



Nov. 13, 2025

Market Transformation Advisory Board (MTAB) Meeting

CalMTA is a program of the
California Public Utilities
Commission and is administered
by Resource Innovations.

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Agenda



Time	Agenda item	Presenter
9:00 AM	1. Welcome & Agenda	Stacey Hobart
9:05 AM	2. Safety Minute	Stacey Hobart
9:10 AM	3. Introductions	Stacey Hobart
9:20 AM	4. CRAWs: Market Characterization	Sarah Zahid
10:10 AM	<i>Break (15 min.)</i>	
10:25 AM	5. CRAWs: Market Transformation Theory & Logic Model	Rick Dunn
11:55 AM	6. Public Comment	
Noon	<i>Lunch (45 min.)</i>	

Phone participants will be muted throughout the meeting and can raise their hand during the public comment period to be unmuted.

Agenda - *continued*

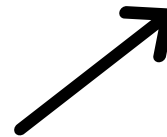


Time	Agenda item	Presenter
12:45 PM	7. Residential Heat Pump Water Heating (HPWH): Market Characterization	Jordan Decker
1:45 PM	8. Residential HPWH: Logic Model & Market Transformation Theory	Alexis Allan
3:15 PM	9. Public Comment	
3:20 PM	10. Next Meeting & Next Steps	Stacey Hobart
3:30 PM	<i>Adjourn</i>	

Phone participants will be muted throughout the meeting and can raise their hand during the public comment period to be unmuted.

- Two escape routes: turn right or left to exit this floor and the building. Emergency exit routes will be indicated by the exit signs

- ## You are here



Idea to Initiative schedule

CRAWS and Residential HPWH

Part 1

- Market Characterization
- Logic Model
- Market Transformation Theory

November 12 & 13, 2025

Part 2

- Market Progress Indicators & Milestones
- Product Assessment

January 29, 2026

Part 3

- Evaluation Plan
- Draft Market Transformation Initiative Plan & Appendices
- Total System Benefit & Cost Effectiveness

March 2026

MTI Plan Appendices – discussing today

A: Logic Model Packet

B: Market Forecasting & CE Modeling Approach

C: Product Assessment Report

D: Market Characterization Report

E: External Program Alignment & Coordination

F: Evaluation Plan

G: Risk Mitigation Plan

H: MTI Lifecycle Cost Estimate

I: MTAB Feedback

A large teal circle containing the text "Market Transformation Initiative Plan".

**Market
Transformation
Initiative Plan**



4. CRAWs Market Characterization

Sarah Zahid | Contractor, Cadmus

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What we'll cover

Introduction

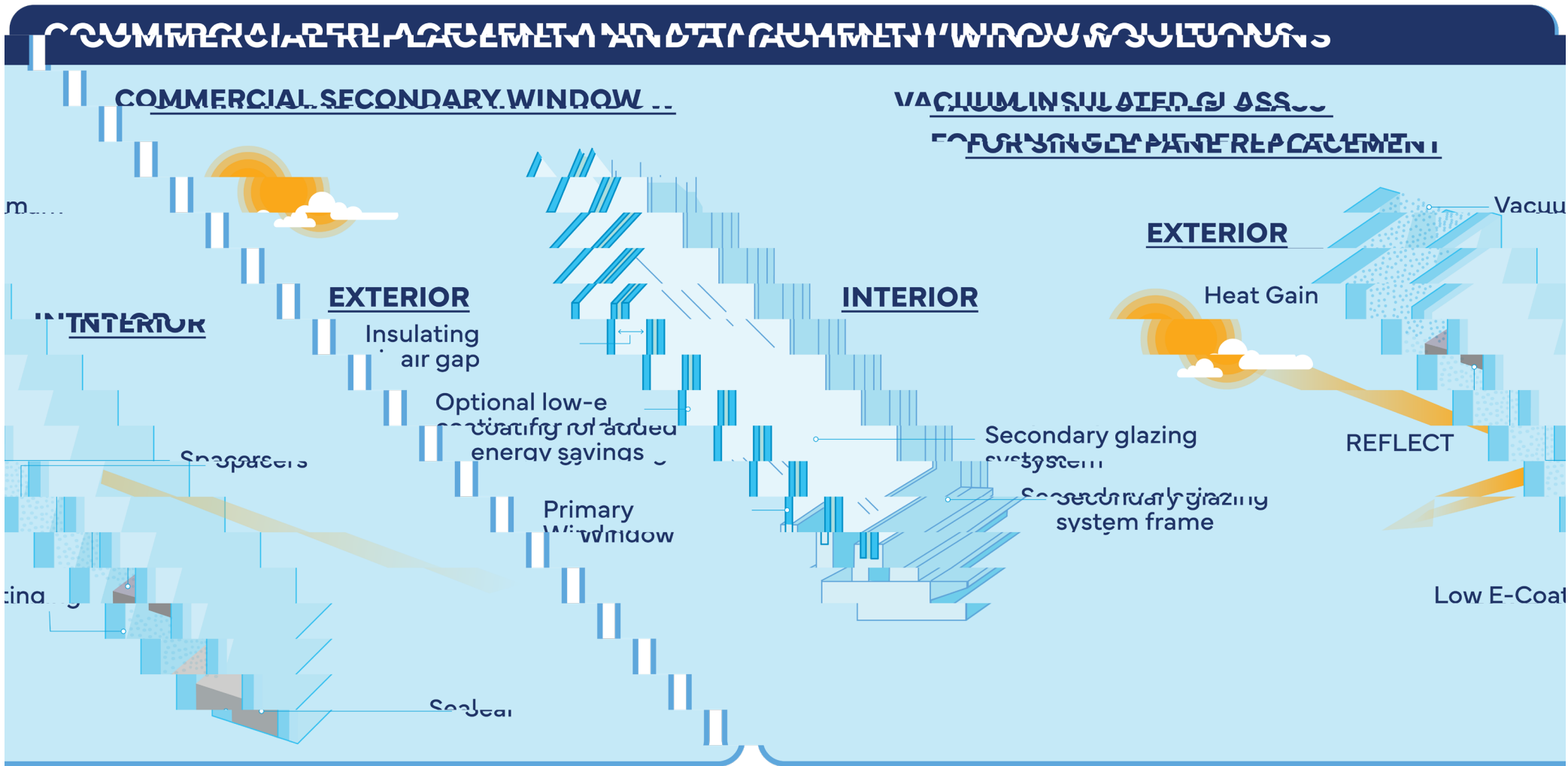
Key findings

Market characteristics

Policies and programs

Barriers and opportunities

CRAWS technologies



Product definition

Vacuum Insulated Glass (VIG)

- Replace existing single-pane windows while retaining use of the existing frame; two glass panes with hermetic seal and vacuum gap
- R-Value: R10-R15
- May include low-e coating
- Higher insulation
- High product and installation costs

Commercial Secondary Windows (CSW)

- Retrofit frame attached to existing window, creating air pocket; 1+ pane and low-E coatings
- Removable or permanent installation
- Lower cost than full window replacement
- Easier installation

Market Characterization Research Goals



Characterize the existing commercial windows program landscape, barriers, and opportunities



Assess product cost and financing options



Assess the policy and regulatory environment



Understand completed and ongoing market research, evaluation, and research and development efforts



Understand the supply-side dynamics of the CSW market



Understand the demand-side dynamics of the CSW market

Research Methodology

Audience or Task	Research Description	No. Completed
Existing articles, reports, presentations, and data sets	Secondary data review and analysis; literature review of evaluation and market reports	17
Manufacturers, energy service companies (ESCOs), and installers	In-depth interviews	13
Commercial tenants	In-depth interviews	6
Building owners and property managers	In-depth interviews	8
Building owners and property managers	Quantitative survey	114

Key findings



Market opportunity is large.

Single-pane windows constitute 52% of commercial floor space vs. 48% double-pane and 0% triple-pane (ComStock).



Window performance has a strong influence on a building's energy usage.

Windows represent roughly 15% of a building's exterior surface but account for about 40% of HVAC-related energy losses, equivalent to approximately 12% of total building energy use (Northwest Energy Efficiency Alliance, 2018).



Cost is a primary barrier to window improvements.

High upgrade and replacement costs of windows often deter owners.

Key findings (cont.)



Market actors see meaningful benefits from window solutions adoption: energy-savings, thermal, aesthetics, comfort, soundproofing, and occupant safety, etc.



Persistent barriers inhibit the adoption of CSW and VIG technologies. CSW offer lower price points and other benefits compared to traditional replacements, but misconceptions hinder their adoption.



Current incentives and codes are insufficient to drive widespread adoption in the CSW and VIG market.



Some decision-maker research findings are consistent with other studies and suggest confusion about CSW and VIG.



Market Characteristics

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Target Market

Target market overview

- **Focus:** Commercial buildings, built **pre-2000** with **single-pane** or **clear double-pane** windows
- **Reason:** CA only mandated double-pane windows starting in **2000**
- Many older buildings still have inefficient windows—prime for **decarbonization**

Priority segments

- Commercial buildings
- **Targeted types:** Municipal, University, School, Healthcare (MUSH)
- Also includes **hospitality** & **historic** buildings for **non-energy benefits** (e.g., comfort, noise reduction)

- Municipal buildings are a part of this analysis but are segmented under offices in CBECS.
- Warehouses were excluded from the market characterization due to the low window area and low potential for energy savings.

Market segments

Building Type	Sq ft (in Millions)
College/university	174
Healthcare	427
Lodging	342
Office	1,314
School (non-college/university)	1,028
Subtotal	3,284
Other	5,681
Total floor space	8,965

Floor space by window type

Analysis from ComStock shows that when we look at floor space by window type 52% of the windows are single pane and 48% are double pane windows.

Window Category	ComStock	
	Sq. ft. (in mill.)	Proportion
Single-pane/Single-layer	3,355	52%
Double-pane/multilayer	3,109	48%
Triple-pane	13	0%
Total	6,477	100%

Source: NREL ComStock 2018

Window performance has a strong influence on energy use

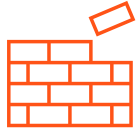
- Buildings account for nearly 40% of total U.S. energy use and about 75% of electricity use.
- Windows play a significant role in building energy savings by reducing peak loads and easing stress on HVAC systems.
- Windows represent roughly 15% of a building's exterior surface but account for about 40% of HVAC-related energy losses, equivalent to approximately 12% of total building energy use (Northwest Energy Efficiency Alliance, 2018).
- Properly installed, high-performing windows can reduce peak loads, improve thermal comfort, enhance aesthetics, and increase resilience to extreme weather.



Policies and Programs

CalMTA is a program of the California Public Utilities Commission and is administered by Resource Innovations.

Regulatory framework & performance standards



Beyond Title 24

New regulatory frameworks that emphasize long-term energy and emissions performance are influencing the CA window market.



Building Performance Standards (BPS)

Require large commercial and multifamily buildings to meet energy and emissions targets within set compliance periods.
(Cities like Chula Vista and others are early adopters of BPS-type rules.)



Compliance implications for advanced windows

Performance-based compliance paths favor high-performance glazing, positioning VIG as a strategic compliance solution.



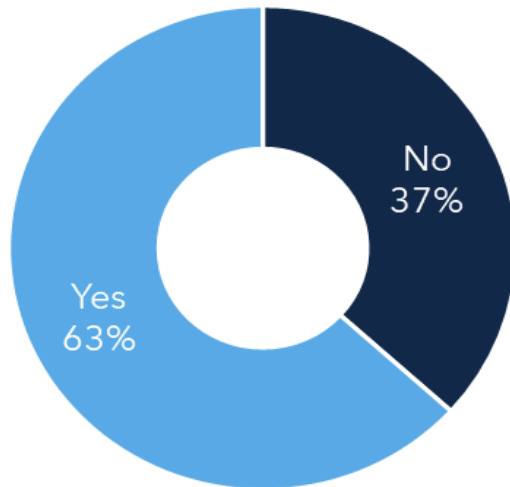
California Energy Commission (CEC)

Actively promoting advanced fenestration and secondary window solutions to support CA decarbonization goals.

Regulatory and program awareness

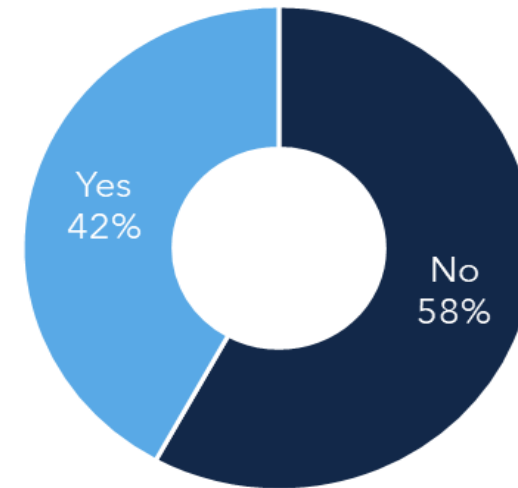
Building owners/managers have limited awareness of regulatory policies and energy efficiency programs.

Regulatory Policy Awareness



Source: CalMTA CRAWs Building Owner and Property Manager Survey Q G5: "Are you aware of any current or potential regulatory policies that may affect the way you operate your business in California, particularly how you make decisions regarding building upgrades?" (n=114) Results rounded to the nearest percentage.

Energy Efficiency or Decarbonization Program Awareness



Source: CalMTA CRAWs Building Owner and Property Manager Survey Q G1: "Do you know of any energy efficiency or decarbonization programs that provide financial support, incentives, or tax rebates for window solutions to buildings in California?" (n=114) Results rounded to the nearest percentage.

