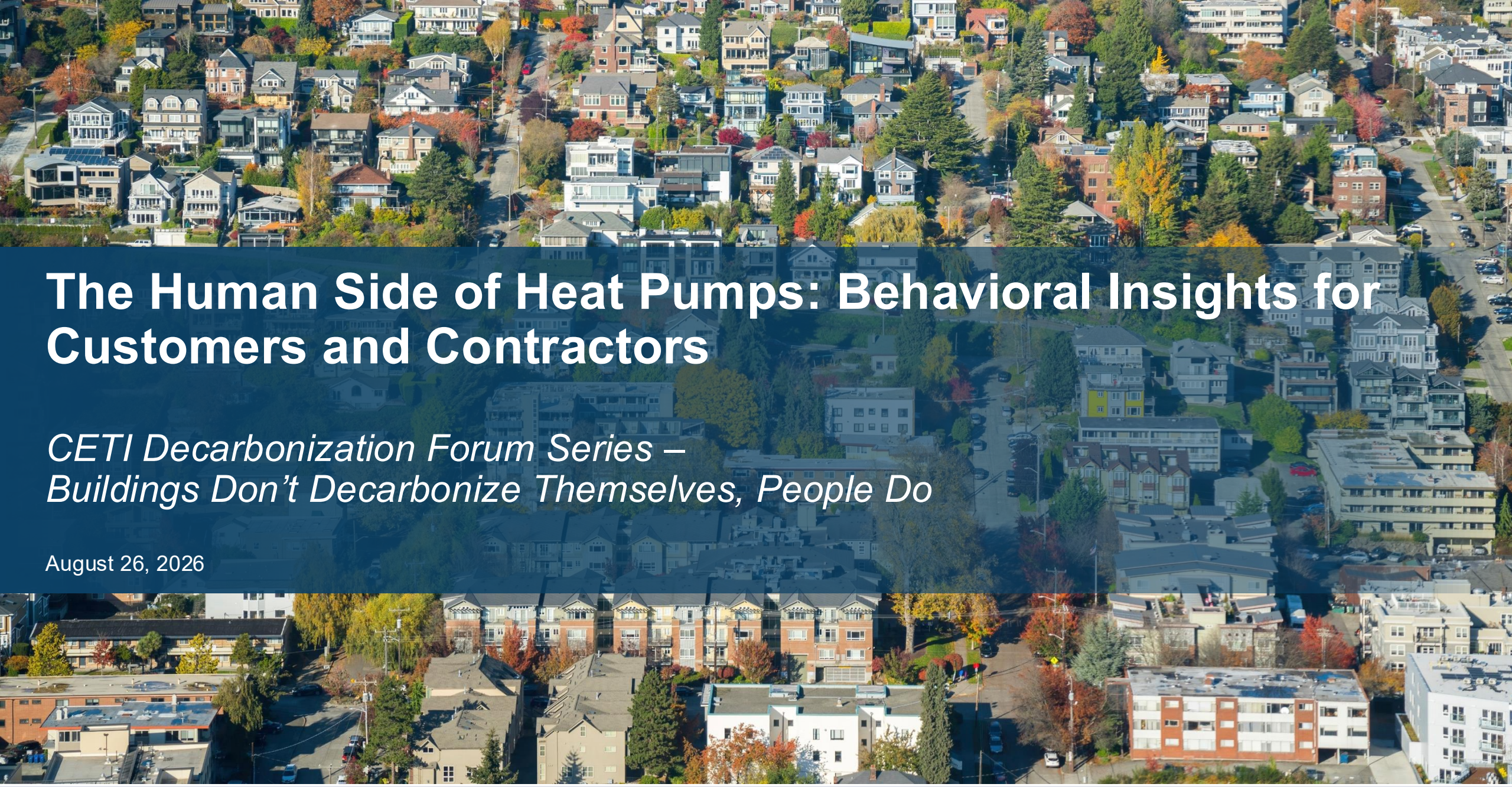


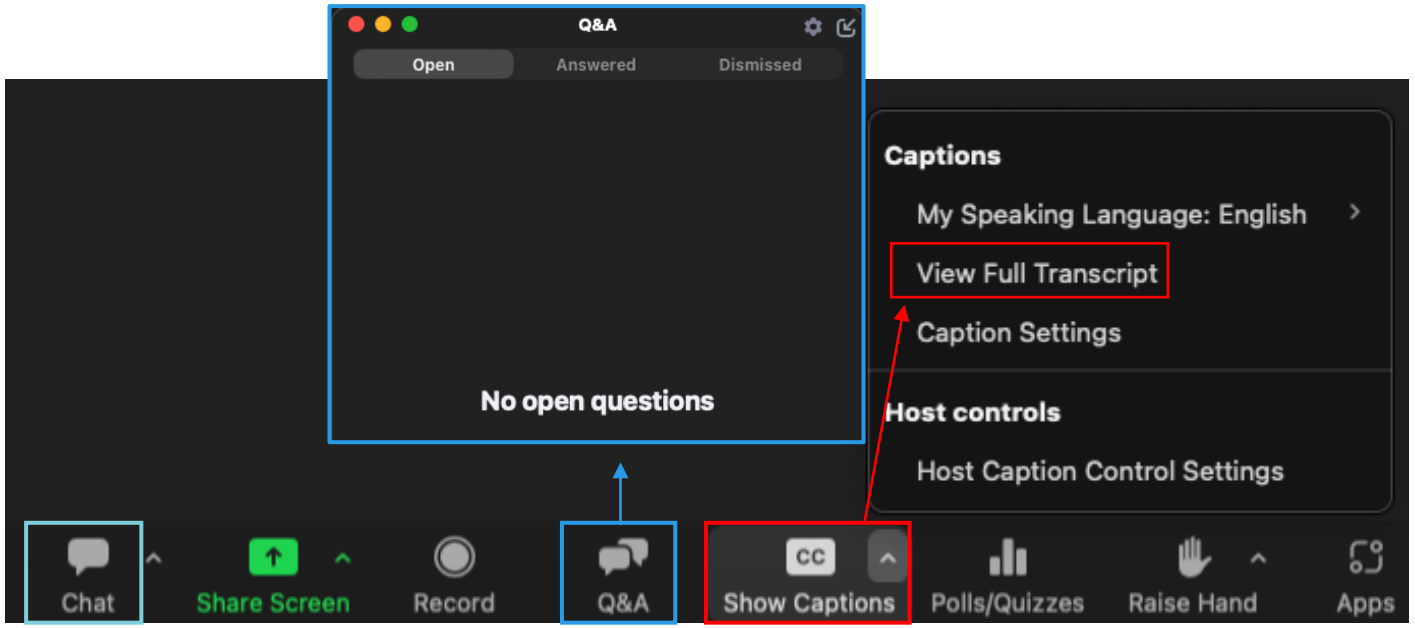
The Human Side of Heat Pumps: Behavioral Insights for Customers and Contractors

CETI Decarbonization Forum Series –
Buildings Don't Decarbonize Themselves, People Do

August 26, 2026

Participating in Today's Webinar

- **Webinar is being recorded**
  - Recording and slides will be shared
- We will be posting links and resources in the **chat**
- Ask questions in the **'Q&A' box**
- **Enable live transcripts** with 'View Full Transcript' setting
- If you have technical difficulties or exit out of the webinar and can't get back in, email jeanne@cleanenergytransition.org

