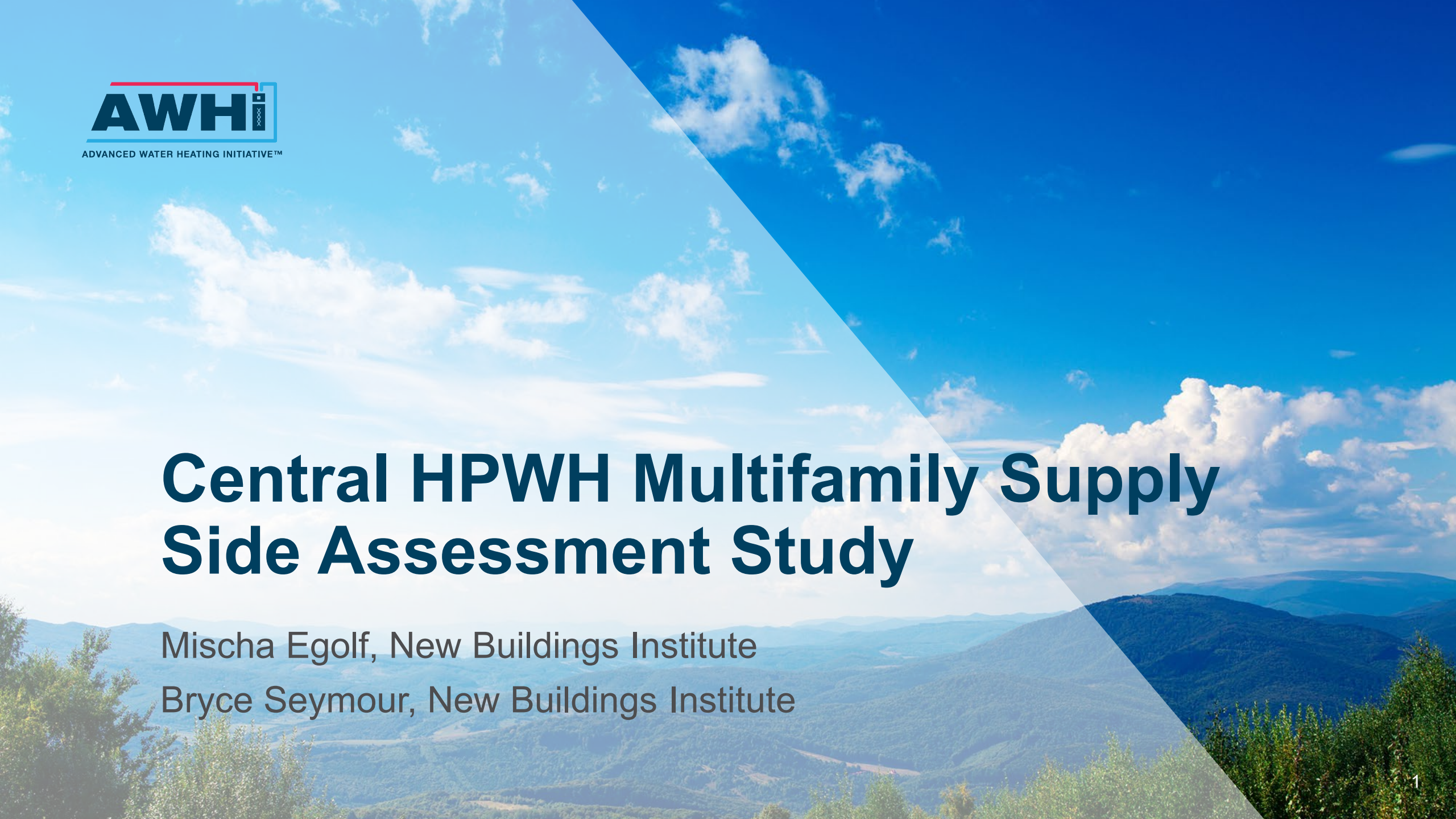


Central HPWH Multifamily Supply Side Assessment Study

Mischa Egolf, New Buildings Institute

Bryce Seymour, New Buildings Institute

Project Background

- **Large Capacity Central CO2 Heat Pump Study**
  - Multifamily installations of Mitsubishi Heat2O; extensive post-install monitoring & testing
  - Prime: Association for Energy Affordability
  - Engineering Lead: Ecotope
  - Market Transformation: EPRI and NBI
- Primary funding: California CEC EPIC Grant
- Match funding from NEEA for market transformation work

Supply Side Research Goals

1. Identify primary barriers to central HPWH adoption in multifamily buildings

2. Better understand drivers for each market actor

3. Utilize market actor feedback to understand the most effective pathways to increased market adoption of central HPWHs


Context

Terminology level-set: system types

Photo credit: Ecotope, Inc.

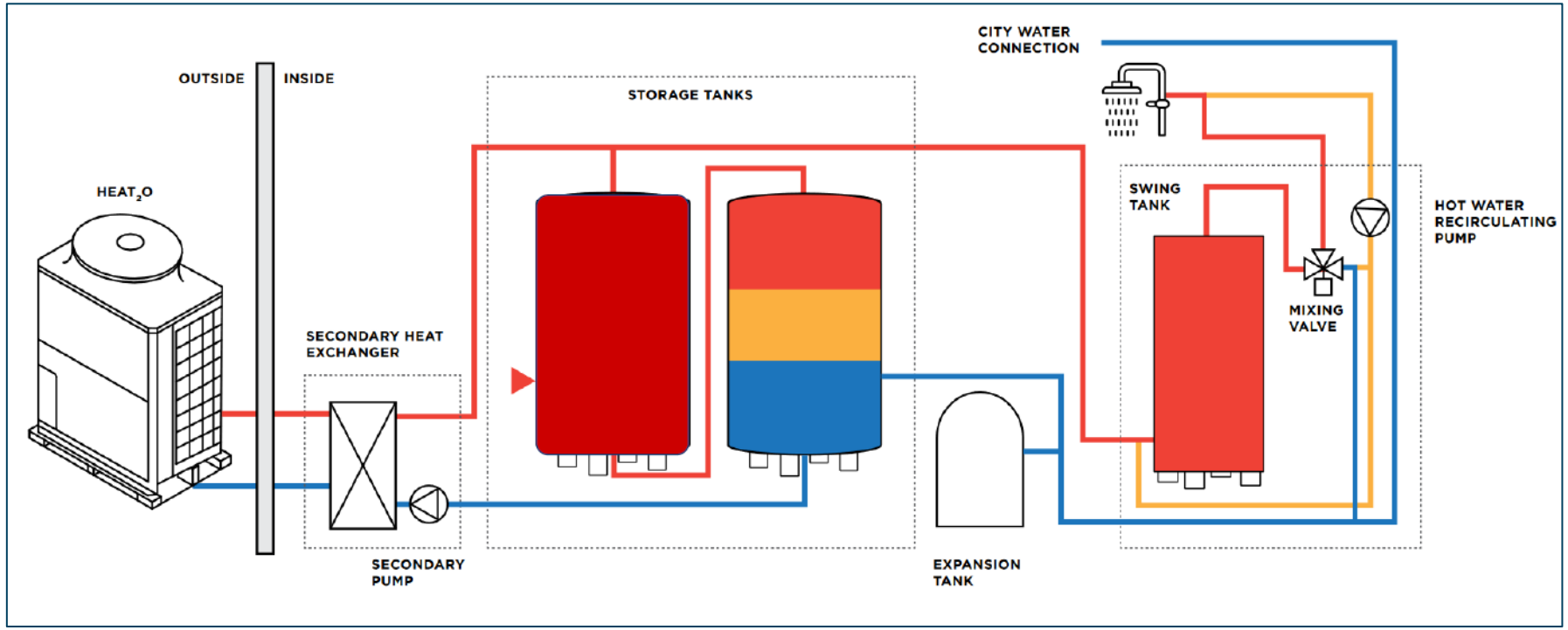
Central/Commercial System
One central plant serving an entire property

Photo credit: Redwood Energy

Semi-central system
Multiple small "plants" throughout a building or property, each serving more than one dwelling unit

