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Brewery Blocks, Portland, OR
Photo: Gerding Edlen Development


nbi new buildings
institute

The Advanced Water Heating Initiative

IEPR Commissioner Workshop on Building Decarbonization – Equipment, Technology, and Supply Chain: Scale of Building Decarbonization in California, Equipment, and Supply Chain

June 22, 2021

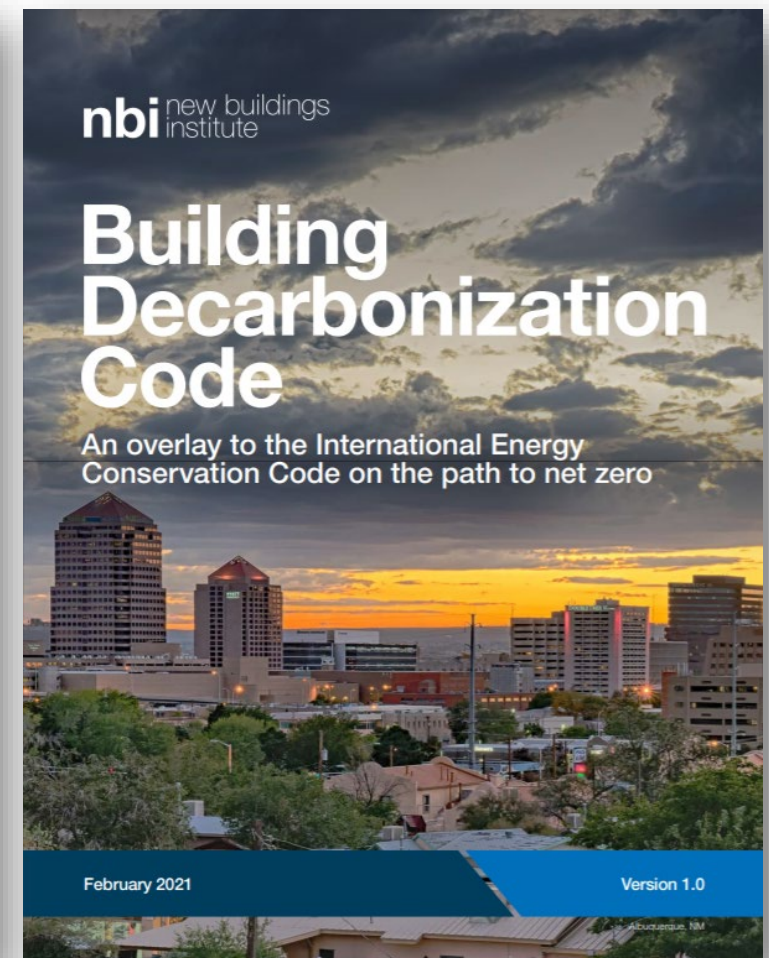
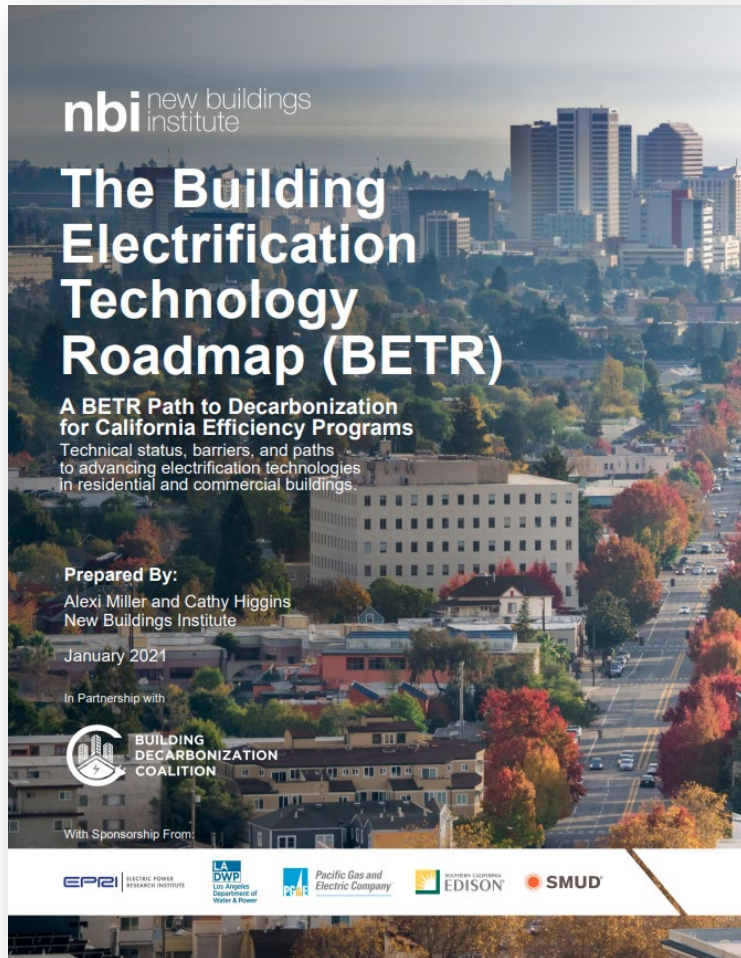
New Buildings Institute



Vision: We envision a transformed built environment that is carbon-free, sustainable, and energy-efficient and supports thriving economies that benefit all people and the planet.

Mission: We push for better buildings that achieve zero energy, zero carbon, and beyond – through research, policy, guidance, and market transformation – to protect people and the planet.