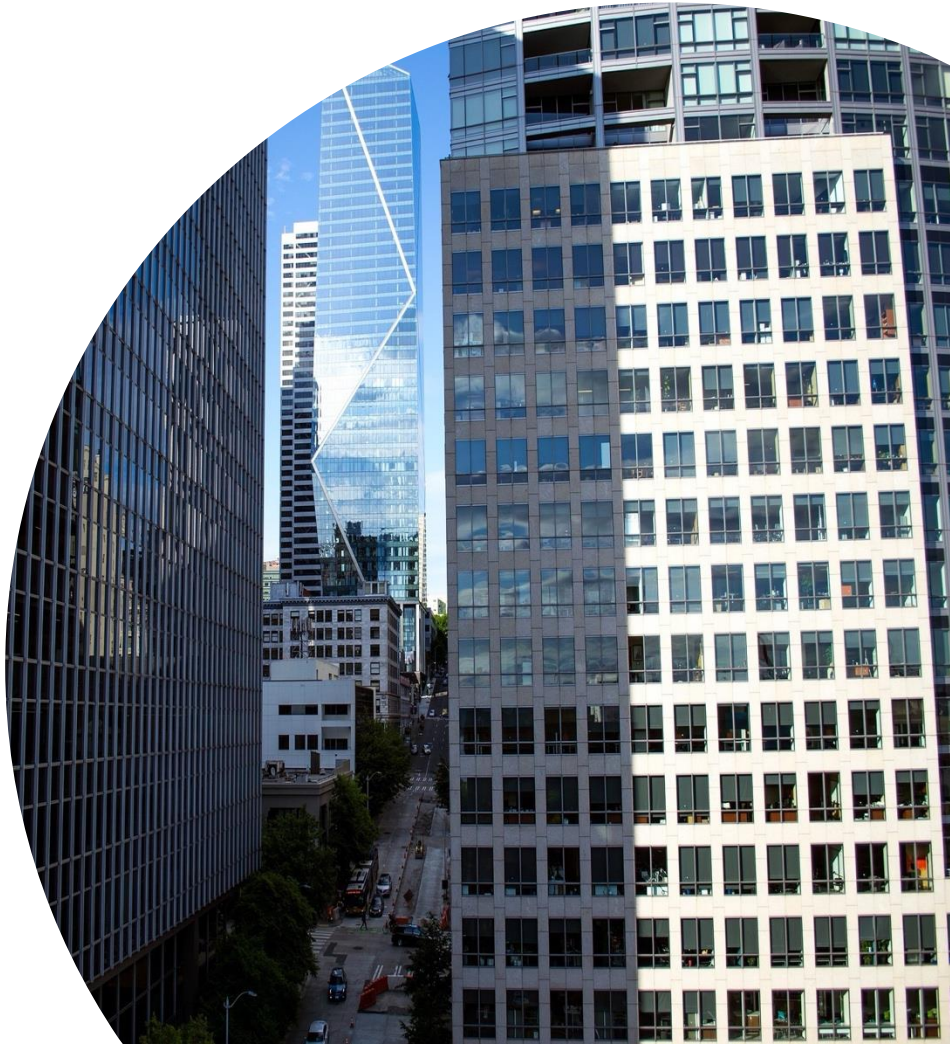


Agenda

- About CETI and Decarbonization Forums
- Webinar series and session introduction
- Presentations by Dr. Jen Loomis and Dr. Sarah Outcault
- Q&A

The Clean Energy Transition Institute

- **Who We Are:** Independent, nonpartisan research and analysis nonprofit
- **Our Mission:** Accelerate an equitable clean energy transition in the Northwest
- **Our Role:** Frame, translate, and demystify decarbonization and the clean energy transition in the Northwest