In-unit water heater
One water heater serving one dwelling unit

Terminology level-set: central HPWH

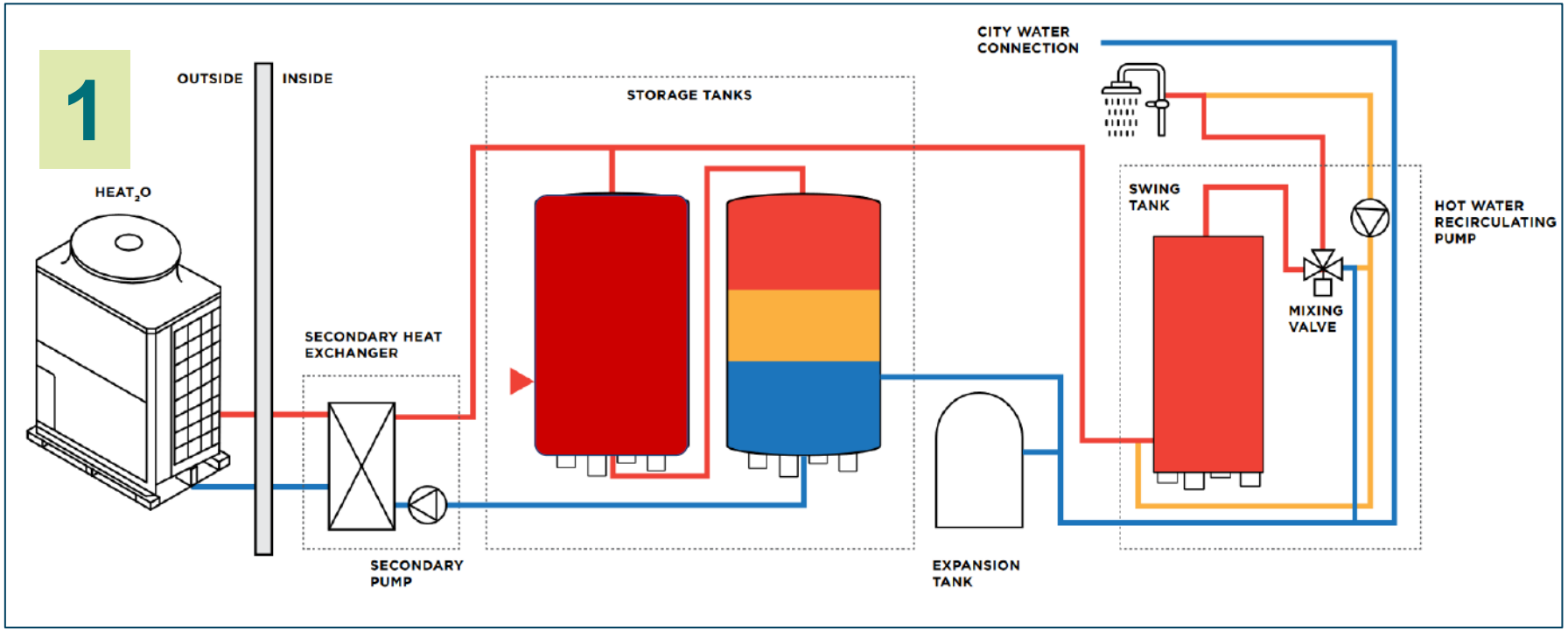


Source: LC-CO2 Project Team

Photo credit: D+R International

Photo credit: Ecotope, Inc.

Terminology level-set: central HPWH



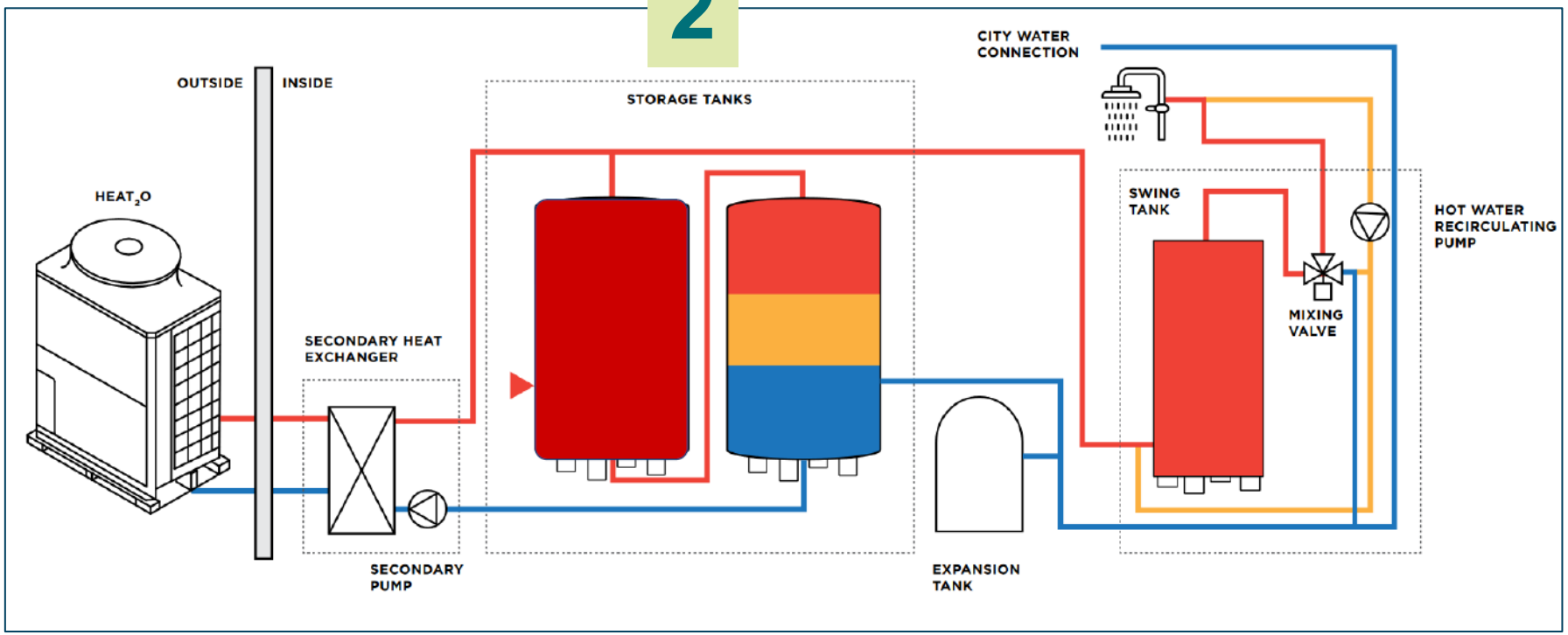
Source: LC-CO2 Project Team

Photo credit: D+R International

Photo credit: Ecotope, Inc.