Building Decarbonization



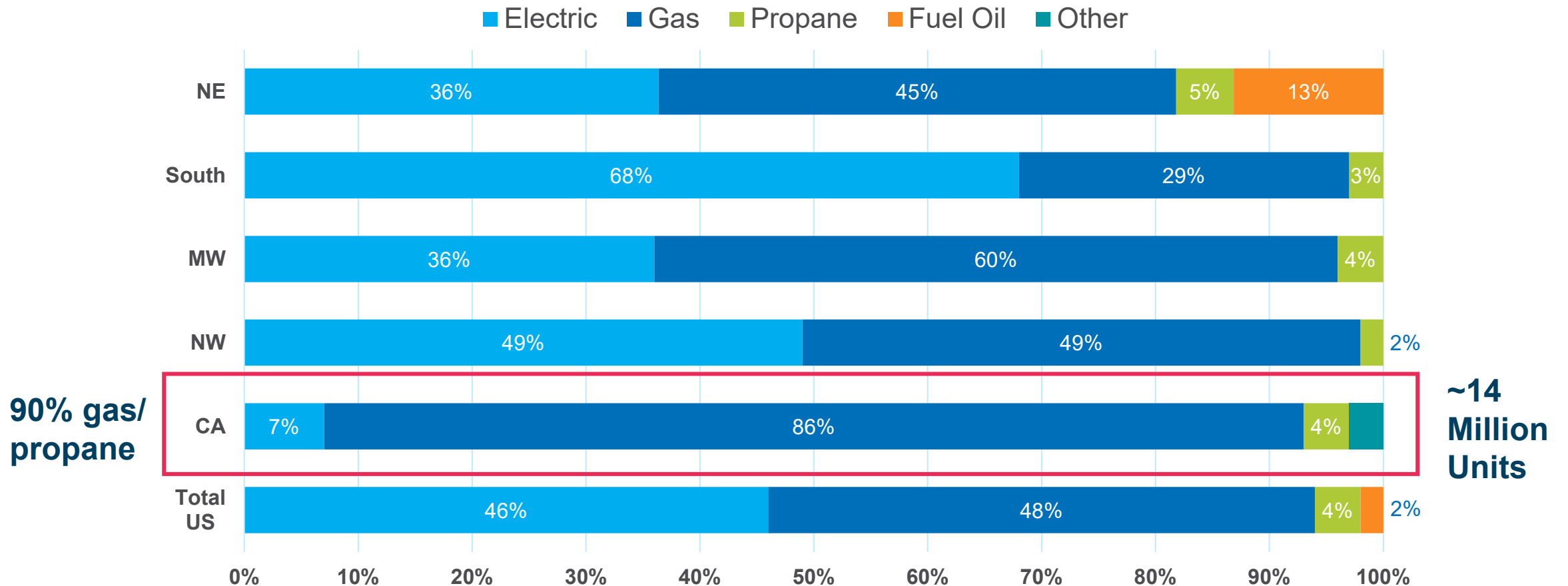


The Advanced Water Heating Initiative

Why Heat Pump Water Heaters

Water Heating Fuel Mix

National Residential Water Heating Stock



Source: 2015 RECS, 2009 RASS, 2017 RBSA

A National Collaboration

Utilities + Manufacturers +
State and Local Governments + Building Industry

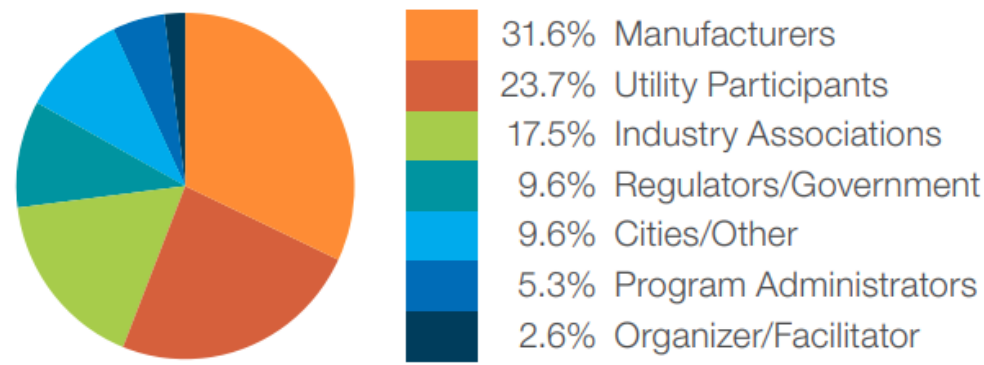
Strategic Partners and Supporters:



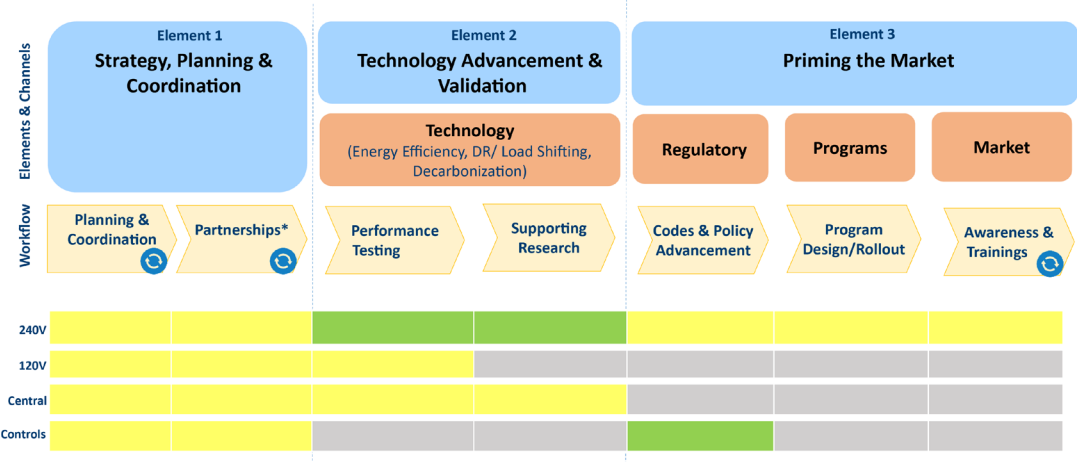
West Coast AWHI

Collaborative effort of over 50 organizations, 100+ active members

COUNT OF ORGANIZATION TYPES



Key Partners



A.O. Smith

American Council for an Energy Efficient Economy

Ariston Thermo USA

Association for Energy Affordability

BC Hydro

Beyond Efficiency

Bonneville Power Administration (BPA)

Bradford White Water Heaters

Building Decarbonization Coalition (BDC)

California Energy Commission (CEC)

Carbon Free Silicon Valley

California Public Utilities Commission (CPUC)

Colmac

D+R International

e-Radio

East Bay Community Energy

Ecotope

Efficiency First CA

Energy Solutions

ENERGY STAR

Electric Power Research Institute (EPRI)

Elevate

GE Appliances

Grasteu Associates

Guttmann & Blaevoet

HTP Comfort Solutions LLC

Hot Water Research

Katerra

Laars Heating Systems

Larson Energy Research

Los Angeles Dept. of Water & Power (LADWP)

Midwest Building Decarbonization Coalition

Mitsubishi Electric

New Buildings Institute (NBI)

Northwest Energy Efficiency Alliance (NEEA)

Northwest Power Planning Council (NWPPC)

National Renewable Energy Lab (NREL)

Natural Resources Defense Council (NRDC)

Nyle

NYSERDA

Pacific Northwest National Lab (PNNL)

People's Self Help Housing Corp

Redwood Energy

Repcor Plumbing

Rheem

RMI

Sacramento Municipal Utility District (SMUD)

Sanden

San Diego Gas & Electric (SDG&E)

Silicon Valley Clean Energy

Sonoma Clean Power

Southern California Edison (SCE)

South Coast Air Quality Management District

StopWaste

Skycentrics

Turnbull Energy

U.S. Department of Energy

U.S. Environmental Protection Agency

Washington State University Energy Program

MAY
17-20
2021

Better Buildings, Better Plants SUMMIT

A LEADERSHIP SYMPOSIUM



May 17, 2021

In partnership with the Advanced Water Heating Initiative, DOE is launching a new initiative to **increase market adoption** of high-efficiency, grid-connected Heat Pump Water Heaters in residential and commercial buildings – which are two to four times more efficient than conventional water heaters – in homes across the country.

www.advancedwaterheatinginitiative.org

MOST READ CLIMATE-ENVIRONMENT



1 Biden administration announces new Energy Star standards, plans for emissions targets for federal buildings

U.S. DEPARTMENT OF ENERGY Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

The E3 Initiative

A Buildings Initiative focused on better energy, emissions and equity

The Department of Energy's Building Technologies Office is developing a national initiative focused on efficient and clean heating and cooling systems in residential and commercial buildings, making it easier to afford and install high performance heat pump solutions.

The E3 Initiative will work closely with stakeholders to develop regional solutions that support both technology innovations and accelerate deployment.

Advantages of Heat Pumps

Space conditioning and water heating consume over 40% of the nation's primary energy. Fossil fuels burned in space and water heating are some of the largest contributors to greenhouse gas emissions. Heat pumps, which extract heat from the air, are an efficient alternative to conventional equipment.

Other advantages include:

- Healthier year-round indoor and outdoor air quality
- Provides both heating and cooling
- Enables temperature control in different areas in the home
- Better humidity control
- Low maintenance and operating costs
- Grid connectivity enables grid optimization and renewable integration

Heat Pumps – The Future for a Clean, Affordable Environment



Planned Engagement Activities
The E3 Initiative will provide opportunities for stakeholder engagement across many areas of interest. The initial launch will focus on the following:

Partnering with the Advanced Water Heating Initiative (AWHI) to transform the water heating market and significantly increase sales of high-efficiency, grid-connected Heat Pump Water Heaters (HPWHs). HPWHs use a third of the energy of conventional water heaters, saving money and reducing emissions.

www.advancedwaterheatinginitiative.org
Implementing the Residential HVAC Smart Diagnostic Tools Campaign to support contractors in commissioning new HVAC systems more efficiently and identifying malfunctions in existing systems through the use of smart diagnostic tools. The Campaign will provide a platform for technical assistance to resources such as best practices and independent testing of smart diagnostic tools.