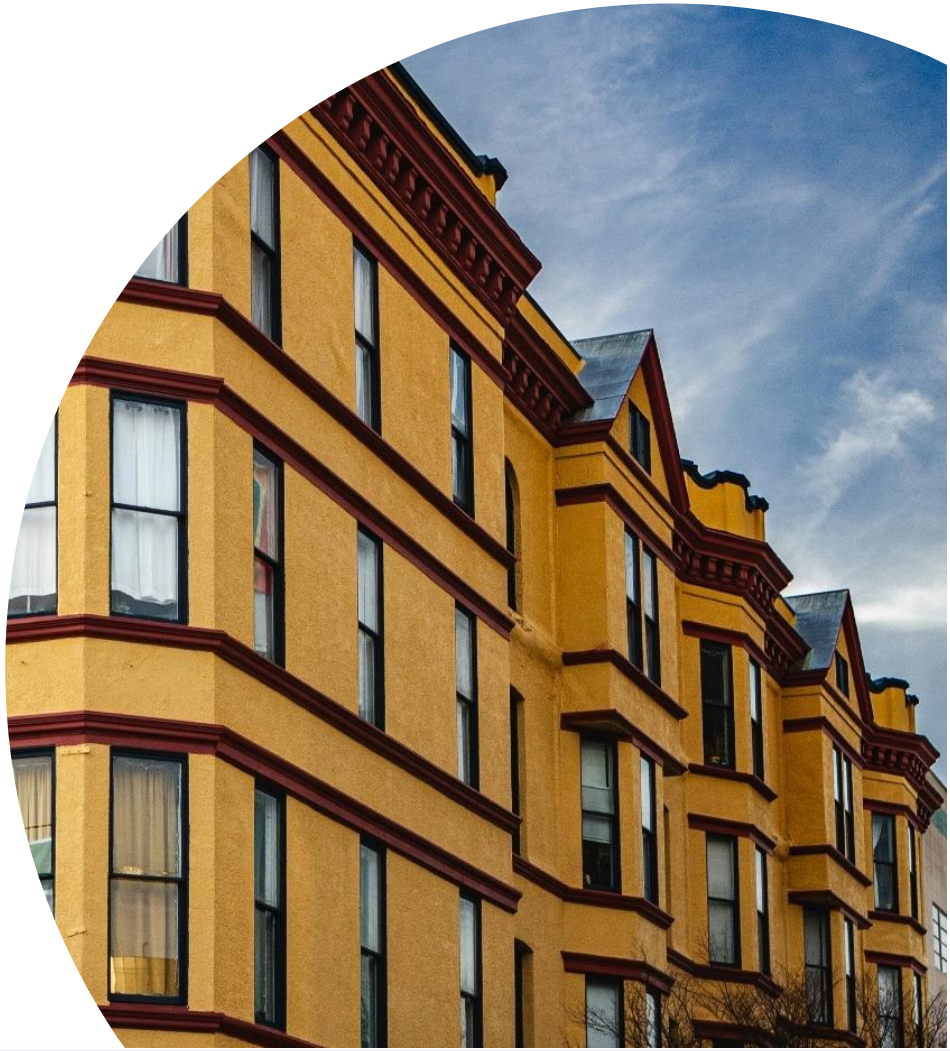


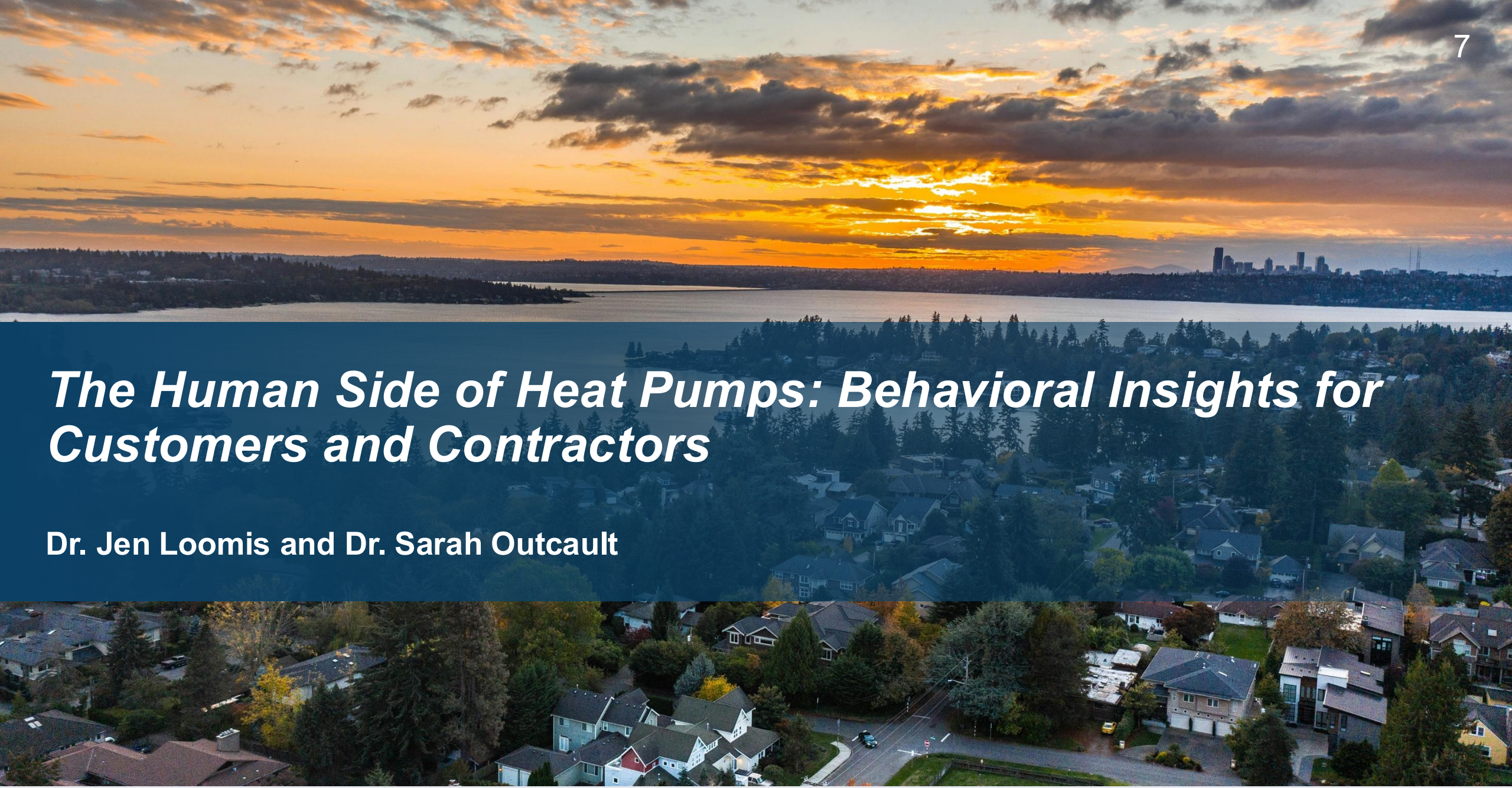
Decarbonization Forums

- CETI presents decarbonization forums to illuminate, demystify, and debate the trade-offs of the most important and complex aspects of decarbonization in Northwest.
  - Bring together experts, policymakers, industry representatives, civil society organizations, and interested individuals to learn about and discuss the challenges and opportunities of transitioning to a clean energy economy.
- Past forums:
  - Climate Solutions for Aviation (in-person)
  - Data Center Energy Use (online)
  - Demystifying Emissions Accounting (in-person)
  - Clean Materials Manufacturing Summit (in-person)

Buildings Don’t Decarbonize Themselves, People Do

- Webinar series exploring the intersection of building decarbonization and the behavioral and social sciences
  - Session 1: *Human Insights 101: What do the behavioral and social sciences have to do with building decarbonization?*
    - July 21st
  - Session 2: *The Human Side of Heat Pumps: Behavioral Insights for Customers and Contractors*
    - Today!
  - Session 3: TBD





The Human Side of Heat Pumps: Behavioral Insights for Customers and Contractors

Dr. Jen Loomis and Dr. Sarah Outcault

The contractor perspective

The Human Side of Heat Pumps

Dr. Jen Loomis

- Market Research & Evaluation Senior Manager at Resource Innovations/California Market Transformation Administration (CalMTA)
- Jen will discuss the following questions from a contractor's perspective:
  - What is a heat pump and why should I care?
  - How do I make it work in this home?
  - How much do I charge?
  - How do I get one?

Q1: What are heat pumps and why should I care?

Q2: Will a heat pump work in this home?

Q3: How much should I charge?

Q4: How can I get one?

Heat Pump 101

- Popular elsewhere in the world, US behind
- They move heat, not generate it
- Electric and usually require 240V circuit
- Applied to space-conditioning, water-heating, clothes drying, pool pumps
  - HVAC can be ducted, ductless, or portable
- Keystone technology for decarbonization to achieve rapid electrification by leveraging renewables for load flexibility

What are heat pumps and why should I care?

- They're substantially different than common gas equipment
- Contractors have to learn these differences to sell and install appropriately

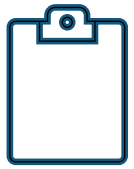
- HVAC heat pumps heat and cool
- Have slower fan speeds
- Don't heat air as hot

- HPWH have slower recovery rates
- Have ambient air space requirements
- Can act as a grid resource

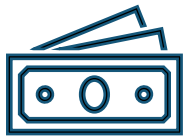
What are heat pumps and why should I care?

- Offering them allows contractors to differentiate themselves in the market

Green-minded customers and those with solar want heat pumps



Contractors can future-proof their businesses



Potential to make more money

Q1: What are heat pumps and why should I care?

Q2: Will a heat pump work in this home?

Q3: How much should I charge?

Q4: How can I get one?

Will they work in this home?

- Not guaranteed!
- Complicating factors include
  - Electrical panel
  - Home envelope
  - Cold climate
  - Ductwork and electrical work
  - Parasitic heat loss for HPWH
- Technology innovations
  - ccHPs
  - Ductless and room/window heat pumps
  - 120V HPWH

Q1: What are heat pumps and why should I care?

Q2: Will a heat pump work in this home?

Q3: How much should I charge?

Q4: How can I get one?

How much should I charge?

- Contractor companies have a lot of discretion
- Total cost accounts for decommissioning and removal of old system, equipment, labor, permitting, etc.
- “Risk pricing” is common with unfamiliar technologies
  - an inflation of labor costs to cover the unknowns associated with a job
- Labor costs increase in markets with smaller supply of skilled workers and higher costs of living

*Source: https://opiniondynamics.com/wp-content/uploads/2025/06/OD-CPUC-Heat-Pump-Market-Study-Report-5-17-2022_NAZGH4Q.pdf

How much should I charge? (HVAC)

- Online survey with 64 TECH Clean California-enrolled contractors

Project Type	Total Cost	Equipment Cost	Labor Cost	Misc. Cost
CAC → Ducted Heat Pump	$11,201	$6,767	$3,495	$1,103
CAC + Gas Furnace → Ducted Heat Pump	$13,281	$7,761	$4,284	$1,371
Gas Furnace → Ducted Heat Pump	$14,909	$8,185	$5,029	$1,854

All scenarios assume no equipment relocation, no panel upgrades necessary, and no ductwork needed to be replaced. All heat pumps are 3-ton code-minimum 14 SEER

Source: https://opiniondynamics.com/wp-content/uploads/2025/06/TECH_Cost_Study_-_FINAL_Phase_I_Findings_2.12.24_2.pdf

How much should I charge? (HPWH)

- Mystery Shopping Study in California in 2024: Average costs

Project Type	Total Cost	Equipment Cost	Labor Cost	Misc. Cost
Gas storage water heater	$4,264 (n=20)	$3,994 (n=10)	--	$591 (n=4)
Gas tankless water heater	$9,011 (n=24)	$7,867 (n=13)	--	$5,690 (n=7)
Heat pump water heater	$8,549 (n=31)	$8,024 (n=23)	$2,758 (n=1)	$1,750 (n=9)

All scenarios had a gas storage water heater as the existing equipment.
Trained mystery shoppers met with real contractors and got bids.
Bids varied in how much was broken out by cost.

