

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

Mekoryuk Final Report



Community Summary

8 Community buildings and 4 teacher housing units received energy efficiency upgrades October '05 – Summer '07

Mekoryuk IRA Office, Old City/Clinic, Public Safety Bldg., Washeteria, NIMA Corporation Office, Store, Warehouse, Mekoryuk High School Multipurpose and 4 LKSD Teacher Housing Units.

Village-Wide Lighting Retrofit Summary:

- Retrofitted 129 light fixtures village-wide with electronic ballasts and T8 lamps
- Installed: 136 compact fluorescent light bulbs village-wide
- T5 Light fixtures were installed in the school gym
- Pre-retrofit energy use for all lighting: 23,711 watts
- Post-retrofit energy use for all lighting: 12,855 watts
- Energy savings projection: 10,856 watts (10.86 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	\$5,102	778 Gallons	\$1,423
7 Hours	\$8,929	1,361 Gallons	\$2,490
10 Hours	\$12,756	1,944 Gallons	\$3,558

- Total project cost for village lighting: \$ 37,250
- Simple payback (lighting measures only): 4.17 Years
- Total village wide in-kind contribution: \$ 9,255

Additional Energy Efficiency Measures: (Budget Expense: \$ 5,144)

- 16 hour energy efficiency boiler training for 1 local maintenance staff – at Bethel regional Boiler training in March, 2006 (Classroom hours provided in-kind by ABSN).
- Three programmable thermostats were installed village wide

Mekoryuk City Owned Buildings

City owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in October, 2005
- Retrofitted 61 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 22 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 7,601 watts
- Post-retrofit energy use for all lighting: 3,987 watts
- Energy savings projection: 3,614 watts (3.61 kW)
- **Pre-retrofit to post retrofit energy reduction: 48 %**
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$1,699	259 Gallons	\$474
7 Hours	\$2,973	453 Gallons	\$829
10 Hours	\$4,246	647 Gallons	\$1,184

Old Clinic/City Office Building



T8 lamps installed in Old City Office/Clinic.



Clifford Whitman and Alvin David work on a light fixture.



Programmable thermostat replaces old thermostat.

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	13w CFL	25w CFL
Old Clinic/Old City Office	4	3	5	6	2

- Pre-retrofit energy use: 2,670 watts
- Post-Retrofit Energy Use: 963 watts
- Energy savings projection: 1,707 watts (1.71 Kw)
- **Pre-retrofit to post retrofit energy reduction: 64 %**
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$802	122 Gallons	\$224
7 Hours	\$1,404	214 Gallons	\$392
10 Hours	\$2,006	306 Gallons	\$559

Notes: All 4-lamp fixtures de-lamped to 2-lamps while five total fixtures were taken offline for additional savings. Programmable thermostat also installed.

Public Safety Building



T8 lamps installed in Public Safety Building.



Alvin David works on a fixture.



Old High Output fixture taken off line.

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
Public Safety Building	9	0	0	2	0	1	0

- Pre-retrofit energy use: 1,235 watts
- Post-Retrofit Energy Use: 748 watts
- Energy savings projection: 487 watts (.49 Kw)
- **Pre-retrofit to post retrofit energy reduction: 39 %**
- **Estimated Annual Savings:**

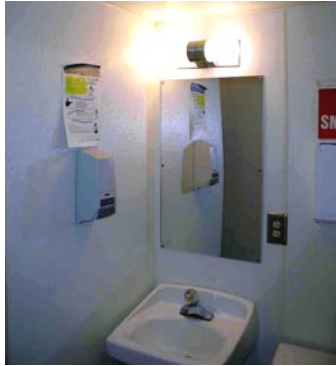
Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$229	35 Gallons	\$64
7 Hours	\$401	61 Gallons	\$112
10 Hours	\$572	87 Gallons	\$160

Notes: Twelve High output fluorescent fixtures were taken offline while the remaining nine standard fixtures were upgraded with T-8 lamps and electronic ballasts. This strategy greatly reduced over-all wattage and improved light levels in this building.

Water Treatment Plant / Washeteria



Washeteria lobby with T8 upgrades.



CFLs installed in shower room.



Malfunctioning photo sensor replaced on outside security light.

