Juneau Heat Pump Deployment

Photos courtesy of Alaska Heat Smartt

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Project Summary

Objective and Outcome

Through a residential energy efficiency pilot program in Juneau, Alaska:

- Field validate climatic limits of efficiency retrofits including ductless heat pumps.
- Develop a market-based approach for rural communities to accelerate efficiency technology adoption and integration.

Team and Partners

Alaska HEAT SMART
akheatsmart.org

information insights

Stats

Performance Period: July 2020–Sept. 2023

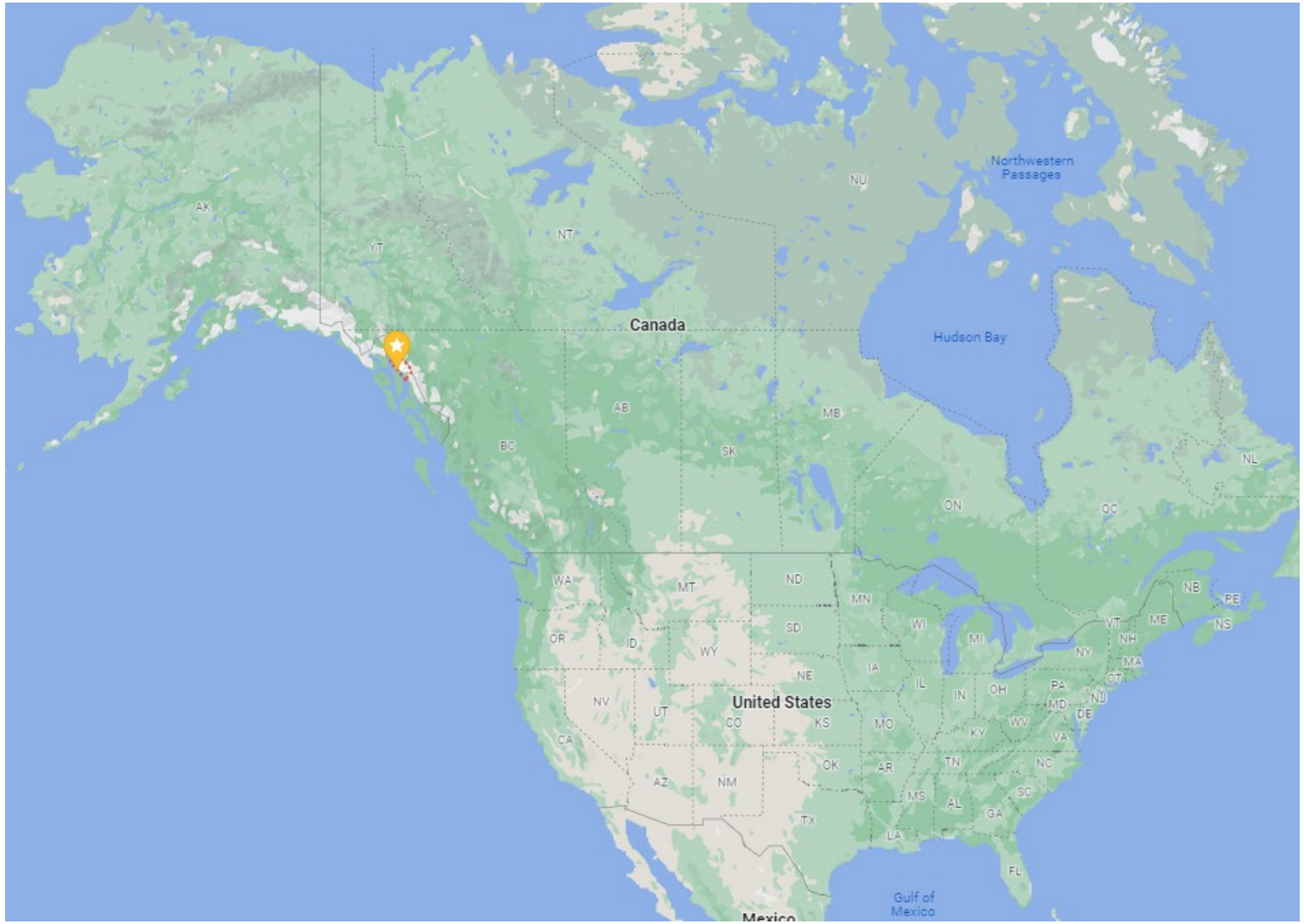
DOE Budget: $336k, Cost Share: $133k

Milestone 3: Implement outreach campaign to recruit participants

Milestone 8: Implement energy efficiency retrofits

Milestone 16: Share materials and engage stakeholders

Problem: How can we facilitate an equitable transition to net-zero greenhouse gas emissions in a cold, remote community?



The City and Borough of Juneau, Alaska has a renewable energy goal:

80% renewable energy for space heating and electrification by 2045

The renewable energy resource:

Local hydropower grid

Alignment and Impact: Thermalize Juneau had the following outcomes.