Source: https://opiniondynamics.com/wp-content/uploads/2026/01/TECH-Incremental-Cost-Study-Final-Report.pdf

Q1: What are heat pumps and why should I care?

Q2: Will a heat pump work in this home?

Q3: How much should I charge?

Q4: How do I get one?

How do I get one?

- Contractors almost exclusively purchase from distributors
  - Likely to have product in stock
  - Have models on display
  - Better warranty support
  - Discounts associated with incentive programs
  - Knowledgeable about equipment and can advise on projects
- They avoid retailers because
  - Heat pumps are not always in stock
  - There can be long lines
  - They perceive staff as not as knowledgeable as distributors

Sources: https://www.ilsag.info/wp-content/uploads/AIC-Market-Effects-2021-HPWH-Market-Characterization-Report-FINAL-2021-09-15.pdf
https://www.ilsag.info/wp-content/uploads/AIC-Market-Effects-2021-HVAC-Market-Characterization-Report-FINAL-2021-09-15.pdf

The consumer perspective

The Human Side of Heat Pumps

Dr. Sarah Outcault

- Market Transformation Research Director, Western Cooling Efficiency Center at UC Davis
- Sarah will discuss the following questions from a consumer's perspective:
  - What are heat pumps and why should I care?
  - Will they work in my home?
  - What will it cost?
  - How do I get one?

Q1: What is a heat pump and why should I care?

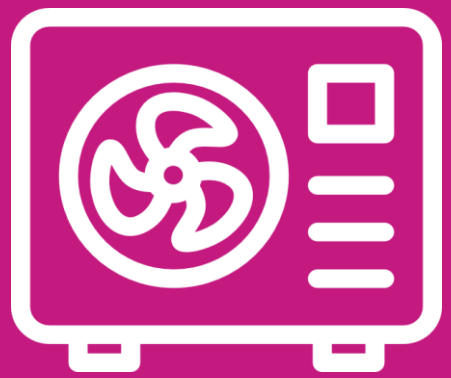
Q2: Will a heat pump work my home?

Q3: What does a heat pump cost?

Q4: How do I get one?

What is a heat pump? Why should I care?

Barriers & Challenges: Awareness



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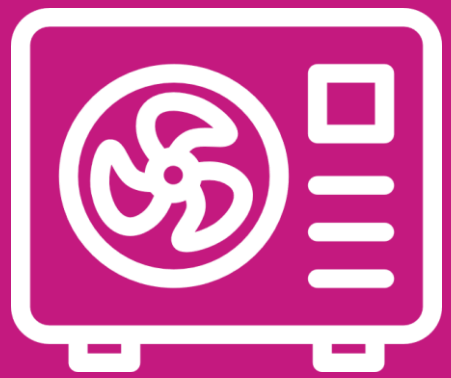
- Low general awareness
- Low awareness of non-energy benefits

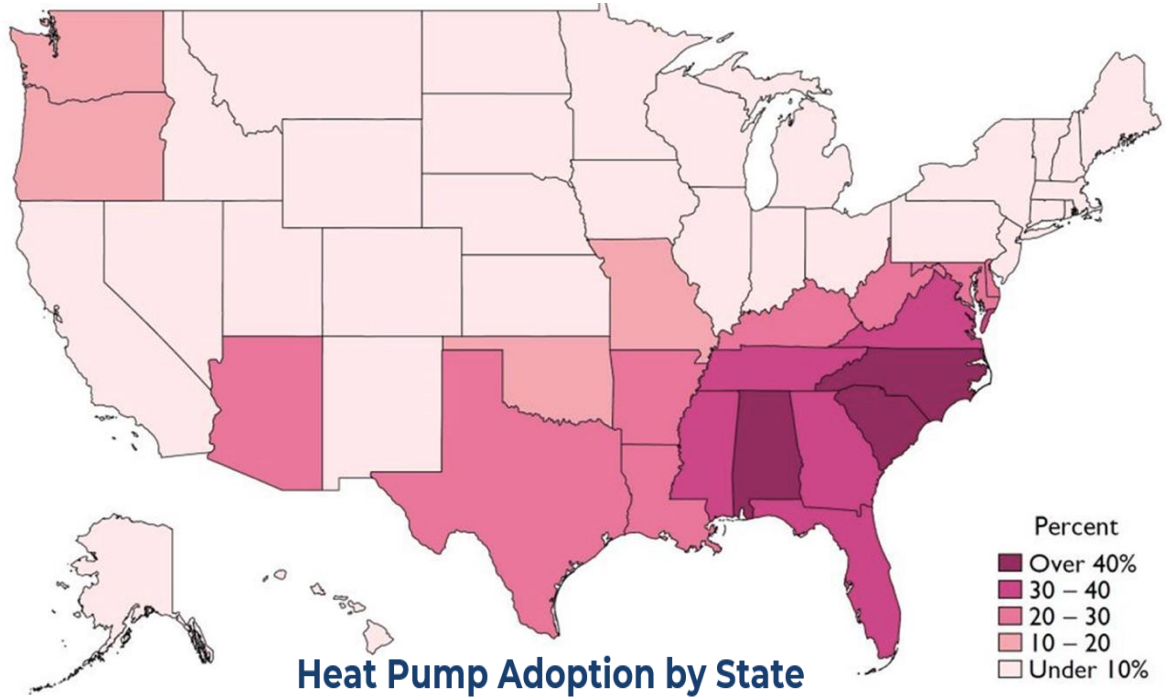
58% **of California homeowners are familiar with space conditioning heat pumps (Opinion Dynamics, 2024)**

What is a heat pump? Why should I care?

Barriers & Challenges: Observability



- Largely invisible, installed out of sight
  - Unlike solar PV, EVs
- Relatively uncommon in many states (but growing!)



Heat Pump Adoption by State

Source: U.S. Department of Energy, *Residential Energy Consumption Survey 2020*

UCDAVIS Market Transformation Research Program

What is a heat pump? Why should I care?

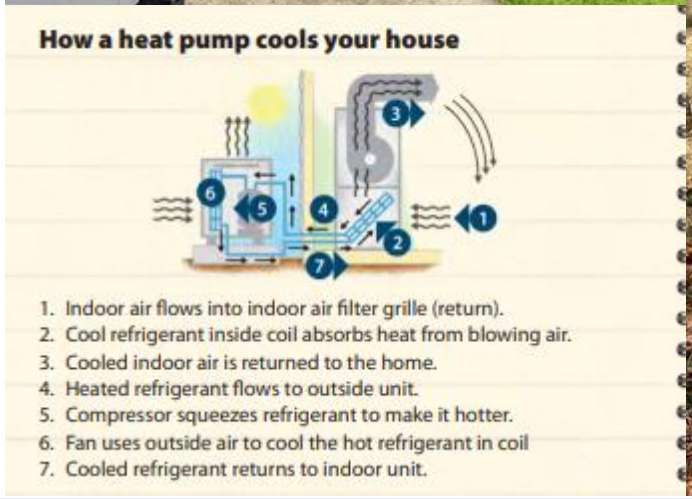
Awareness & observability
Solutions & opportunities

Educational resources

- Explainer videos
- FAQs
- Apps
- HP owner testimonials

Increase observability through:

- Public awareness campaigns
- Social media
- Community events (e.g., heat pump “parties”)



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Bottom left: https://singingriver.com/wp-content/uploads/2018/01/smepa_ca_bklt_12-2-2015-web-1.pdf
Bottom right: https://www.canarymedia.com/articles/heat-pumps/heat-pump-coaches-help-neighbors-ditch-fossil-heat-in-Massachusetts

Leveraging non-energy benefits

UCDAVIS
Market Transformation
Research Program

		Physiological	Psychological	Economic	Practical	Sociological
Functional outcomes	Spatial		✓	✓	✓	✓
	Thermal	✓	✓	✓	✓	✓
	Air	✓	✓	✓	✓	✓
	Acoustic	✓	✓	✓	✓	✓
	Visual	✓		✓		
	Building Integrity					

Q1: What is a heat pump and why should I care?