Materials Installed	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL	4ft 1-Lamp Fixtures 32w lamps
Water Treatment / Washeteria	22	0	15	6	7	0	1

- Pre-retrofit energy use: 3,696 watts
- Post-Retrofit Energy Use: 2,276 watts
- Energy savings projection: 1,420 watts (1.42 Kw)
- **Pre-retrofit to post retrofit energy reduction: 38 %**
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$667	102 Gallons	\$186
7 Hours	\$1,168	178 Gallons	\$326
10 Hours	\$1,669	254 Gallons	\$465

Notes: One programmable thermostat was installed in the main lobby and three malfunctioning photo sensors were replaced on outside security lights enabling them to turn off during daylight hours.

Mekoryuk IRA Owned Buildings



IRA Office



T8 lamps installed in IRA boardroom



Hallway.

Mekoryuk IRA Traditional Council Office - Lighting Retrofit Summary:

- Lighting upgrades completed in October, 2005
- Retrofitted 16 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 11 compact fluorescent light bulbs

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
IRA Building	16	0	0	6	4	1

- Pre-retrofit energy use for all lighting: 1,880 watts
- Post-retrofit energy use for all lighting: 1,015 watts
- Energy savings projection: 865 watts (.87 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	\$407	62 Gallons	\$113
7 Hours	\$711	108 Gallons	\$198
10 Hours	\$1,016	155 Gallons	\$283

Mekoryuk Village Corporation Owned Buildings

Village Corporation Owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in October, 2005
- Retrofitted 41 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 20 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 4,565 watts
- Post-retrofit energy use for all lighting: 2,891 watts
- Energy savings projection: 1,674 watts (1.67 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	\$787	120 Gallons	\$219
7 Hours	\$1,377	210 Gallons	\$384
10 Hours	\$1,967	300 Gallons	\$549

NIMA Corporation Board Office



NIMA Corporation office building.



Faulty motion sensor replaced on security light.

Materials Installed	2-Lamp Ballasts 32w lamps			
	13w CFL	20w CFL	25w CFL	
NIMA Corp Board Office	5	1	1	0

- Pre-retrofit energy use: 485 watts
- Post-Retrofit Energy Use: 333 watts
- Energy savings projection: 152 watts (.15 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	\$71	11 Gallons	\$20
7 Hours	\$125	19 Gallons	\$35
10 Hours	\$179	27 Gallons	\$50

Notes: One faulty motion sensor was replaced on an outdoor security light for additional energy savings.

Main Store



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
Main Store	36	0	0	0	1	2	2

- Pre-retrofit energy use: 2,930 watts
- Post-Retrofit Energy Use: 2,263 watts
- Energy savings projection: 667 watts (.67 Kw)
- **Pre-retrofit to post retrofit energy reduction: 23 %**
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$313	48 Gallons	\$87
7 Hours	\$549	84 Gallons	\$153
10 Hours	\$784	119 Gallons	\$219

Notes: One programmable thermostat was installed for fuel savings.

Warehouse

Village Corp Buildings	2-Lamp Ballasts 32w lamps	4-Lamp Ballasts 25w lamps	20w CFL	25w CFL
Warehouse	0	0	6	7

- Pre-retrofit energy use: 1,150 watts
- Post-Retrofit Energy Use: 295 watts
- Energy savings projection: 855 watts (.86 Kw)
- **Pre-retrofit to post retrofit energy reduction: 74 %**
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$402	61 Gallons	\$112
7 Hours	\$703	107 Gallons	\$196
10 Hours	\$1,005	153 Gallons	\$280

Lower Kuskokwim School District Owned Buildings - Mekoryuk School

School owned Buildings - Lighting Retrofit Summary:

- Lighting upgrades completed in Summer 2007
- Retrofitted 11 linear fluorescent fixtures with T8 lamps and electronic ballasts
- Installed: 83 compact fluorescent light bulbs
- Pre-retrofit energy use for all lighting: 9,665 watts
- Post-retrofit energy use for all lighting: 4,962 watts
- Energy savings projection: 4,703 watts (4.70 kW)
- **Pre-retrofit to post retrofit energy reduction: 49 %**
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$2,210	337 Gallons	\$617
7 Hours	\$3,868	590 Gallons	\$1,079
10 Hours	\$5,526	842 Gallons	\$1,541

Teacher Housing



Used incandescent bulbs replaced with CFLs in one LKSD teacher housing unit.