California IOU programs & incentives

California IOUs also offer incentives for windows, albeit nominal.

Program/Initiative	Type	Applicability to Advanced Window Solutions	Source
SDG&E Normalized Metered Energy Consumption	Pay for performance	Efficiency-enhancing retrofits, including windows	Savings at the Meter - SD EnergyEdge for SDG&E Customers
SoCal Gas Customized Incentives	IOU incentives	Efficiency-enhancing retrofits, including windows	Business Equipment Rebates SoCalGas
SCE Window Incentives	IOU incentives	Incentives are available for efficient window retrofits and film	32nd Ed SolutionsDirectory2021Feb Draft 5 review.pdf

California statewide programs & incentives

Few statewide programs currently offer incentives for windows (retrofits or otherwise).

Program/Initiative	Type	Applicability to Advanced Window Solutions	Source
California Energy Commission GFO-22-501	Grant program	High-performance window retrofits for commercial buildings	California Grants Portal
179D Commercial Buildings Deduction	Federal tax deduction	Up to \$5.65 per sq ft deduction for envelope energy savings, including windows	Energy-efficient commercial buildings deduction Internal Revenue Service



Market Barriers

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Manufacturer perception: Cost is a primary barrier to (overall) window adoption

When asked, what issues arise that prohibit clients from adopting these measures?

“Primarily upfront cost. Even if the payback is, you know, let's say five years or less - still, the investment required at the beginning is something that stops a lot of building owners, especially when you know doing nothing is an option. They don't have to do it.



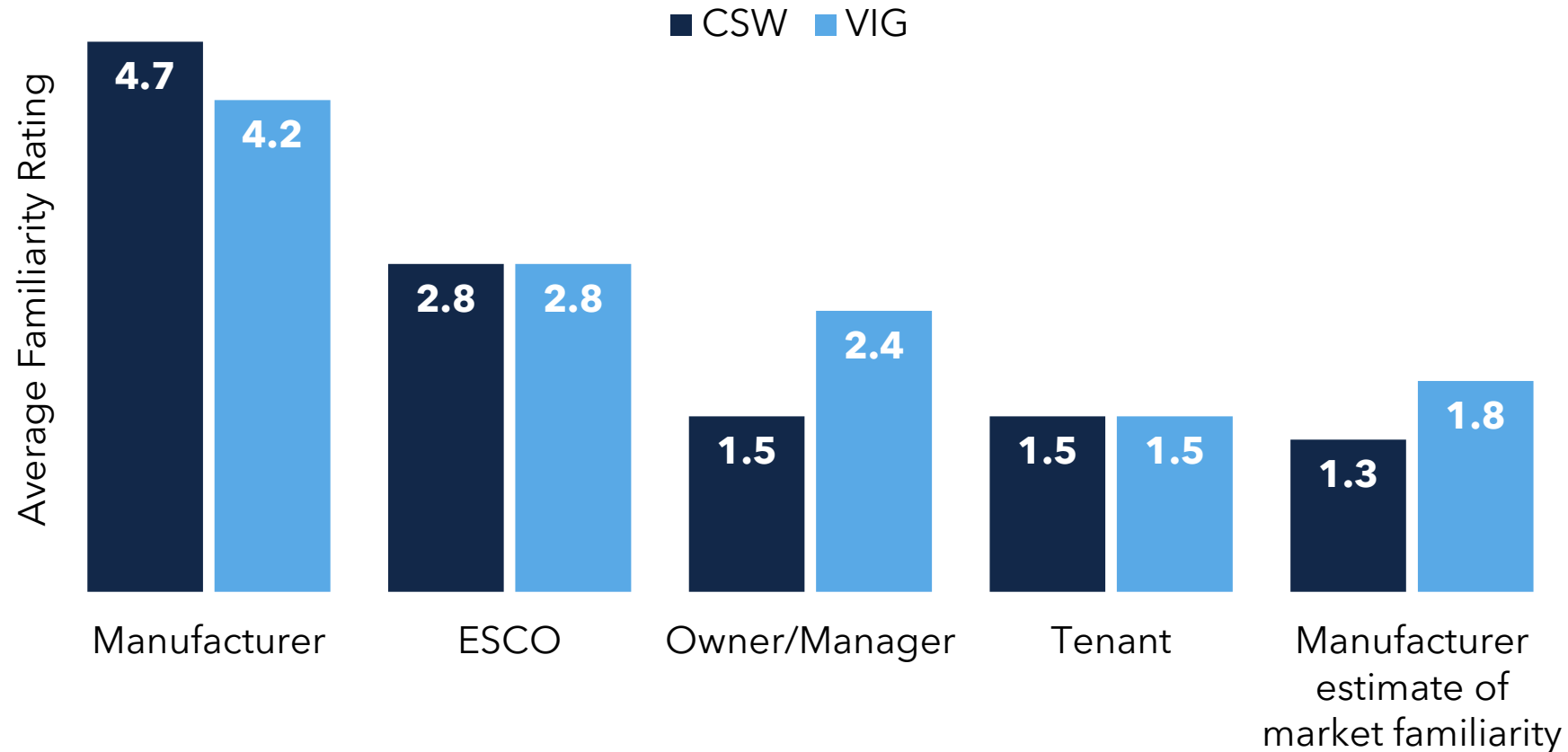
CSW Manufacturer

Advanced window solutions are less expensive than traditional window replacements

Category	Material Cost (Avg.)	Estimated Installation Cost	Notes
Typical CSW	\$34-\$40/sq ft	\$8.50/sq ft	Average material cost quoted by two manufacturers. Installation costs vary; \$8.50 based on a CA school case-study.
Typical VIG	\$25-\$100/sq ft	N/A	VIG material cost estimate is based on various sources, including a pilot project shared by the Building Technology & Urban Systems Division at Lawrence Berkeley National Laboratory.

Sources: (CSW) Field-study site at Madison Elementary in the Madera Unified School District CalMTA, 2025; (CSW) Attachments Energy Rating Council (AERC). Secondary Windows – Technical Factsheet. May 2023. Retrieved from <https://aercenergyrating.org/wp-content/uploads/2023/05/CSW-Technical-Factsheet.pdf>; (VIG) CalMTA personal interview. 6 Nov. 2025

Market actor familiarity is limited



Source: CalMTA Manufacturer interviews (n = 6), ESCO interviews (n = 5), owner/manager interviews (n = 8, and tenant interviews (n = 6). "On a scale from 1 to 5 where 1 is not familiar at all and 5 is very familiar, how would you describe your level of familiarity with Commercial Secondary Window (CSW) technology?" and "On a scale from 1 to 5 where 1 is not familiar at all and 5 is very familiar, how would you describe your level of familiarity with Vacuum Insulated Glass (VIG) technology?"

Market actor price misperceptions

ESCOs

Manufacturers



Cost Misinformation

- 100% reported CSW/VIG **installation costs > than traditional windows.**

- VIG ballpark **pricing parity with standard double-pane.**



Disconnect

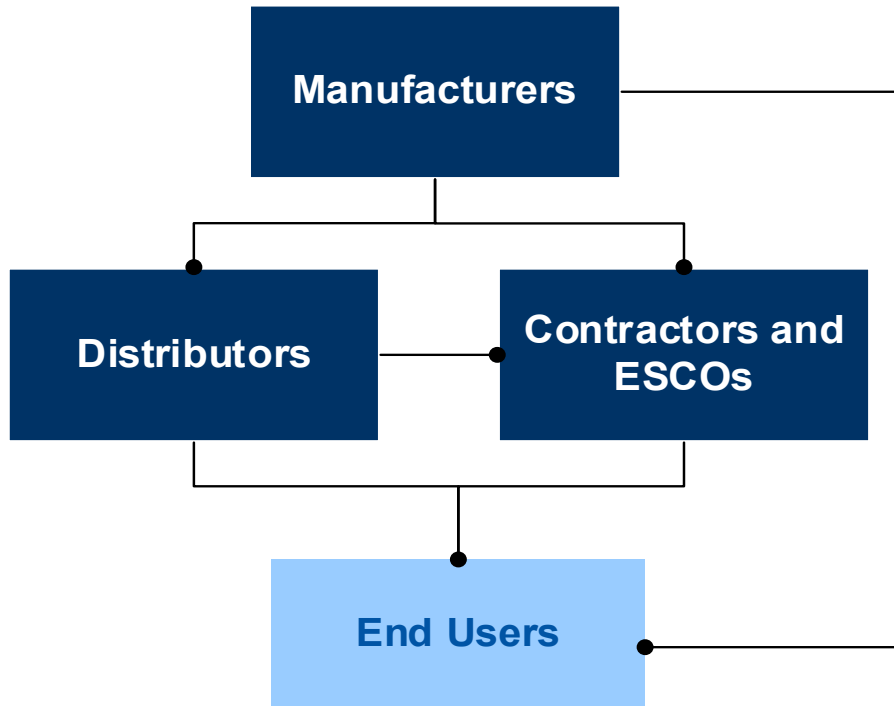
- **CSW is > than traditional window replacement** (3 of 3)
- **Reasons:** Low awareness, outdated assumptions; mistrust

- Some state CSW **prices are comparable** to double-pane.
- 2 of 3 CSW MFRs reported **lower prices** than low-E double-pane.

Note: ESCOs Interviewed (n=5); Manufacturers Interviewed (n=6)

Manufacturer approach leaves out other market actors in nascent market

Supply Chain Barriers



Manufacturers work directly with purchasers - leaving out the other market actors in the process.

For VIG, three of five manufacturer interviewees said that large manufacturers typically maintain in-house distribution channels.

All respondents mentioned that supply chain challenges are a concern, reflecting broader issues across the building materials sector.

- Availability of the product is limited, due to nascency of the market.
- Three of six manufacturers identified tariffs / escalating conflicts as a key challenge.

Financing insights from ESCO interviews



Current financing use is historically limited; many projects are self-financed.



Flexible internal financing and partnerships with green banks, utilities and lending offer viable pathways.



Low-cost financing appeals to those lacking capital. Financing mostly used by non-profits or budget-constrained organizations.



Financing a perceived barrier due to capital access; cannot justify low ROI projects.

“

Our assumption is that a sophisticated commercial building owner has their own line of credit

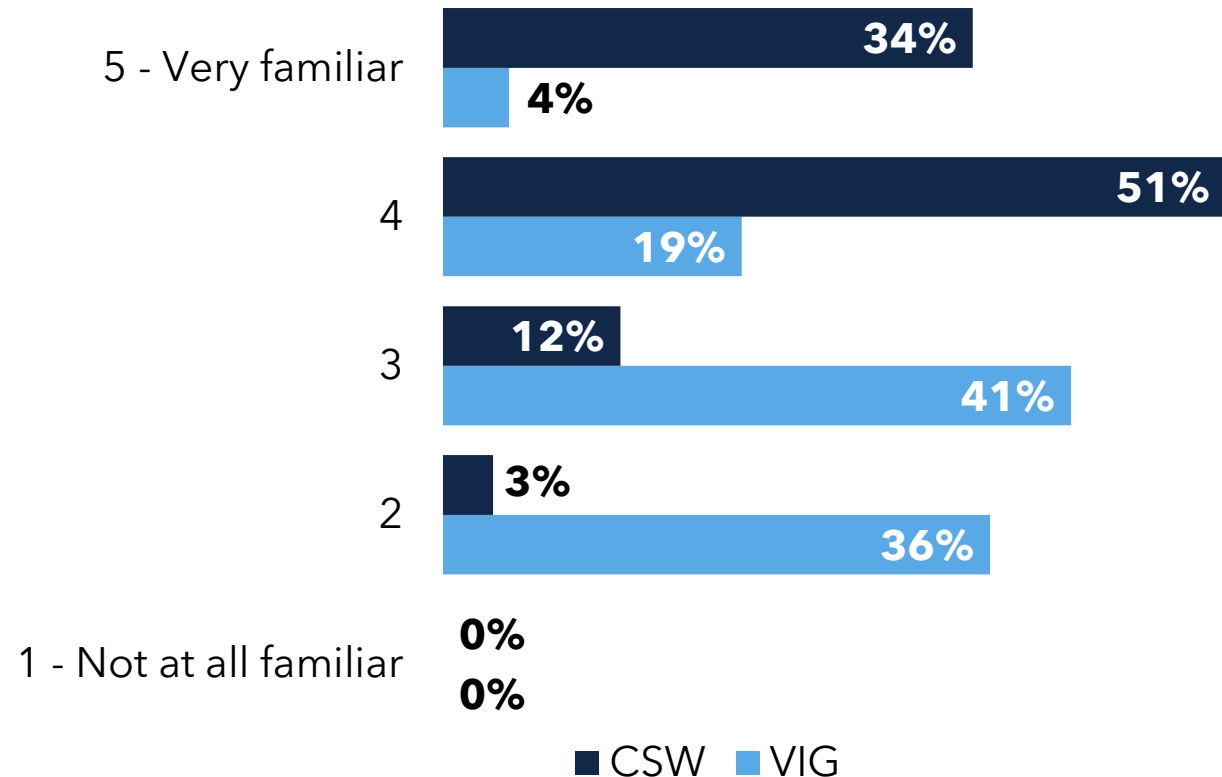


- CSW Manufacturer

Reported decision-maker familiarity suggests product confusion

Building owners/managers showed low familiarity with VIG technology compared to CSW.