Terminology level-set: central HPWH

2

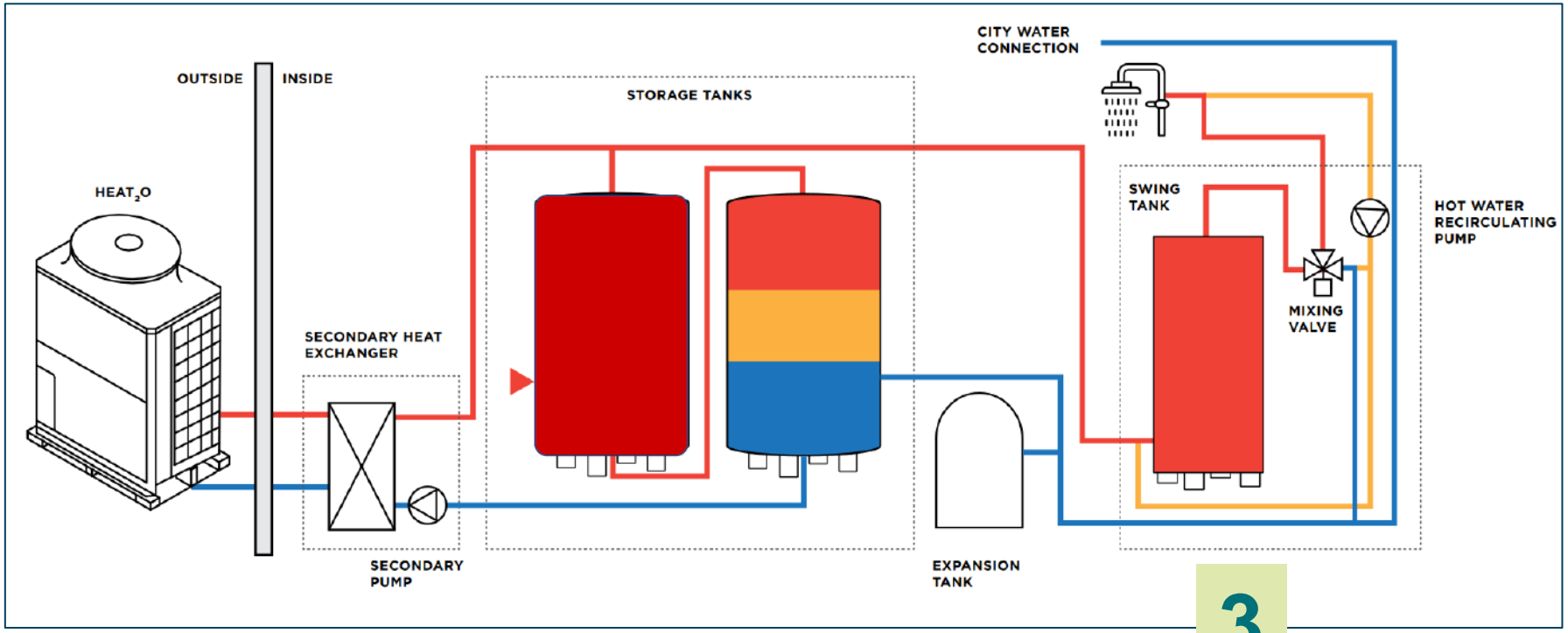


Source: LC-CO2 Project Team

Photo credit: D+R International

Photo credit: Ecotope, Inc.

Terminology level-set: central HPWH



Source: LC-CO2 Project Team

Photo credit: D+R International

Photo credit: Ecotope, Inc.

Importance

Water heating accounts for nearly 1/3 of annual energy consumption in large multifamily buildings

- ✓ High efficiency = energy and cost savings
- ✓ Load shifting potential
- ✓ Equity considerations

Source: Ecotope, Inc.

Blog post about Bayview Towers load shifting

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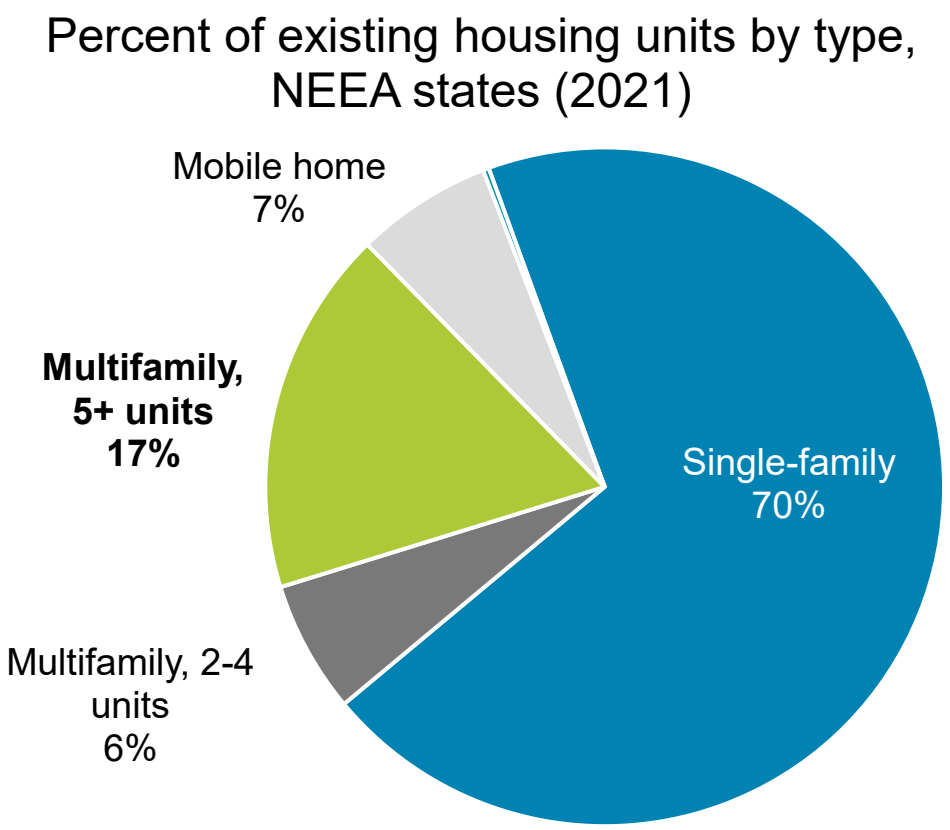
Housing Units in the NW

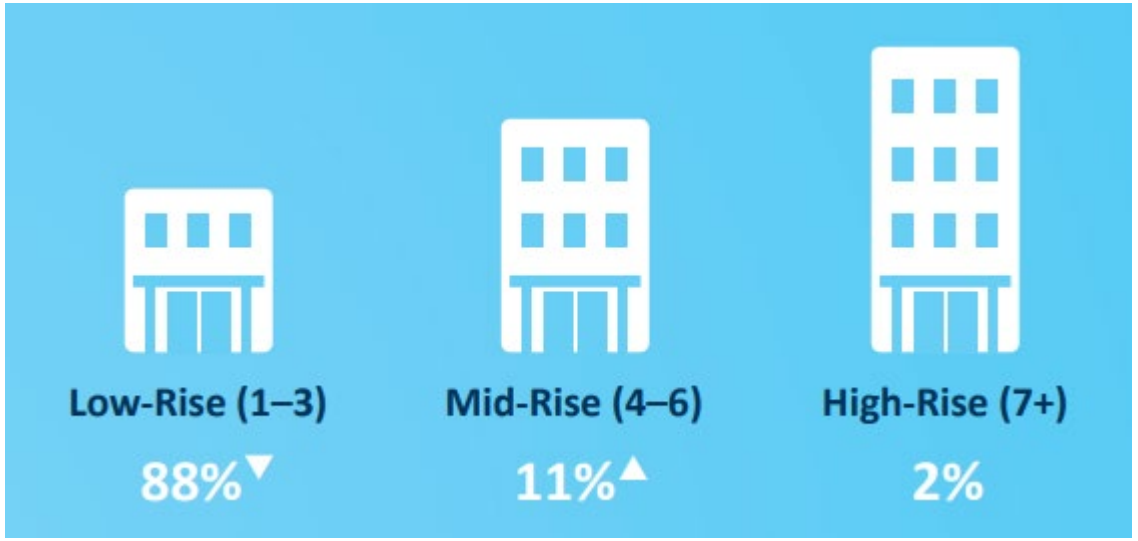
- As of 2021, there are over 1 million multifamily housing units (5+ units/building) in NEEA territory
- As of mid-2022, over 35,000 units are under construction in Puget Sound and Portland



Sources: American Housing Survey (2021), Colliers (2022)

