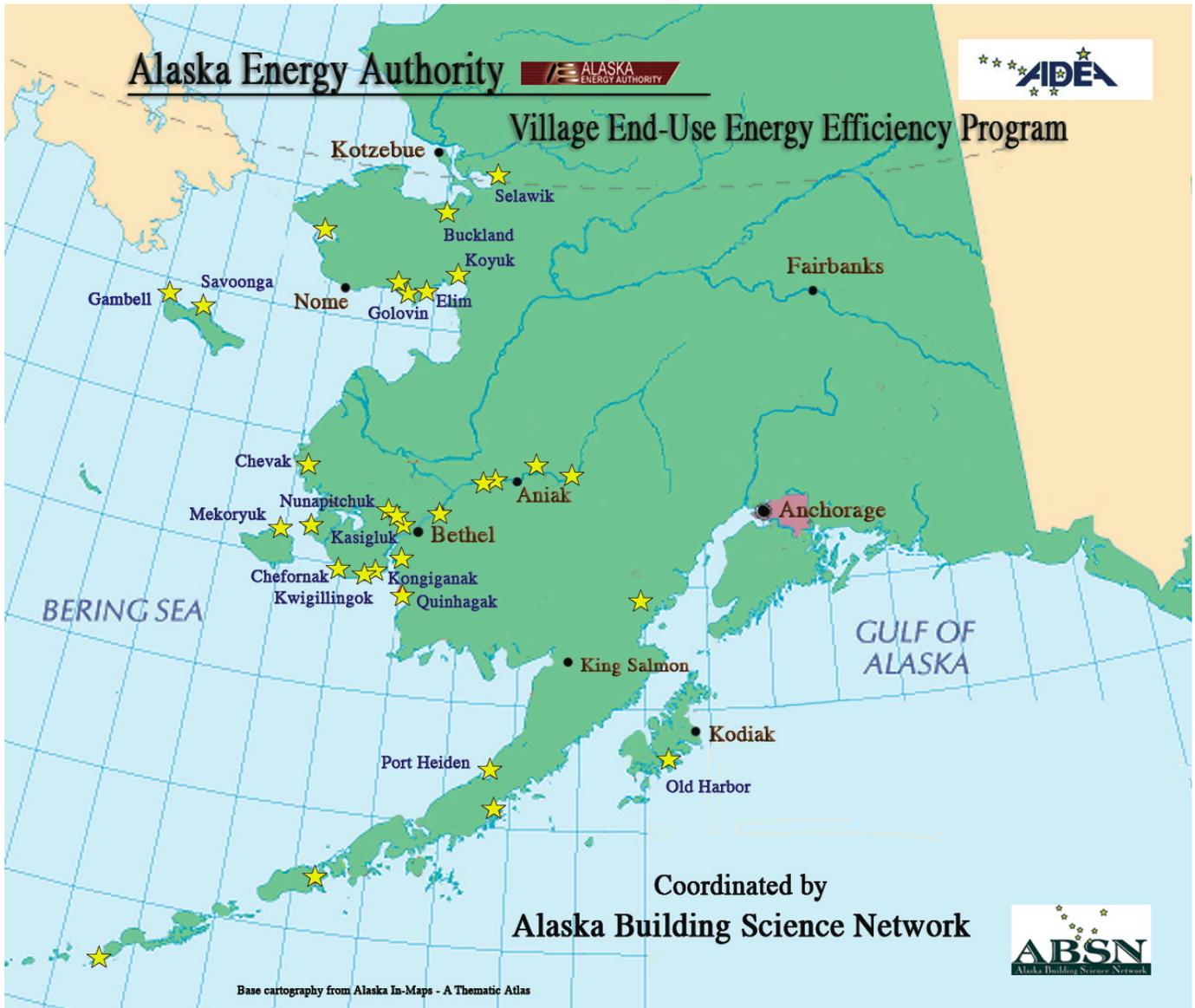


FINAL REPORT
AEA Grant # 2195225



Northwest – Southwest Regions
2005 – 2007

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Village End Use Energy Efficiency Measures Program '05 – '06 AEA Grant # 2195225 Administered by Alaska Building Science Network