Increased building efficiency and acceleration of building electrification

164 registrants in Thermalize Juneau 2021

Reduced cost of building decarbonization

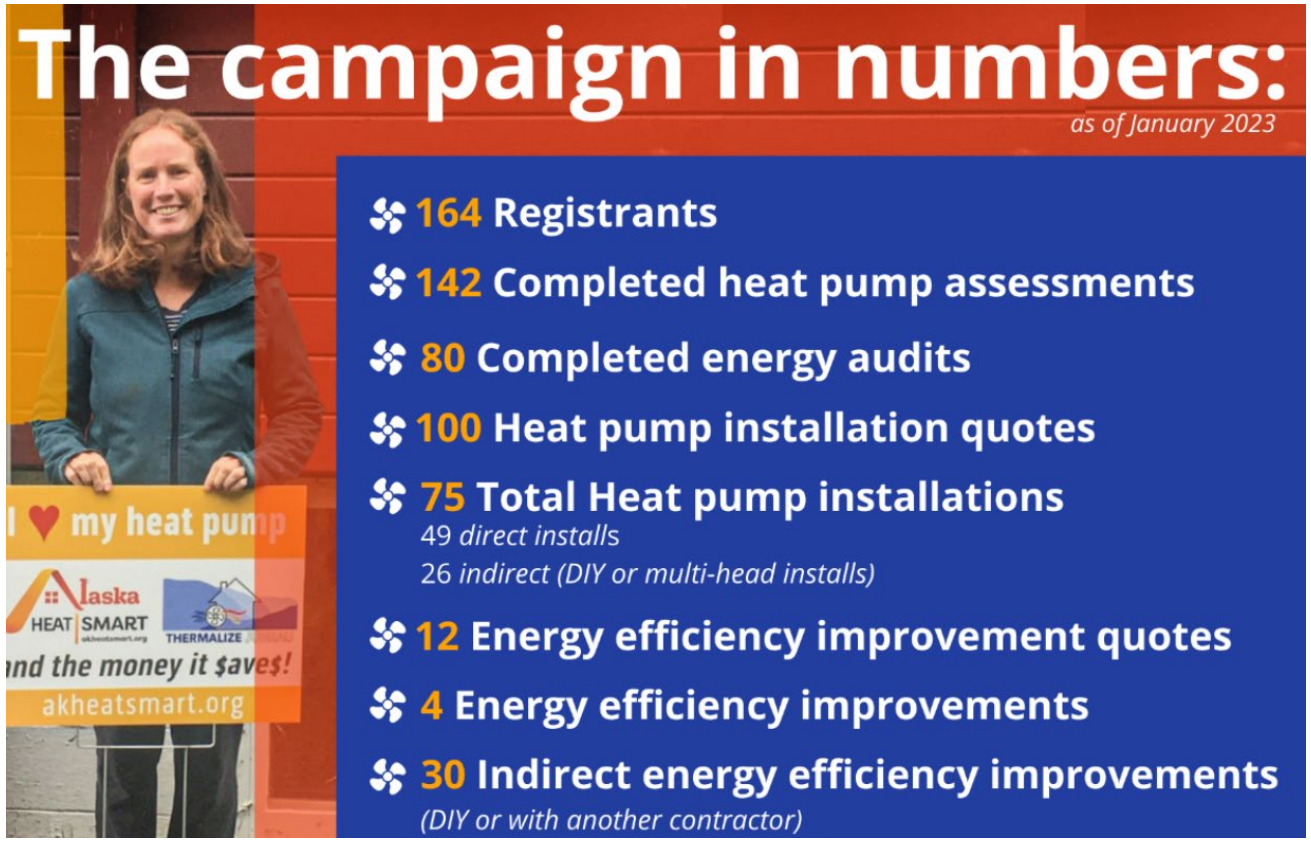
- $400 rebate achieved, after 40 installations
- 3% discount for efficiency retrofits after 5 installations (not achieved by thermalizers)
- Return the Rebate program
- Local bank financing option

Reduced consumer energy burdens

- Pre-campaign modeling predicted 50% decrease in EUI from ductless heat pump (DHP) installation
- Similar predictions from heat pump assessments and energy audits

Increased community resiliency

- 3 new jobs
- Smaller dependence on fuel oil & advancement toward renewable energy goal