The Cold Climate Heat Pump Challenge is a collaborative effort with heat pump manufacturers to develop a new technology specification for a high-performance cold climate heat pump, followed by field validation and pilot programs with utilities to address installation challenges and expand market demand.

Additional opportunities for collaboration will be developed in the next year that include reducing the global warming potential of refrigerants used in heat pumps, improving workforce training, and reducing the costs of panel upgrades.

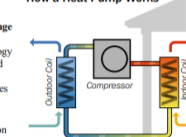
Interest in Participating

DOE's goal is to engage stakeholders, such as utilities, manufacturers, state and local governments, trades, efficiency organizations, and contractors in partnerships to accelerate heat pump adoption rates throughout the U.S. Efforts will concentrate on research activities and deployment strategies to address existing barriers, such as:

- high installation costs
- awareness of consumer benefits
- performance, especially in cold climates
- qualified installers and service personnel
- adequate electrical power for retrofit installations

To participate or learn more, please email us at E3Initiative@ee.doe.gov

How a Heat Pump Works



Outdoor coil absorbs heat from the air, then the compressor concentrates the heat, and finally the indoor coil releases heat into the air.

BUILDING TECHNOLOGIES OFFICE

For more information, visit: energy.gov/eere/buildings/better-energy-emissions-and-equity-e3-initiative
DOE/E3-2006 • May 2021

News: [Biden administration announces new Energy Star standards, plans for emissions targets for federal buildings](#)

The Washington Post reported that the White House said that, for the first time, the government will develop “building performance standards” for federal facilities. It will also establish new Energy Star standards for heat pumps and invest in programs meant to boost adoption of the potentially emissions-saving technology. (May 2021) [Related Fact Sheet](#)

DOE E3 Website : <https://www.energy.gov/eere/buildings/energy-emissions-and-equity-e3-initiative>

<https://www.whitehouse.gov/briefing-room/statements-releases/2021/05/17/fact-sheet-biden-administration-accelerates-efforts-to-create-jobs-making-american-buildings-more-affordable-cleaner-and-resilient/>

Market Sector Goals



RESIDENTIAL HPWHS

100% market share
by 2030



COMMERCIAL HPWHS

90% of multifamily new
construction by 2026



Strategies for Market Transformation



HPWHs for every type of building



Create experts along the supply chain



Programs and policies working together



Drive higher consumer demand

Centered on affordability and equity

AWHI Focus as Working Groups

240V

- Playbook
- Rapid deployment



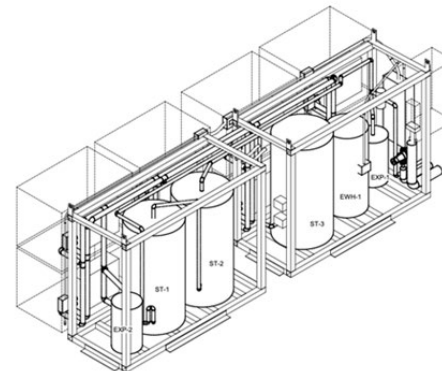
120V

- 4 manufactures
- 7 Products to market in <2 yr.
- Field study underway in CA



Central

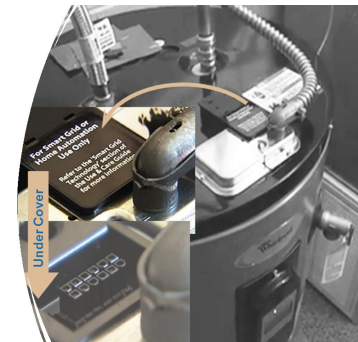
- Tools for sizing and performance
 - Ecosizer
 - Ecosim
- Packaged systems – skid mount



Source: Water Drop/ SANCO2

Connectivity

- CTA 2045
- NEEA Tier 3 Spec – Title 24 JA13 adoption



Market Transformation and Building Demand (Residential)

To reach the most cost-effective installations first, the [Advanced Water Heating Initiative](#)² (AWHI) has identified the following order of priority for transforming the water heater market:

Pathway 1:

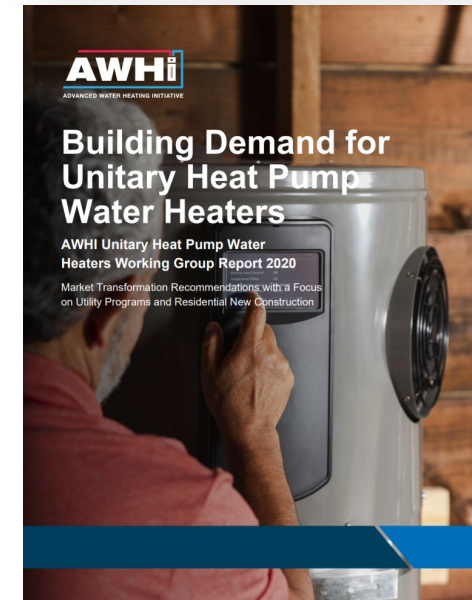
Install heat pump water heaters (HPWHs) in all newly-constructed single-family and multifamily homes

Pathway 2:

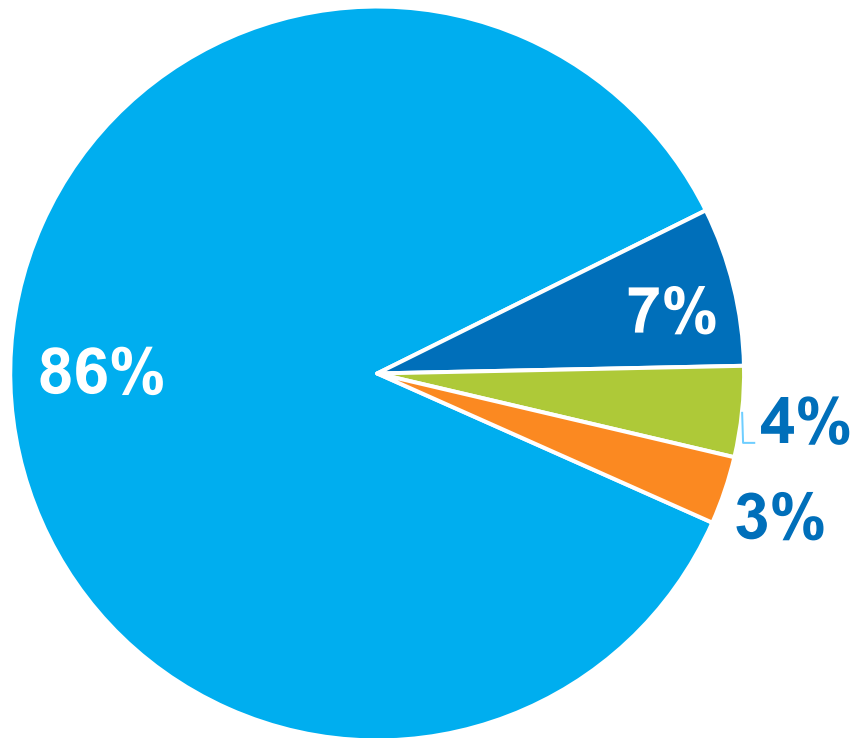
Replace existing electric resistance water heaters with HPWH (240V)

Pathway 3:

Replace existing gas and propane water heaters with HPWH (240V or 120V)