Q2: Will a heat pump work in my home?

Q3: What does a heat pump cost?

Q4: How do I get one?

Will it work in *my* home?

Barriers & Challenges:

Compatibility & Trialability

40% **of homes in the U.S. have electrical panels that would not support an ASHP's power requirements (240V)**
(Gul & Meier, 2024)

UCDAVIS Market Transformation Research Program

Are heat pumps compatible with my home?

- Technical compatibility & complexity
  - Need to integrate HPs with existing home infrastructure (e.g., electrical panels, ducts, insulation, refrigerant lines, air handler, physical space)
  - Solutions:
    - Pre-screening tools for electrical compatibility
    - Alternative form factors (e.g., multifunction HPs)

Are heat pumps compatible with my household?

- Personal compatibility: Will it work for *me/us*?
  - Difficult to test out without major investment

Will it work in *my* home?

Trialability
Solutions & opportunities

Incidental exposure
- Public installations
- Airbnb properties

Virtual experience
- Online demo

Demonstration
- Tiny home
- Showrooms

Tour
- Home tours

Trial
- Heat pump rental
- Portable/room HP

Outcault, S., Alston-Stepnitz, E., Sanguinetti, A., & Eorwyn, E. (forthcoming). Trialability as a lever for heat pump adoption: Insights from a review of field initiatives. *Findings.*

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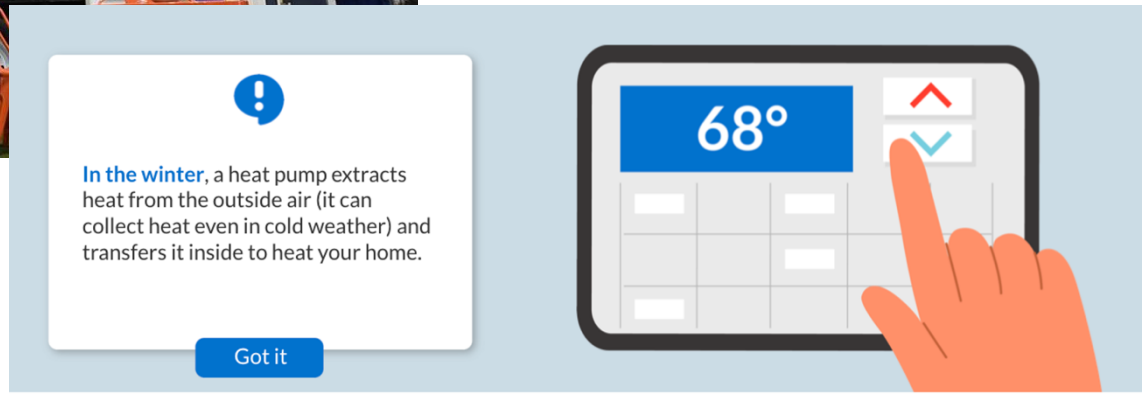
Look out for our forthcoming publication



Top: https://www.les.com/sustainability/educational-interactive-tiny-house
Bottom: https://wattsmarthomes.com/heat-pump-comfort/

Q1: What is a heat pump and why should I care?

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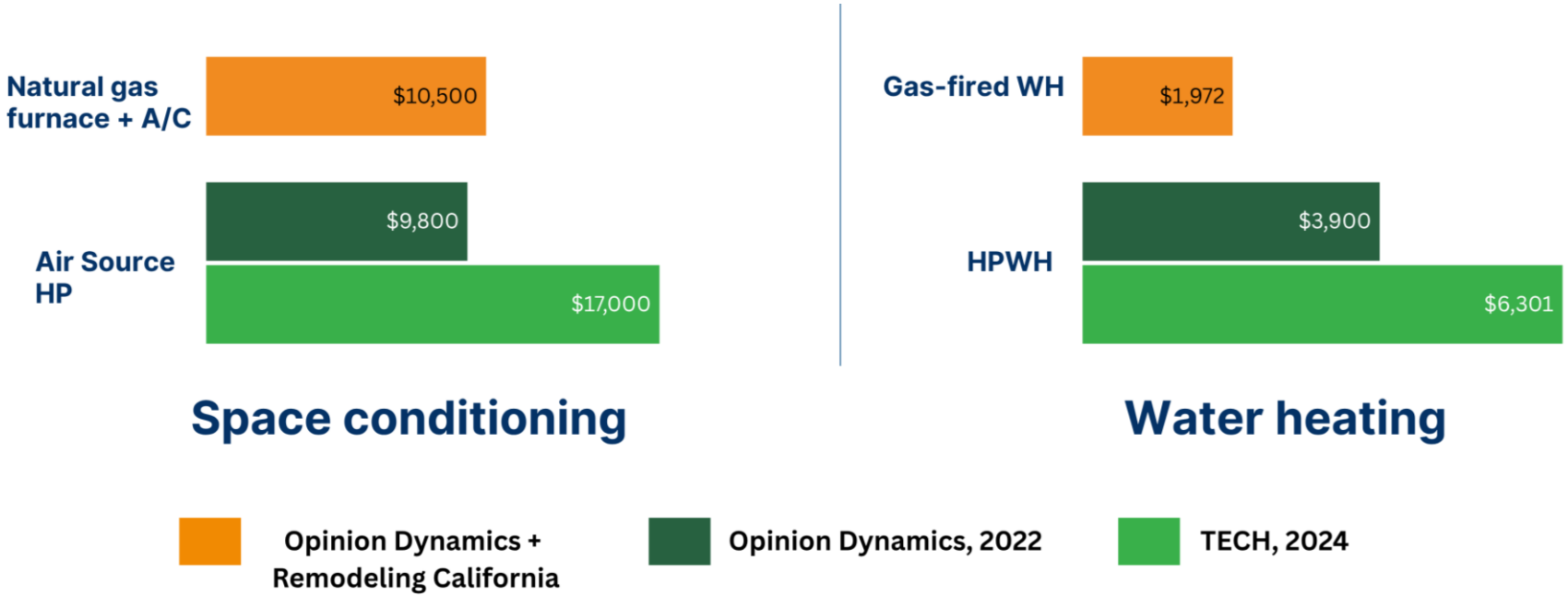
Q3: What does a heat pump cost?

Q4: How do I get one?

What's the customer value proposition?

Barriers & Challenges:

Costs



-Higher upfront costs
-Higher operating costs

vs.