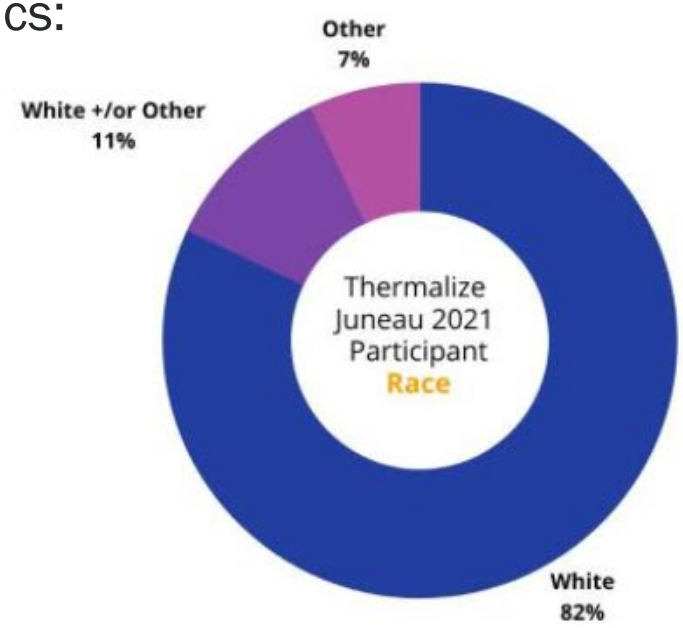


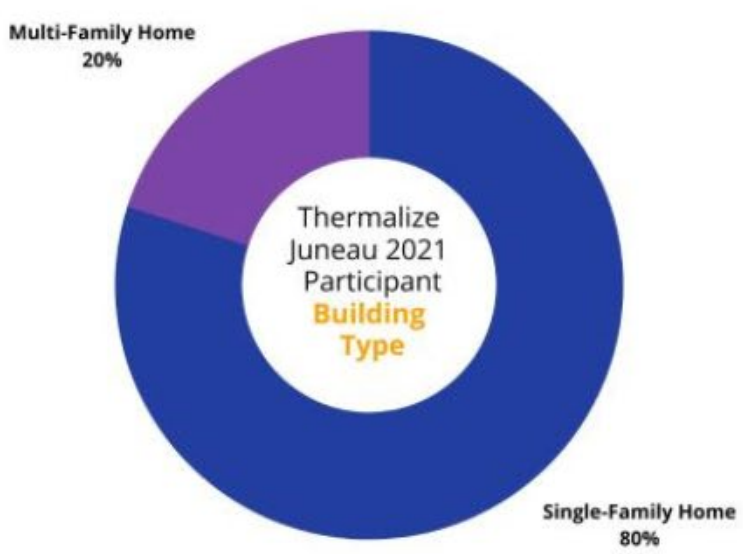
Alignment and Impact: Definition of Success

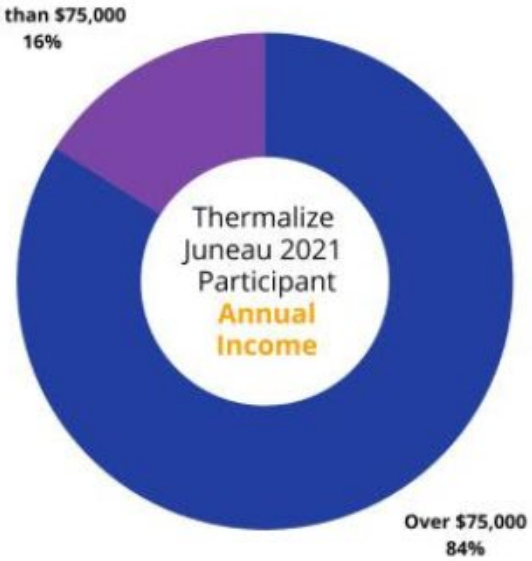
By the numbers:

- ❑ 150 registrants
- ❑ 50 households with a heat pump installed
- ❑ 50 households with a heat pump and energy efficiency retrofits
- ❑ 100 audits (pre and post)

By demographics:





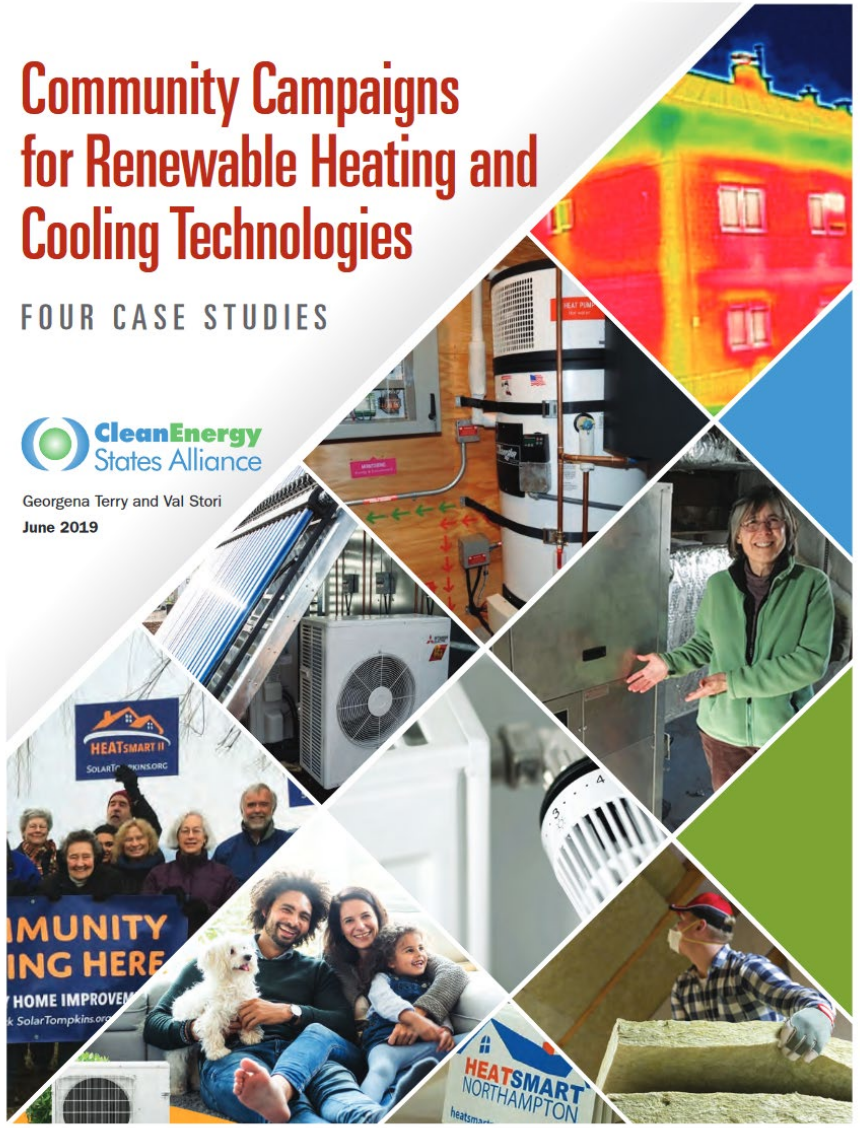


Demographic details of Thermalize Juneau 2021 Participants

Novelty: Thermalize Juneau was the furthest north Thermalize campaign.

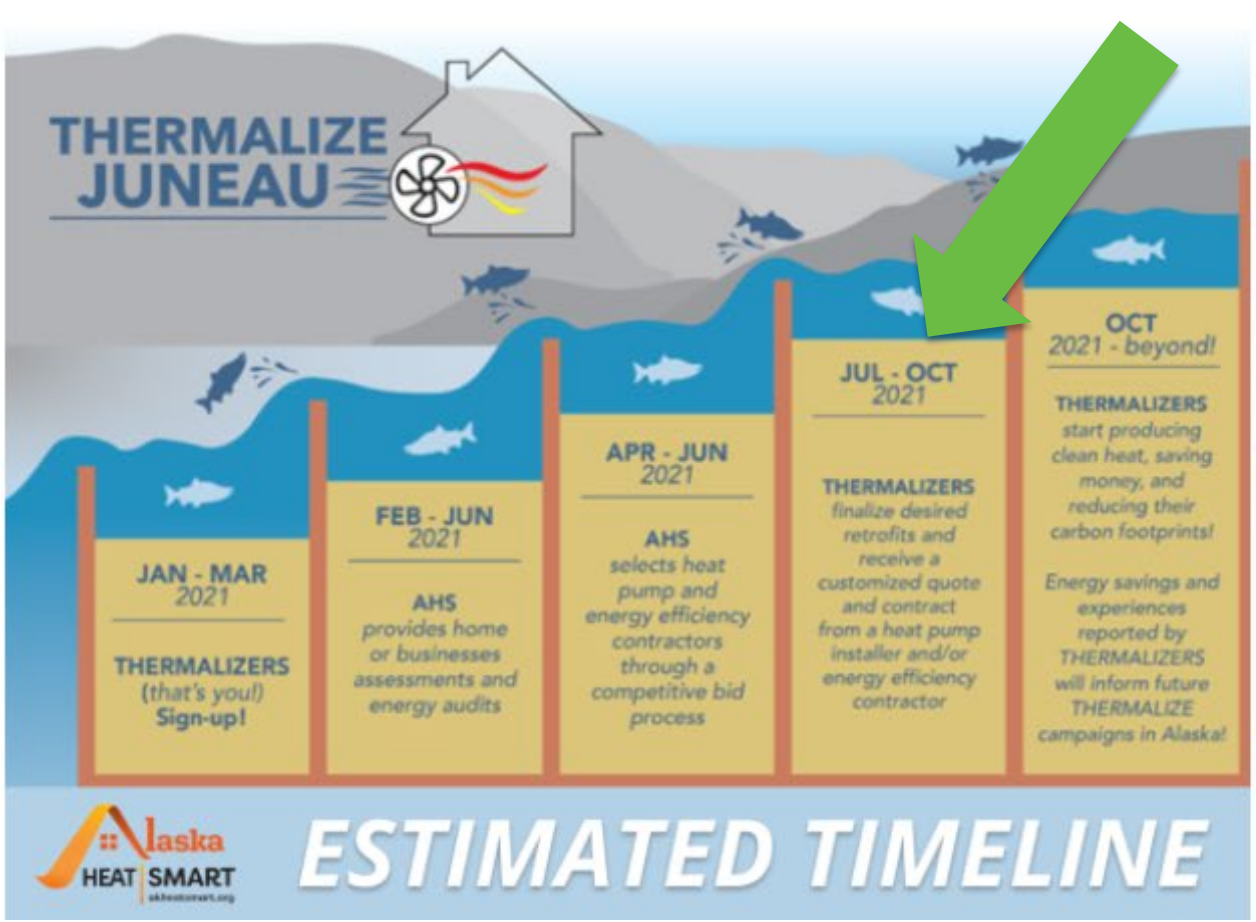
- Clean energy campaigns operate throughout the United States.
- At the time this program started, the team knew of 4 thermalize campaigns, thanks to the Clean Energy States Alliance.
- Thermalize Juneau 2021 was the first thermalize campaign in Alaska, and the most northern to date in the U.S.
- Unique collaboration between federal, state, and local partners.