California Water Heating Stock by Fuel Type



■ Gas ■ Electric ■ Propane ■ Other

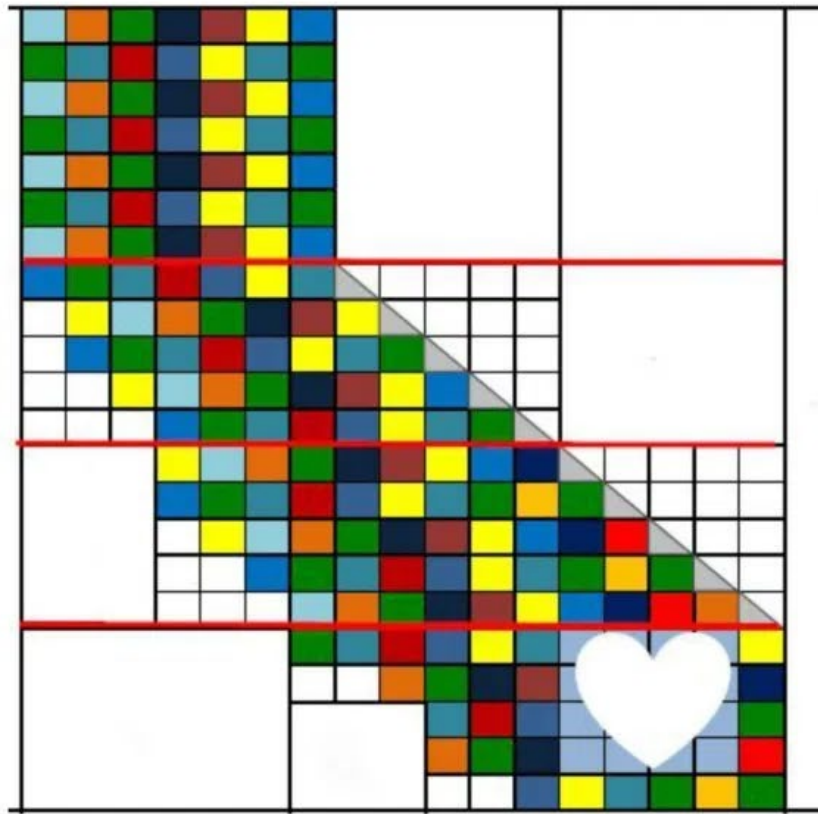
To Achieve Climate Goals:

- 1. New Construction:**
~ 120,000 240V units/year
- 2. Electric Resistance Replacement:**
~ 60,000 240V units/year
- 3. Gas Replacement:**
~ 600,000 240V and 120V units/year

(current national market ~85,000 240V units/year)

MY CALIFORNIA HOME

Pattern by: Beth Bryant



California Patchwork Quilt Pattern

100% of sale proceeds
go to Wildfire Relief Fund

<https://www.diaryofaquilter.com/2018/11/free-motion-quilting-at-home.html/california-patchwork-pattern>

HPWH Program Framework Summary for Unitary Water Heater Programs

Scale

Program coordinated with other utilities statewide or nationally
Use common data collection when possible
Program volume calculated to reach eventual 100% market adoption of HPWHs

Duration

Commit to 10 years+

Incentive type

Upstream and Midstream

1. Incentives direct to distributors/installers, and/or manufacturers
2. Utility may require the entire incentive to be passed through to customers
3. For customers who use the retail channel, provide instant rebate at point of sale
4. See Appendix D for examples

Incentive amount

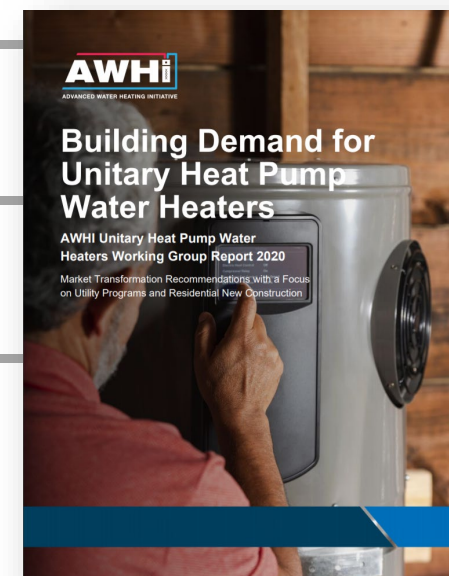
~\$500 to ~\$1,000 per unit initially
\$ additional for installation as required

Priorities

New Construction
Pathway 1: New Construction

Retrofit Programs (Including both planned replacement and replace-on-burnout)
Pathway 2: Electric Resistance to HPWH (240V HPWHs)
Pathway 3: Gas/Propane to HPWH

- 3.1: Gas to 240V HPWH
- 3.2: Gas to 120V HPWH



AWHI 120V “Plug-in” HPWH Field Study

- Independent field verification to advance market commercialization and program promotion
- Diversity of demonstration sites
 - Home type, installation location, climate zone
- Four participating manufacturers
- Three funding partners
- **Seeking pilot participants!**
 - Visit <https://www.advancedwaterheatinginitiative.org/join-us> to express interest