Multifamily buildings in the NW

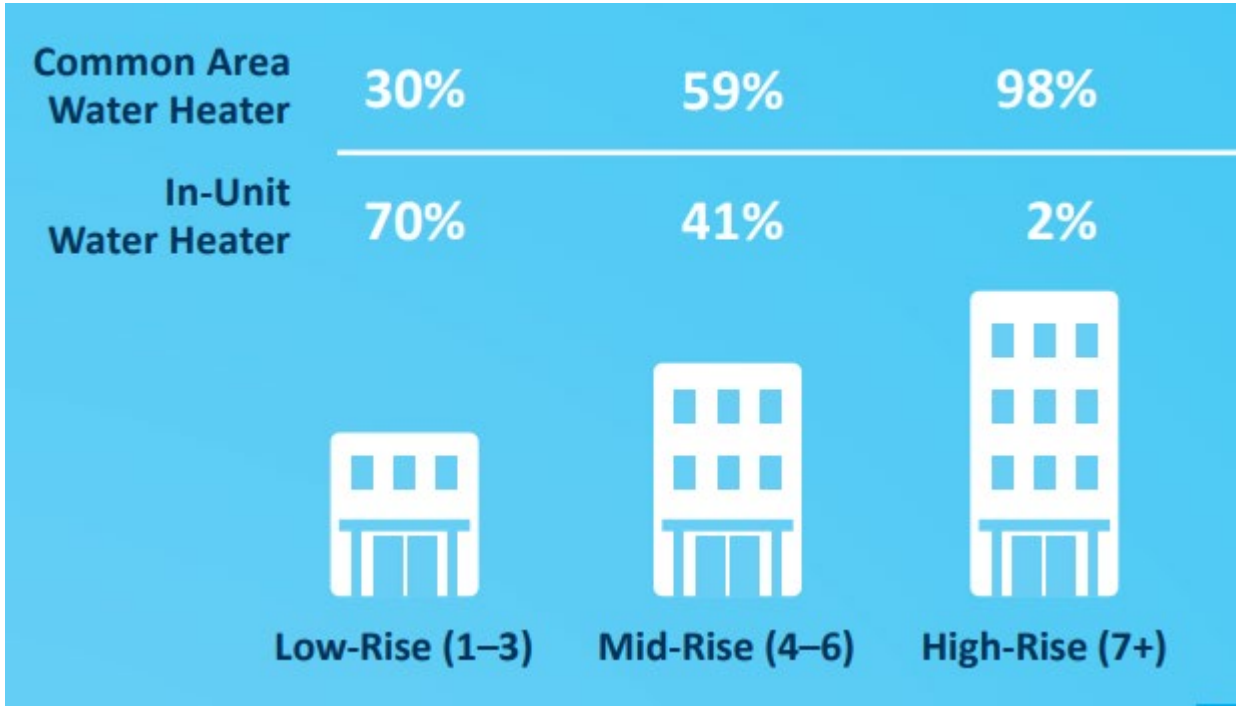
- In NEEA territory, low-rise multifamily buildings are most common
- High-rise typically found in large urban centers (e.g., Seattle)



Source: NEEA RBSA II (2016-2017)

Multifamily buildings in the NW

- Even though low-rise multifamily is more common, mid- and high-rise are more likely to have a central water heating system
- Most (84%) central water heating systems in the NW are electric, per 2020 RECS



Source: NEEA RBSA II (2016-2017)

A lot of work has already been done…

…Related to performance specifications

- AWHS 8.0
- Qualified Products List
- EcoSizer
- Integration into CA Code Compliance Software

…Related to the supply chain

- Educational offerings
- Resources
- Pilot projects
- Packaged solutions

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…but there is more to do

- Long-term (5-10 years) goal:

HPWHs are the central system of choice for large multifamily buildings

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State and City codes require that all central systems installed in multifamily buildings are HPWH

Audience homework: Use the information we share as inspiration for the workshop session!

- How can we address the barriers to achieve this?
- What questions remain to be answered?