Final Report - Executive Summary: Northwest – Southwest Region

- By ABSN Project Manager Geoff Butler, May, 2007

From Jan. 2005 – Jan. 2007 the following 9 rural Alaska villages received energy efficiency upgrades to community buildings:

Buckland, Elim, Gambell, Golovin, Koyuk, Old Harbor, Port Heiden, Savoonga, Selawik

Total program grant funds: \$344,116 Grant funds averaged per village: \$38,235

The goal of these grant projects was to facilitate energy efficiency upgrades to community buildings that would deliver the greatest energy savings at the fastest payback on grant funds. Energy efficient lighting upgrades were the first measures undertaken. ABSN provided project development, coordination, training, technical assistance, materials and logistical support to facilitate these projects. To advance technology transfer and provide rural employment and skills training, we partnered directly with 26 rural village entities region-wide and provided lighting retrofit training to approximately 40 local maintenance staff who completed lighting and other energy upgrades in their buildings. Region-wide, 64 community buildings and 48 teacher-housing units operated by rural school districts received energy efficiency improvements.

Original energy audits for these projects estimated light fixture (replacement) at a cost of \$355 per fixture. Within this scenario, the 1,789 linear fluorescent light fixtures retrofitted region-wide, alone, would have cost \$635,095 to complete! With ABSN's methods, when we deduct materials costs of heating measures, T5 and CFL lighting materials grant-wide, our cost for linear fluorescent retrofits is \$128 per fixture. ABSN's approach of partnering with local city, tribal governments, village corporations and rural school districts, coupled with the substantial in-kind contributions arising from these partnerships - facilitated the lighting upgrades and allowed us to pursue many additional energy savings measures as well as provide skills training and employment for 40 rural maintenance staff, all at a fraction of original audit estimates for these projects.

Primary Accomplishments of this Grant Region-wide:

- 1,789 linear fluorescent lighting retrofits
- 661 Compact fluorescent light bulb installations
- Nine T5 light fixture upgrades in gym and multi-purpose facilities, and maintenance shops
- \$ 87,678 grant funds spent on additional energy efficiency measures beyond lighting
 - Partial materials for two school-wide energy efficiency boiler heating system retrofits
 - 7 low-mass boiler installations (all in-kind labor)
 - 3 Monitor heater installations (all in-kind labor)
 - 5 boilers received energy efficiency cleaning, tuning and outdoor temp controls
 - 18 programmable thermostats installed
- 26 rural maintenance staff received ABSN's 16-hour boiler energy efficiency and maintenance training course (classroom hours provided in-kind by ABSN).
- Acquired \$ 130,697 in matching grant resources – extending the capacity of AEA grant funding by 38%
- **All within the total budget of \$344,116**

Grant funds payback and fuel saving measures

Savings from heating measures and corresponding grant expenditures are not included in payback calculations. Our region-wide payback estimate of 4.34 years on total grant funds* includes spending for all lighting and heating measures, but it does not account for any savings from the heating measures. In other words, our payback figures absorb the full cost of fuel savings measures, but do not benefit from any savings resulting from them. The heating measures will result in measurable fuel savings which we currently do not have data to calculate. If it was possible to calculate fuel savings from the heating measures we are confident it would significantly reduce pay-back time on total grant funds.

(*based on a building/lighting use time of 7 hrs/day for 250 days/year.)