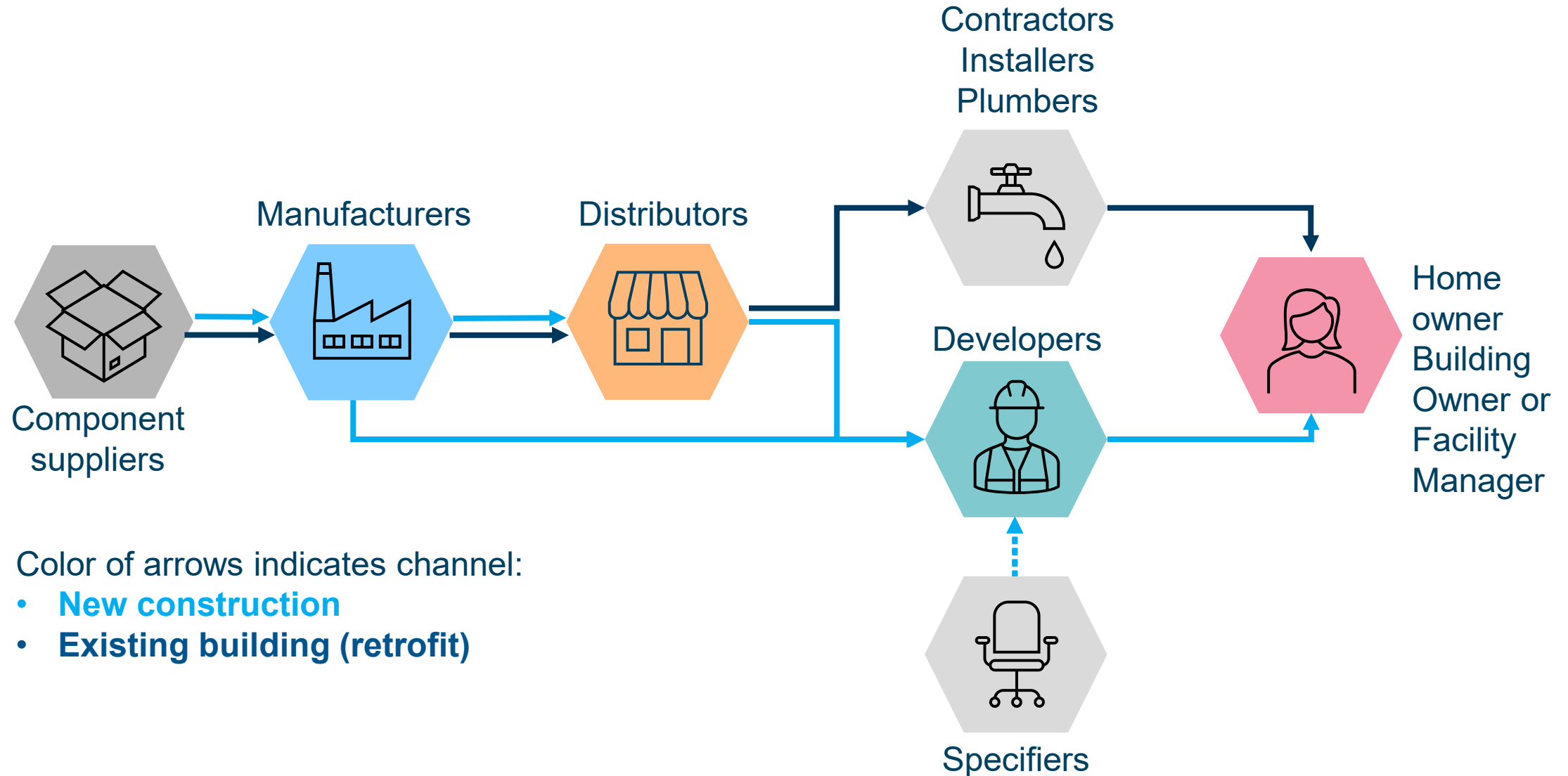


Supply-Side Market Transformation for Low-GWP Multifamily Central HPWH

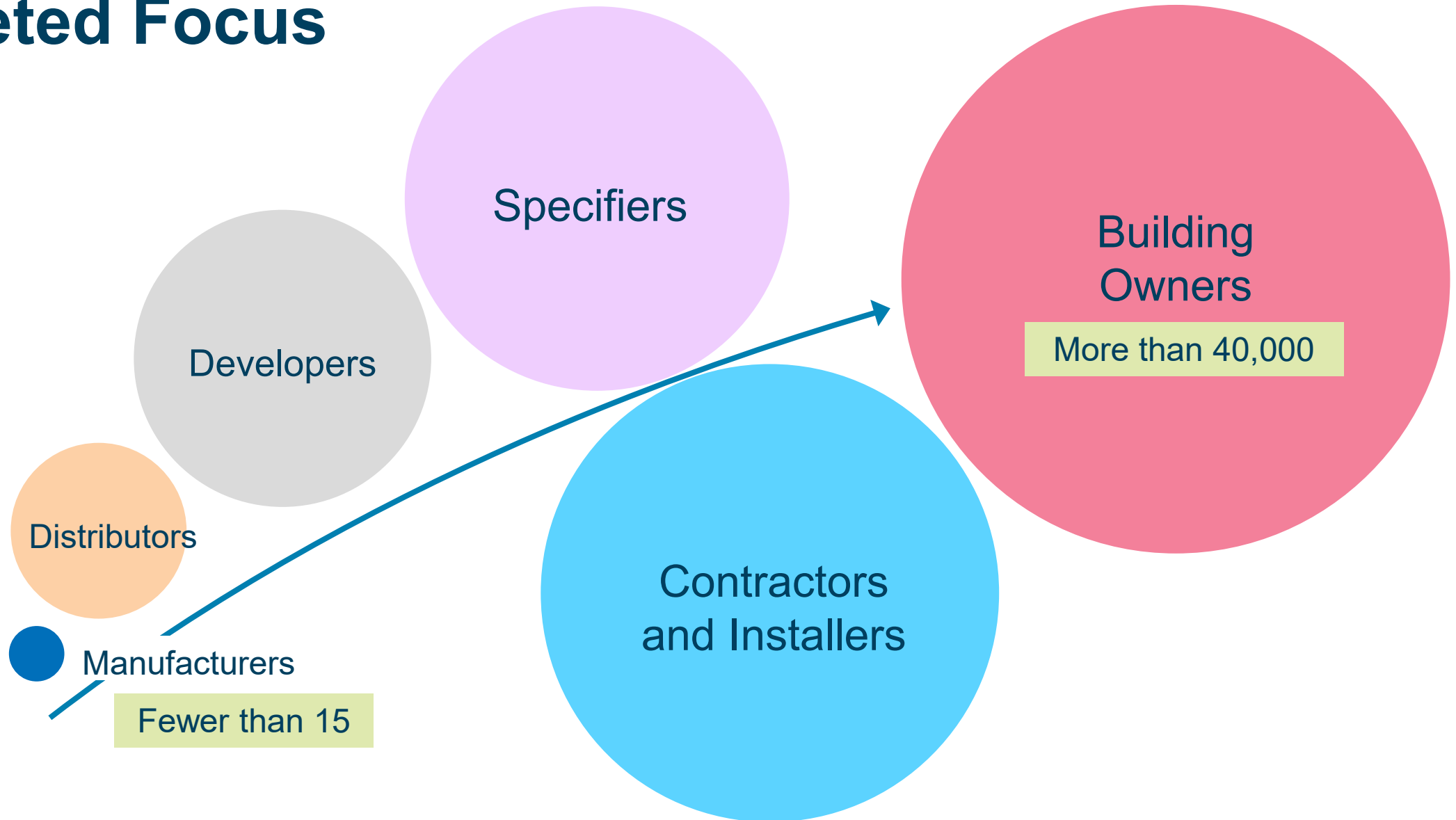
- **CEC EPIC funded work**
 - “Large Capacity CO2 Heat Pump Water Heater Project”
- Deep-dive into the multifamily supply chain
 - Mapping market actor influences
 - Market characterization and engagement
 - Expanded understanding of drivers and barriers
- Supply-side engagement and tech transfer activities