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Research Overview

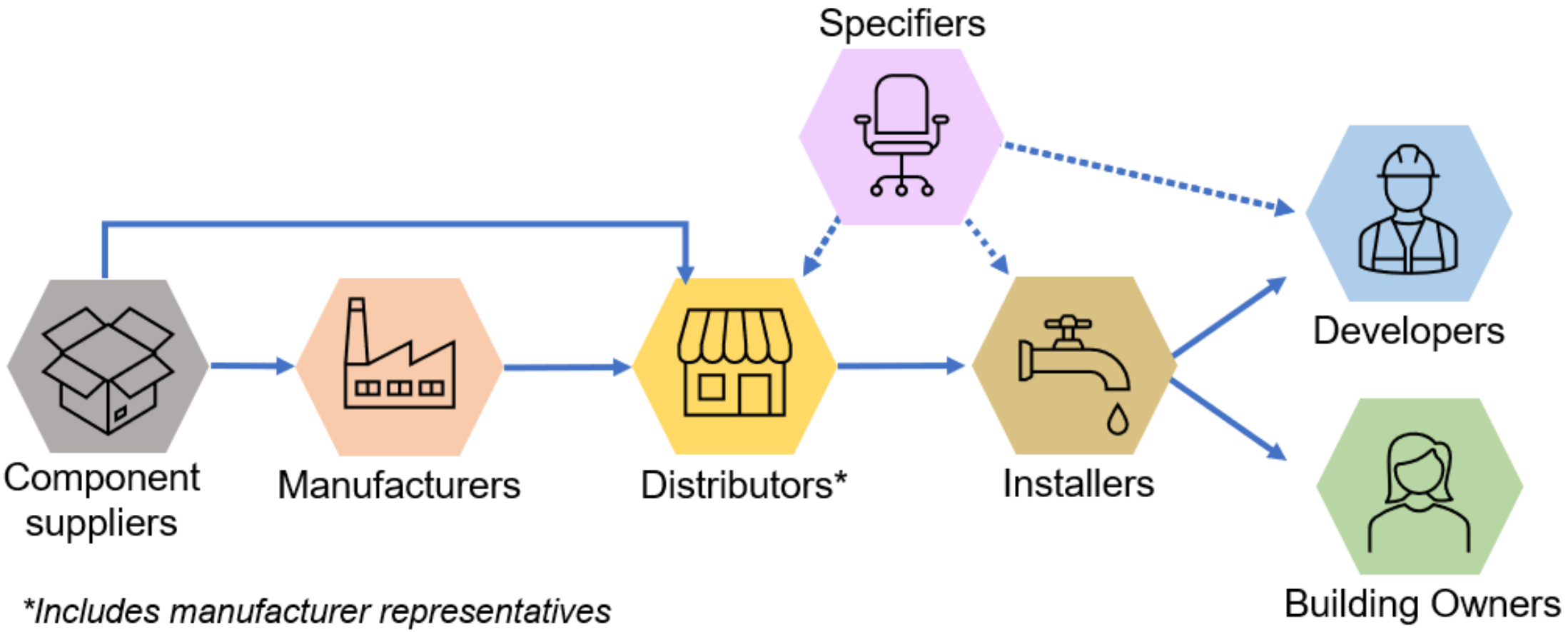
Supply Side Research Goals

1. Identify primary barriers to central HPWH adoption in multifamily buildings

2. Better understand drivers for each market actor

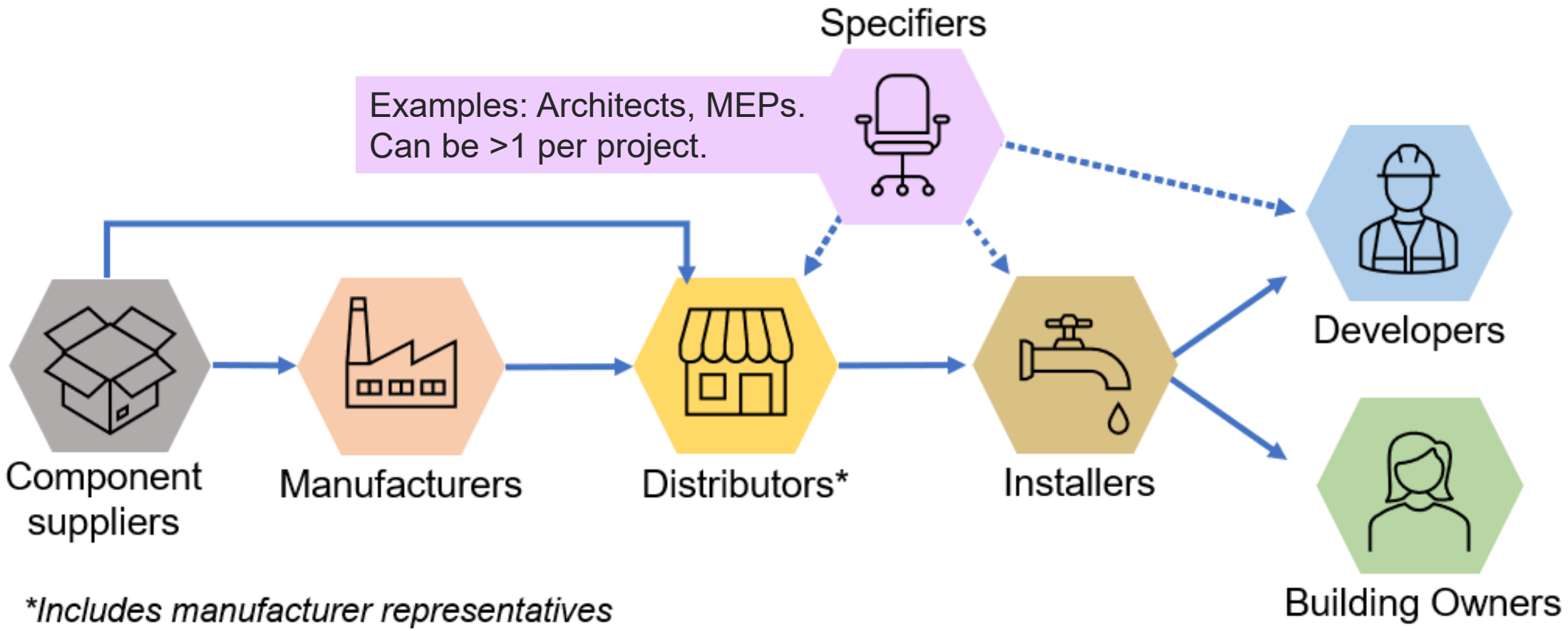
3. Utilize market actor feedback to understand the most effective pathways to increased market adoption of central HPWHs

