 760 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
4 Hours/day	$395.20	70.24	$188.95
7 Hours/day	$691.60	122.92	$330.66
10 Hours/day	$988.00	175.60	$472.37
1375 Hours/year (Est.)	$543.40	96.58	$259.80

KW12 - Teacher Housing

Materials Installed	Quantity
CFL-14 W	2
CFL-20 W	9
CFL-23 W	6

- Pre-retrofit energy use: 1110 watts
- Post-retrofit energy use: 346 watts
- Energy savings projection: 764 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	$397.28	70.61	$189.94
7 Hours/day	$695.24	123.57	$332.40
10 Hours/day	$993.20	176.52	$474.85
1375 Hours/year (Est.)	$546.26	97.09	$261.17

KW13 - Teacher Housing

Materials Installed	Quantity
CFL-14 W	7
CFL-20 W	1
CFL-23 W	3
CFL-9 W	6
• Pre-retrofit energy use:	915 watts
• Post-retrofit energy use:	241 watts
• Energy savings projection:	674 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
4 Hours/day	$350.48	62.29	$167.57
7 Hours/day	$613.34	109.01	$293.24
10 Hours/day	$876.20	155.73	$418.91
1375 Hours/year (Est.)	$481.91	85.65	$230.40

KW14 - Teacher Housing

Materials Installed	Quantity
CFL-14 W	2
CFL-20 W	4
CFL-23 W	4
CFL-9 W	2
• Pre-retrofit energy use:	720 watts
• Post-retrofit energy use:	218 watts
• Energy savings projection:	502 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	$261.04	46.40	$124.80
7 Hours/day	$456.82	81.19	$218.41
10 Hours/day	$652.60	115.99	$312.01
1375 Hours/year (Est.)	$358.93	63.79	$171.61

KW18 - Teacher Housing

Materials Installed	Quantity
CFL-14 W	1
CFL-20 W	2
• Pre-retrofit energy use:	210 watts
• Post-retrofit energy use:	54 watts
• Energy savings projection:	156 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
4 Hours/day	$81.12	14.42	$38.78
7 Hours/day	$141.96	25.23	$67.87
10 Hours/day	$202.80	36.04	$96.96
1375 Hours/year (Est.)	$111.54	19.82	$53.33

KW19 - Teacher Housing

Materials Installed	Quantity
CFL-14 W	2
CFL-20 W	9
• Pre-retrofit energy use:	1020 watts
• Post-retrofit energy use:	208 watts
• Energy savings projection:	812 watts
• Pre-retrofit to post retrofit energy reduction:	80%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$422.24	75.05	$201.87
7 Hours/day	$738.92	131.33	$353.28
10 Hours/day	$1,055.60	187.62	$504.69
1375 Hours/year (Est.)	$580.58	103.19	$277.58

KW20 - Teacher Housing

Materials Installed	Quantity
2-lamp electronic ballast, (2) 25 watt T8 lamps	4
CFL-20 W	3
• Pre-retrofit energy use:	513 watts
• Post-retrofit energy use:	244 watts
• Energy savings projection:	269 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
4 Hours/day	$139.88	24.86	$66.88
7 Hours/day	$244.79	43.51	$117.03
10 Hours/day	$349.70	62.15	$167.19
1375 Hours/year (Est.)	$192.34	34.18	$91.96

Church Owned Buildings

3 Community Church Buildings received energy efficient lighting upgrades as follows:

Moravian Church, Russian Orthodox Church, Russian Orthodox Quarters

- Lighting upgrades completed in
- Retrofitted 10 light fixtures with electronic ballasts & T8 lamps
- Installed 46 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 5.196 Kilowatts
- Post-retrofit energy use for all lighting: 1.87 Kilowatts
- Energy savings projection: 3.326 Kilowatts
- 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
Locally Estimated	$1,383.62	245.91	$661.51
4 Hours/day	$1,729.52	307.39	$826.89
7 Hours/day	$3,026.66	537.94	$1,447.06
10 Hours/day	$4,323.80	768.48	$2,067.22

Moravian Church

Materials Installed	**Quantity**
CFL-23 W	26

- Pre-retrofit energy use: 2450 watts
- Post-retrofit energy use: 598 watts
- Energy savings projection: 1852 watts
- Pre-retrofit to post retrofit energy reduction: 76%
- Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$963.04	171.16	$460.43
7 Hours/day	$1,685.32	299.54	$805.76
10 Hours/day	$2,407.60	427.91	$1,151.08
800 Hours/year (Est.)	$770.43	136.93	$368.35

Russian Orthodox Church

Materials Installed	**Quantity**
8 ft fixture, 2 lamp electronic ballast, (2) 59 watt T8	6
CFL-14 W	6
CFL-20 W	3
CFL-27 W	4

- Pre-retrofit energy use: 1915 watts
- Post-retrofit energy use: 960 watts
- Energy savings projection: 955 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	$496.60	88.26	$237.43
7 Hours/day	$869.05	154.46	$415.50
10 Hours/day	$1,241.50	220.66	$593.57
800 Hours/year (Est.)	$397.28	70.61	$189.94

Russian Orthodox Living Quarters

Materials Installed	**Quantity**
2-lamp electronic ballast, (2) 25 watt T8 lamps	4
CFL-14 W	2
CFL-20 W	5
• Pre-retrofit energy use:	831 watts
• Post-retrofit energy use:	312 watts
• Energy savings projection:	519 watts
• Pre-retrofit to post retrofit energy reduction:	62%

• Estimated annual savings:

Hours Per Day / 250 Days Per Year	Electrical Savings	Comparative Avoided Diesel Use (gal)	Comparative Avoided Diesel Costs
4 Hours/day	$269.88	47.97	$129.03
7 Hours/day	$472.29	83.94	$225.80
10 Hours/day	$674.70	119.92	$322.58
800 Hours/year (Est.)	$215.90	38.37	$103.22