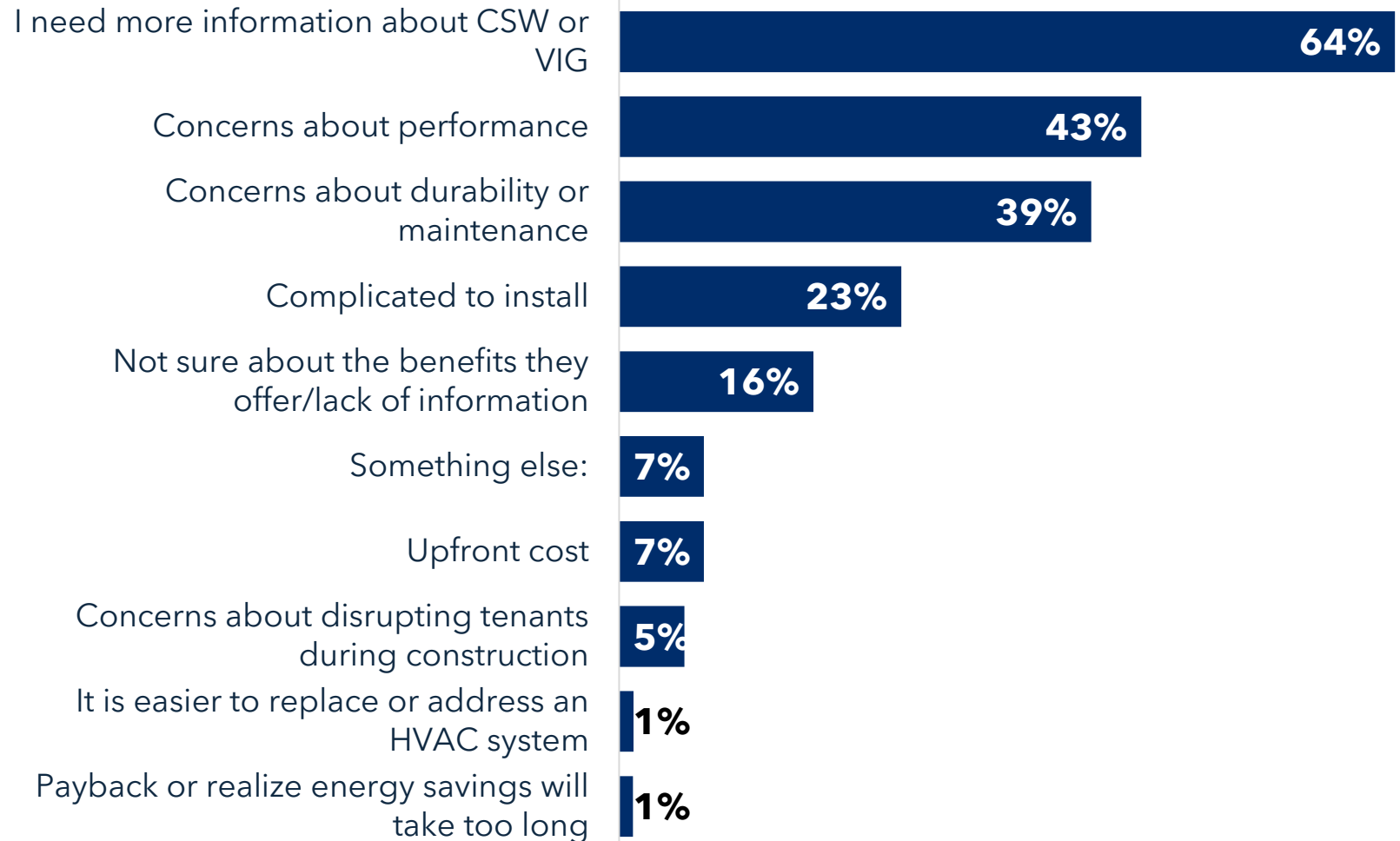
Source: CalMTA CRAWs Building Owner and Property Manager Survey D1: "Prior to this survey, how familiar were you with CSW?" (n=114) and D11: "Prior to this survey, how familiar were you with VIG?" (n=114)



Top-ranked barriers to VIG or CSW replacement or upgrade

Commercial building owners/managers ranked a **lack of information** as the *most important* barrier preventing them from selecting CSW or VIG for window projects.

Source: CalMTA CRAWs Building Owner and Property Manager Survey Q F1: "What factors, if any, would prevent you from selecting CSW or VIG as a replacement or upgrade solution to your window needs? Please rank up to three factors, where #1 is the most important and #3 is the third-most important." (n=114) Results rounded to the nearest percentage.





Market Opportunities

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Market actors are aware of benefits

ESCOs

50% **noted long-term value via energy savings, lifecycle, performance;** despite upfront costs

Manufacturers

Acknowledged non-energy benefits: **thermal comfort, noise reduction, leak prevention, and aesthetics**

Note: ESCOs Interviewed (n=5); Manufacturers Interviewed (n=6)

Similar benefits found across studies

Non-energy benefits of advanced window solutions

Benefit	Sources
Aesthetics	Manufacturer interviews, CalNEXT Commercial Windows Market Study ^a
Comfort	Manufacturer interviews, ESCO interviews, CalNEXT Commercial Windows Market Study, NEEA Secondary Window Market Characterization ^b
Soundproofing	Manufacturer interviews, ESCO interviews, CalNEXT Commercial Windows Market Study, NEEA Secondary Window Market Characterization
Cost-effectiveness (CSW only)	Manufacturer interviews, NEEA Secondary Window Market Characterization
Safety and security	Building owner interviews, NEEA Secondary Window Market Characterization

^a: Energy Solutions. 2024. Commercial Windows Market Study and Measure Package Development. Prepared for CalNEXT.

^b: Evergreen Economics. 2020. Commercial Window Attachments: Secondary Window Market Characterization. Prepared for NEEA.

Secondary case studies prove benefits

BetterBricks / AERC Case Studies

Aerospace Manufacturer

(single-pane to CSW)

- **12% reduction** in energy use → **\$4,066 annual savings**
- **Payback:** 10.7 years | 331 windows installed in 3.5 days

Montana University (66,000 sq ft)

- **5.9 dB noise reduction; 11% air leakage decrease;**
improved thermal comfort

Portland, OR Legal Office (15,741 sq ft)

- **13.4% reduction** in air leakage
- Installation averaged **20 min. per window**

Secondary case studies prove benefits (cont.)

LuxWall Case Study (VIG vs. Single & Double Pane)

Enthermal glass (VIG) outperformed both alternatives on: U-value, interior surface temperature, energy & carbon savings

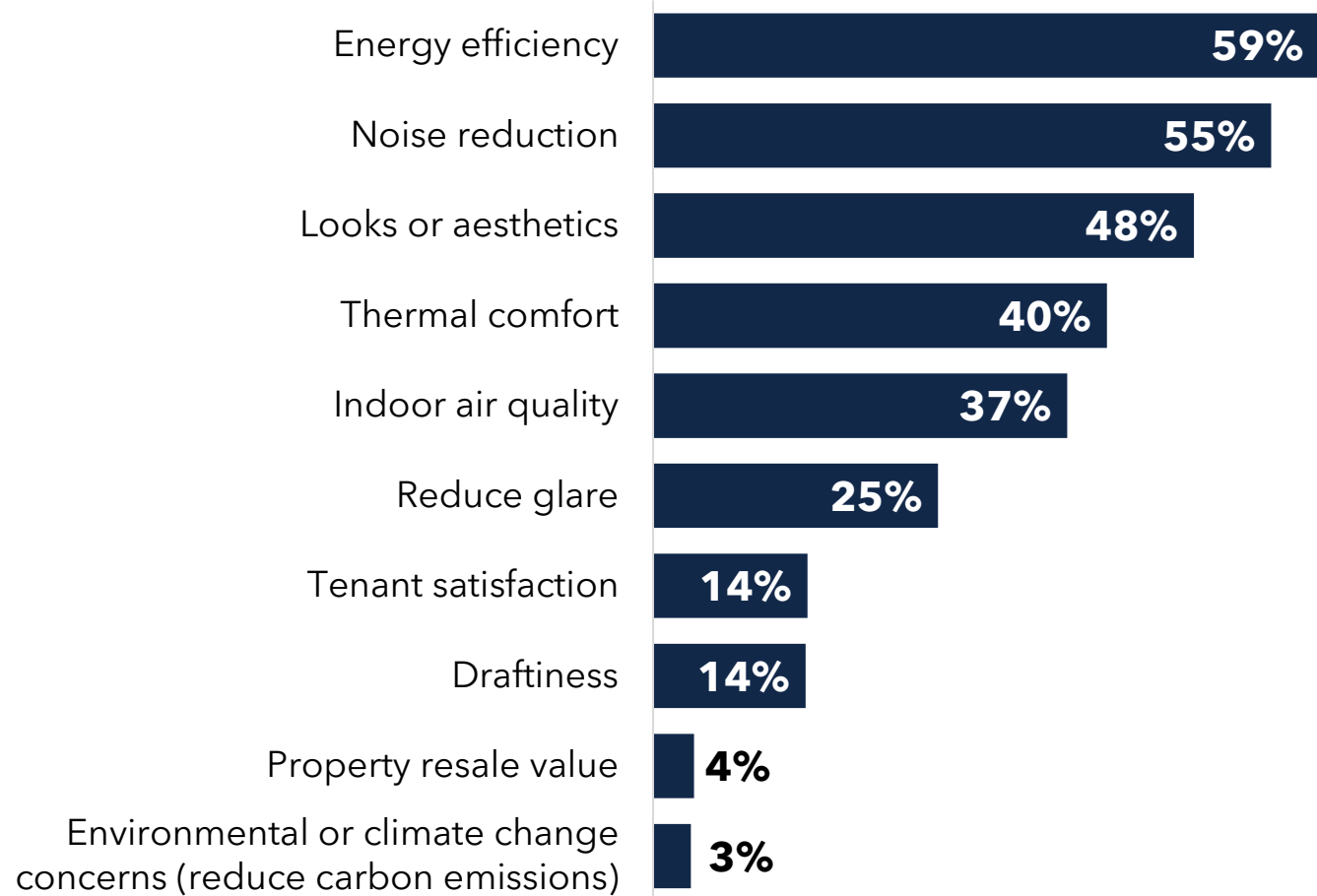
Compared to single-pane:

- **60% lower solar heat gain, 45% less heat loss, 43% lower peak load**
- **2 to 3× higher ROI** than high-performance double-pane replacements

Motivations for upgrading windows - decision-makers

Energy efficiency and noise reduction are top reasons for considering replacement or upgrade.

Source: CalMTA CRAWs Building Owner and Property Manager Survey Q C3: "If you were to upgrade or replace any of the windows in your building(s), what would you say are the most important reasons that you would consider doing so? Please rank up to three reasons, where #1 is the most important and #3 is the third-most important." (n=114) Results rounded to the nearest percent.

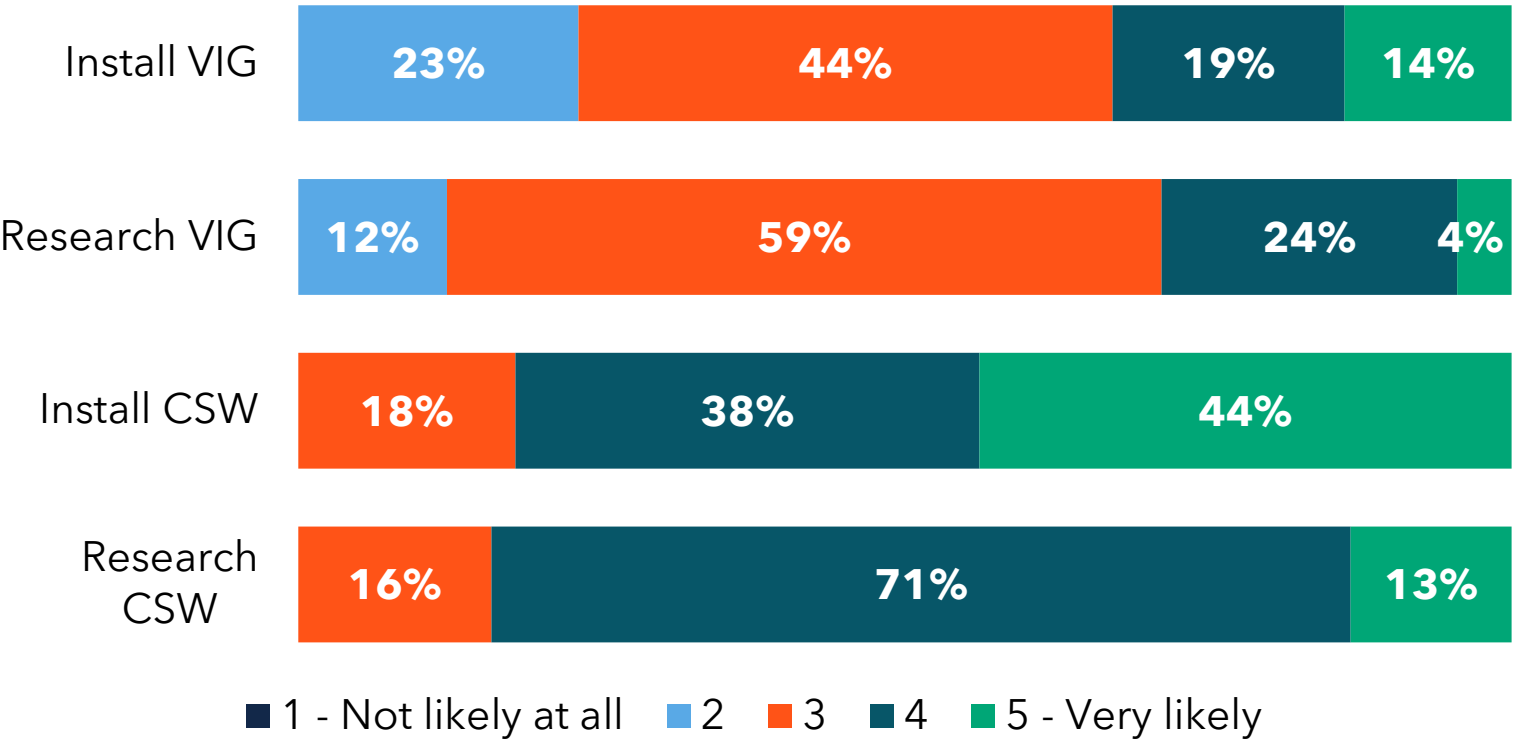


Reported decision-maker interest in CSW is strong



Respondents were **more likely to install and research CSW than VIG.**

Source: CalMTA CRAWs Building Owner and Property Manager Survey Q E1: "Assuming you needed to replace or upgrade windows in one or more of your buildings, how likely would you be to research CSW on a scale of 1-5, where 1 is "Not at all likely" and 5 is "very likely"?" (n=114) & Q E2: "Assuming you needed to replace or upgrade windows in one or more of your buildings, how likely would you be to install CSW (with the level of understanding you have now)?" (n=114) & Q E3: "Assuming you needed to replace or upgrade windows in one or more of your buildings, how likely would you be to research VIG on a scale of 1-5, where 1 is "Not at all likely" and 5 is "very likely"?" (n=114) & Q E4 "Assuming you needed to replace or upgrade windows in one or more of your buildings, how likely would you be to install VIG (with the level of understanding you have now)?" (n=114) Results rounded to the nearest percentage. Results may not sum to 100% due to rounding.



