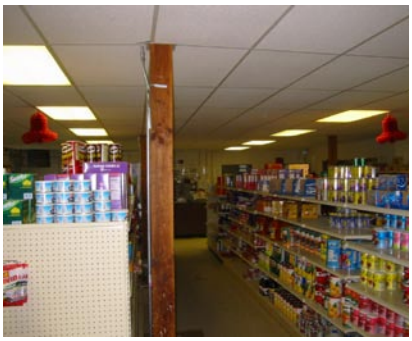
Village End Use Energy Efficiency Measures Program '05 – '06
AEA Grant # 2195234 Administered by Alaska Building Science Network

Quinhagak Final Report





Community Summary

7 Community buildings and 4 teacher housing units received energy efficiency upgrades December 2006 – Summer 2007

Public Safety Building, Water Treatment Plant, Headstart, City/NVK Building, Main Store, Hardware, Quinhagak School and 4 Teacher Housing Units

Village-Wide Lighting Retrofit Summary:

- Retrofitted 148 light fixtures village-wide with electronic ballasts and T8 lamps
- Installed: 78 compact fluorescent light bulbs village-wide
- T5 Light fixtures were installed in the school gym
- Pre-retrofit energy use for all lighting: 24,180 watts
- Post-retrofit energy use for all lighting: 14,279 watts
- Energy savings projection: 9,901 watts (9.90 kW)
- **Pre-retrofit to post retrofit energy reduction**: 41 %

- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$4,653	738 Gallons	$1,351
7 Hours	$8,144	1,292 Gallons	$2,365
10 Hours	$11,634	1,846 Gallons	$3,378

- Total project cost for all measures: $ 37,250
- Simple mean payback*: 4.57 Years
  *(All grant funds, but accounting for lighting savings only)
- Total village wide in-kind contribution: $ 7,408

Additional Energy Efficiency Measures: (Budget Expense: $ 5,377)

- 16 hour energy efficiency boiler training for 2 local maintenance staff – at Bethel regional Boiler training in March, 2006 (Training hours provided in-kind by ABSN.)

Quinhagak City Owned Buildings

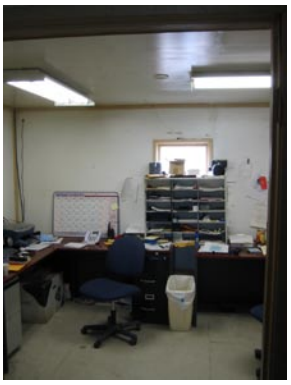
Energy efficient lighting upgrades were completed in four buildings owned by the City of Quinhagak.

City owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in December 2006
- Retrofitted 71 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 39 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 8,176 watts
- Post-retrofit energy use for all lighting: 4,042 watts
- Energy savings projection: 4,134 watts (4.13 kW)
- **Pre-retrofit to post retrofit energy reduction**: 51 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$1,943	308 Gallons	$564
7 Hours	$3,400	539 Gallons	$987
10 Hours	$4,857	771 Gallons	$1,410

Public Safety Building



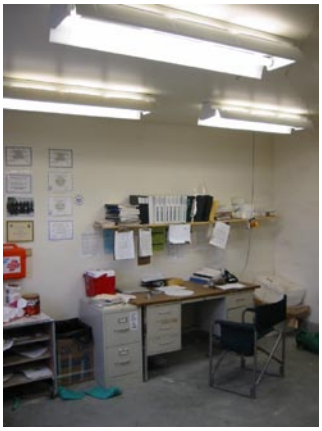
Materials Installed	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
Public Safety Building	6	0	0	4	0	1	0

- Pre-retrofit energy use: 1,221 watts
- Post-Retrofit Energy Use: 662 watts
- Energy savings projection: 559 watts (.56 Kw)

- **Pre-retrofit to post retrofit energy reduction**: 46 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$263	42 Gallons	$76
7 Hours	$460	73 Gallons	$133
10 Hours	$657	104 Gallons	$191

Water Treatment Plant



Materials Installed	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
Water Treatment Building	25	0	0	0	0	0	0

- Pre-retrofit energy use: 2,100 watts
- Post-Retrofit Energy Use: 1,175 watts
- Energy savings projection: 925 watts (.93 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 44 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$435	69 Gallons	$126
7 Hours	$761	121 Gallons	$221
10 Hours	$1,087	172 Gallons	$316

Headstart Building

Materials Installed	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
Headstart Building	0	0	0	36	0	0

- Pre-retrofit energy use: 2,160 watts
- Post-Retrofit Energy Use: 468 watts
- Energy savings projection: 1,692 watts (1.69 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 78 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$795	126 Gallons	$231
7 Hours	$1,392	221 Gallons	$404
10 Hours	$1,988	315 Gallons	$577

Notes: Since the Head-start building was originally lit by 36 incandescent bulbs, retrofits were simple and comparative savings will be huge.

