



Thermalize Juneau

Energy Savings & Annual Electric Load Shift Due to Heat Pump Installations

The City and Borough of Juneau set a goal to transition to clean energy and lower local carbon footprint by reaching 80% renewable energy generation for heating and transportation by 2045. Reaching this goal will largely mean electrification of these two sectors since Juneau's electric grid, operated by Alaska Electric Light & Power (AEL&P), operates at 100% hydropower generation for its base load power. Five local hydroelectric plants create power from high mountain lake drainage. All operations and maintenance costs are borne locally, providing an average residential rate lower than other regulated Alaska utilities (\$0.1235 per kWh in 2023 during peak season of November to May). In high precipitation years, these plants provide more than enough power to meet demand. In low precipitation years, AEL&P can provide adequate electricity for residential customers by disconnecting Greens Creek Mine, which can generate its own electricity if necessary. While AEL&P will eventually look to secure additional hydroelectric resources, in the short term the company is looking to ensure demand can be met with existing resources to keep electricity costs low for customers.

AEL&P was a partner in the recent Thermalize Juneau 2021 pilot program, a local campaign that promoted heat pumps and energy efficiency. The campaign provided education on heat pumps and other efficiency retrofits through events, workshops, and online education. It also competitively procured a heat pump installer, electrician, and builder to provide participants with a simplified installation process for retrofits and an opportunity for rebates if the group exceeded installation goals. Thermalize Juneau enrolled 164 participants and facilitated approximately 75 heat pump installations and over 30 energy efficiency upgrades.

Study Objectives

Researchers used energy savings data from Thermalize households to analyze the impact on the overall electric load from heat pump installations. This knowledge is crucial to inform deployment campaigns in communities that are managing an annual electric load like Juneau and looking to promote a sustainable future for all residents. Households installing heat pumps fell into two groups:

- 1) Homes converting from electric resistance heating and expecting to see a decrease in overall electric use
- 2) Homes converting from fuel oil-fired appliances and expecting to see an increase in overall electric use

Want to Learn More?

See the full Thermalize Juneau Guidebook at:

<https://arcg.is/1Cvu981>

Methodology

Homes were selected based on availability of clean, reliable energy data. Researchers obtained information about heating fuel and fuel usage data from Thermalize participants who had installed a heat pump (28% response rate). Homes heating with biomass were eliminated since accounting for factors such as wood moisture and stove efficiency was beyond the scope of this study. Ten homes had adequate data for a pre- and post-heat pump installation analysis. With permission of the homeowner AEL&P provided data by billing period which researchers converted to a per diem rate. Data was then correlated to calendar month. Fuel oil data was provided in gallons per delivery date and the amount was proportionately divided into months based on the published Juneau heating degree days.

Results

Two homes had previously used only electric resistance heating, 8 homes had utilized fuel oil prior to a heat pump. Overall, the 10 buildings saw a 4% decrease in annual electric load, which shows promise in maintaining the overall annual electrical load demands to remain within existing hydropower capacity. Fuel oil buildings saw an 84% decrease in fuel oil use, including some homes that removed the fuel oil appliance altogether. Overall, total on-site energy decreased by 44% across the buildings.

Recommendations

More work is necessary to inform future decisions. Researchers are currently monitoring the electrical energy use of heat pumps in 14 homes to help confirm these results. Additionally, the following steps would enable AEL&P and other communities to plan clean energy campaigns that advance community goals while preserving electrical capacity:

- Look at the effects on **multifamily housing** by monitoring electric baseboards pre & post heat pump installation.
- Widespread installation of advanced metering infrastructure (AMI) to analyze heat pump electrical use
- Weather normalization of Juneau electric data to quantify the impact of cold temperatures & separate the effect of higher heating degree days (HDD) from that of a true increase in load
- Large scale modeling of potential energy efficiency gains in appliances or building envelopes to offset electric use from heat pumps or electric vehicles

Home Energy Use After Heat Pump Installations

4% Decrease in Electrical Energy Use

84% Decrease in Fuel Oil Use

44% Decrease in Total On-site Energy