Questions & Discussion

Break (15 min.)
We will be back soon.





5. CRAWs Market Transformation Theory & Logic Model

Rick Dunn | Strategy Manager

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Vision for the future

- Envelope assessments are required as part of BPS prescriptive and performance-based pathways.
- Utilities include CSW and VIG in incentive programs and deploy educational/awareness-building to promote an envelope-first approach as a means to secure grid flex. benefits.
- Building owners and operators utilize CRAWs technology as a means to achieve energy and non-energy benefits, improve building resilience, and position buildings to be grid assets.



End-state impact

By 2045, **over 25% (1.25 billion sq. ft.) of the existing commercial building sector** square footage that currently has single pane or double pane clear windows utilizes CRAWs technology.



Snapshot of CRAWs logic model

Barriers/ Opportunities



Strategic Interventions



Short, mid-, and long-term outcomes

Impact

By 2045, over 25% of the existing commercial building sector square footage that currently has single pane or double pane clear windows utilizes CRAWs technology in line with California's overall decarbonization targets.

Logic Model - Barriers

Low market awareness of window-related problems and solutions



High upfront costs relative to the “do-nothing” alternative



Non-energy benefits are a key driver but are not well-quantified



Immature supply chain for CSW and VIG



High vacancy rate in commercial office space market reducing appetite for improvements



No standard methodology to rate installed performance for VIG



Key



Market



Financial



Technology

Logic Model - Opportunities

SB 48 and forthcoming CA policy on commercial building energy use and emissions reduction

Meeting climate policy goals in pre-2000 buildings necessitates envelope improvement

Momentum from DOE, National Labs, GSA, CEC, REEOs and utilities (ComED) testing and promoting window solutions

BPS nationally is driving new financial and financing models for building upgrades (Green Banks, evolving ESCO models, C-PACE, on-bill financing) enabling windows to be bundled and financed with other measures

Growing financial, technical and manufacturing investment in CSW and VIG manufacturing

Key

-  Market
-  Financial
-  Technology

Logic Model - Interventions

Leverage strategic interventions of CBEA & CRTU MTIs

In-field demonstrations

Build "envelope first" business case for commercial buildings

Industry engagement for technical support and demand creation

Awareness-building with strategic partners and CA external programs (SEM, commercial utility Programs, etc.)

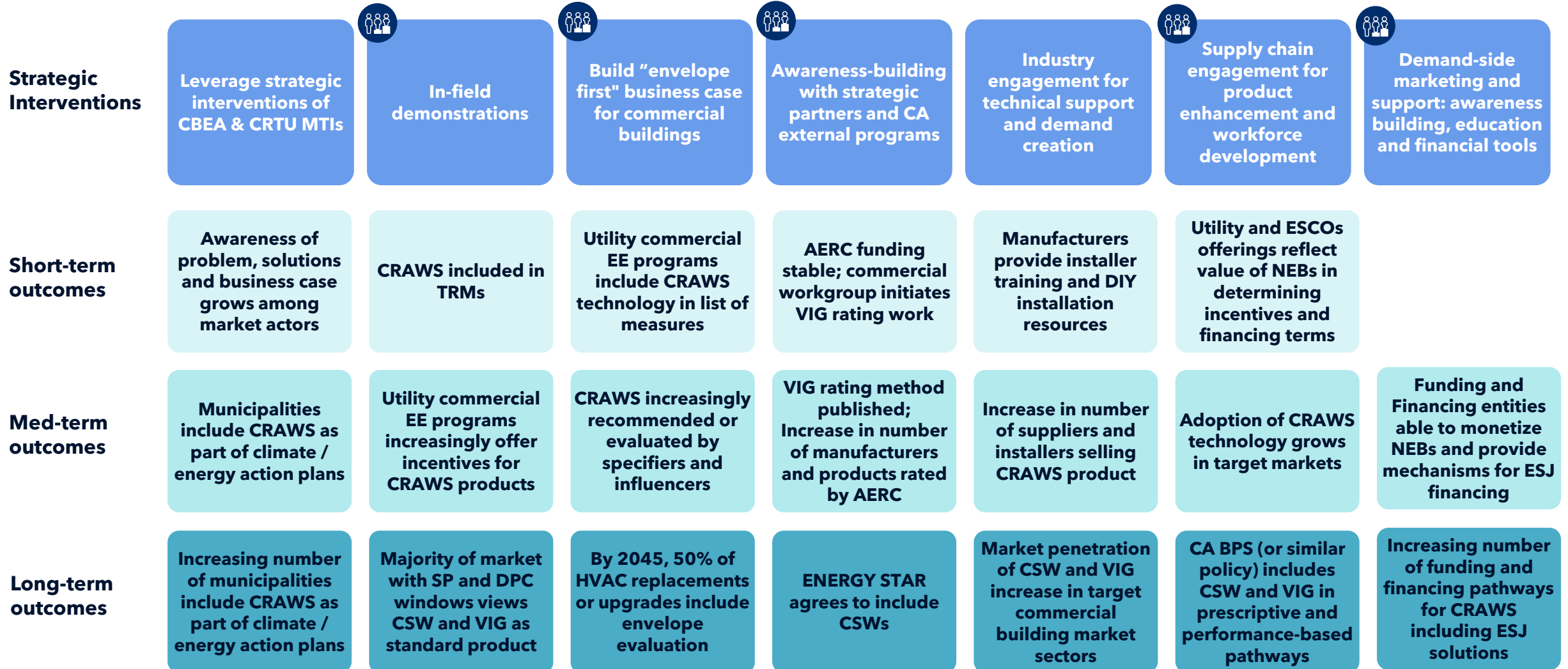
Supply chain engagement for product enhancement and workforce development

Demand-side marketing and support: awareness-building, education, and financial tools