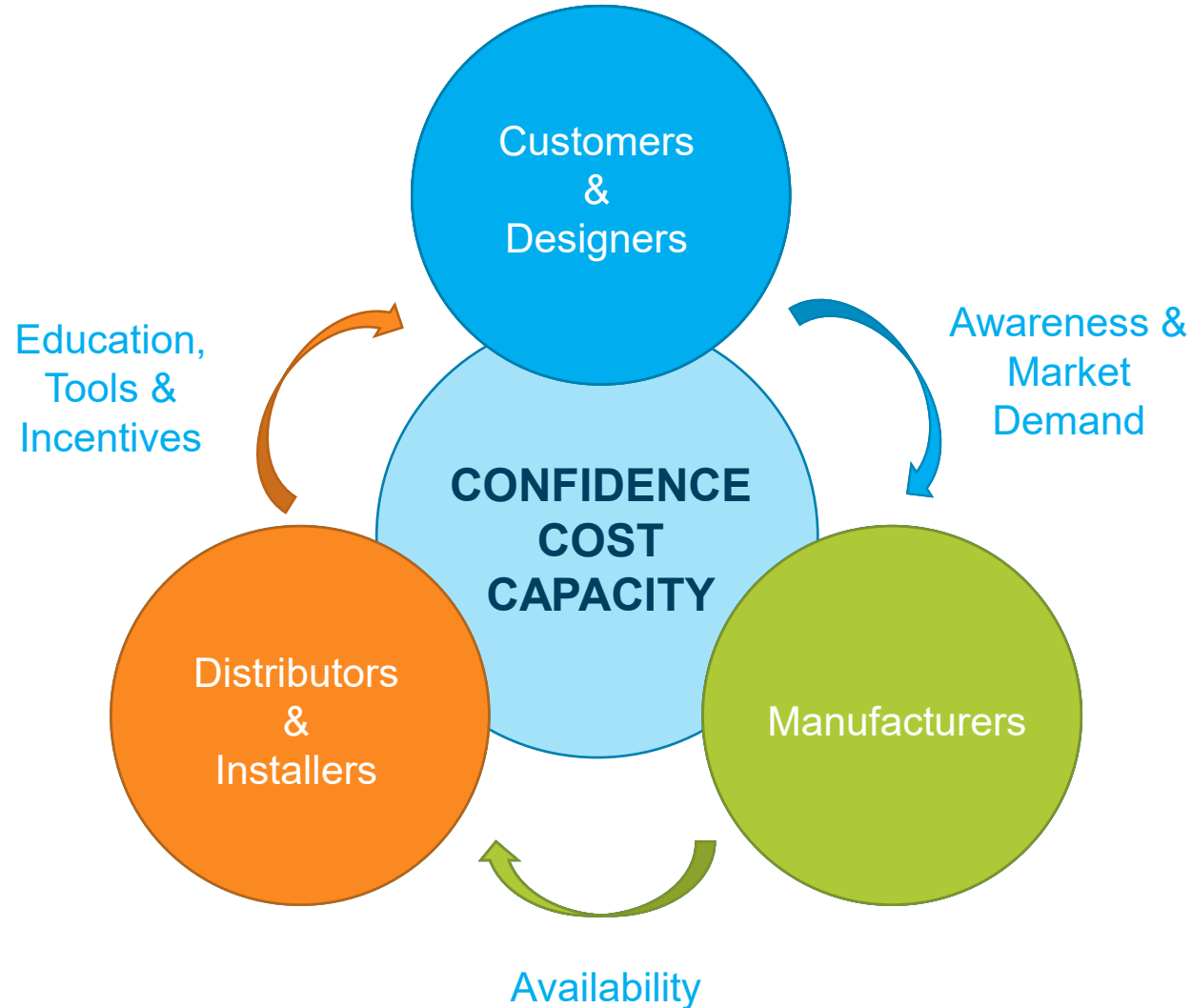
HPWH Supply Chain



Market Transformation: Targeted Focus



Market Transformation: Overcoming Key Barriers to Product Adoption




Confidence: Promote Consumer Campaigns and Provide Contractor and Installer Training

[How it Works](#)[What it Costs](#)[FAQs](#)[Get Started](#)[Contractor Portal](#)[Select Language](#)

Take action on climate change
without leaving your house.

Cost: Support Cost Compression

Top Rated



Performance 50 Gal. Short 6 Year
40,000 BTU Natural Gas Tank Water
Heater

[Shop this Collection](#)

★★★★★ (906) Model# XG50S06EC40U1

Expert Installation Available

\$629⁰⁰

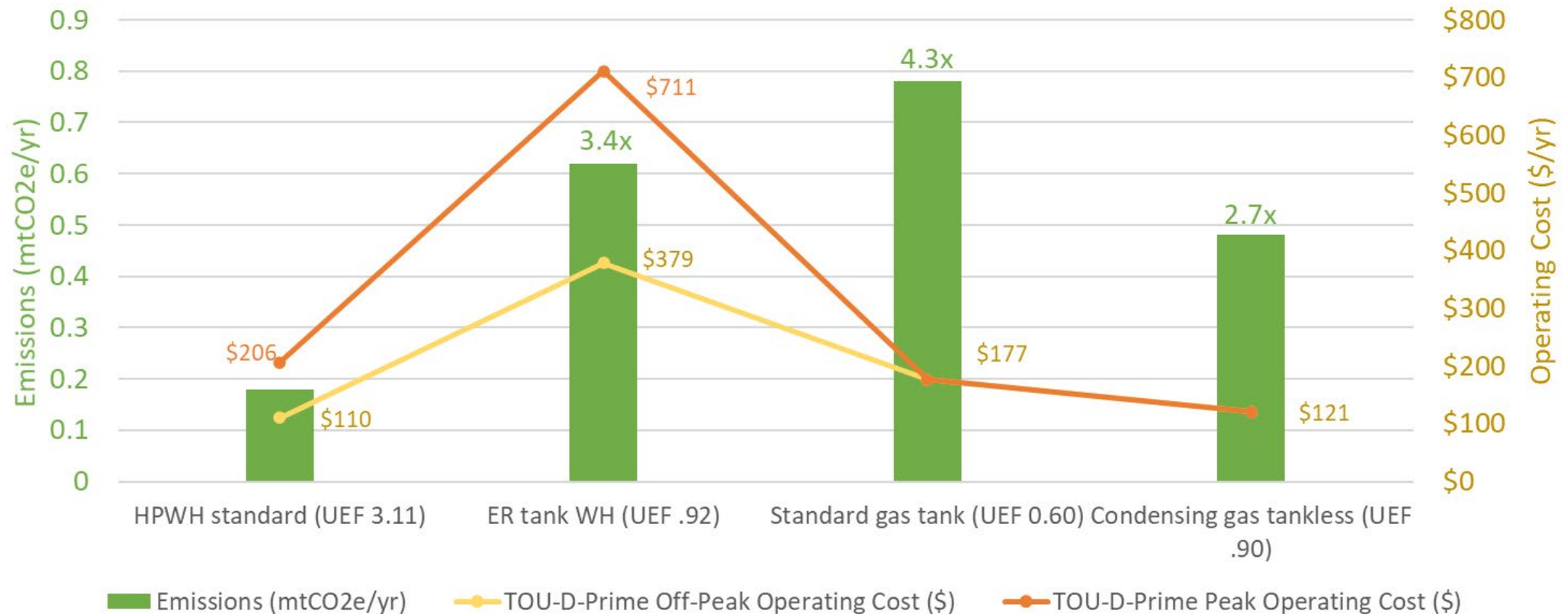


\$600 - \$650



Cost: Drive Operating Cost Reduction

HPWH Residential **Emissions** and **Operating Cost**
Compared to Conventional Efficiency Water Heaters
in CA



Capacity: Support Production through Demand



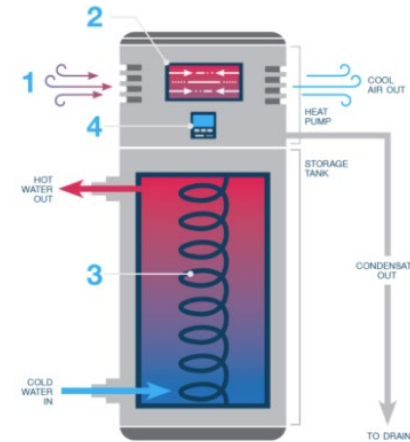
feyenzylstra.com



electronicsb2b.com

Characteristics of an ideal Utility Program according to a subset of HPWH OEMs to AWHI

1. Rebate: Instant at POS (retail) or mid-stream (wholesale); \$500 minimum value.
2. Minimal data collection requirement if manual process (i.e., customer zip code).
3. Additional data collection if automated/digitized process (i.e., address, product spec).
4. Targeted audience is homeowner.
5. Increase demand with direct messaging, constant education, and repetition.
6. Willingness to co-brand marketing collateral to drive traffic to retailer or wholesaler.
7. Prominent call-out of robust offers on website and across social media channels. Optimized user experience.
8. Minimum 30% of territory electric service.
9. Market transformation goal >10% of eligible households in region.
10. Additional incentives available for new home builders.
11. Consistent program design and execution across multiple state utilities to leverage scale (i.e., Efficiency Maine influencing program designs in MA/VT/CT).
12. Supportive of ongoing installation contractor training.
13. Bulk purchasing is available.
14. Financing options are offered.



We could save 100 million tons of carbon emissions every year



Create thousands of good-paying jobs in the building industry




Promote equity through investment in under-resourced communities



Enable a cleaner, more resilient electric grid

The solution is a piece of equipment that every home needs...



AWHI is a member-funded initiative, and our work is not possible without the contributions and support of our volunteers, partners, and participating organizations.

Join the Effort!

<https://www.advancedwaterheatinginitiative.org/>

Thank you!