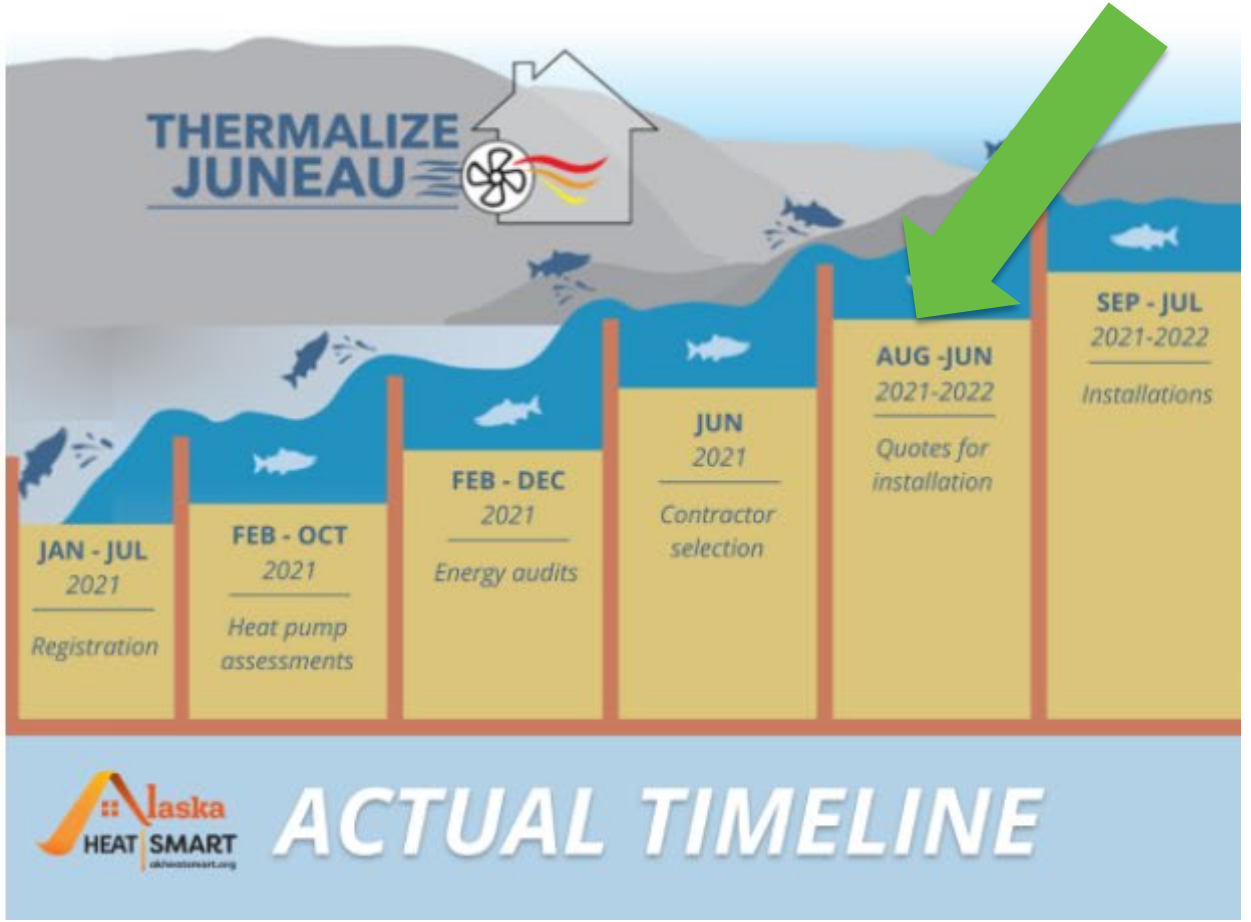
THERMALIZE JUNEAU



Approach: Project timeline

Year 1: Planning and Recruitment **Year 2:** Implementation **Year 3:** Evaluation and Dissemination





Approach: Barriers started with the climate.

