Energy Efficiency in Public Buildings: Rural Retrofits

Nathan Wiltse and Dustin Madden *November 21st, 2014*

One of the strongest cases for energy efficiency is that it produces jobs[1]. Money spent on energy efficiency retrofits involves a significant amount of labor, including construction, maintenance, and engineering. With a properly trained workforce much of this labor can be provided locally keeping more money in the local economy than if it was spent on fuels, which typically require little labor. Additionally, reduced spending on energy can allow organizations to spend more money on program staffing. Residential energy efficiency programs in Alaska are estimated to have already created 2,700 short-term jobs and 300 permanent jobs, with potential to create an additional 30,000 short-term jobs and 2,600 permanent jobs.[2]

Energy efficiency has the potential to be particularly beneficial to rural Alaskan economies. The economy in rural western and northern Alaska is unique in that it is based not only on cash, but also networks of subsistence, sharing, and trading. Approximately 71% of the cash portion of this economy and 36% of the jobs comes from government sources, according to research done by the Institute of Social and Economic Research.[3] These jobs include positions in schools, tribal offices, health clinics and more. The cost for the energy required to maintain a comfortable environment in these rural public buildings is often high—for example, the average annual energy cost of the 10 schools that received an energy audit in the Bering Strait region was over $200,000. As heating fuel prices have already risen by more than 50% in western and northwestern Alaska since 2005[4] and are projected to increase by 41% by 2040[5], reducing energy consumption is a crucial part of maintaining economically viable rural communities.

In 2013 the Cold Climate Housing Research Center analyzed the types of retrofits recommended in Alaska Native Tribal Health Consortium (ANTHC) energy audits in an effort to understand the possible effects of energy efficiency retrofits in rural Alaska. These energy audits were completed in 2012 on 68 tribal buildings located primarily in Western Alaskan villages, which fell into one of the following 3 categories: Water Systems, Tribal Buildings, and Health Clinics. The data from these audits was stored in the Alaska Retrofit Information System (ARIS) which is owned and operated by the Alaska Housing Finance Corporation (AHFC). Preliminary analysis indicates that the average potential energy cost savings of 31% found for these buildings are comparable to those found through AHFC's public building audits. A further review showed the audit data to be of a similar level of quality.

---

[1] For a detailed discussion of the jobs benefits from energy efficiency, see Bell, Casey. "Energy Efficiency Job Creation: Real World Experiences. October 2012. American Council for an Energy Efficient Economy. Available at: http://www.aceee.org/files/pdf/white-paper/energy-efficiency-job-creation.pdf

[2] Colt, Steve, Fay, Ginny, Berman, Matt, Pathan, Sohrab. *Energy Policy Recommendations.* (January 25, 2013). Institute of Social and Economic Research.

[3] Goldsmith, Scott. January 2008. "Understanding Alaska's Remote Rural Economy." Institute of Social and Economic Research.

[4] "Current Community Conditions Alaska Fuel Price Report." July 2012. Department of Commerce, Community, and Economic Development.

[5] U.S. Energy Information Administration, "Annual Energy Outlook 2014", website: http://www.eia.gov/forecasts/aeo/er/pdf/0383er(2014).pdf

After conducting the audits, ANTHC staff classified each of the 517 recommended retrofits by the type of retrofit and whether it can be performed solely by local village personnel, by a combination of village personnel and technicians from outside the village, or whether the retrofit would largely be conducted by engineers and professionals who reside outside of the village. Figure 1 defines these different retrofit types, and gives common examples that were found during the audits.

Figure 1: ANTHC Retrofit Types

Retrofit Types	Description	Example
Operations	Simple projects that require little time or money to accomplish. Local village fully capable of doing.	Shut off heat tape, setback thermostat, shut off pumps, reduce temperature in loop
Maintenance	Projects that may require a specialized person from the village, but the village has most necessary supplies. May need some funding.	Clean boilers, reduce air transfer, clean and adjust floats in lift station
Local Retrofit	Projects that may require significant funding, but local village has all necessary skills and capabilities. Village may or may not have supplies for the job.	New thermostats, new lights, Replace aquastats, insulation additions
Minor Project	Larger scale projects that require outside assistance. Project may require technicians to assist and/or very significant funding.	Controls retrofitting, new boiler installation, resizing and replacing pumps
Major Project	Largest scale projects that will require significant outside assistance. Projects may potentially need an engineer, superintendant, or other professionals. Technical experts and very significant funding required.	Waste heat projects, Outfall replacement

Figure 2 shows that a significant portion of savings can potentially be done by local labor. Of the approximately $525,000 of annual energy savings found in the audits, roughly half can be achieved by trained local people. This is significant, as the audits were done in the rural areas with some of the highest average unemployment rates in the state (Figure 3) and currently approximately 41% of workers in rural Alaska are non-local[6]. Figure 2 also shows that on average, the costs for these local projects are lower so they can be done with only minimal capital investments.