Region-Wide Lighting Upgrade Summary

For all linear fluorescent, compact fluorescent bulb and T5 lighting retrofits and installations:

- Pre-retrofit energy use for all lighting: 289.42 kW
- Post-retrofit energy use for all lighting: 169.28 kW
- Energy savings from all lighting upgrades: 120.15 kW
- **Pre-retrofit to post retrofit energy reduction: 42 %**

- **Estimated Annual Savings Range:**

Hours Per Day / 250 Days Per Year	Electrical Savings	Avoided Diesel Use	Avoided Diesel Costs	Payback Estimate
4 Hours				
7 Hours	\$ 79,276	15,768 gallons	\$ 34,581	4.34
10 Hours				

- Total grant funds for all energy efficiency measures: \$ 344,116
- Simple mean payback (All grant funds, but accounting for lighting savings only) 4.34 Years

Additional Energy Efficiency Measures (Region-wide grant funding: \$87,678)

After completing lighting measures with good payback, we dedicated remaining grant funds to fuel saving measures and heating system energy efficiency training for village maintenance staff. For our regional boiler training in Nome and our village boiler trainings, ABSN provided \$2,100 for each of 3 trainings, or \$6,300 total in-kind contributions region-wide. Our organizational focus in energy efficiency and northern building science places us in the unique position of being able to dovetail similar objectives from different projects providing a win-win benefit to the VEUEEM grants. These and many other in-kind resources enabled us to go far beyond the originally conceived scope of work and greatly expand the capacity of these energy efficiency projects.

Lighting Strategy and Savings Estimates

During initial site visits we verified lighting assessments including quantity, locations, and wattage of existing fixtures. From initial assessments and site visits we designed lighting plans and applied various lamp and ballast combinations along with de-lamping strategies to achieve a balance of optimal energy efficiency and good light levels for the activity at hand. From initial assessments and our lighting retrofit plans we determined pre and post energy use by building, village entity, village-wide and region-wide. With a known energy use, we could estimate energy and cost savings based on a predicted building and lighting use pattern. Since this information is extremely variable and would require separate grant funds to determine for these projects, we chose to report our saving estimates based on 250 days / year use and a 3-tier range of 4, 7, and 10 hours/day. For the purposes of this report we will focus on a mean lighting use of 7 hours/day. This generic use time is intended to average the use pattern of all buildings in our projects. Individual buildings and individual room spaces will have a wide range of use patterns. The actual savings and payback resulting from these projects we feel will fall somewhere within our range of 4 to 10 hours a day.

When considering savings estimates, it should be noted that for all practical purposes the only thing we can determine with reasonable accuracy is pre and post energy use. When it comes to savings, there are other questions that arise including: Who actually sees the savings? If the energy use is reduced in a village, the required operating costs of a village utility must still be met. Utility rates will continue to increase to meet operating costs. Where savings occur, some will be to the State of Alaska in reduced PCE payments, and some will be to the electricity rate-payer. There is also the question of load verses capacity of a given generation system. In some cases where a generation system's capacity is over-extended, dropping the electrical load will be favorable for that utility as they may be spared the costs of generator replacement or overhaul. In other cases, if a system is somewhat oversized for the load already, an additional drop in electrical use may not be favorable to the utility or school. The optimal operating cycle of a given generator will consume a set amount of fuel over time. Reduction in electrical load may not translate directly to how much fuel is burned in a given generator.

Although these factors should be understood, the pressures of ever-increasing fuel costs, coupled with the facts of life in rural Alaska, necessitate the pursuit of energy efficiency programs wherever possible. Also, the trend of improved diesel generation technology, and the ability to tailor power generation levels to match load cycles, means that projects dedicated to overall load reduction are critical. This trend is another practical reason to pursue energy efficiency as an important principle.

We at ABSN are extremely pleased with the results of our work in association with these projects and are happy to be contributing toward energy efficiency cost savings for rural Alaska.

Notes on Budget and Grant Spending

Our objective has been to spend grant funds evenly between villages to the greatest extent possible. Since the beginning of the grant in January, 2005 expenditures were separated by village, and also by specific budget category. Expenses were entered into individual village budget spreadsheets according to the following categories: Field Management, Project Management, Travel Expenses, Materials, and Village Labor. Each village budget totals \$38,235, which is the original total grant amount of \$344,116 divided by nine villages. As we got into spending on measures beyond lighting we did our best to choose projects that stayed within the individual village budgets. To adequately cover energy savings measures beyond lighting, left over village budgets within the region were pooled as needed to cover these measures. Pooling budgets was accomplished between villages sharing the same school districts. It should be noted that all additional energy savings measures were undertaken in villages that showed interest and that provided matching funds for labor or materials to help make the projects happen.