Photo courtesy of Alaska Heat Smart

- Can heat pumps work well in a cold, maritime climate?
- Can a team run a ‘solarize’ campaign in a location where solar PV doesn’t make sense?
- Will a rural location be able to support a bulk discount for a community energy campaign?
- Will there be contractors that can handle increased workload?
- Will the local electric grid support heat pump mass adoption?

Approach: Surveys informed approach, identified issues, and validated benefits.

- Ductless heat pump (DHP) user survey
- Participant entry and exit surveys
- Community survey
- Interviews with contractors and stakeholders

Top 3 barriers to participation
(*after explaining a thermalize campaign*):

- Lack of homeownership
- High installation costs
- Not knowing if a heat pump is right for one's home

Top 3 reasons to participate
(*after explaining a thermalize campaign*):

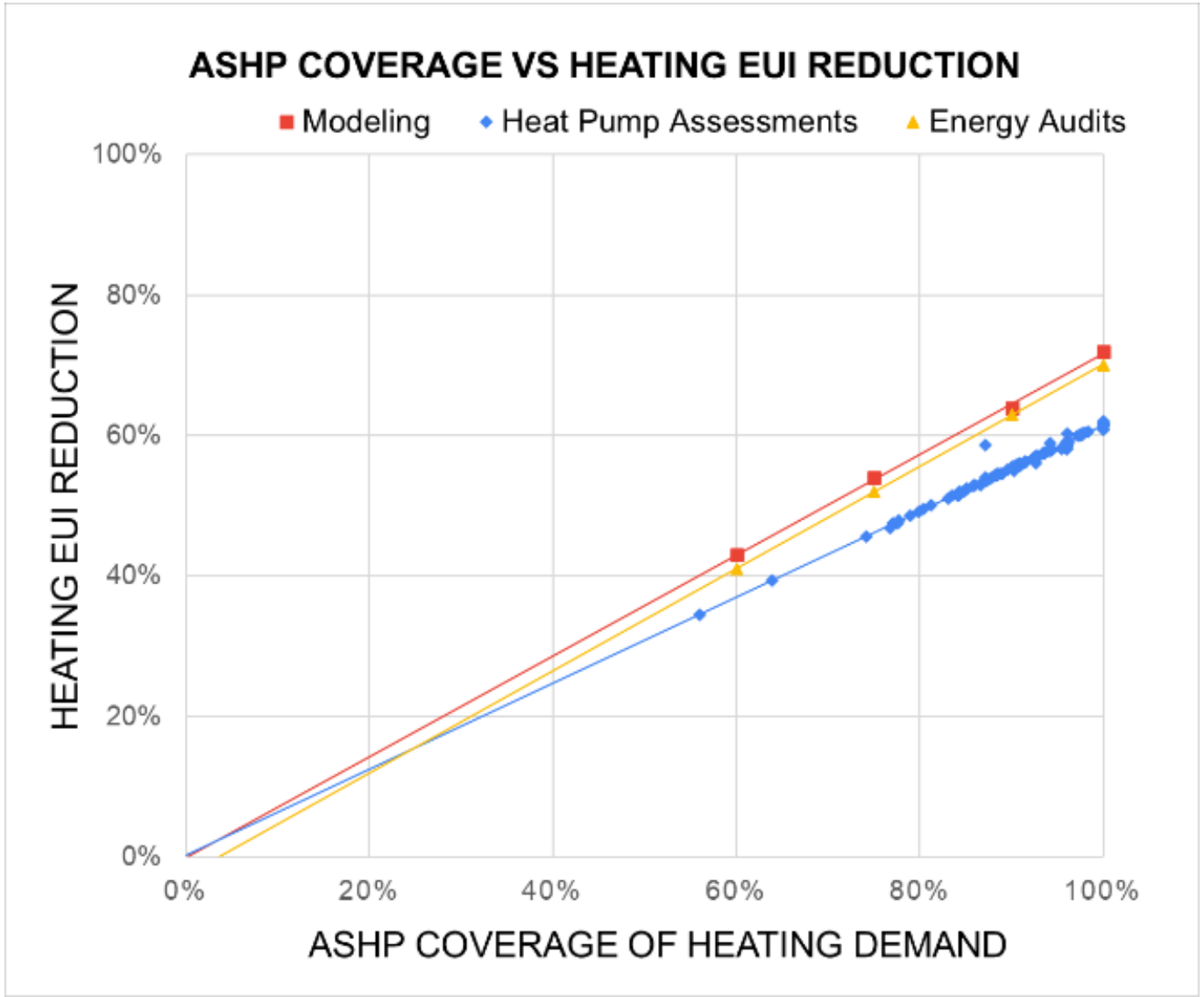
- Supporting a community effort to reduce personal fossil fuel use
- Helping Juneau reach its renewable energy goal
- Not having to purchase fuel oil

Energy modeling predicted savings; actual bills validated results.

