



Methodology for Cleaning and Processing Baseline Fuel Oil Consumption Data for Thermalize Juneau Campaign

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Introduction

What is **Thermalize Juneau**?

- Clean-energy campaign consisting of 165 registered participants in Juneau, Alaska.
- Provided free heat pump assessments and energy audits, bulk discounts and simplified installation process, and energy efficiency retrofits.

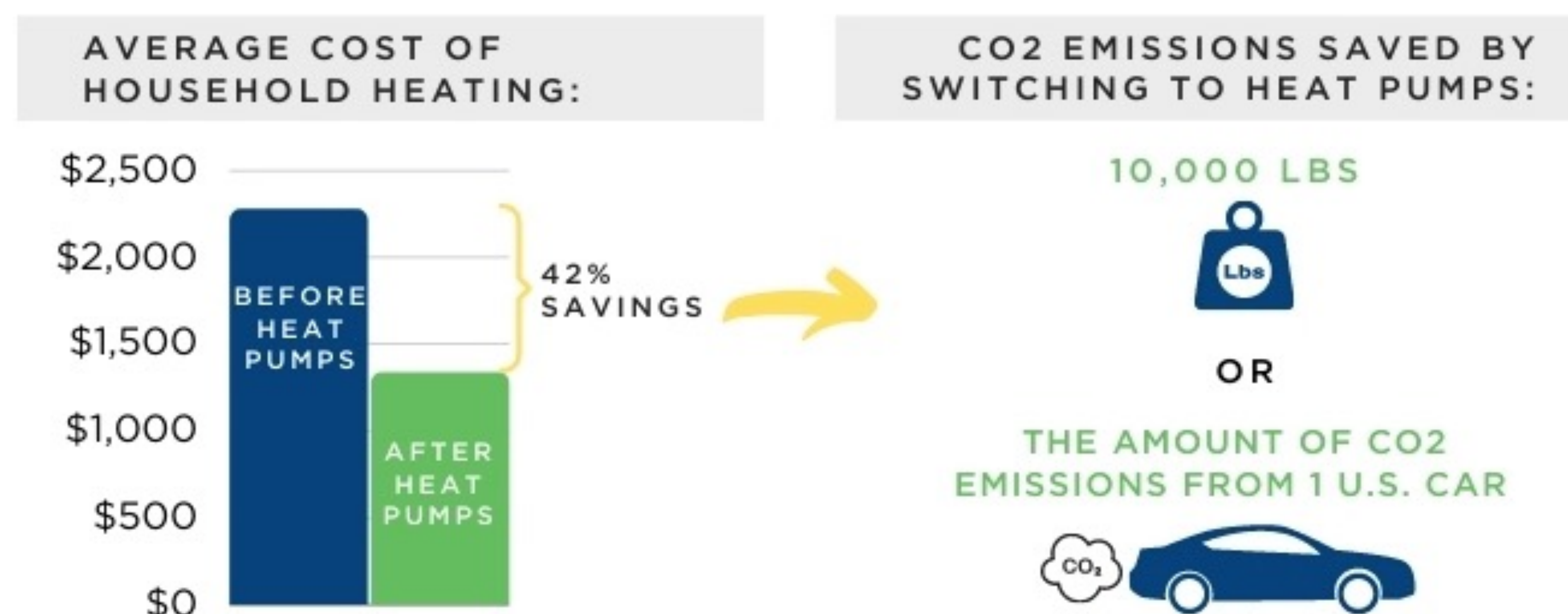


Figure 1: Decarbonization in Juneau Preliminary Findings for One Household.

www.eesi.org/articles/view/how-juneaus-climate-action-plan-inspired-city-wide-building-decarbonization

What is an **air source heat pump (ASHP)**?

- Partially renewable heating appliance that gathers heat from outdoor air.
- Uses electricity to step up the heat from outdoor air and deliver it to indoor units.
- Since Juneau's electricity is generated by hydropower plants, ASHPs are 100% renewable for this campaign.