CHPWH Supply Chain – Multifamily

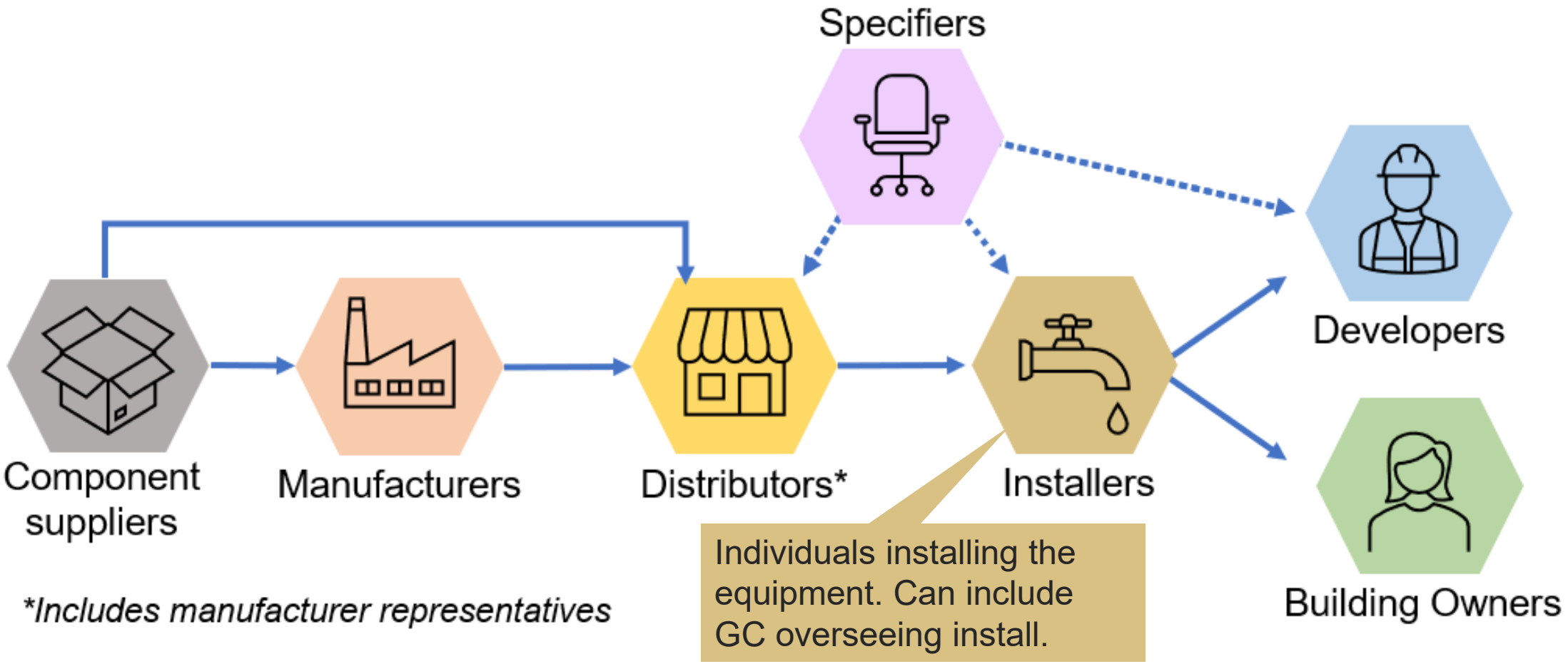


*Includes manufacturer representatives

CHPWH Supply Chain – Multifamily



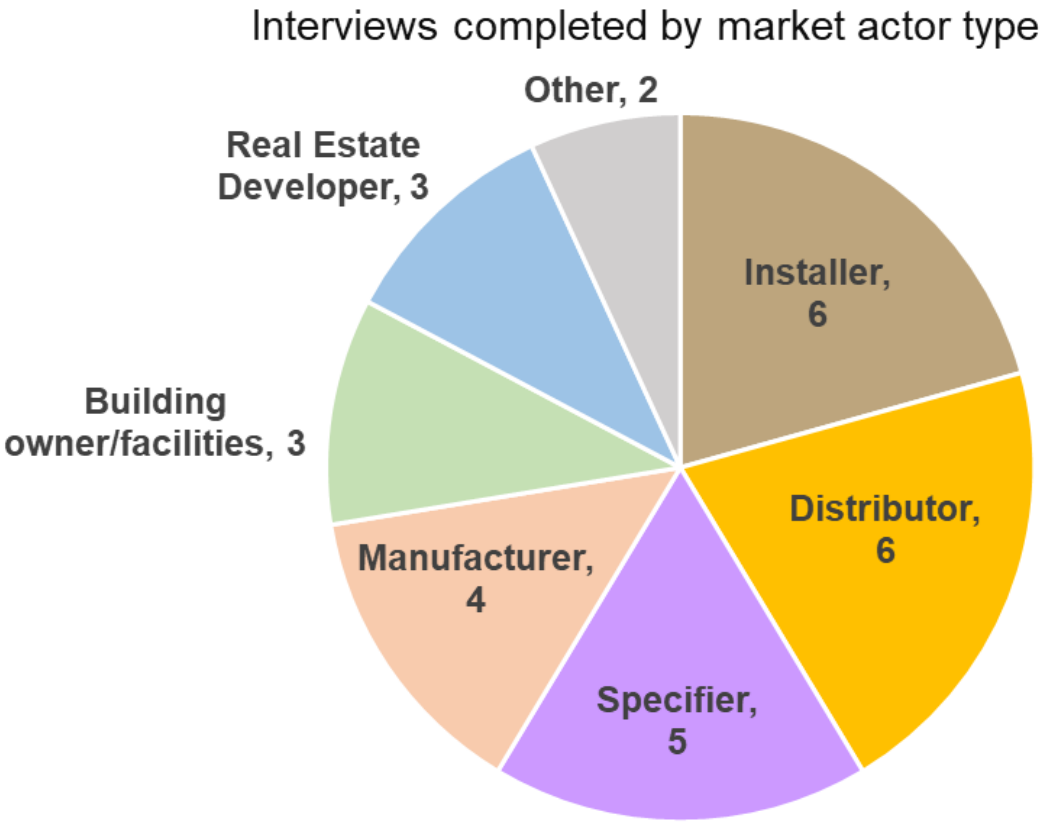
CHPWH Supply Chain – Multifamily



*Includes manufacturer representatives

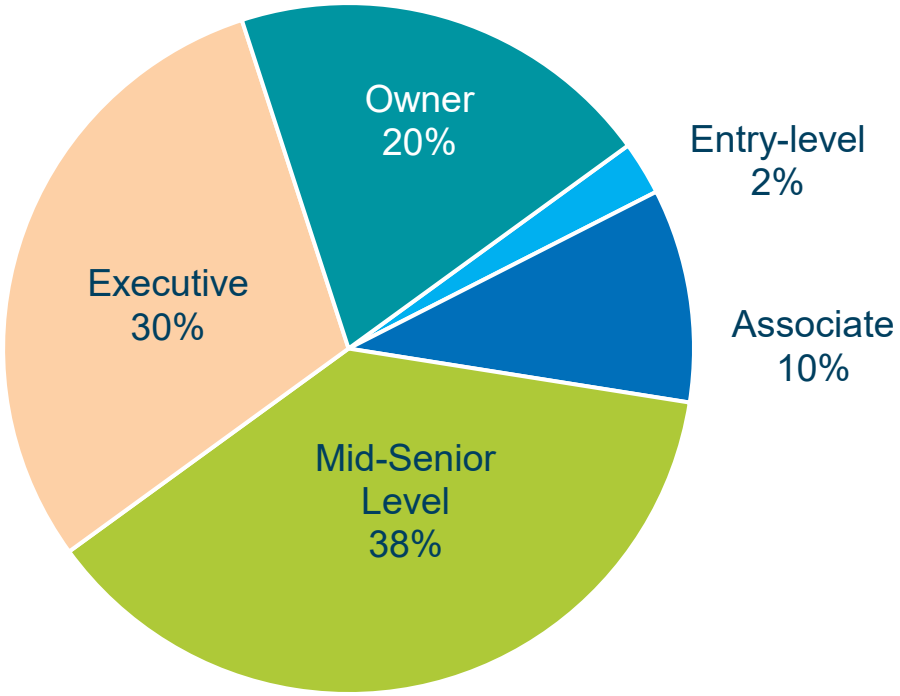
Methodology

Literature review and preliminary interviews	Ecotope, AEA Mitsubishi, Eco2 Systems D+R, Cadeo
Online survey targeting specifiers and installers	34 complete responses
Targeted interviews	29 interviews completed

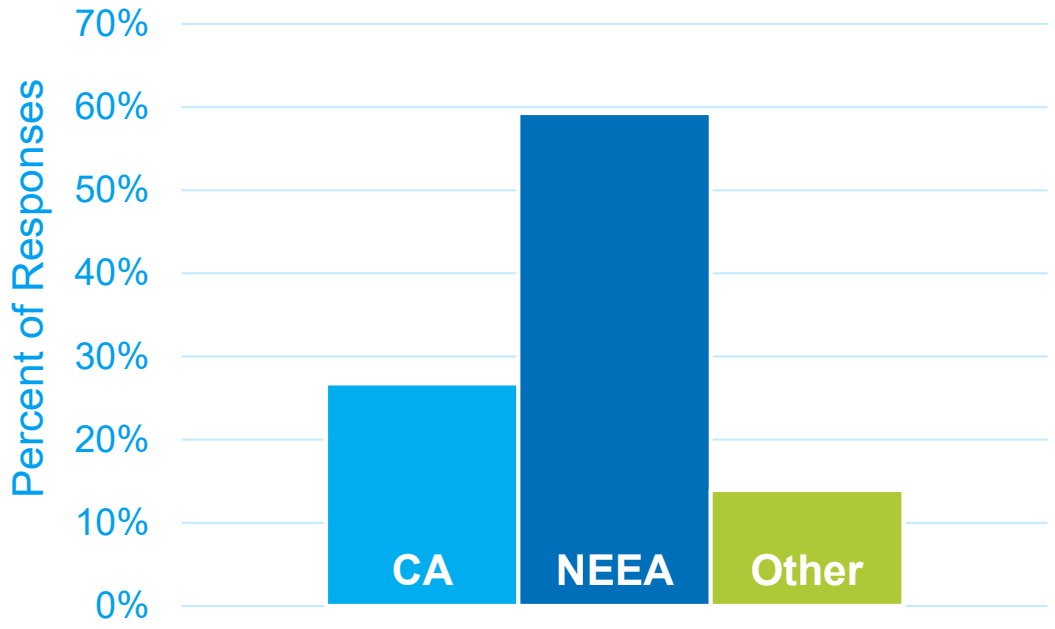


Survey Demographics

Respondent Career Level



Survey Respondent State(s) of Operation



Survey and Interview Demographics

- ✓ Representation from both new construction and retrofit perspectives
- ✓ For retrofit perspective, respondents had experience with existing electric and gas water heating systems
- ✓ Over half the survey respondents were moderately or extremely familiar with in-unit, semi-central, and central systems
- ✓ Surveys and interviewed captured both market-rate and affordable housing perspectives

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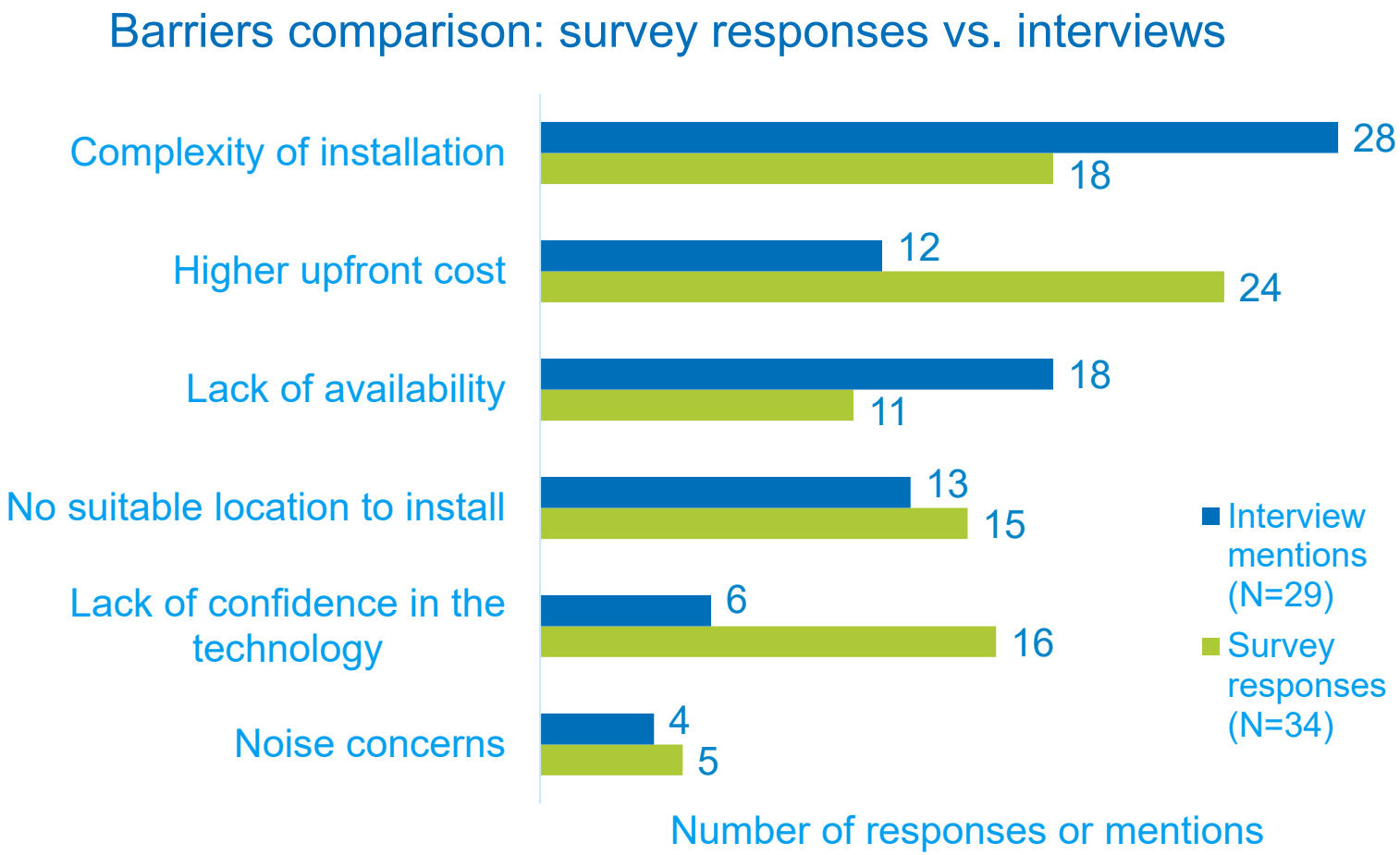
Findings: Barriers

Barriers: Survey Responses vs. Interviews



Results – Primary Barriers

Metric	Supply chain	Designers	Installers	End-users
Complexity of installation				
No suitable location to install				
Lack of availability (equipment and labor)				
Higher cost				
Lack of confidence in the technology				
Noise concerns				

Darker red cells indicate a higher frequency of mentions for the associated barrier. Unshaded cells indicate no mentions of the barrier by the market actor group.