Energy data:

- Pre-campaign modeling (prediction)
- Heat pump assessments (prediction)
- Energy audits (prediction)
- Actual whole-house energy data from 10 participants (actual)
- Actual energy reduction of 10 buildings with DHPs installed through Thermalize Juneau:

Energy	Change pre & post heat pump installation
Electrical energy	4% decrease
Fuel oil	84% decrease
Total on-site energy	44% decrease



Approach: Thermalize Juneau engaged partners in the city and region.

Stakeholder engagement before and during campaign:

- Focus groups
- Outreach to Juneau partners

Workforce development:

- Realtors
- Builders

Dissemination:

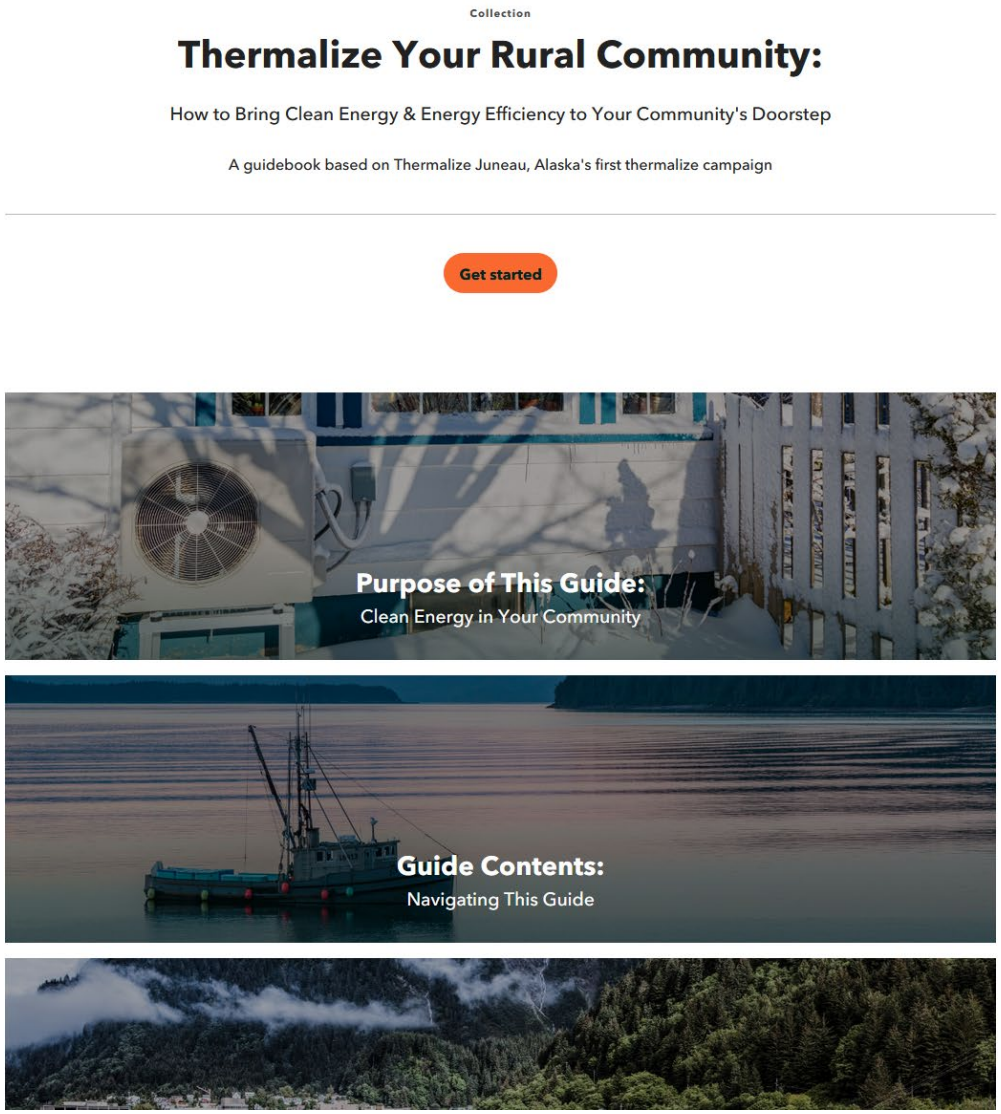
- One workshop in Juneau
- One workshop in another community

Progress and Future Work: Milestones

Milestones: 17 in total / 16 met / 1 pending (Sept. 2023)

End of project goals:

- Achieve 50% EUI savings in households receiving efficiency retrofits and DHPs, without increasing the net load to the electric utility
- A program guide for other rural communities to transition residential space heating from fossil fuels to increasingly renewably powered electric grids
- Guidebook link: https://storymaps.arcgis.com/collections/3d626f877dac4505ae88694469a1f905



The challenges informed the guidebook and resources for others.