Ralph DiNola
ralph@newbuildings.org

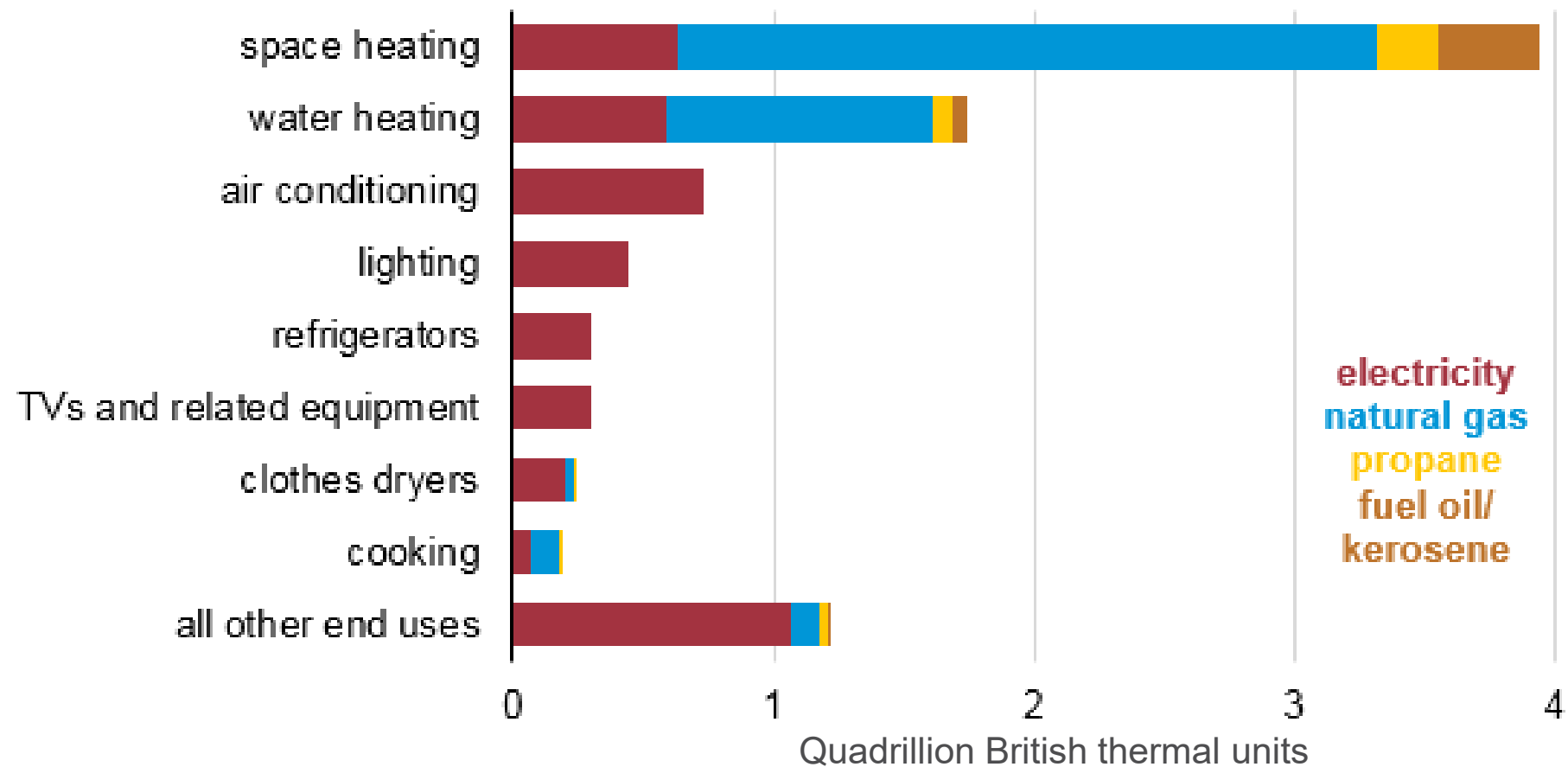
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institute

www.newbuildings.org

Appendix

The Advanced Water Heating Initiative

Space and water heating = 2/3 of home energy



Source: 2015 RECS

The future of water heating



Water heating uses up to 1/3 of building energy

Heat pump water heaters are 2-4 times more efficient than standard water heaters

New technologies are **available** for all residential, multifamily, and commercial buildings

HPWH compared to DG solar



Annual energy **cost** savings would be roughly

3 times

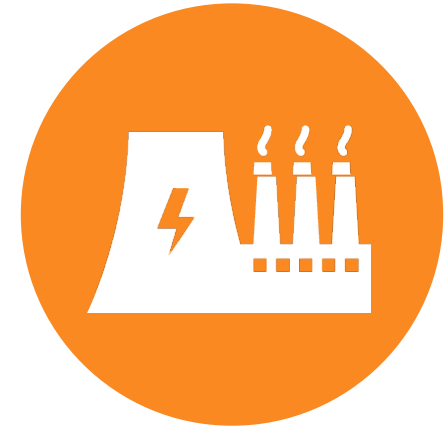
the value of **all** US small-scale distributed solar generation in 2020



The annual **energy** savings would be about

10 times

more than **all** US distributed solar PV generation in 2020



It would save about

3 times

more **carbon** annually than was saved by **all** US distributed solar PV in 2020

Magnitude of the Opportunity

118.2 mil Residential Buildings	1+ mil Annual New Home Construction	7.5 mil Water heaters replaced annually	27 mil Households w/WH >10 yr old
5.9 mil Commercial Buildings	100 mil tons Carbon emissions saved per year	18 Coal fired power plants annually	

AWHI Five Priorities

1. TRANSFORM THE MARKET.

Advance from an increase in market penetration to market transformation. This includes simplifying and targeting policy and program levers.

2. FOCUS FIRST ON NEW CONSTRUCTION.

Help establish universal program adoption and policy performance requirements that support HPWHs.

3. BUILD DEMAND.

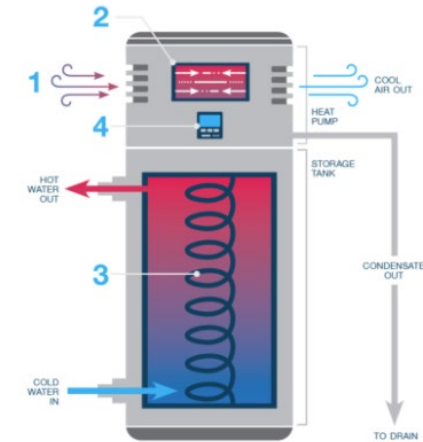
Build awareness through a coordinated marketing campaign customized for various audiences to provide inspiration, awareness, confidence, and education.

4. CREATE UNIFORM PROGRAMS AND INCENTIVES.

Create a consistent statewide approach that results in uniform program design and incentive amounts that include direct-to-consumer rebates and incentives for distributors and retailers.

5. ESTABLISH TRAINING AND TOOLS.

Provide training and tools to distributors, contractors, and installers.



Heat Pump Water Heater

Heat pumps deliver hot water 2-4 times more efficiently than conventional water heaters by transferring heat rather than creating it.

HERE'S HOW IT WORKS:

- 1** Heat pump pulls warmth from nearby air.
- 2** Warm air is compressed, increasing its temperature.
- 3** Refrigerant lines transfer heat from warm air to water.
- 4** Smart grid connectivity controls help manage energy use.