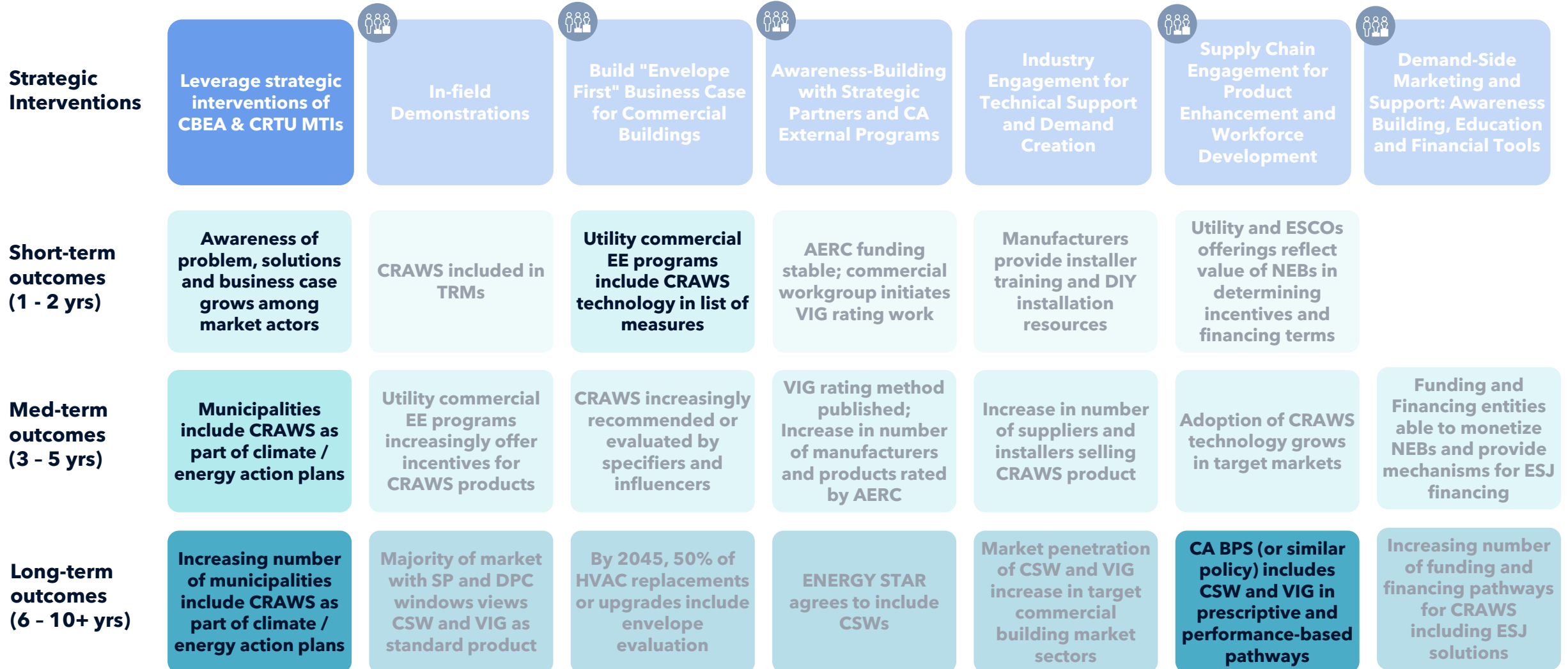
Key

-  Market
-  Financial
-  Technology

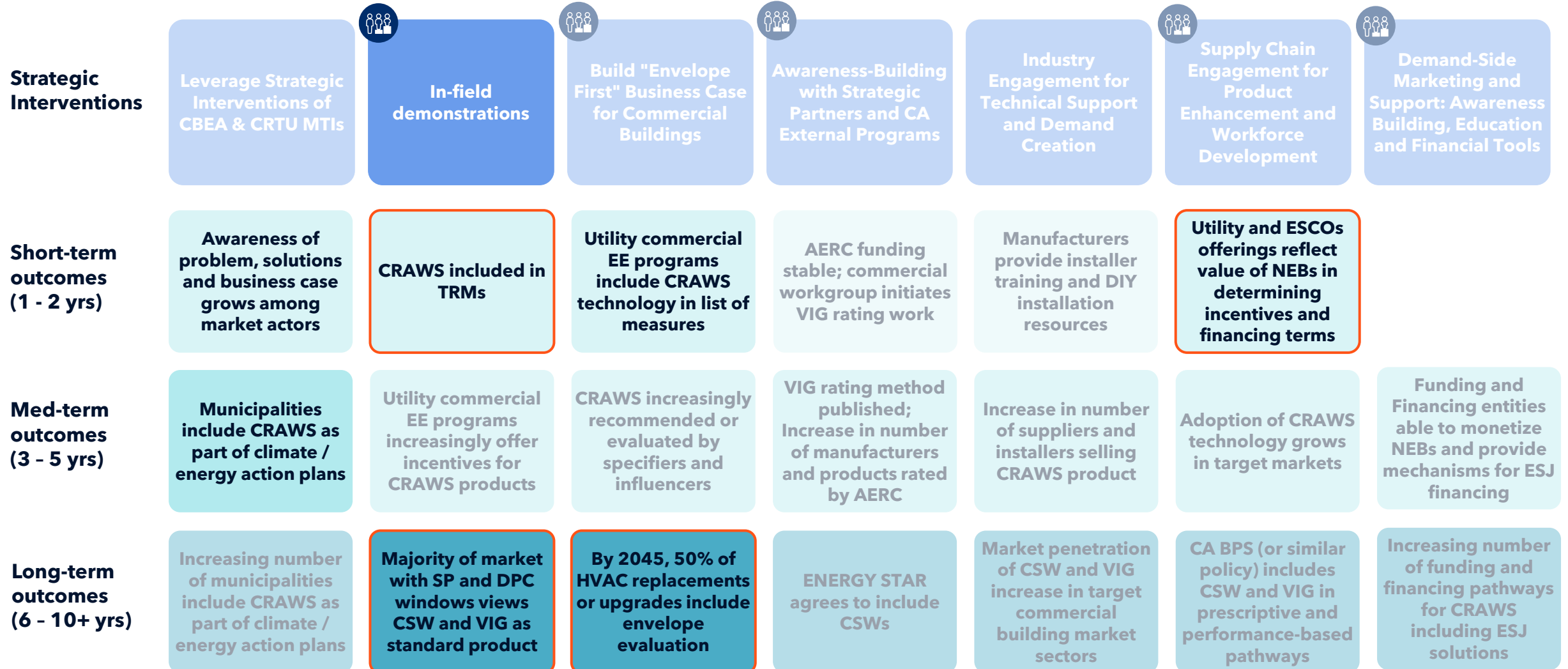
Snapshot of CRAWs logic model



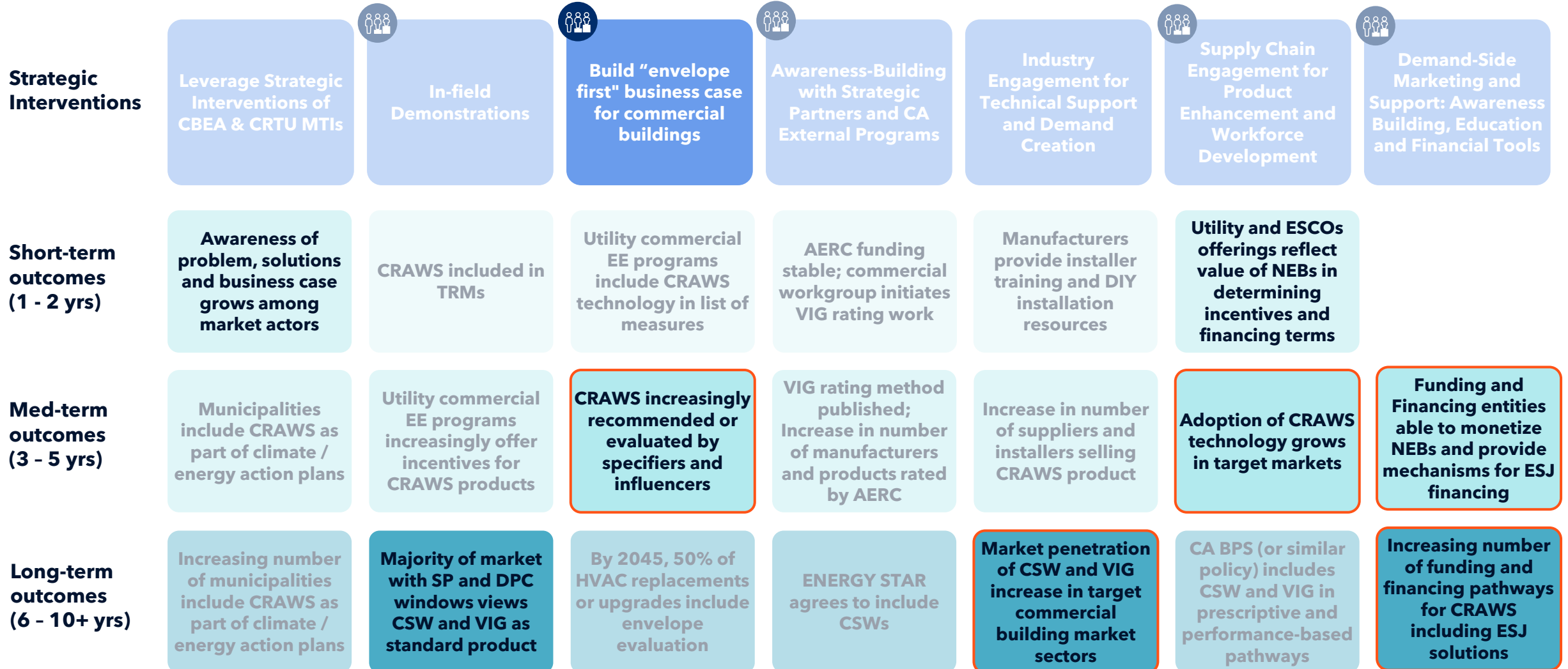
1. Leverage strategic interventions of CRTU & CBEA MTIs



2. In-field demonstrations



3. Build "envelope first" business case



4. Awareness-building with strategic partners and CA external programs

Strategic Interventions



Short-term outcomes (1 - 2 yrs)



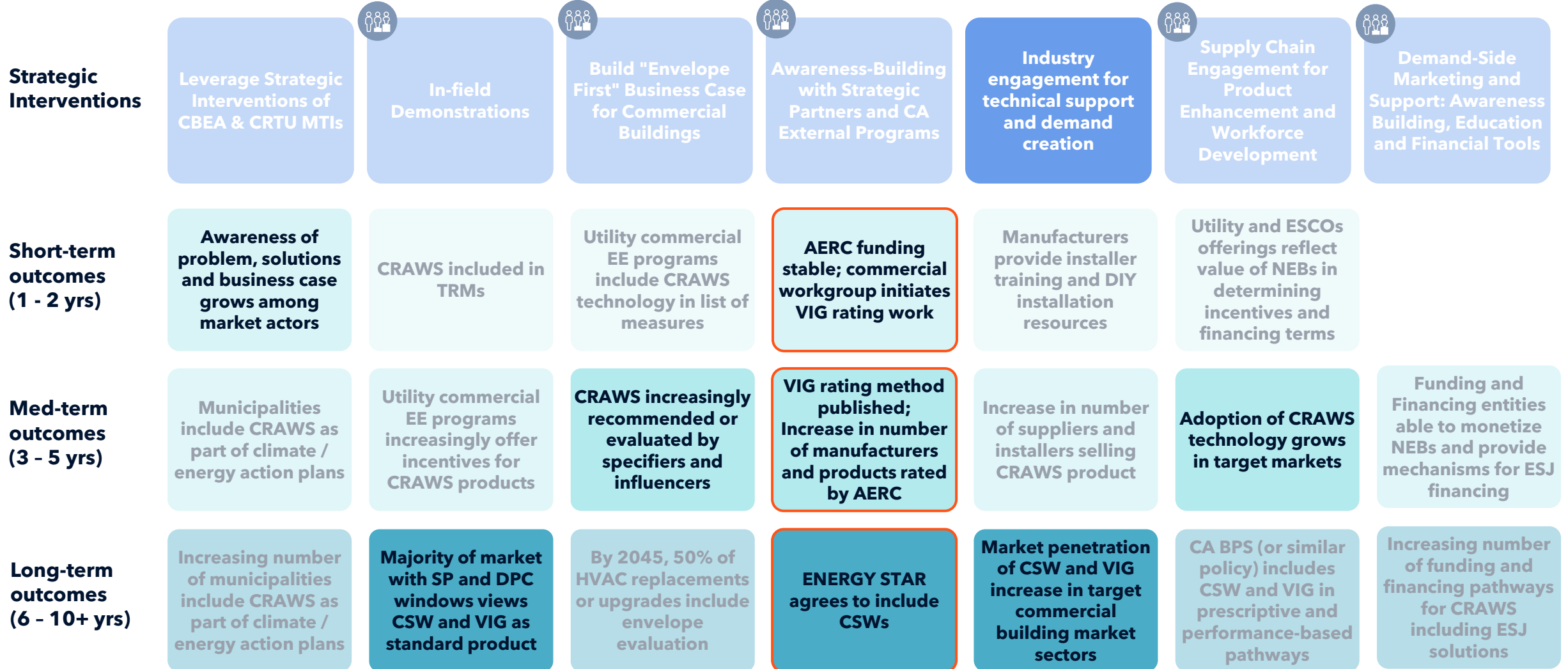
Med-term outcomes (3 - 5 yrs)



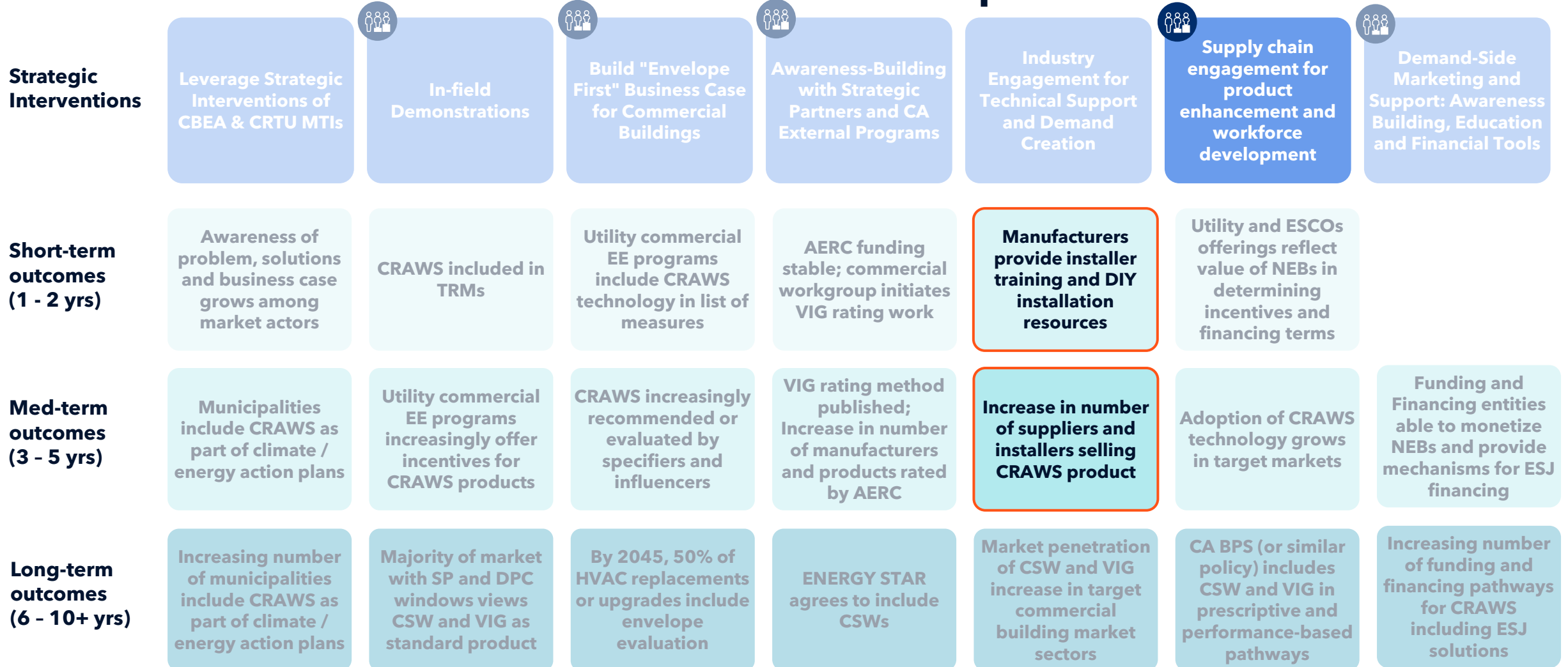
Long-term outcomes (6 - 10+ yrs)



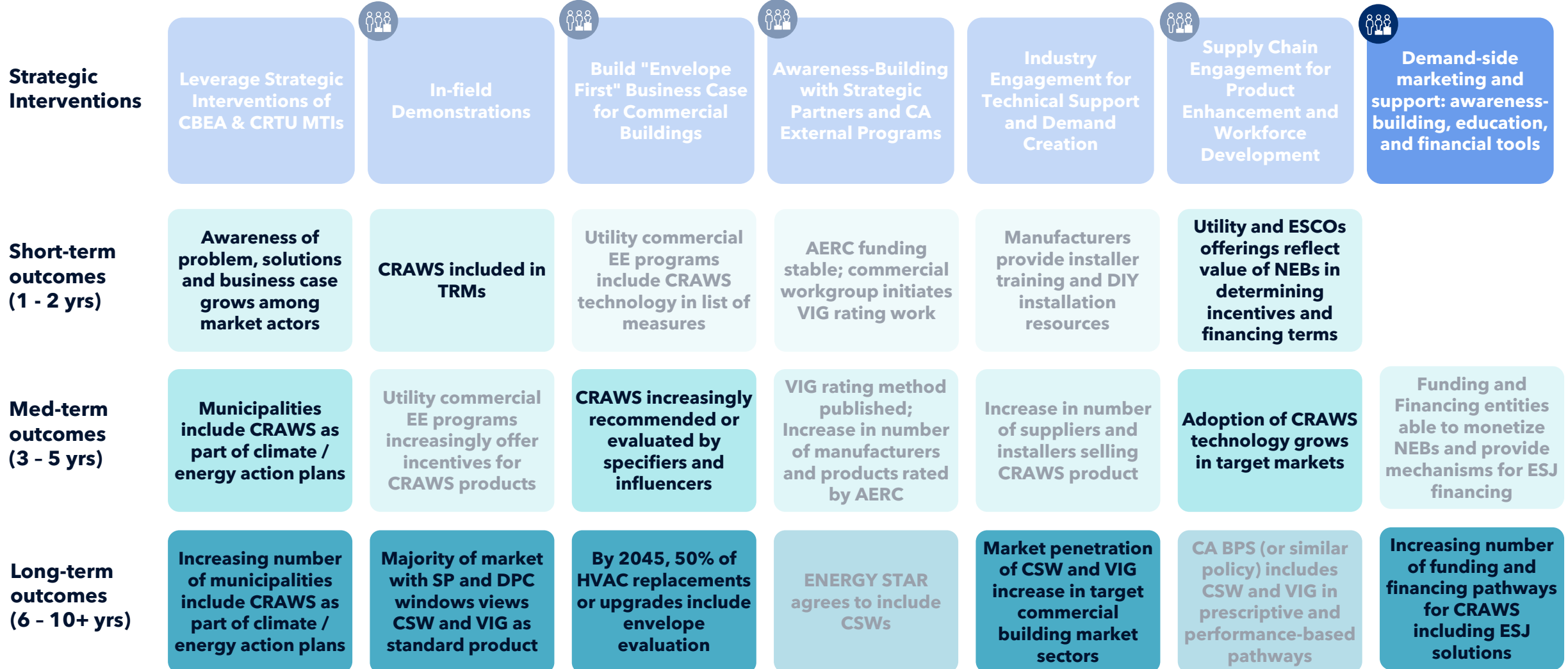
5. Industry engagement for technical support and demand creation



6. Supply chain engagement for product enhancement and workforce development



7. Demand-side marketing and support: awareness-building, education, and financial tools



Theory of market change

IF

If we drive awareness of real-world energy and non-energy benefits of CSW and VIG...