Materials Installed	2-Lamp Ballasts 32w lamps	2-Lamp Ballasts 25w lamps	2-Lamp Fixtures 3-lamp ballasts 25w lamps	4-Lamp Ballasts 25w lamps	13w CFL	20w CFL	25w CFL
Teacher Housing	2	5	2	2	45	14	24

- Pre-retrofit energy use: 5,790 watts
- Post-Retrofit Energy Use: 2,112 watts
- Energy savings projection: 3,678 watts (3.68 Kw)
- **Pre-retrofit to post retrofit energy reduction: 64 %**
- **Estimated Annual Savings:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$1,729	263 Gallons	\$482
7 Hours	\$3,025	461 Gallons	\$844
10 Hours	\$4,322	659 Gallons	\$1,205

Notes: Various CFL wattage combinations and de-lamping greatly improved light levels in living spaces while substantially reducing over-all energy use.

High Output T5 Lighting Upgrades for the School Gym

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs
4 Hours	\$482	73 Gallons	\$134
7 Hours	\$843	128 Gallons	\$235
10 Hours	\$1,204	184 Gallons	\$336

For Mekoryuk High School, the school gym/multi-purpose room will be retrofitted during the summer '07 recess with 4', linear T5 fluorescent light fixtures providing much improved light quality at reduced energy use. Twenty-five high-pressure sodium fixtures, operating at 157 watts each, will be replaced by twenty-five, 2-lamp T5 fixtures operating at 114 watts each. This upgrade will greatly improve light levels with an estimated 27% savings in total wattage.

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

These retrofits will be completed by LKSD before fall school session '07.

Mekoryuk Gym	Length (feet)	Width (feet)	Ceiling Hieght (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
	75	56	20	25	157	3,925	USKH says 41	38	25	2	114	2850

New T5 wattage = 57 watts / lamp, which includes ballast wattage

DL, fc = direct-(40-ish)
indirect (25-30)

Total New wattage for gym = 27% savings

Savings & Payback Calculation for Gym:

27.38853503

Assume 1,750 hrs / year for 250 days/year of use

Full cost of electricity: \$0.47 /kWh

Watts of existing lighting: 3,925

New wattage for T5 fixtures: 2,850

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

Existing Cost: \$3,228

Retrofitted Cost: \$2,344

Annual Savings: \$884

Material & shipping cost of Gym retrofit: \$5,851.00

Simple Payback: Materials cost / annual savings = **6.617374708** years (for retrofit to pay for itself in materials)

T12 Lamp and magnetic ballast recycling

All waste lamps and ballasts were removed from the community for recycling including forty-four PCB ballasts.



PCB Ballast drum.



Old magnetic ballast.



Waste lamps and ballasts prepared for 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

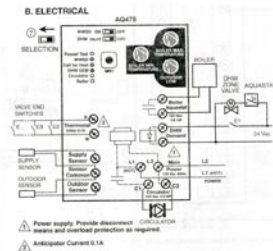
Mekoryuk maintenance staff: Alvin David traveled to Bethel March 24 and 25, 2006 to participate in this training. ABSN partnered with Bethel Community Services Association, YKHC's Yuut Elitnaurviat Learning Center and AVCP Housing Authority to provide ABSN's 16 hour boiler training course to 7 rural maintenance staff. Charlie deer's training hours were covered by \$2,100 in matching funds from ABSN. AEA VEUEEM grant funds were used to cover air fair 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 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.

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

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

In-Kind Item	Dates	Hours Contributed	Hourly Wage	Value / Amount	Notes
Staff time for project contact, introduction, and review of 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		6	\$15.00	\$90.00	Hrs contributed column indicates length of telecon multiplied by # of village telecon participants
Office manager and/or Staff time for site visit set-up		6	\$15.00	\$90.00	city, tribal, corp store manager mtg time 1.5 hrs.
Maint. Staff all entities - research and record lighting counts and PCB info. City/TC - 6 hrs, School - 4 hours, Village Corp - 5 hours		9	\$14.00	\$126.00	After we discovered USKH counts were quite spotty in the West region we asked some villages to re-do counts and check for PCBs
Maint. Staff time to attend ABSN training		6	\$14.00	\$84.00	Hrs contributed column indicates length of training multiplied by # of in-kind training participants
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 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	Jan/Dec 2006	4	\$75.00	\$300.00	For Dan Lung to stay through Native village of Mekoryuk
Transportation and fuel costs - 1st assessment site-visit				\$50.00	NIMA Corp. transport of waste ballasts/lamps to airstrip x2
LKSD local maint labor for T8 retrofits		120	\$15.00	\$1,800.00	
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.
LKSD local maint labor for T5 retrofits		24	\$15.00	\$360.00	
Employer expense for Workman's Comp		2035	0.05	\$101.75	Generic multiplier: .05 x gross payroll of village labor
	TOTAL			\$9,255.75	