+Health & safety benefits
+Environmental benefits

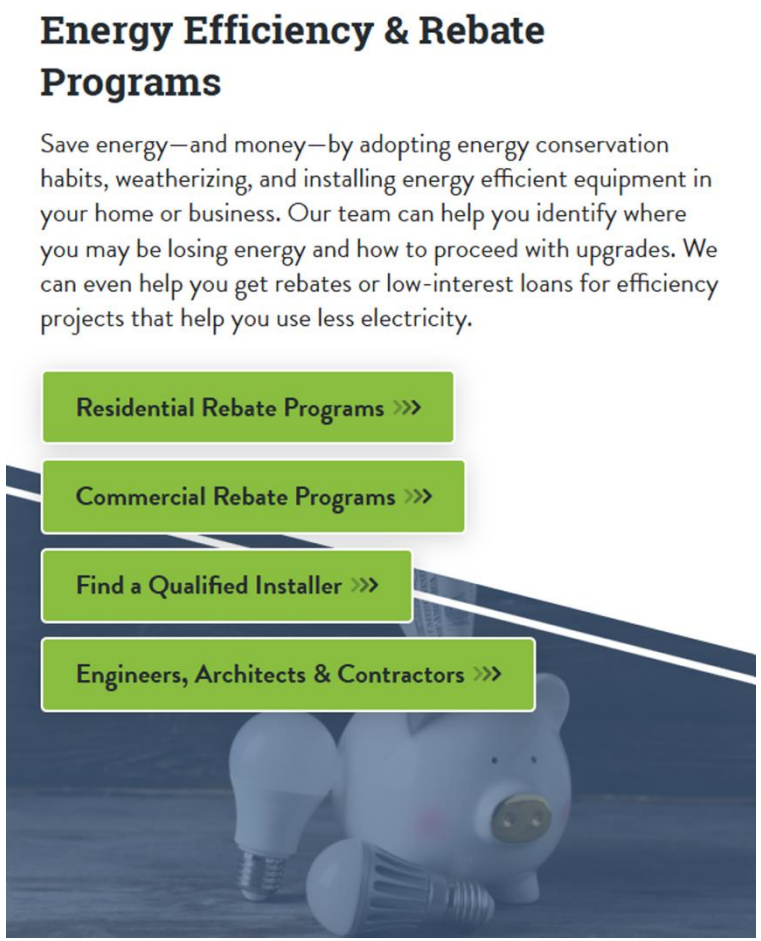
What's the customer value proposition?

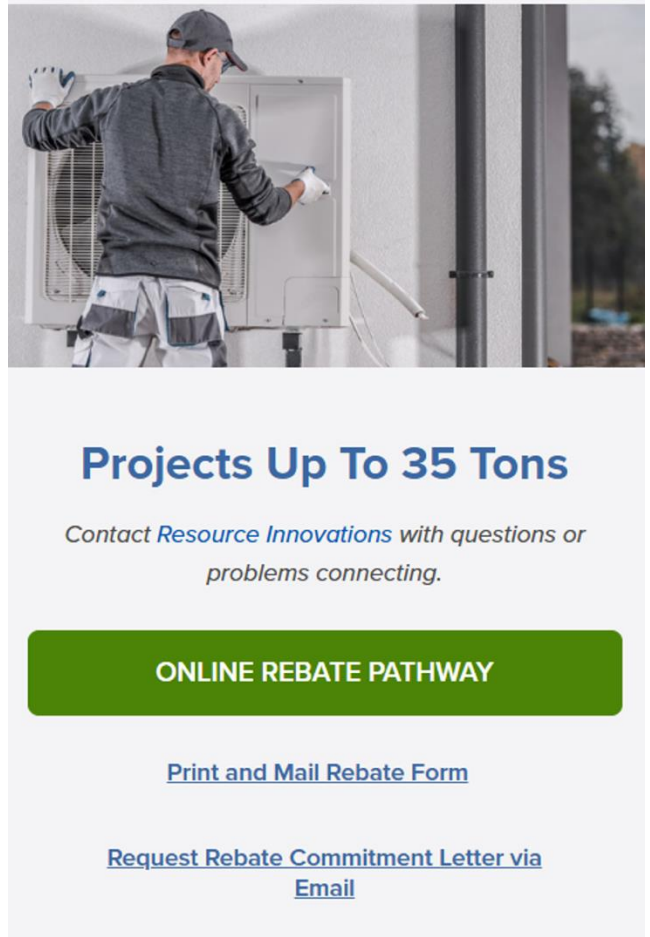
Upfront costs
Solutions & opportunities

Addressing incentive complexity
- Incentive eligibility screening
- One-stop shop

Expand/bundle incentives for related costs
- e.g., panel upgrades, weatherization

Bringing down market costs
- Easy-to install designs
- Multifunction heat pumps





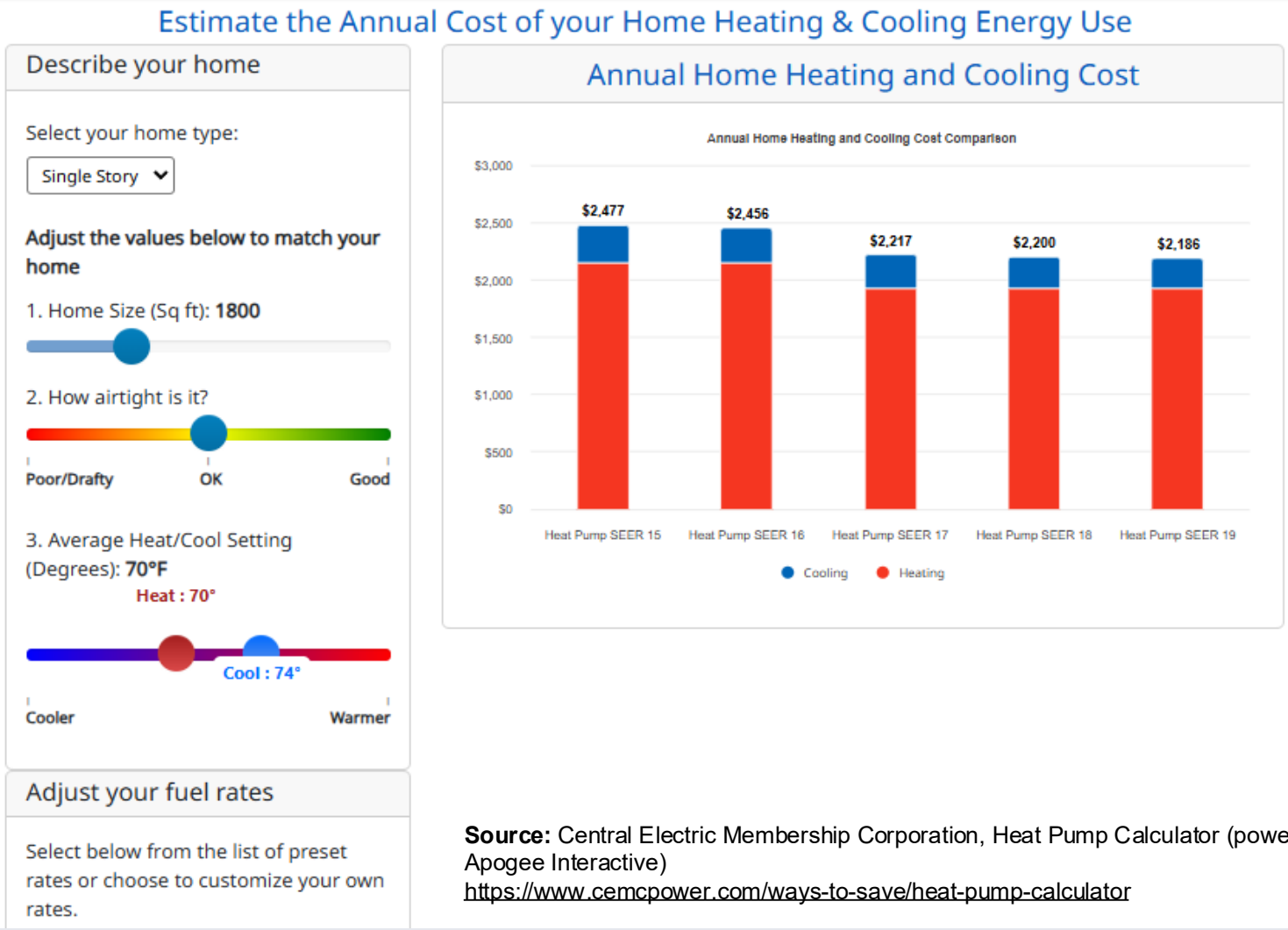
Left: https://www.flatheadelectric.com/energy-solutions/ **Right:** https://www.masssave.com/business/rebates-offers-services/heating-and-cooling/heat-pumps/air-source-heat-pumps

What's the customer value proposition?