If we develop a cohesive strategy for addressing envelope and HVAC solutions concurrently...

THEN

then we dispel myths that windows don't impact building energy performance in mild climates, and will increase market commitment to exploring window solutions

then we will bring down the capital and operational costs of electrification and can create an "envelope-first" business case for commercial building retrofits

Theory of market change (cont.)

IF

If we bring down the capital costs and/or improve the ROI of envelope upgrades...

If California implements a statewide BPS or similar policy to manage energy efficiency and emissions of existing commercial buildings...

THEN

then we will be able to leverage green banks, ESCOs, C-PACE and OBF to finance window solution projects

then the occurrence of whole-building retrofits will increase significantly above the current rate of 1-2% per year; demand for window solutions will also increase

Theory of market change cont.

IF

If building owners are compelled to investigate window solutions, either voluntarily by the strength of the business case or mandated by state policy, and have the financial tools to fund or finance window upgrades...

THEN

then they will demand CSW and VIG products

Questions & Discussion



6. Residential HPWH Market Characterization

Jordan Decker | Contractor, Cadmus

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What we'll cover

- Introduction
- Key findings
- Market characteristics
- Product characteristics
- Programs and policies
- Customer and installer experience
- Barriers and opportunities



Introduction

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Market characterization goals



Characterize the existing HPWH program landscape, barriers, and opportunities



Assess the policy and regulatory environment



Characterize the baseline market conditions



Understand completed and ongoing market research, evaluation, and research and development efforts



Understand the supply-side dynamics of the residential HPWH market



Understand the demand-side dynamics of the residential HPWH market

Methodology

Type of Research	Detail
Secondary Research	
Existing research	• Residential HPWH sales and residential stock and relevant segmentations in CA • Relevant pilots, policies and programs
Literature review	• Characterizations, evaluations, and other reports related to HPWH efficiency, program support, performance, deployments, and reception
Primary Research	
Interviews	• 20 stakeholders • Six manufacturers
Surveys	• Residential survey (n=856) • Building owner and property manager survey (n=162) • Installer survey (n=149)



Key Findings

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Key findings on HPWHs

Low saturation and market share

HPWHs represent <2% of 11+ million residential CA water heaters, and an estimated 5-6% of CA annual sales.

Upfront cost is a top barrier to HPWH purchase

HPWHs are ~ \$1,000+ more expensive or, with professional installation, ~\$4,000 more expensive than alternatives.

Incentives to support are complex

30+ active programs exist. Incentives motivate some, but incentive/program complexities also create barriers.

Key findings on HPWHs (cont.)

HPWH fit is uncertain in some existing buildings

Physical footprint, ventilation and condensate needs, and electrical capacity can complicate install and may require additional work for HPWH installation.

Bill savings are uncertain to most converting from gas to HPWHs

Bill savings are a leading benefit and driver of HPWH adoption nationally, but gas customers worry about bill increases in many CA service territories.

Regional variations leave a disconnect from HPWHs and limit broad adoption

Limited customer awareness and installer familiarity persists, impaired by limited HPWH availability, visibility. Greater retail engagement may support BIY/DIY market segments.



Market Characteristics

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Target market: residences with existing per-household water heaters

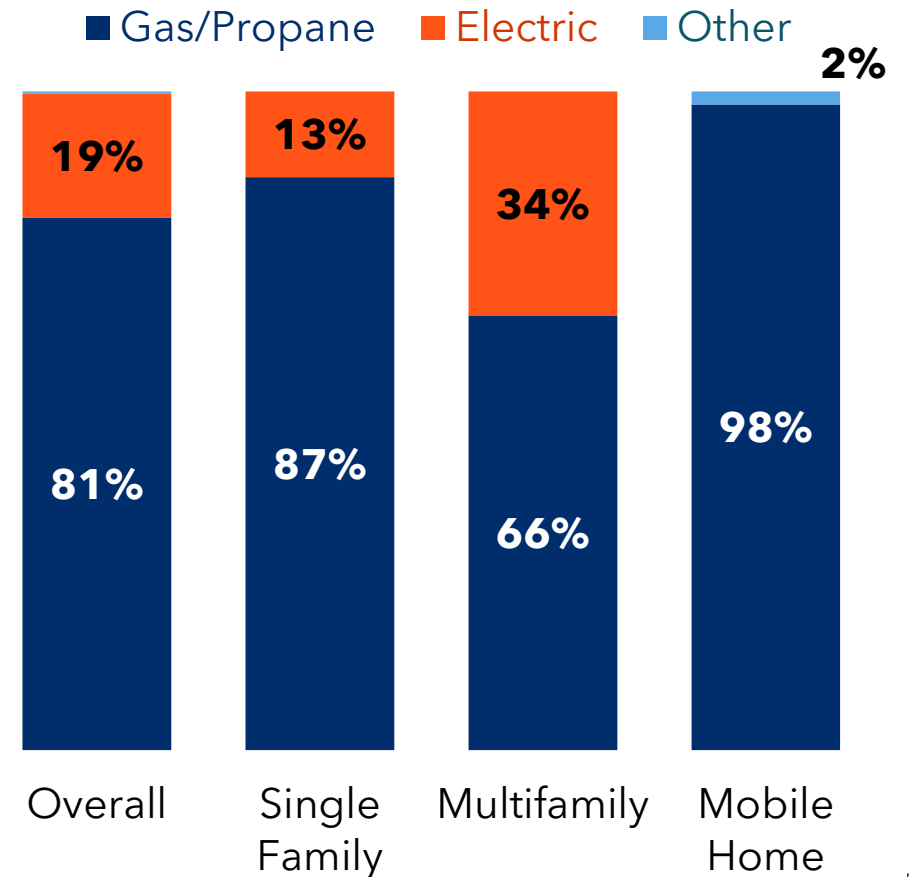


Residential households served by per-household water heaters in California
~ **11.5 million households**

CalMTA estimates **~4% increase in electric water heater saturation since RECS 2020**

Electric water heaters represent **23% of existing stock (2.5 million WHs)**.

Water Heaters by Fuel Type, RECS 2020



HPWHs in existing CA residential

Residential households served by per-household water heaters in California: ~ **11.5 million households**

CalMTA estimates current HPWH saturation of ~1.6%¹

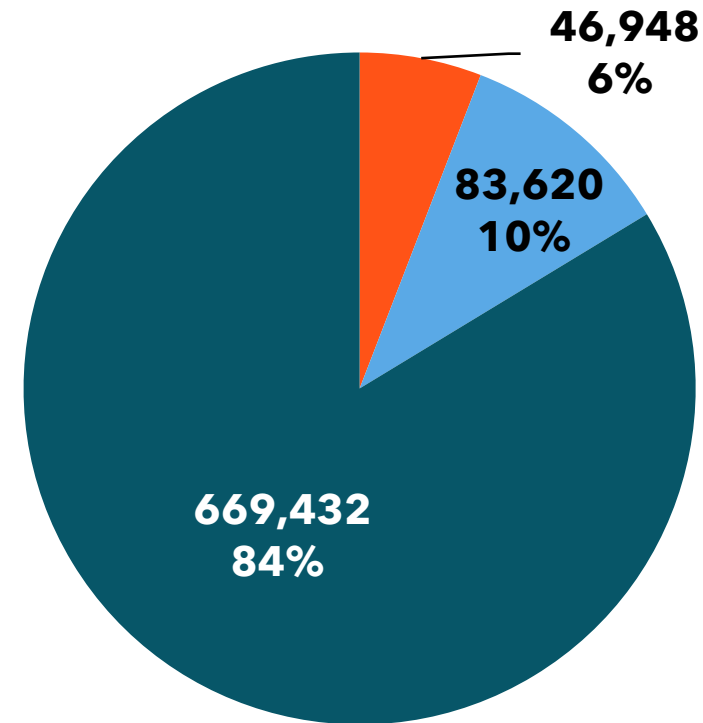
	HPWH Market Share (% of 753,000 units annually) ^a	HPWH Market Share (Units Annually)	Estimated Saturation (Units)	Estimated Saturation (% of 11.5 million installed units)
2019			56,536	
2020	1.5%	11,110	67,648	0.6%
2021	1.8%	13,351	81,000	0.7%
2022	2.7%	20,189	101,193	0.9%
2023	5.1%	38,702	139,902	1.2%
2024	5.7%	43,002	182,911	1.6%

¹CalMTA calculation referencing new construction rates, total annual water heater sales in California, CEC/CHEERS, Incentive estimates from TECH data, CEDARS data, SMUD data

Market share: existing and new construction



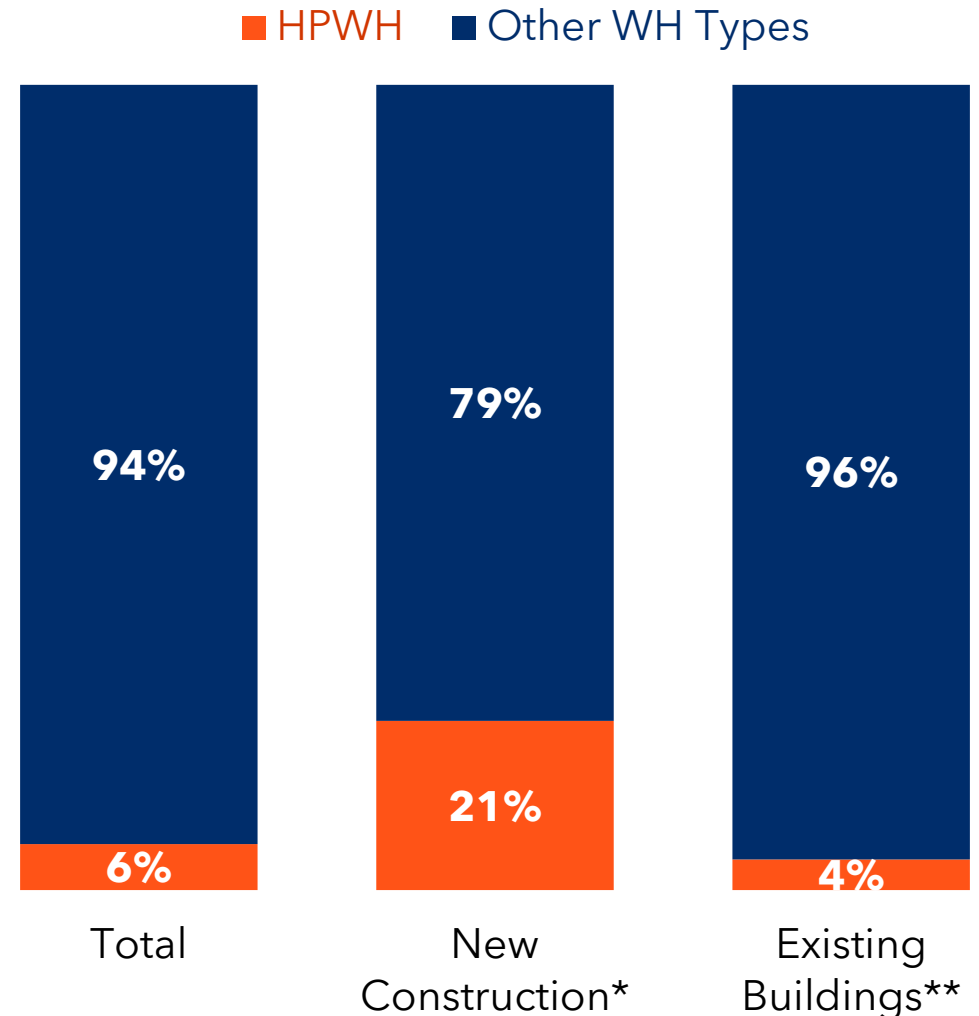
Of the ~800,000 water heaters sold annually, 669,000 are installed in existing buildings with dedicated WHs and 84,000 are a component of new construction.



- Central Water Heaters (Not Dedicated Per-Household)
- Dedicated Water Heaters, New Construction
- Dedicated Water Heaters, Existing Buildings

Market share: existing and new construction

Estimated California HPWH market share of 5.7%: Market share is higher in new construction market than retrofit market.