Our Vision and Mission

VISION

Efficient heat pumps are
universal in all water
heating applications
by 2030

MISSION

1

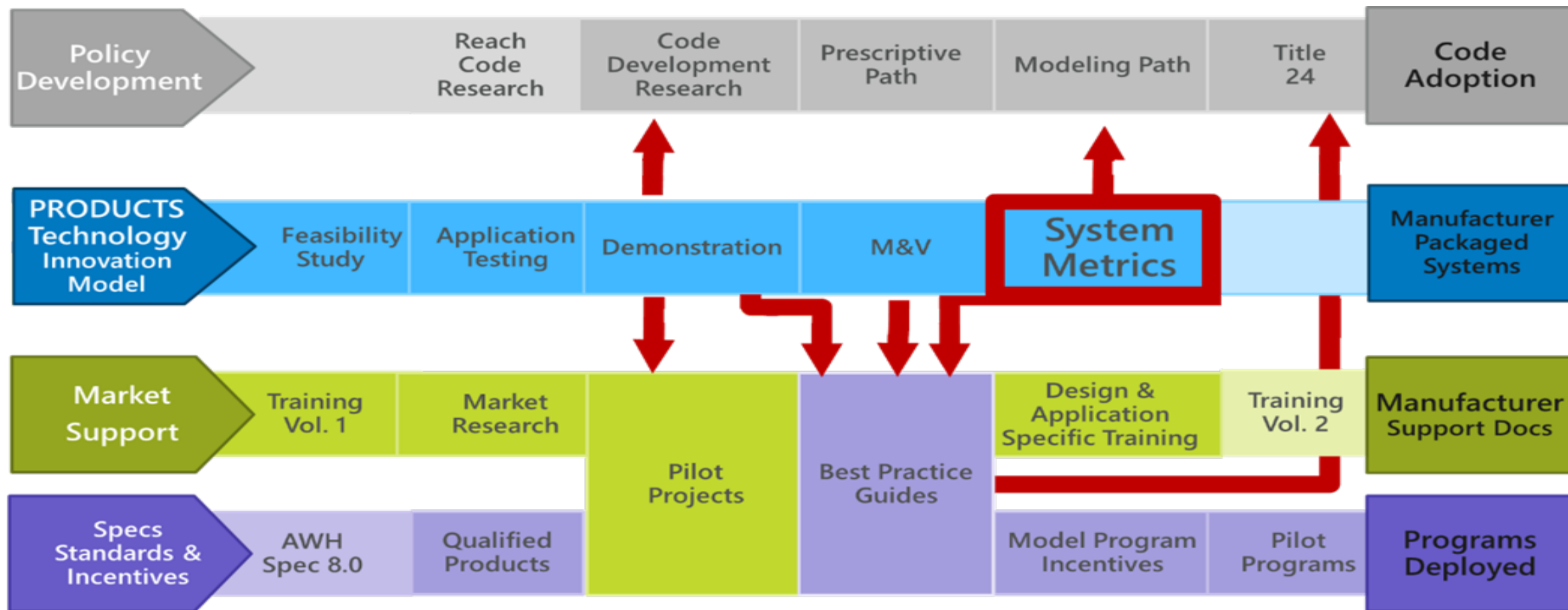
Improve building
energy
efficiency and
cut emissions
by bringing
HPWH to
mainstream

2

Engage with
state/regional partners
and community-based
organizations, and
support their success
with national
coordination,
resources and
expertise

3

Promote equity
through workforce
development and
investment in
under-resourced
communities

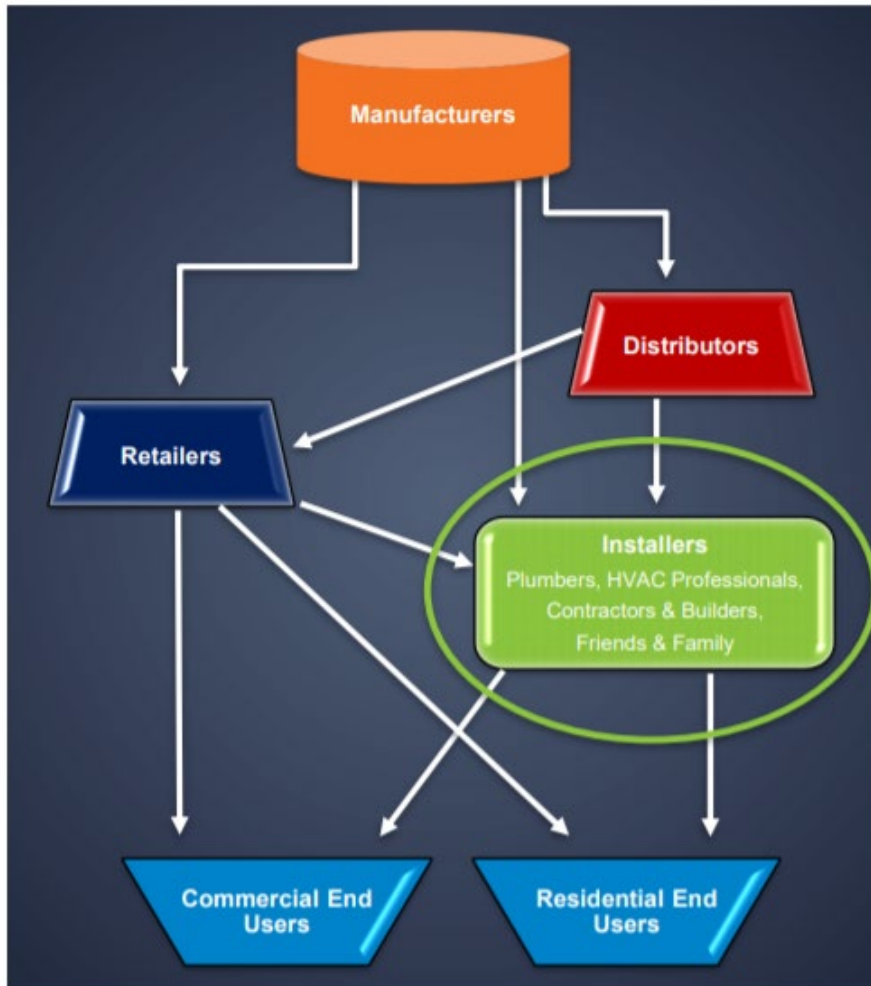


Technology Innovation Model



Coordinated management of multiple swim lanes – single voice to manufactures and regulators

Typical Single-Family Supply Chain



- Strong interconnectivity between all market actors
- Installers play a critical role

Source: NEEA

AWHI Success Metrics

Success Metrics	Value To
1. Program incentive dollars: increased amounts and availability of incentives for HPWHs as compared to standard water heaters	Manufacturers, Contractors and Customers, Utilities
2. Number of utilities/Program Administrators (PAs) providing HPWH incentive programs that offer statewide aligned program and incentives (percent of incentive-offering utilities that include HPWHs)	Manufacturers, Utilities, Contractors and Customers
3. HPWHs sold vs. total water heaters sold (percent HPWH as compared to standard water heaters sold should increase) by region	Manufacturers, Utilities
4. Technology development and advancements. Central systems: Manufacturers develop plug-and-play, fully packaged products sold by local suppliers Unitary: 120Vs products on the market	Program Administrators, Utilities, Building owners and occupants, and Manufacturers
5. Affordability. Reduced first cost and installation costs as well as clear and validated energy cost reduction	Customers, building occupants and building owners, Disadvantaged Communities

Join AWHI as a member!

Membership levels available to range of organizations. Benefits include:

AWHI is a nationally supported, locally run effort that will cut carbon and other greenhouse gas (GHG) emissions, invest in underserved communities, and create thousands of good-paying jobs.

Creating the change we need is not something one entity can do on its own. There is an important role for organizations across the building and energy industries—building owners, utilities, state and local governments, efficiency programs, manufacturers, engineers, and other industry professionals—to leverage their work and act collectively.

[Learn more about our community](#)



New construction.



Existing buildings.



A new HPWH market.

Curated **educational resources** for building energy professionals

A shared repository of real-time, **nationwide M&V data**

Co-branded marketing and communication materials for utility and local government water heating programs

Personalized **strategic sessions** with industry experts

Working Groups to shape technology and policy development

Thank You !