Operating costs
Solutions & opportunities

Addressing operating costs *and* uncertainty

- Offer energy savings/cost calculators
- Promote high efficiency equipment
- Bundle with solar PV
- Offer heat pump electricity rates



Source: Central Electric Membership Corporation, Heat Pump Calculator (powered by Apogee Interactive)
https://www.cemcpower.com/ways-to-save/heat-pump-calculator

Q1: What is a heat pump and why should I care?

Q2: Will a heat pump work in my home?

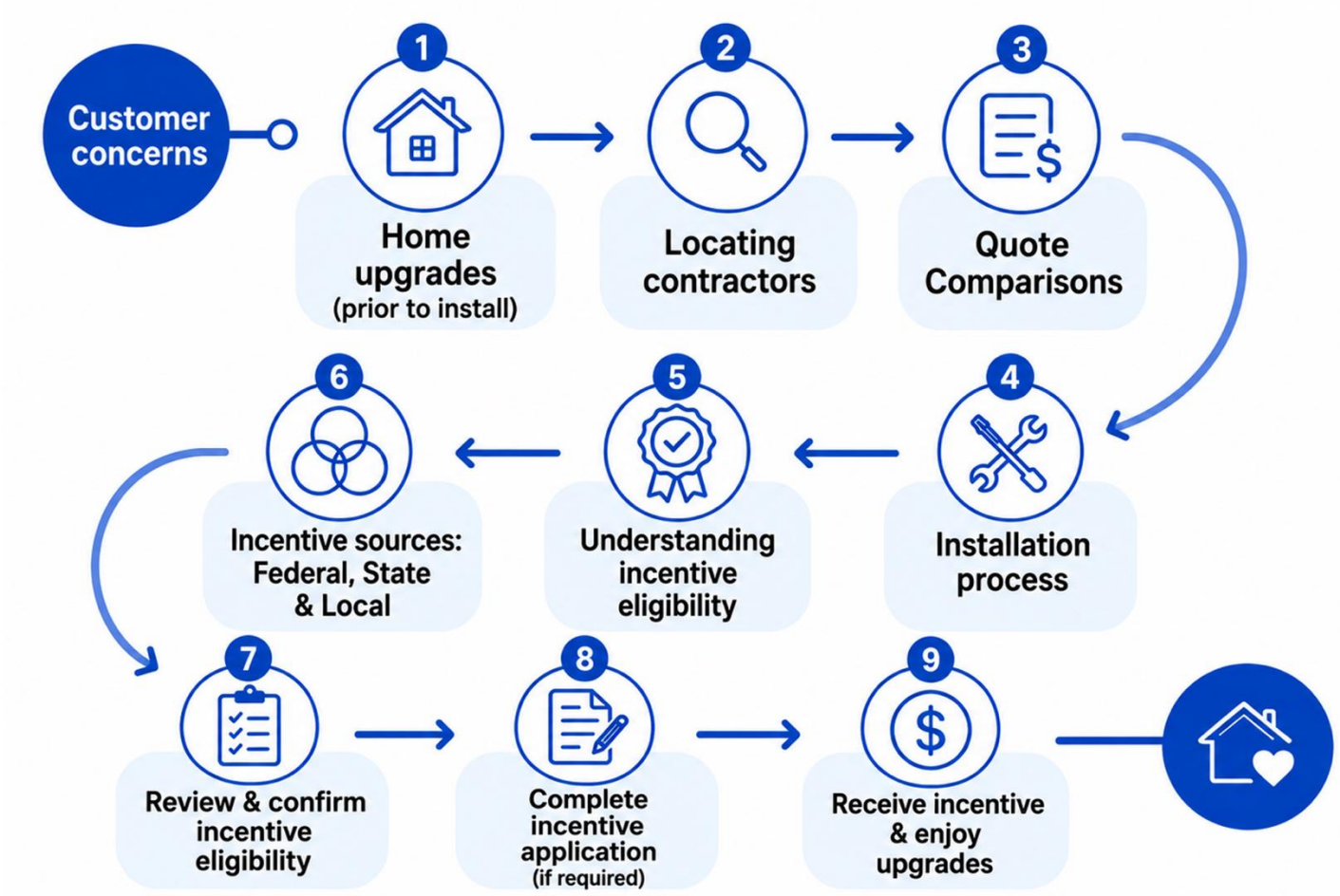
Q3: What does a heat pump cost?

Q4: How do I get one?

How do I get one?

Barriers & Challenges:

Implementation

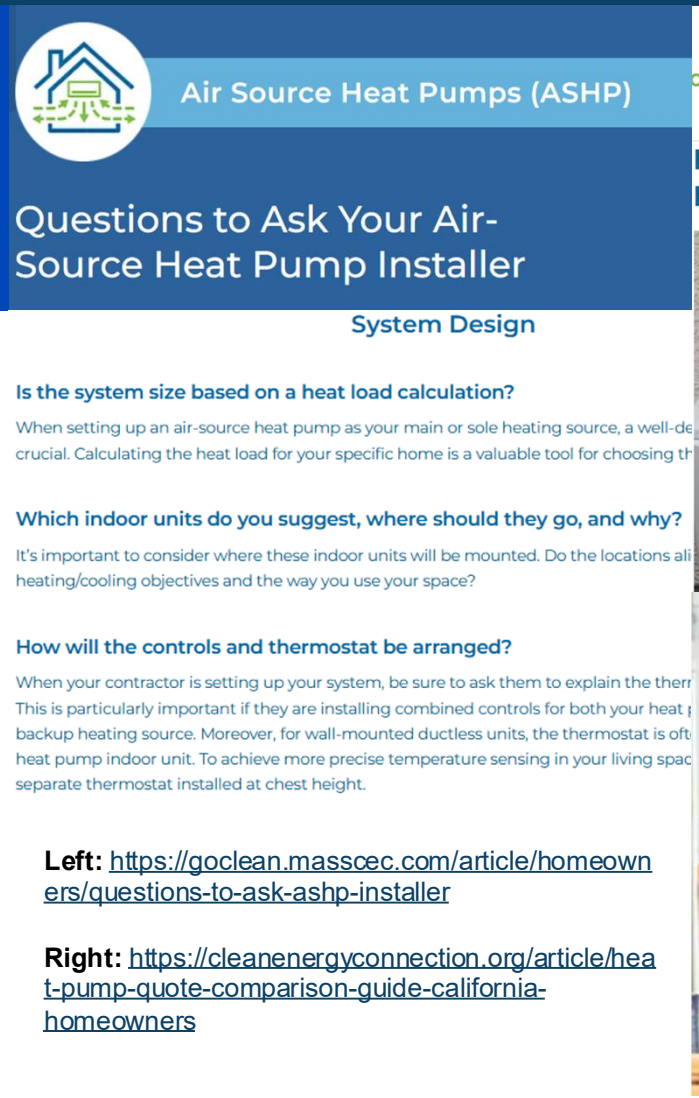


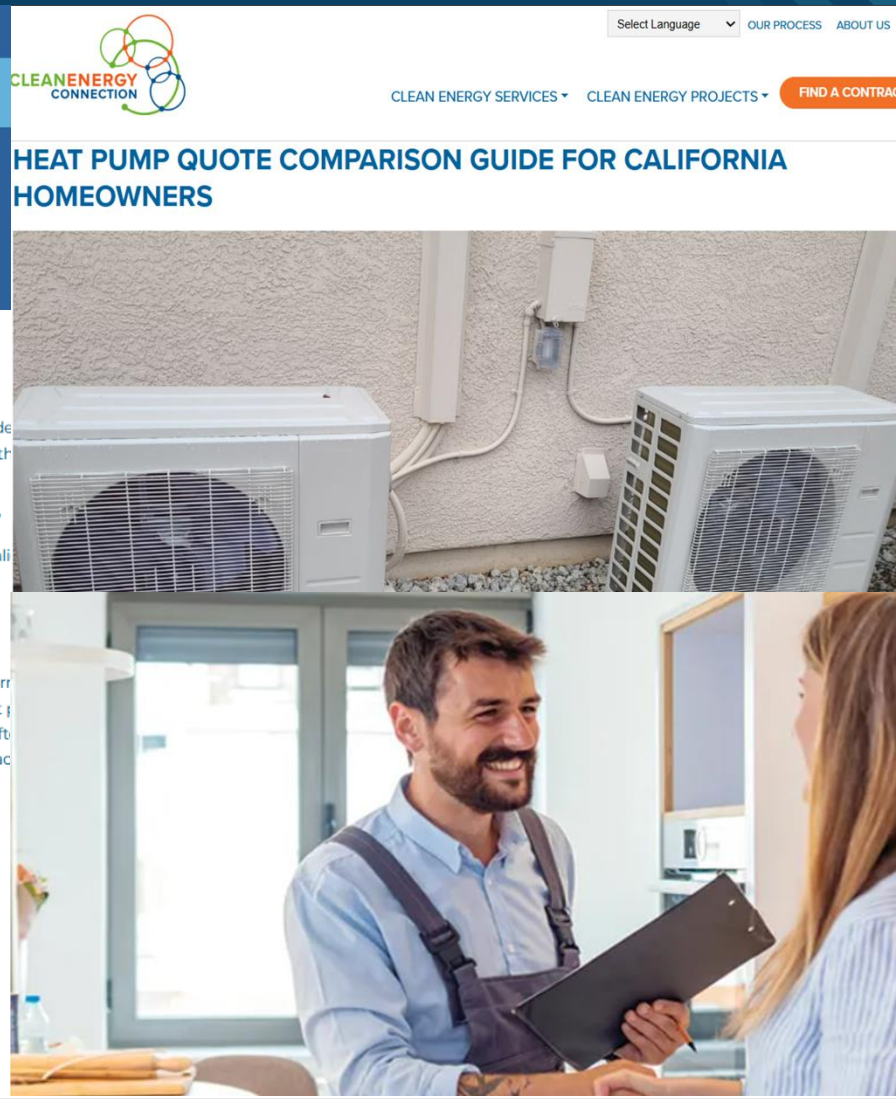
How do I get one?

Implementation
Solutions & opportunities

Consumer resources

- Contractor lists
- Questions-for-contractors guides
- Quote comparison tools and services
- Concierge and coach services





Left: https://goclean.masscec.com/article/homeowners/questions-to-ask-ashp-installer

Right: https://cleanenergyconnection.org/article/heat-pump-quote-comparison-guide-california-homeowners

Questions & Answers

Closing

- Recording and slides will be shared by the end of next week
- Session 3: Look for announcement soon
- Sign up for CETI's mailing list to be informed about future forums
  - cleanenergytransition.org/sign-up

Thank you very much

Contacts

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Sarah Outcault: smoutcault@ucdavis.edu

Citations

- Gul, S. and Meier, A., 2024. A Comprehensive Survey of Electrical Panel Capacities in US Single-Family Homes and Implications for Nationwide Electrification. In *Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings*.
- Opinion Dynamics. (2022). Heat Pump Market Baseline and Characterization for the State of California. California Public Utilities Commission (CPUC). https://opiniondynamics.com/heat-pump-market-baseline-and-characterization-for-the-state-of-california/
- Harrington, C., Outcault, S., Feng, J. & A. Frasier. 2024. "Field Evaluation of Affordable Low Global Warming Potential Residential Heat Pumps." In *Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings.* https://www.aceee.org/sites/default/files/proceedings/ssb24/pdfs/Field%20Evaluation%20of%20Affordable%20Low%20GWP%20Residential%20Heat%20Pumps.pdf
- Outcault, S., Alston-Stepnitz, E., Eorwyn, E., Magaña, C. & E. Searl. 2024. Innovative Approaches to Residential Heat Pump Promotion. CalNEXT report. Available at: https://calnext.com/wp-content/uploads/2024/06/ET23SWE0053_Insights-from-Innovative-Programs-on-Barriers-and-Opportunities-for-Heat-Pump-Adoption_Final-Report.pdf
- Outcault, S., Alston-Stepnitz, E. & A. Sanguinetti. 2026. "From Barriers to Breakthroughs: Social Science Insights for Accelerating Heat Pump Adoption." *ASHRAE Transactions.* https://doi.org/10.63044/w26out54
- Outcault, S., Alston-Stepnitz, E. Sanguinetti, A. & E. Eorwyn. (2026, under review) "Trialability as a Lever for Heat Pump Adoption: Insights from a Review of Field Initiatives." *Findings*.
- Outcault, S., Alston-Stepnitz, E., Sanguinetti, A., & Searl, E. 2024. 'What's the ETA for heat pump adoption? Assessing barriers and opportunities with the Energy Technology Adoptability framework.' In *ECEEE 2024 Summer Study Proceedings: Sustainable, safe and secure through demand reduction,* 10–15 June 2024, Center Parcs Lac d'Ailette, Chamouille, France. https://ucdavis.app.box.com/s/r5ng3yqrirgc2bhqoluw1na7rs2fhu9b
- Outcault, S., Alston-Stepnitz, E., Searl, E., & C. Magaña. 2024. "Harnessing non-energy impacts to promote residential heat pump adoption: Examples from the U.S. and beyond." In *Proceedings of the 2024 International Conference on Energy Efficiency in Domestic Appliances and Lighting.* https://ucdavis.app.box.com/s/dbmzd1km6lwyfeo6sws4227xrd4lx9gh
- Outcault, S., Sanguinetti, A., Dessouky, N. & Magaña, C., 2022. Occupant Non-Energy Impact Identification Framework: A human-centered approach to understanding residential energy retrofits. *Energy and Buildings*, 263, p.112054. https://doi.org/10.1016/j.enbuild.2022.112054
- Outcault, S., Sanguinetti, A. & Nelson, L., 2022. Technology characteristics that influence adoption of residential distributed energy resources: Adapting Rogers' framework. *Energy Policy*, 168, p.113153. https://doi.org/10.1016/j.enpol.2022.113153
- Outcault, S., Zach, S., Eorwyn, E., Alston-Stepnitz, E., Searl, E. & C. Magaña. 2025. Heat Pump Consumer Questions Study. CalNEXT report. https://calnext.com/wp-content/uploads/2025/08/ET24SWE0022_Heat-Pump-Customer-Questions-Study_Final-Report.pdf
- Pedroso, S., Alston-Stepnitz, E., and S. Outcault. 2025. Market Study—Residential Multifunction Heat Pump. CalNEXT report. Project # ET25SWE0024. https://www.etcc-ca.com/reports/residential-multi-function-heat-pump-market-study
- TECH Clean California. (2024). TECH Public Reporting Data. https://techcleanca.com/public-data/download-data/
- UC Davis MTRP. Database of residential heat pump promotion efforts. https://ucdavis.box.com/s/7pqpnqm99ltidftugqaubfegbhzcfvpg