*Note that percentages may not sum due to rounding. *Sources: construction starts from First Tuesday Journal; all-electric rates estimated from CA stakeholders, CPUC all-electric extension request data, HPWH rates projected forward from CHEERS 2022 as referenced by CEC ** Sources: analysis of incentivized HPWHs in retrofit programs (TECH, CEDARS, SMUD), national ENERGYSTAR shipment data, CalMTA residential survey results*

Market trends

HPWHs are growing in market share nationally:

- National ENERGY STAR® shipment data shows a 34% growth in shipments between 2022 to 2023.
- Estimated national HPWH market compound annual growth rate from 2025 to 2030 is 14.9%.

Manufacturers projected a developing market in response to federal standards, and shared **projections on HPWH costs:**

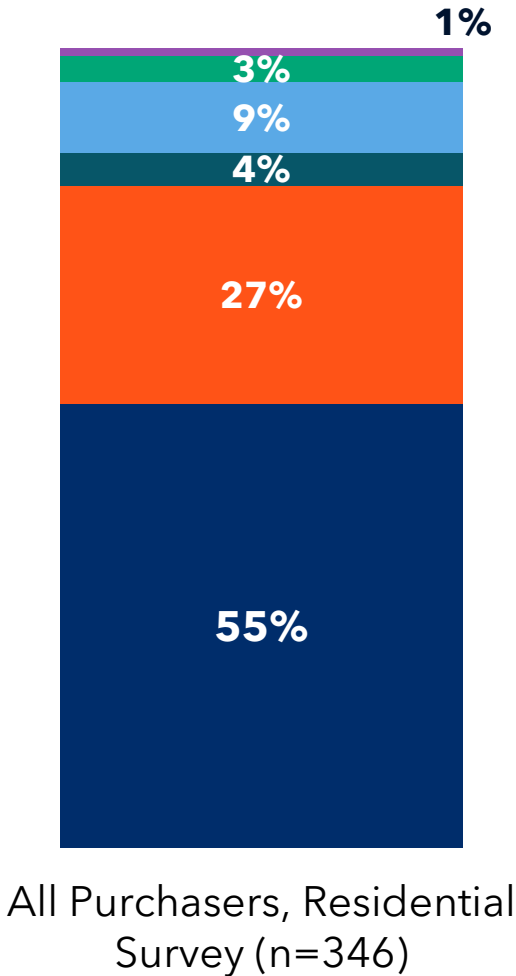
Potential Cost Increases

- Increase in cost of product components
- Refrigerant regulation

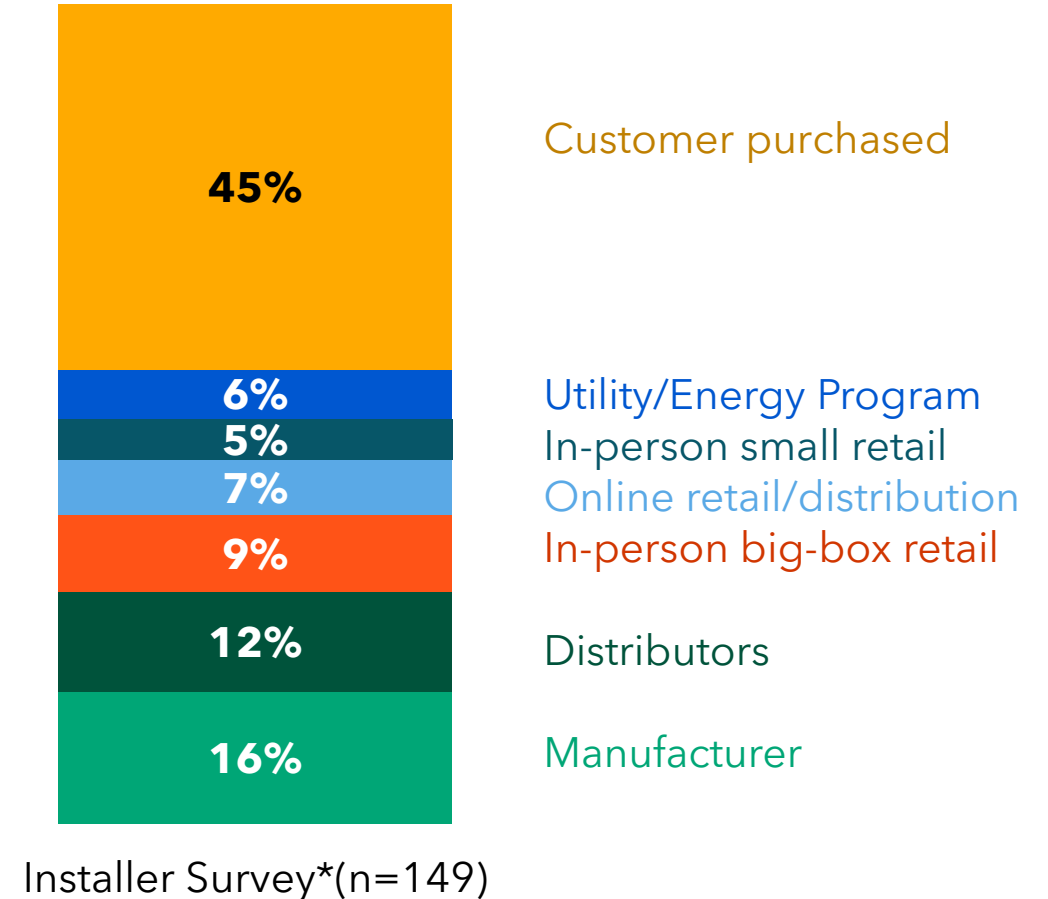
Potential Cost Decreases

- Scale and market competition
- Bulk purchases to lower total costs

Supply side: reported purchase channels

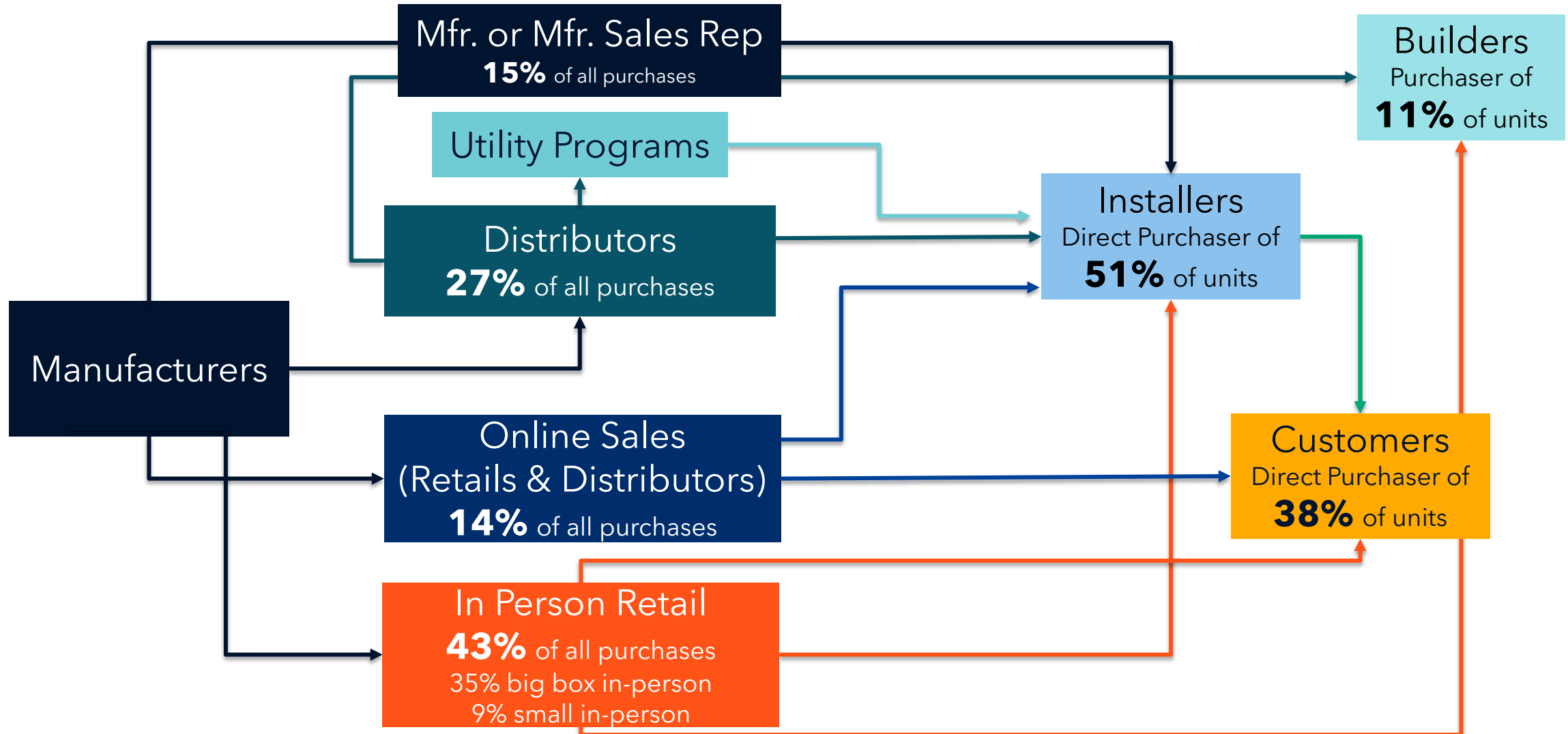


Other/Someone else purchased/Don't Know
Online manufacturer
Online retail/distribution
In-person small retail
In-person big-box retail
Installer purchased



CalMTA Residential Survey, QB9. "Where did you purchase your water heater?" (n=346) and CalMTA Installer Survey, QB3. "Approximately what percentage of water heaters do you purchase from each of the following sources? (Please ensure the total adds up to 100%.)" (n=149)

Supply side: residential WH market map





Product Characteristics

CalMTA is a program of the California Public Utilities Commission and is administered by Resource Innovations.

HPWH Characteristics

More Efficient, with Reduced GHGs

Larger than Standard WHs

Unit Controls include Grid Connection & Load Shifting

Greater Ventilation Needs

Alternate Form Factors Address Space Issues

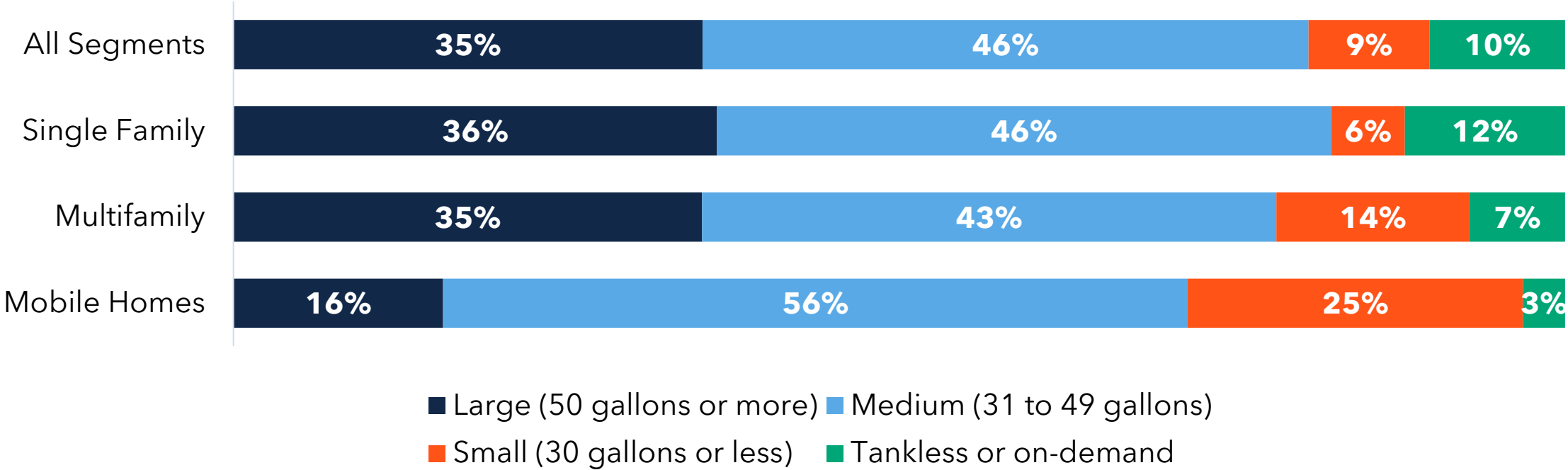
Condensate Management Needs

Ambient Temperature, Able to Heat & Dehumidify

Often Upsized to Maximize Performance

California water heater characteristics

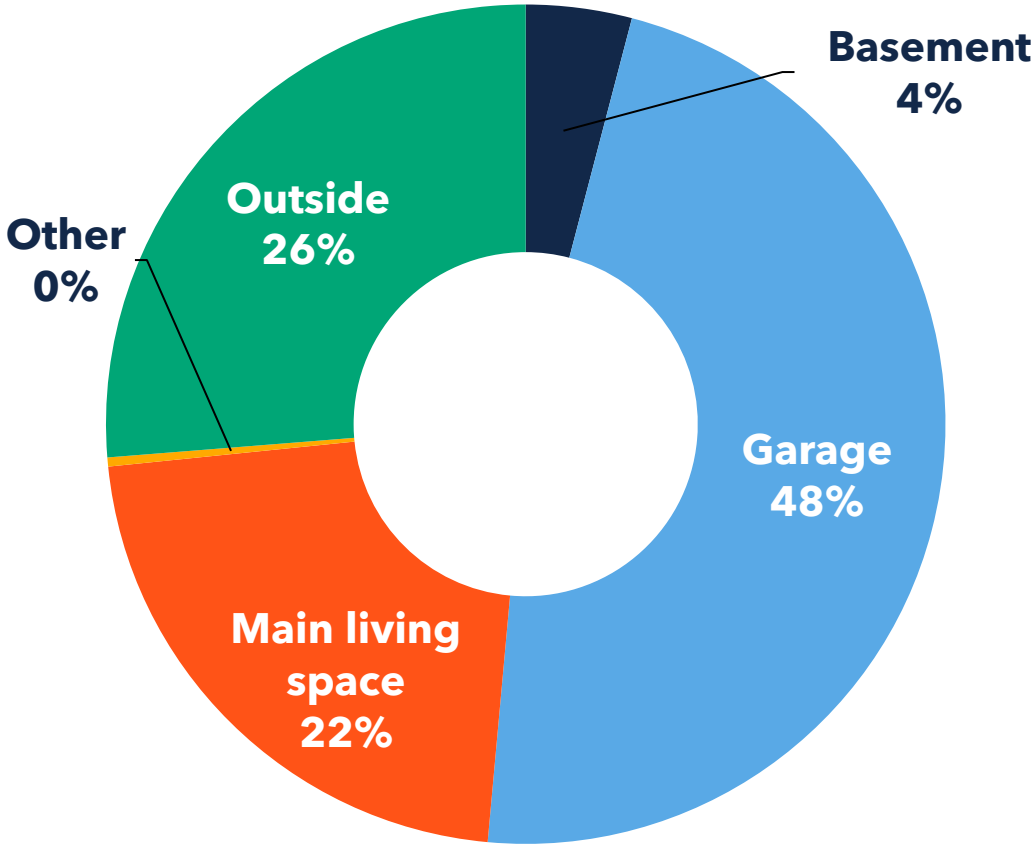
Water Heater Capacity Distribution



2020 RECS data, calibrated to ACS 2023

California water heater characteristics (cont.)