City/NVK Office Buildings

Materials Installed	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
City/NVK Building	36	0	0	0	0	1	1

- Pre-retrofit energy use: 2,695 watts
- Post-Retrofit Energy Use: 1,737 watts

- Energy savings projection: 958 watts (.96 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 36 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$450	71 Gallons	$131
7 Hours	$788	125 Gallons	$229
10 Hours	$1,126	179 Gallons	$327

Native Village of Kwinhagak (NVK) Owned Buildings

Energy efficient lighting upgrades were completed in one building owned by the Native Village of Kwinhagak (NVK).

Traditional Council Bingo Hall - Lighting Retrofit Summary:

- Lighting upgrades completed in December, 2006
- Retrofitted 10 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 3 compact fluorescent light bulbs

Materials Installed	4-Lamp Ballasts 32w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
Traditional Council Bingo Hall	1	9	0	0	0	3	0

- Pre-retrofit energy use for all lighting: 1,103 watts
- Post-retrofit energy use for all lighting: 765 watts
- Energy savings projection: 338 watts (.34 kW)
- **Pre-retrofit to post retrofit energy reduction**: 31 %

- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$159	25 Gallons	$46
7 Hours	$278	44 Gallons	$81
10 Hours	$397	63 Gallons	$115

Qanirtuuq, Incorporated Owned Buildings

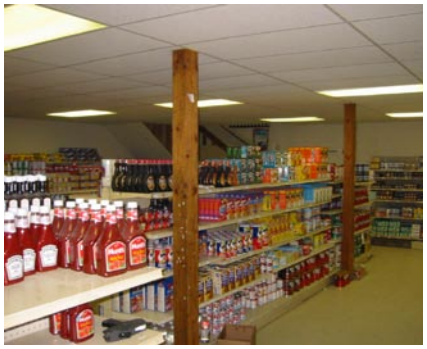
Energy efficient lighting upgrades were completed in two buildings owned by Qanirtuuq, Inc

Village Corporation owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in December 2006
- Retrofitted 63 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 7 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 9,458 watts
- Post-retrofit energy use for all lighting: 6,515 watts
- Energy savings projection: 2,943 watts (2.94 kW)
- **Pre-retrofit to post retrofit energy reduction**: 31 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$1,383	219 Gallons	$402
7 Hours	$2,421	384 Gallons	$703
10 Hours	$3,458	549 Gallons	$1,004

Main Store



Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
Corp Main Store	2	46	0	0	0	0	6

- Pre-retrofit energy use: 8,308 watts
- Post-Retrofit Energy Use: 5,790 watts
- Energy savings projection: 2,518 watts (2.52 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 30 %

- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$1,183	188 Gallons	$344
7 Hours	$2,071	329 Gallons	$601
10 Hours	$2,959	469 Gallons	$859

Hardware Store

Materials Installed	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
Corp Hardware Store	15	0	0	0	0	1	0

- Pre-retrofit energy use: 1,150 watts
- Post-Retrofit Energy Use: 725 watts
- Energy savings projection: 425 watts (.43 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 37 %

- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$200	32 Gallons	$58
7 Hours	$350	55 Gallons	$101
10 Hours	$499	79 Gallons	$145

Notes: Most of the existing lighting in these teacher housing units were circular fluorescent fixtures which are actually an older application of fluorescent T8 lighting, so the existing energy use of those fixtures could not be improved on. School maintenance staff changed out the 4 existing T12 fluorescent fixtures and all incandescent bulbs to achieve a 68% overall savings.

Lower Kuskokwim School District Owned Buildings - Quinhagak School

Energy efficient lighting upgrades were completed in four teacher housing units owned by the Lower Kuskokwim School District.

School owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in December 2006
- Retrofitted 71 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 39 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 5,443 watts
- Post-retrofit energy use for all lighting: 2,957 watts
- Energy savings projection: 2,486 watts (2.49 kW)
- **Pre-retrofit to post retrofit energy reduction**: 46 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$1,168	185 Gallons	$339
7 Hours	$2,045	324 Gallons	$594
10 Hours	$2,921	463 Gallons	$848

Teacher Housing Units

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
Teacher Housing	3	1	0	0	29	0	0

- Pre-retrofit energy use: 2,146 watts
- Post-Retrofit Energy Use: 677 watts
- Energy savings projection: 1,469 watts (1.47 Kw)
- **Pre-retrofit to post retrofit energy reduction**: 68 %
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$690	110 Gallons	$200
7 Hours	$1,208	192 Gallons	$351
10 Hours	$1,726	274 Gallons	$501

Notes: Most of the teacher housing was already furnished with circular fluorescents which are relatively energy efficient. This meant only a few fixtures could be upgraded in LKSD facilities. Still 29 incandescents were changed to CFLs resulting in an overall 68% savings.

High Output T5 Lighting Upgrades for the Quinhagak School Gym

Quinhagak School

Existing157 watt HPS lighting

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	$478	76 Gallons	$139
7 Hours	$836	133 Gallons	$243
10 Hours	$1,195	190 Gallons	$347

Notes: When the new T5 fixtures are installed during the summer recess of ’07, the new energy use will be reduced by about 31% overall. Switching options will provide opportunity to achieve even more savings by choosing to power partial lighting. The following page details this lighting upgrade that will be installed by in-kind labor provided by LKSD. ABSN will keep AEA appraised of progress and provide pictures of the finished T5 upgrades.