[6] Goldsmith, Scott. January 2008. "Understanding Alaska's Remote Rural Economy." Institute of Social and Economic Research.

Figure 2: ANTHC Retrofits Savings & Costs by Project Type

ANTHC RETROFITS BY PROJECT TYPE		#	Annual Energy Savings (in $ thousands)			One-time Retrofit Costs (in $ thousands)		
			Total	AVG	MED	Total	AVG	MED
Totals		517	$525	$1.02	$0.27	$2,451	$4.74	$0.50
Project Type	Local	438	$203	$0.46	$0.21	$539	$1.23	$0.50
	Outside Help /Local	36	$95.9	$2.66	$1.30	$482	$13.4	$3.01
	Outside Help	43	$227	$5.28	$1.99	$1,430	$33.3	$5.00

Figure 3: ANTHC Retrofits vs. Unemployment Rates

ANTHC RETROFITS BY CENSUS AREA	# Retrofits	Percent of retrofits with local labor	Regional Unemployment Rate[7]
State of Alaska	n/a	n/a	6.5%
Municipality of Anchorage	n/a	n/a	5.2%
Bethel Census Area	396	86%	14.8%
Nome Census Area	39	74%	10.1%
Wade Hampton Census Area	51	84%	20.8%
Yukon-Koyukuk Census Area	31	87%	15.1%

In addition to having the lowest capital costs, the retrofits identified as local projects also tend to have the quickest payback periods, as can be seen in Figure 4. Both the average payback period and the median payback for local projects are significantly shorter than for those projects that were identified as requiring some outside help or those that would be almost totally dependent upon outside engineers and specialists.

[7] *December 2013 Preliminary Unemployment Rate.* State of Alaska Department of Labor and Workforce Development. Retrieved February 24th, 2014 from Live.laborstats.alaska.gov/labforce/index.cfm

Figure 4: ANTHC Retrofits Simple Paybacks by Project Type

ANTHC RETROFITS BY PROJECT TYPE		# Retrofits	Paybacks (yrs)	
			AVG	MED
Totals		517	5.0	2.3
Project Type	Local	438	4.8	1.8
	Outside Help/Local	36	5.2	4.4
	Outside Help	43	6.8	4.0

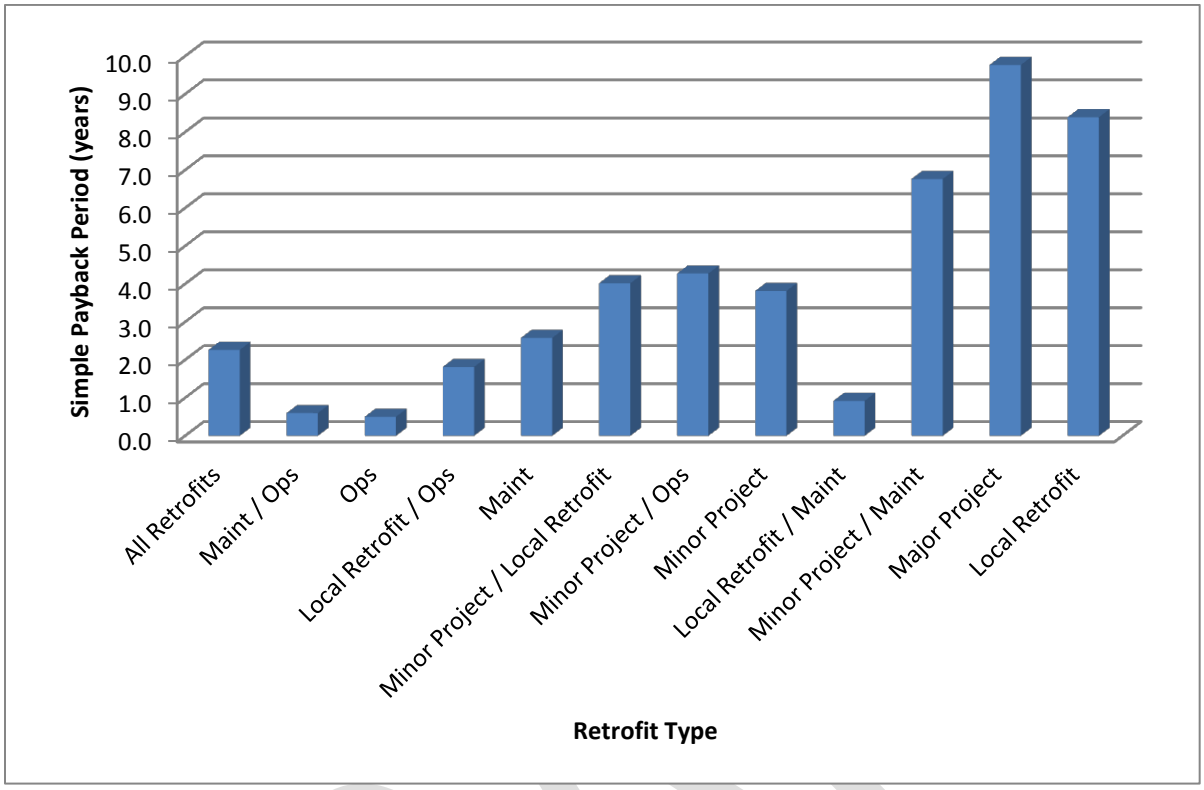
Analyzing the data by retrofit type shows that there are significant opportunities for energy savings through changing operational practices and by doing regular maintenance on buildings and mechanical systems. Figure 5 shows the annual savings and one-time costs for the different retrofit types. Because the average capital costs on operations and maintenance retrofits are typically much lower than other retrofits, paybacks are often very quick, as can be seen in Figure 6. While major and minor projects account for approximately 43% of the total potential annual energy savings, because of their significant costs, they tend to have longer payback periods. These findings are in line with the recommendations made by energy auditors in the *White Paper on Energy Use in Public Facilities*.[8]