The village budget spreadsheets that come with these final reports as appendices are current to the beginning of January, 2007 when new AEA grant funds were added to this grant. Toward the end of the '05-'06 grant cycle in late 2006, the individual village budgets allowed us to determine where remaining monies could be spent on additional energy saving measures. Between January, 2005 and the end of June, 2007 financial reporting period, all '05-'06 spending for this grant will have been billed to AEA.

Disposing and Recycling Old Lamps and Ballasts

ABSN's goal was to ensure that all old and unused lamps and ballasts were shipped out of the villages to Anchorage for proper disposal and recycling. In cases where the existing 34-watt T-12 lamps were fairly new, village building owners sometimes preferred to keep the materials and pass them along for continued use. In most cases, lamps were at or near their useful lifespan and were no longer putting out optimum light. All fluorescent lamps contain mercury and as such should not be disposed of in landfills. As part of '05 – '06 projects, ABSN developed a system of packing and shipping used lamps and old magnetic ballasts from the villages to Total Reclaim Inc. of Anchorage - the largest recycler of fluorescent lamps in the state. From Anchorage the lamps and ballasts travel by container ship to lower 48 recycling facilities. The mercury from lamps is reclaimed, and the ballasts are recycled for their materials.

For shipping used lamps and ballasts from most villages to regional hubs we arranged free back-haul service - generously provided by Alaska Transportation Service (ATS). From the hub communities back to Anchorage, Northern Air Cargo provides backhaul at reduced rates for this program. Used lamps and non-PCB ballasts travel as general freight in properly sealed containers. Used lamps are categorized as non-hazardous universal waste.



Packing used lamps for recycling



A village shipment of used lamps and ballasts



Bring used lamps to the air strip

PCB Ballast Disposal

Ballasts manufactured during or before 1979 are considered to contain PCBs, and are classified hazardous waste. In some villages where PCB ballasts are found, they must be dealt with under OSHA, EPA, and DOT regulations for proper removal and transportation. About half our villages in this region had some PCB ballasts to remove and dispose of in order to complete lighting retrofits in all community buildings. As part of '05 – '06 projects, ABSN developed a PCB ballast removal and disposal method for village maintenance staff within EPA and DOT compliance and approved by Alaska State OSHA office. Proper removal procedures were facilitated by ABSN, with the village building owner and their maintenance staff taking responsibility for proper removal - as the generator of the hazardous waste.



Double checking ballasts for PCBs



DOT approved haz-mat container of PCB ballasts ready for shipment



The following nine village reports detail lighting and heating measures

undertaken in each of our Northwest – Southwest region villages:

ELECTRONIC APPENDICES

Village End Use Energy Efficiency Measures Program '05 – '06 Northwest – Southwest Regions Final Reports

Electronic appendixes associated with these projects are provided as part of our final reports including:

- Cover page and Final Report Executive Summary, file name:
(Cover_ExecSummary_NW_SW_FinalReport05-06.doc)
- Regional final reporting summary data, charts and calculations spreadsheets:
(SummaryFinalReportDataNW-SW_'05-'06.xls)
- Final reports for each village in a folder titled:
(Final_Reports_NW-SW)
- Pre-Post retrofit spreadsheets for each village, in folder titled:
(TallySheets_NW-SW_'05-'06Final_Reports)
- Regional final reporting summary data – By building, energy savings calcs
(BldgSummary_ReportNW-SW'05-'06.xls)
- Contact information for all village contacts, file name:
(Contacts_NW-SW_VEUEEM'05-'06.xls)
- Budget breakdowns – by village from 12-31-06:
(BudgetByVillageNW-SW_'05-'06_FinalReport.xls)