Supply chain = manufacturers and distributors. Designers = engineers and consultants. Installers = general contractors and installers. End users = developers, building owners, and facility managers.

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Installation Complexity

Installation complexity and lack of installer education creates barriers across the supply chain

- *The complexity of the technology, workforce shortages, and lack of interest from installers causes project delays and increased costs that jeopardize central HPWH selection.*

Primary factor	Project considerations
Detailed barriers	• Multiple trades required (e.g., plumbing, refrigeration, mechanical) • No sense of responsibility for installer when GC is overseeing • Project delivery method – design-build vs plan-spec

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Primary factor	Project considerations	Installer education
Detailed barriers	• Multiple trades required (e.g., plumbing, refrigeration, mechanical) • No sense of responsibility for installer when GC is overseeing • Project delivery method – design-build vs plan-spec	• Lack of confidence in the technology • Unfamiliar with electrical requirements and maintenance • No value proposition to learn

Installation complexity and lack of installer education creates barriers across the supply chain

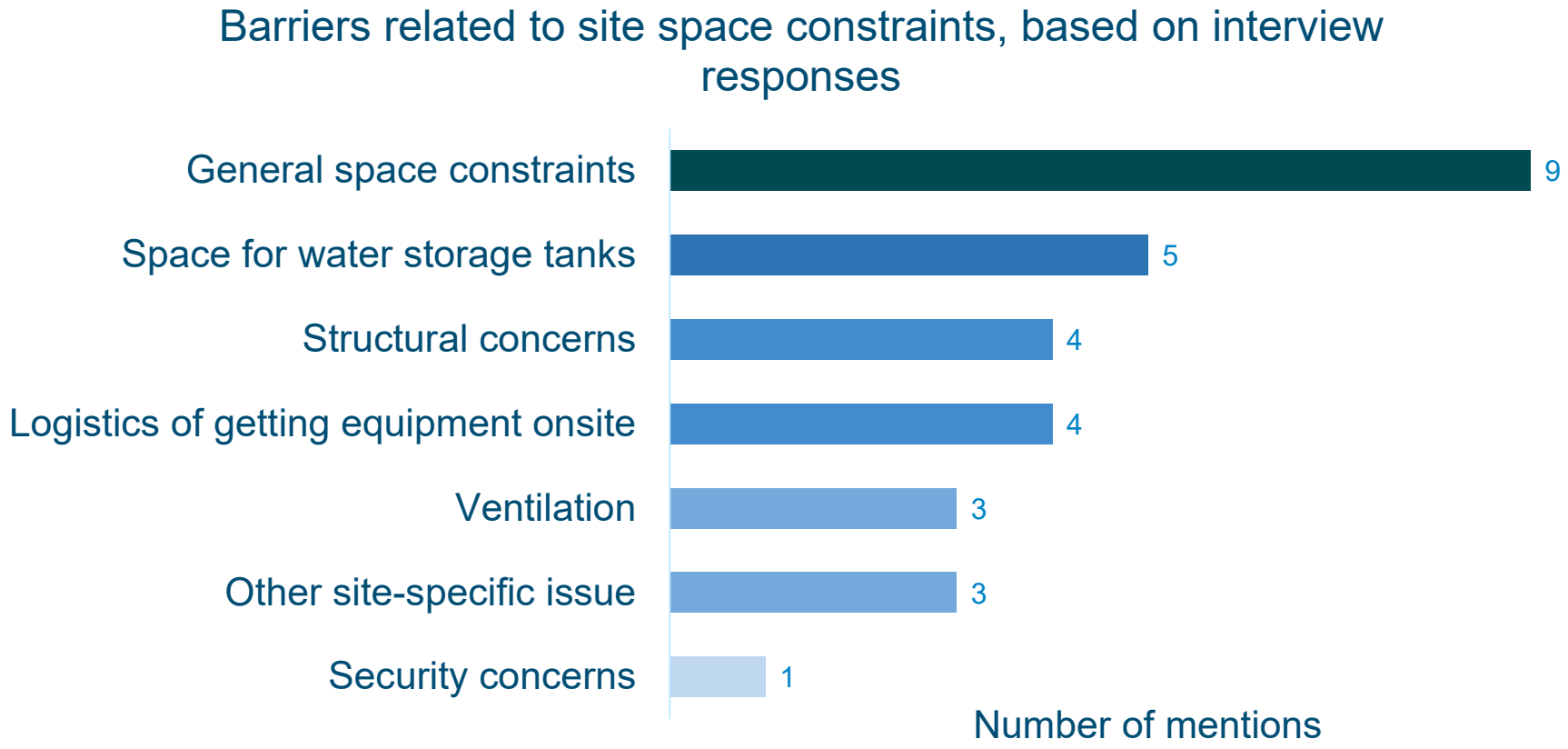
- *The complexity of the technology, workforce shortages, and lack of interest from installers causes project delays and increased costs that jeopardize central HPWH selection.*

Primary factor	Project considerations	Installer education	Workforce shortage
Detailed barriers	• Multiple trades required (e.g., plumbing, refrigeration, mechanical) • No sense of responsibility for installer when GC is overseeing • Project delivery method – design-build vs plan-spec	• Lack of confidence in the technology • Unfamiliar with electrical requirements and maintenance • No value proposition to learn	• Qualified contractors are overbooked • Lack of service contractors • Service contractors face barriers to training

Space constraints

Space constraints create early roadblocks to adoption

- *The size, ventilation needs, and other attributes of central HPWH systems limit installation location options inside the building, and outdoor installations bring their own challenges.*



Space constraints create early roadblocks to adoption

- Geographic location of the building is another important factor
  - Colder ambient conditions limit outdoor installation capabilities
  - Many successful installs in the PNW utilize parking garages – not an option everywhere

Photo credit: AEA

Commissioning and Operational Education

Proper commissioning and building staff handoff are critical to end—user satisfaction and operational success

- *Day-to-day operations fall to maintenance staff, who need to feel confident in the system, competent to troubleshoot minor issues, and supported by a service contractor*

Primary factor	Commissioning	Operations
Detailed barriers	• Tenant complaints related to system downtime • Immediate performance issues resulting from subpar commissioning • Experiencing issues right away erodes confidence in the system	• Staff only employed part-time • Language barriers • Staff turnover causes knowledge gaps • Lack of confidence due to complexity • Performance issues due to improper maintenance