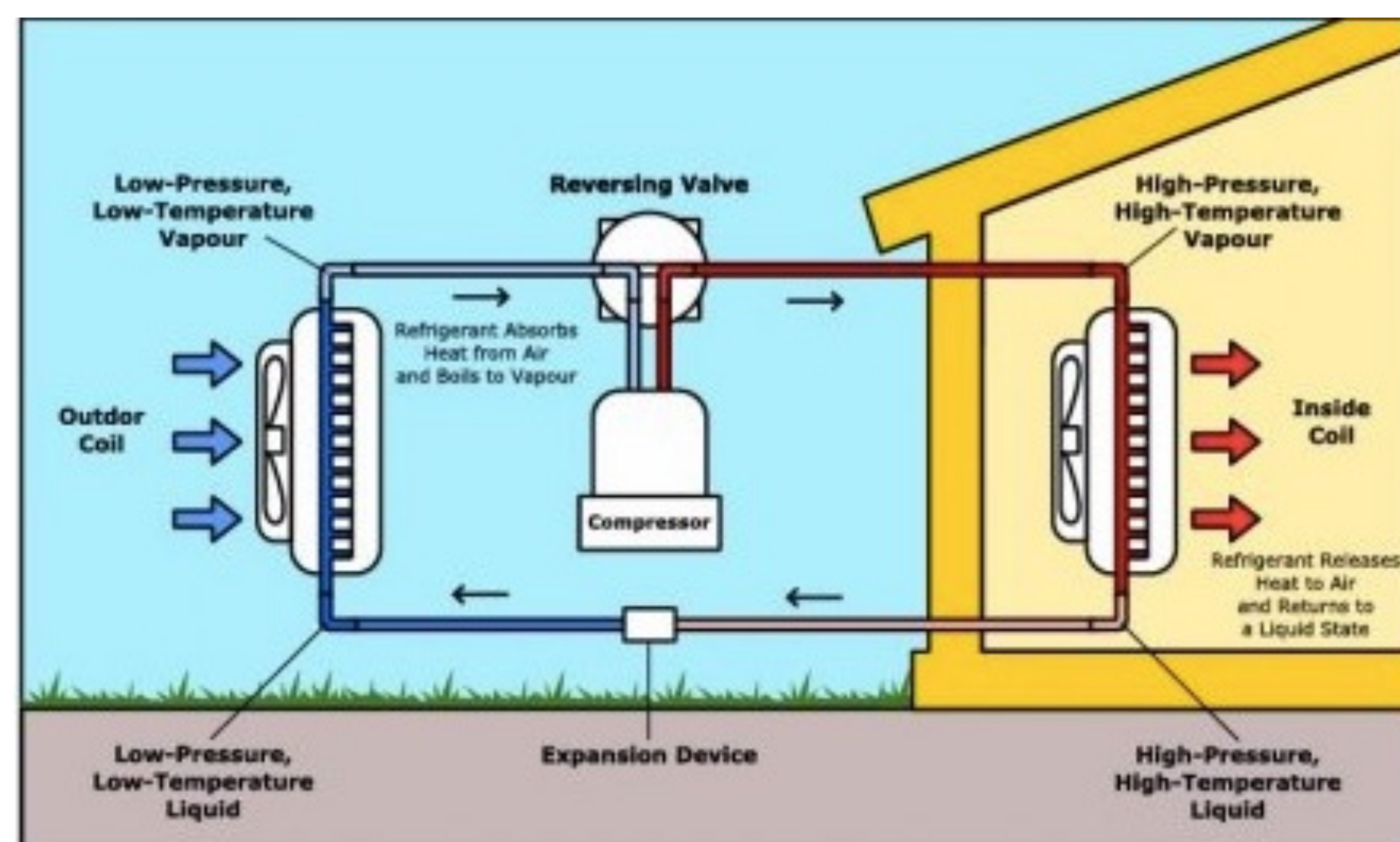


Figure 2: ASHP refrigeration cycle in heating mode. Image courtesy of DOE www.energy.gov/energysaver/air-source-heat-pumps

Research Objectives

1. Document baseline electrical data algorithm
2. Process and establish baseline fuel oil consumption data
3. Collect climate chamber data and conduct housing surveys

Outcomes

Documentation:

- Documented electrical data cleaning and processing algorithm.
- Provided a coherent method for researchers to duplicate, revise, and implement in future thermalize campaigns.

Cleaning:

- Developed method for cleaning and compiling fuel oil data into a format for programming.
- Researchers will gather and consolidate all fuel oil data into a single excel spreadsheet, accessible through python.

Methods

Manipulation:

- Developed a method for transforming fuel delivery date data into gallons of fuel consumed data.
- Systematically process data based on heating degree days (HDD).
- HDD are degrees that a day's average temperature is below 65 Fahrenheit.
- Used to quantify demand for heat energy needed.

- 1) Processing Method 1
 - Extract monthly and annual HDD.
 - Calculate the heating percent load for each.
 - Take the annual gallons of delivered fuel oil and multiply them by the heating percent load.
- 1) Processing Method 2
 - Equate the amount of fuel oil delivered to the amount consumed for time period between delivery dates.
 - Divide the gallons based on HDD.
 - Create a confidence interval of end value estimates based on the total amount of gallons for the heating season.

Future Research

- By doing a comparison of these two methodologies, we can research effective ways to manipulate fuel oil data while maintaining the integrity of the results.
- Future research includes testing both methods and comparing and contrasting the results.
- Once we have selected the best method, we will then compare pre-retrofit fuel data to post-retrofit data.

Complementary Research

Climate Chamber Data Collection:

- Chamber simulated cold temperatures from 10 C down to -25C.
- We evaluated four different models of ASHPs in the laboratory by exposing them to different temperatures within this range.



Figure 3: Climate Chamber

Point Lay Housing Surveys:

- Village depends on cold temperatures to keep the permafrost frozen and practice subsistence living.
- Documented and collected data on the housing issues resulting from permafrost thawing.
- Listened to community concerns and ideas for solutions for their buildings in the future.



Figure 4: Village of Point Lay, seen from incoming passenger plane

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