Figure 5: ANTHC Retrofits Savings & Costs by Retrofit Type

ANTHC RETROFITS BY RETROFIT TYPE		Annual Energy Savings (in $ thousands)			One-time Retrofit Costs (in $ thousands)		
	#	Total	AVG	MED	Total	AVG	MED
All Retrofits	517	$525	$1.02	$0.27	$2,451	$4.74	$0.50
Maint / Ops	2	$4.70	$2.40	$2.40	$0.90	$0.45	$0.45
Ops	118	$22.0	$0.19	$0.05	$14.5	$0.12	$0.03
Local Retrofit / Ops	166	$106	$0.64	$0.36	$146	$0.88	$0.50
Maint	65	$25.90	$0.40	$0.21	$69.3	$1.07	$0.50
Minor Project / Local Retrofit	21	$40.70	$1.03	$1.47	$158	$7.53	$3.01
Minor Project / Ops	7	$10.10	$1.45	$0.87	$26	$3.71	$2.00
Minor Project	33	$89.20	$2.70	$1.30	$333	$10.1	$3.20
Local Retrofit / Maint	3	$5.67	$1.90	$2.18	$6.81	$2.27	$2.00
Minor Project / Maint	8	$45.10	$5.64	$2.24	$298	$37.2	$8.00
Major Project	10	$137	$13.78	$7.44	$1,098	$110	$82.5
Local Retrofit	84	$37.90	$0.45	$0.27	$301	$3.58	$1.98

[8] Armstrong, Richard, Luhrs, Rebekah, Diemer, James, Rehfeldt, Jim, Herring, Jerry, Beardsley, Peter, et. al. (2012). *A White Paper on Energy Use in Alaska's Public Facilities*. Alaska Housing Finance Corporation. Available online at: http://www.ahfc.us/iceimages/loans/public_facilities_whitepaper_102212.pdf

Figure 6: ANTHC Retrofits Median Simple Payback by Retrofit Type



Information from ANTHC staff, interviewed public school energy conservation and facilities managers, and Alaskan energy auditors all pointed to inadequate training for operations and maintenance staff as one of the reasons that these energy saving operations and maintenance measures have not been performed.[7,9,10] Considering the large potential for monetary savings on energy expenditures in public buildings in Alaska that can be accomplished with routine operations and maintenance procedures, this lack of training represents a large untapped resource.

Recommendations:

Energy prices in rural Alaska are high and likely to increase over time, and so inefficient buildings require increasingly larger amounts of public funding to be diverted from meeting program goals to cover energy costs. Additionally, the cash economy is limited in these areas and is largely dependent upon government funding, which is at risk given projected declines in the state revenues.[11] Energy efficiency measures in public buildings can reduce energy costs and free up funding for public organizations to hire new employees or perform more services. As roughly half of the energy efficiency measures recommended in audits were identified as being able to be performed with local

[9] Dixon, Gavin, Reitz, Daniel, personal communication, March 2013.
[10] Wiltse, Nathan, Madden, Dustin. *Energy Efficiency in Public Buildings: Schools.* (2014). Cold Climate Housing Research Center.
[11] *Revenue Sources Book: Fall 2013.* Alaska Department of Revenue - Tax Division. Available at: http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?1022r

labor, funding to increase efficiency in buildings also has the potential to boost employment in local economies. Based on our analysis, we believe that the following recommendations will help improve the long term economic viability of rural Alaska:

- **Conduct energy audits and retrofits on all public buildings in rural Alaska.** Identifying energy cost savings and undertaking local retrofits and maintenance/operations projects will help rural Alaska cope with dwindling government funding and predicted long-term energy price increases.

- **Incorporate energy efficiency training into all major retrofit projects in rural areas.** Training and hiring local workers keeps more of the economic benefits of the energy efficiency measures in remote communities.

- **Track energy use.** Operations and maintenance changes were some of the most cost-effective energy efficiency measures identified in rural Alaska. Installing building monitoring systems and benchmarking buildings using AHFC's ARIS software allows trained local staff to identify areas of excessive energy use and change operation and maintenance procedures to reduce it.