Upfront Cost

Upfront cost remains a top barrier

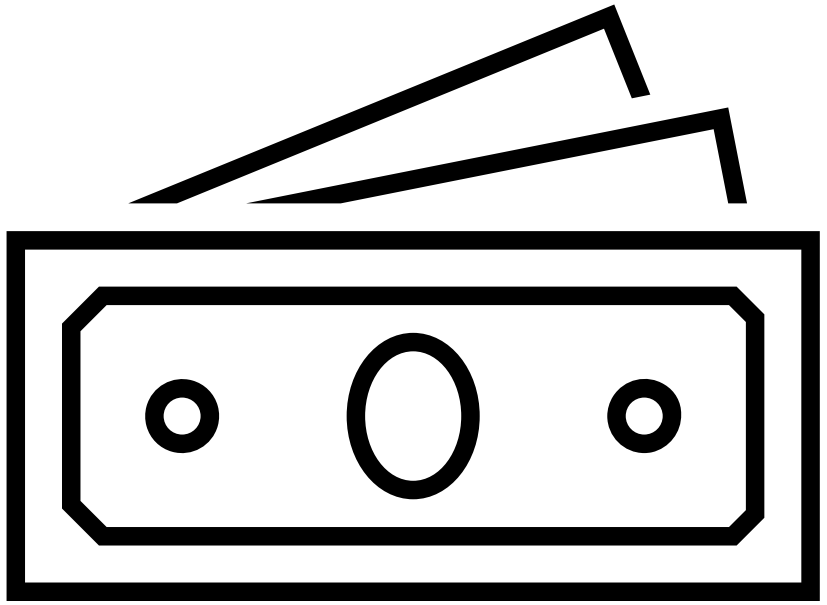
- Most common barrier cited in the online survey
- Dealbreaker for developers with short ROI goals
- Intertwined with other barriers – increased labor cost due to installation complexity and installer education
- Not just system components – upfront electrification infrastructure barriers:
  - Additional transformer
  - Upgraded service
  - Lack of local utility capacity

Findings: Drivers

Primary Drivers for Selecting Central HWPH

Upfront cost is a major barrier to adoption, but incentives can provide an effective solution

- Incentives were the most frequently citied driver for considering a central HPWH system.
- Successful incentives mentioned included the TECH Clean California initiative which offers incentives up to $1,8000 per apartment served for central HPWH systems.
- Pilot demonstration grants have been pivotal in advancement of technology.
- California's Low-Income Weatherization Program (LIWIP)



Balance between incentives, codes and policies

Incentives facilitate adoption of emerging, energy-efficient technologies that are more expensive than traditional offerings.

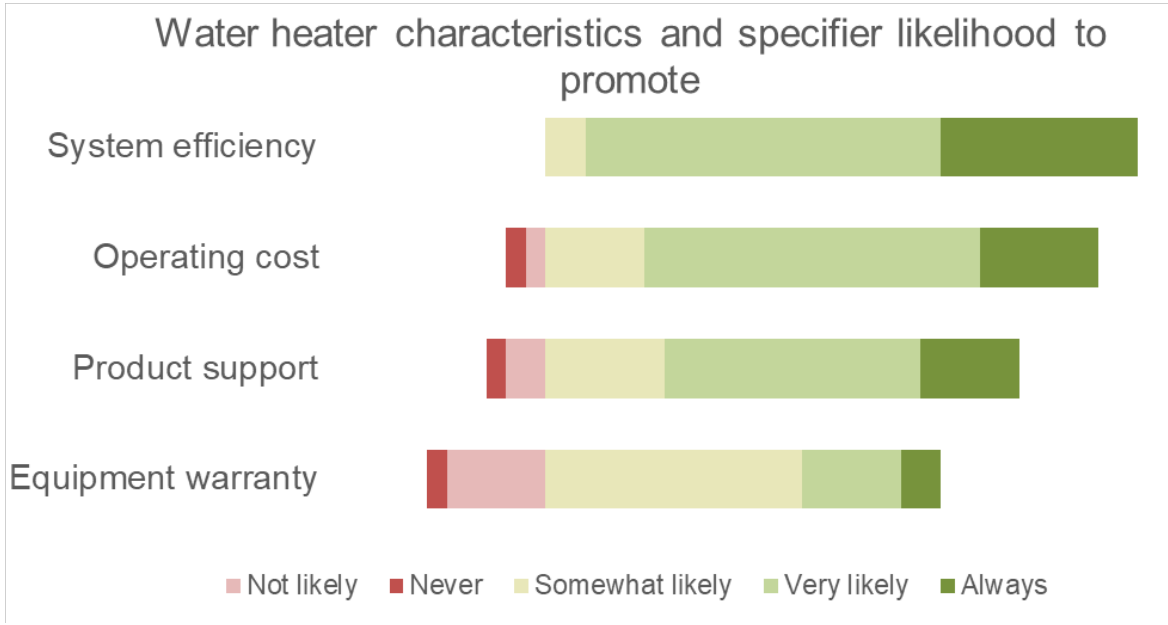
Multiple interview respondents emphasized the importance of streamlining incentive programs and how code and policies will be the future driver of central HPWH adoption.

As soon as a product is adopted into code, it often can no longer be incentivized.

The adoption cycle and incentives could be offered in tandem.

Additional drivers to consider

- ✓ Influence from/familiarity of a member of the project team
- ✓ Project focus (e.g., sustainability)
- ✓ Desire to move away from gas service
- ✓ System efficiency
- ✓ End user demand



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Recommendations

Recommendations

1 **Sharing best practices**

The market needs a comprehensive guide or central repository of best practices.

2 **Workforce education, training, and awareness-building**

Accessible training opportunities and awareness-building activities are a need, especially for installers.

3 **Access to quantitative performance data**

Quantitative performance data will build confidence in the technology.

4 **Development of packaged systems**

Packaged systems can simplify the design process. Cost comparison tools and a better understanding of market potential can help this technology.

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Sharing best practices

- Interview respondents felt that there is not currently a good forum for sharing or learning best practices
- Interest in connecting with others in the industry who have experience
- More detailed recommendations:
  - Ensure lessons learned are documented in pilot projects
  - Include tech transfer budget in proposals
  - Create a central repository of best practices, segmented by market actor

Workforce Education, Training, and Awareness-Building

- Focus on effective installer education
  - Manufacturer-specific
  - Hands-on
  - Include real-world operational data
- Reduce barriers for service contractor training
- Ensure consistent terminology across the industry
- Improve training and resources for building maintenance staff

Increasing Access to Quantitative Data

- Major interest in more quantitative data on cost and performance, especially compared to traditional offerings
- Supply chain is not yet convinced that cold-climate performance has been sufficiently demonstrated
- Ties into installer education: one-page factsheets were a recommended strategy
- A central repository of installed CHPWH systems would be a helpful resource

Promoting Development of a Packaged System

- Packaged systems decrease installation complexity
- Currently difficult to provide “apples-to-apples” cost comparison with non-packaged system
- Standardize terminology and test methods for comparing systems
- Research on market potential is needed

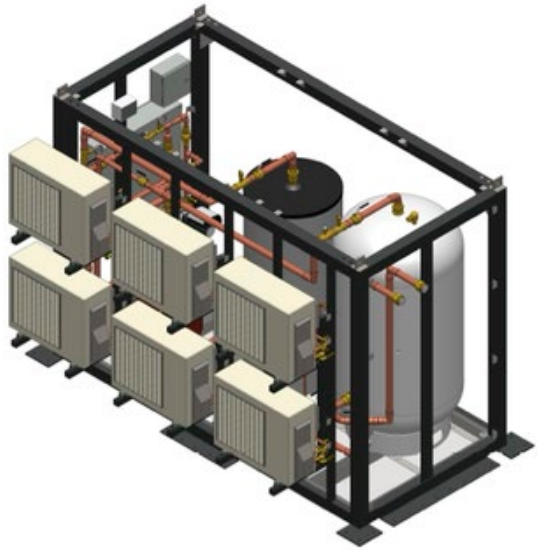

Photo credit: Small Planet Supply

Resources and Next Steps

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Resources

- Full report can be found on NEEA's website here:
  - https://neea.org/resources/central-heat-pump-water-heaters-for-multifamily-supply-side-assessment-study
- Join the AWHI Commercial Working Group
- Check out the CO_2 HPWH Quick Design Guide and other resources on the AWHI Resources webpage

- EPIC Large Capacity Central CO2 HPWH team will continue to report out on pilot projects

Questions and Discussion

https://miro.com/app/board/uXjVPgLI-E4=/?share_link_id=988017313627


Thank you!