Photo courtesy of Building Pros

- COVID / Not being in person
- Number of hours that it takes to operate a campaign of this scale
- Documentation of energy data
- Building in equity goals in the beginning rather than adding them in recruitment stage
- Labor shortages
- Weather
- Tax rebates (which are great!) change the way a campaign looks to some extent
- Aligning the campaign goals and milestone chart to local values and culture

Not encountered:

- Trouble recruiting

Progress and Future Work: Lessons Learned

Community energy campaigns:

- Have a big audience who cares about more than energy savings
- Are hard to fund:
  - "Volunteer" labor is not always a solution
  - Who can pay for this type of campaign is location dependent but can include local governments, utilities, or a coalition of nonprofits

Motivations/Reasons	Weighted Average
Support a community effort to reduce personal fossil fuel usage	2.3
Help Juneau reach its renewable energy goal	2.3
Install a heat pump and not have to purchase fuel oil	2.2
Access a heat pump that improves indoor air quality	2.0
More education about heat pump and energy efficiency options	2.0
Lower installation price for other energy efficiency measures	1.9
Not having to research contractors on my own	1.7
Lower installation price for a ductless heat pump	1.4
Streamlined installation process	1.4
Getting a personalized home assessment	1.3
Install a heat pump and have the ability to cool in summertime	1.2

Progress and Future Work: Project plans

Photo courtesy of Alaska Heat Smart

For the remainder of the project, we will consolidate and analyze energy data from heat pumps:

- Inform calculator accuracy
- Assessing affordability
- Produce outreach materials for Juneau partners

And continue to work with partners throughout the state planning to implement energy campaigns in different locations.

Progress and Future Work: Plans for Juneau

To be clear, this project is scheduled to end in May 2023 (FOA) and September 2023 (AOP).

However, future research and deployment needs in Juneau include:

- Thermalize 2.0 campaign by neighborhood and combined with heavier focus on efficiency
- Large-scale electrical demand modeling effort to quantify the amount of efficiency necessary to offset increased electric demand and prevent need for additional hydropower capacity

Photo courtesy of Alaska Heat Smart

Thank You

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REFERENCE SLIDES

Project Execution: Budget

	FY2020	FY2021	FY2022	FY2023
Planned budget – CCHRC Inc (award)	$21,357.50	$192,150.35	$167,422.30	$88,260.85
Spent budget – CCHRC Inc (award)	$21,357.50	$192,150.35	$167,422.30	$25,120.60 spent through 12/31/2022
Planned - NREL AOP	N/A	$84,112	$59,289	$103,900
Spent – NREL AOP	N/A	$83,189	$43,227	$70,888 spent through 3/31/2023

Project Execution: Go / no go decision point

	Due date	Description	Outcome
Go/no go decision point	End of Q6	At least 50 homes participating and 25% of installations complete	Met

Project Execution: Milestone Chart

	Milestone	Planned completion	Actual completion
1.1	Establish working relationship with project partners / MOUs completed and provided to DOE	Q1	Q1
1.1.1	Establish working relationship with project partners / IPMP signed by partners and provided to DOE	Q1	Q1
2.1	Current DHP user survey	Q2	Q2
3.1	Implement outreach campaign to recruit participants / communication plan completed	Q3	Q3
4.1	Develop energy efficiency retrofit package / package and modeling results provided to DOE	Q3	Q3
5.1	Develop portfolio of incentives / portfolio and partner agreements provided to DOE	Q4	Q4
7.1	Design workforce development program / course outline provided to DOE	Q4	Q4
8.1	Implement energy efficiency retrofits / aggregate information on participants and preliminary results to DOE	Q5	Q3
9.1	Conduct energy audits of participant homes / successful bids provided to DOE	Q6	Q3
10.1	Community wide survey / draft report with results provided to DOE	Q6	Q6
11.1	Finalize workforce development materials / State of Alaska CEU submittal provided to DOE	Q8	Q7
12.1	Conduct program and process evaluation / survey questions provided to DOE	Q9	Q5
12.2	Conduct program and process evaluation / final report on community survey provided to DOE	Q12	Q6
13.1	Evaluate energy effects of program / summary of energy savings for 25% of households provided to DOE	Q10	Q10
15.1	Develop final program guide / provide final program guide to DOE	Q12	Q12
16.1	Share materials and engage stakeholders / regional workshop completed	Q11	Q11
17	Comprehensive report on heat pump monitoring provided to DOE	Q13	On target

Team

Research partners:

Alaska Heat Smart – On the ground support, community partner, local outreach, education, and advising

Information Insights – Education and outreach, workshop facilitation, reporting

Advisory team:

AEL&P – Juneau electric utility, informed campaign design and research questions, provided electrical energy data

Southeast Alaska Building Industry Association – Provided input on the campaign design and assisted with workforce development courses

Panasonic Life Solutions Company – Advised campaign design and technology packages

Environmental and Energy Study Institute – Informed campaign design and reviewed publications

Renewable Juneau – Advised campaign design and reviewed publications

Rocky Mountain Institute – Advised campaign design and reviewed publications