Quinhagak School, T5 Lighting Upgrade Details - ABSN Energy Efficiency Projects '05-'06

These retrofits will be completed during summer recess of 2007 per LKSD.

Gym	Length (feet)	Width (feet)	Ceiling Height (feet)	# of Existing Fixtures	Existing Fixture Wattage	**Total Existing Wattage**	Existing Foot-candles	New Foot-Candles	# of New Fixtures	lamps / fixture	New Fixture Wattage	**Total New Wattage**
	61	46	sloping 16'-25'	21	157	3297	25 JW	38	8	3	171	1368
New T5 wattage = 57 watts / lamp, which includes ballast wattage									4	4	228	912
												2280

Total New wattage for gym = 31% savings

Savings & Payback Calculation for Gym:

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

Full cost of electricity: $0.47 /kWh

Watts of existing lighting: 3,297

New wattage for T5 fixtures: 2,280

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

Existing Cost: $2,712

Retrofitted Cost: $1,875

Annual Savings: $ $836

Material & shipping cost of Gym retrofit: $4,055.56

Simple Payback: Materials cost / annual savings = **4.848350085** years (to pay for job in materials and shipping)

Bethel Boiler Training at Yuut Elitnaurviat Learning Center, March 24 & 25, 2006

16 hours of classroom time at the Learning Center Shop

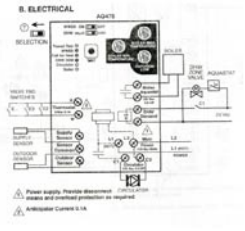
Blue plastic cases are Bacharach flu gas analyzer kits – taken back to villages by maintenance staff

Training on oil burner combustion efficiency

Quinhagak maintenance staff: Norman Cleveland and Adolph Pleasant traveled to Bethel March 24 and 25, 2006 participate in this training. ABSN partnered with Bethel Community Services Association, YKHC's Yuut Elitnaurviat Learning Center and AVCP Housing Authority to provide ABSN's 16-hour boiler training course to 7 rural maintenance staff from VEUEEM grant villages. Charlie Deer's training hours were covered by $2,100 in matching funds from ABSN through AHFC grants. AEA VEUEEM grant funds were used to cover air fare and lodging in Bethel for the following maintenance staff from this grant's villages: **Chefornak**: Bernard Mael, **Kongiganak**: John Phillip, **Kwigillingok**: Benedict White, **Mekoryuk**: Alvin David, **Quinhagak**: Norman Cleveland and Adolph Pleasant. Andrew Lind of Port Heiden (NW-SW Region VEUEEM grant) was also brought to Bethel for this class.

Components of a Bacharach Flu Gas Analyzing Kit used in boiler efficiency training and left with capable maint staff

Smoke-test kit for analyzing flu gases for boiler efficiency



Schematic of outdoor temperature sensing boiler control

During this training 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, programable thermostats, etc.

Quinhagak, In-Kind Contribution Tracking Record - ABSN Energy Efficiency Projects:

Village entities worked with: Tribe, City, Village Corp, School District.

In-Kind Item	Dates	Hours Contri-buted	Hourly Wage	Value / Amount	Notes
Staff time for project contact, introduction, and reviewof intro materials (Number of entities x 1 hour each)		4	$15.00	$60.00	Hrs contributed column indicates # of entities we worked with in the village. $15 / hr is our estimated average wage for local village staff: Tribal Administrators, City Clerks, Facilities Managers, maintenance staff, etc.
Staff time for Attending teleconference - all entities village-wide		16.5	$15.00	$247.50	Hrs contributed column indicates length of telecon multiplied by # of village telecon participants
Tribal Maint. Staff time for initial lighting research		6	$12.00	$72.00	list hrs of in-kind staff assisting FM on building assessments.
CityMaint. Staff time for initial lighting research		4	$12.00	$48.00	
Vilage Corp Maint. Staff time to for initial lighting research		4	$12.00	$48.00	
School Maint. Staff time for initial lighting research		3	$12.00	$36.00	
Village office administrative percentage of total project cost less ABSN Admin %. Total project cost = $37,250/village - (our admin percentage , (around 9%) Approx: $3,352) = $33,897 x 5% = $1,694 (this 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 project support.	Jan '05 - Jan '07			$1,694.00	Each time we call, email, or fax a village entity, someone has to receive the communication, review and/or foward the information, follow-up on requests, etc. Wether 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 ammount.
Lodging for ABSN Field Managers - all site visits				$360.00	6 nights @ $60/night
Transportation and fuel costs - all site visits				$200.00	5 days 4-wheeler rental @ $40/day
School & teacher housing lighting upgrades		5	18	$90.00	local maint staff - to change out 4, linear fluorescent fixtures and 29 CFLs.
School T5 Gym lighting upgrades				$4,500.00	Comparable estimate - In-kind labor, provided by school district - includes airfare & perr diem and lodging.
Employer expense for Workman's Comp		1050	0.05	$52.50	Generic multiplier: .05 x gross payroll of village labor
	TOTAL			$7,408.00	