Location at Residence



2020 RECS data, calibrated to ACS 2023

California segment characteristics

Most retrofit water heater installs (75-90%) are emergency replacements due to failure/performance issues. Many, for simplicity, will choose like-for-like replacements.

Characteristics Affecting Water Heater Install by Segment

Multifamily

- More likely to have existing WH in small interior closet (or exterior)
- Space constraints may limit options for install without relocation

Mobile Homes

- Potential master metering may complicate bill impacts
- HCD authority and questions around exterior placement of units

Homes with Existing Gas Water Heating

- May require electrical work, adding time and \$ (\$100s to \$10,000+) to project
- Interviewed stakeholders estimate 30% of households will require electrical work
- 120V HPWHs may be an option for households with lower water heating usage

HPWH and alternative water heater costs

Unit Size	HPWH			Standard Electric ^a	Standard Gas ^b	Tankless Gas ^{c,d}
	240V (Integrated) ^d	120V (Integrated) ^d	Split System ^e			
40 Gallon	\$1,800	\$2,000	\$3,350-\$5,856	\$1,000	\$700	\$865
50 Gallon	\$2,100	\$2,100		\$1,100	\$1,000	\$1,196
65 Gallon	\$2,400	\$2,600		\$2,100	-	\$1,706
80 Gallon	\$2,500	\$3,000	\$3,650-\$6,128	\$2,400	\$1,400	\$1,733

Source: Retail research March-August 2025

With installation costs, HPWHs cost an average of \$6,000-\$7,000 (stakeholder interviews; TECH BMA), compared to \$2,000-\$3,000 for other WH systems.

Research suggests variation in installation costs reflect installers covering risk and may be higher if large incentives are available.



Programs and Policies

CalMTA is a program of the California Public Utilities Commission and is administered by Resource Innovations.



California program landscape

Interviewed stakeholders agree **programs are critical for HPWH adoption**

Incentives

30+ active programs
lower HPWH upfront
costs

Training

Building a
knowledgeable
contractor base

Financing

State and CCA options
for capitalization

Demand Response

Offering customers \$ for
load shifting

Loaner Programs

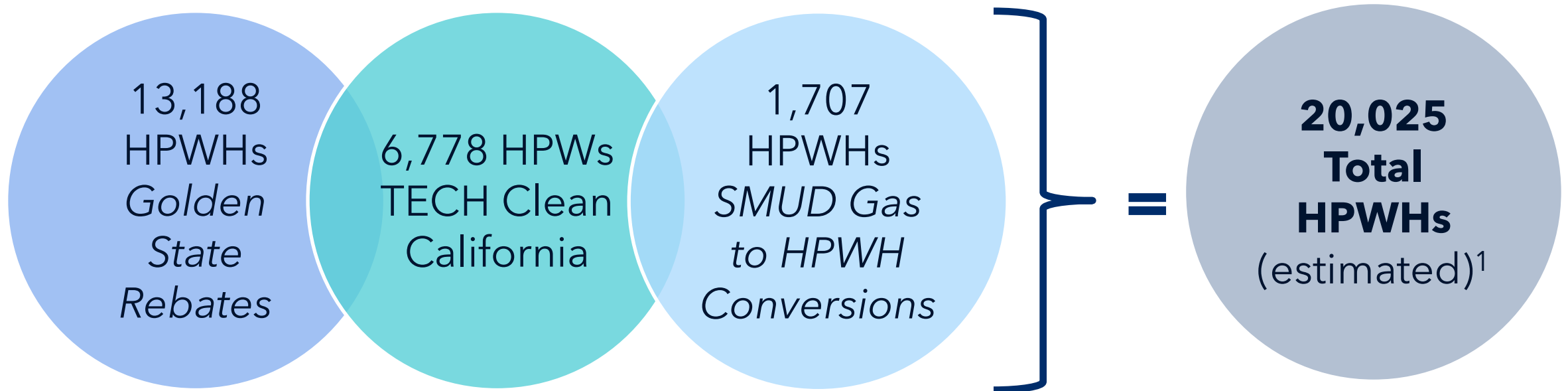
Offer temporary water
heaters to support
HPWH installation

Pilots

Explore new technology
developments, adoption
scenarios, barriers and
deployment solutions

Confirmed HPWHs in programs

Review of major HPWH programs identified 20,000+ incentives for HPWHs issued in 2024



Relevant federal, state, and regional regulations



Federal standards require efficiency levels for electric water heaters that will effectively cease production of standard electric water heaters starting 2029



Title 24 avoids pre-emption by regulating components or aspects of HPWH performance that are not covered under federal efficiency standards.



Zero NOx policies have been implemented for new water heaters in the Bay Area by BAAQMD starting 2027 and explored in Southern California by SCAQMD.



Many local governments in California have banned gas water heating in new construction through requirements for all-electric new construction.



Refrigerant regulation under Senate Bill 1206 (2022) limits distribution of most current HPWH refrigerants starting in 2030.



Customer and Installer Experience

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Market actors

Customers

- Cost-sensitive
- Time-sensitive (high rates of emergency replacements)

Installers

- Residential installers are more often unlicensed
- In high demand (retirements)
- Plumbers may spend less time on sales

Market actors

Manufacturers

- Established three hold 70% WH and 60% HPWH share
- Many sell multiple WH fuels and see HPWHs as premium product
- Some offer new form factors

Distributors

- Experts that installers rely on for guidance
- Engaged by programs

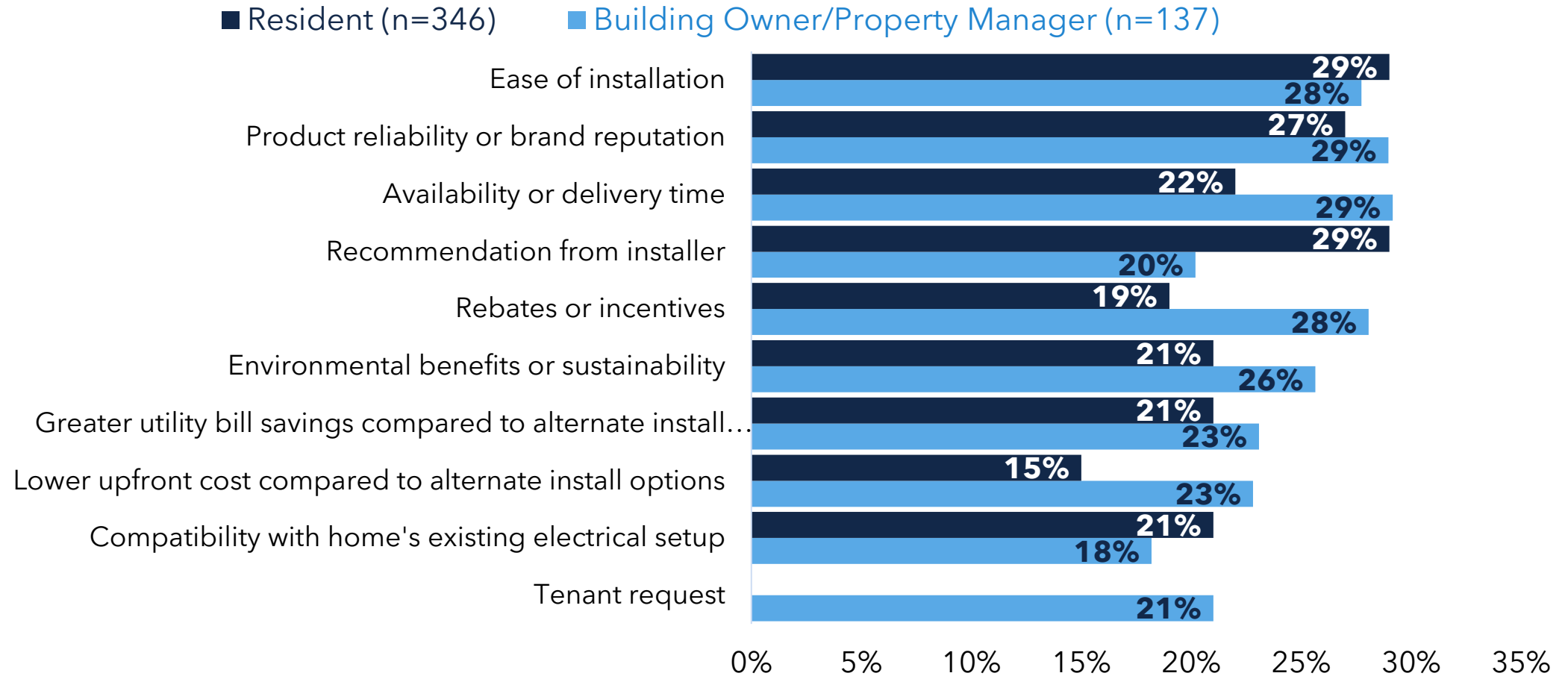
Retailers

- Less access to incentives
- May see HPWHs as larger, more expensive, less likely to move
- Note some blending between retail vs. distribution

Programs

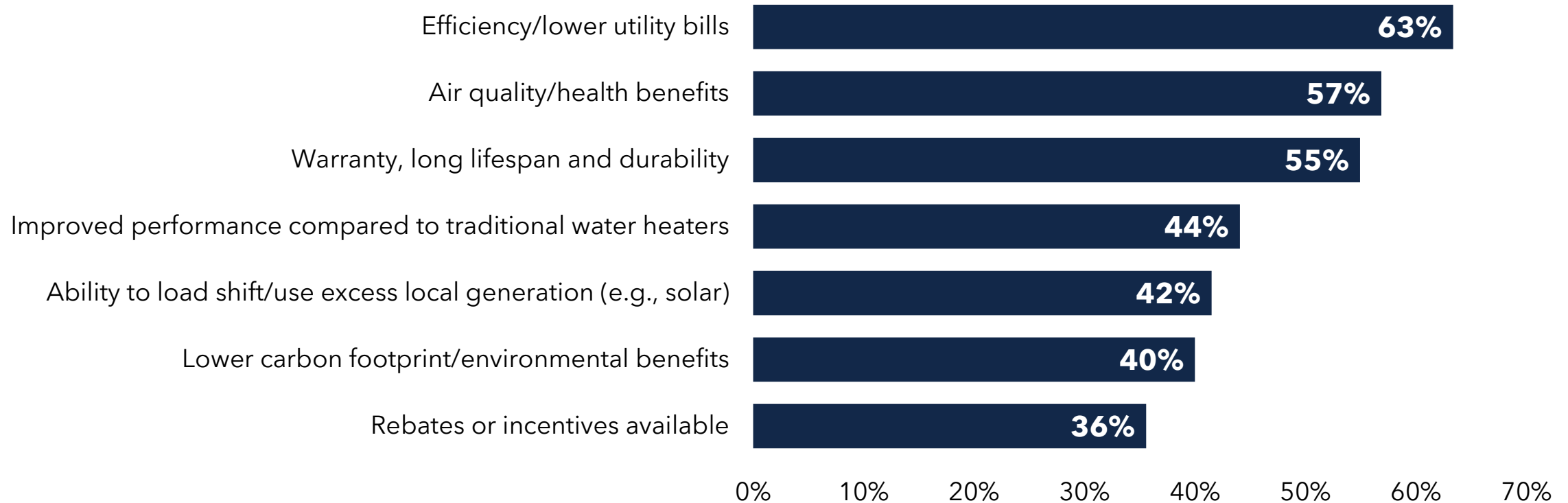
- Seek to offer complementary incentives
- Use midstream structure to engage installers (less DIY)
- May face start/stops due to funding exhaustion

Factors affecting WH selection



Source: CalMTA Residential Survey (n=346), CalMTA Building Owner and Property Manager Survey (n=137) "What were the primary factors in your selection of your water heater? Select up to three responses."

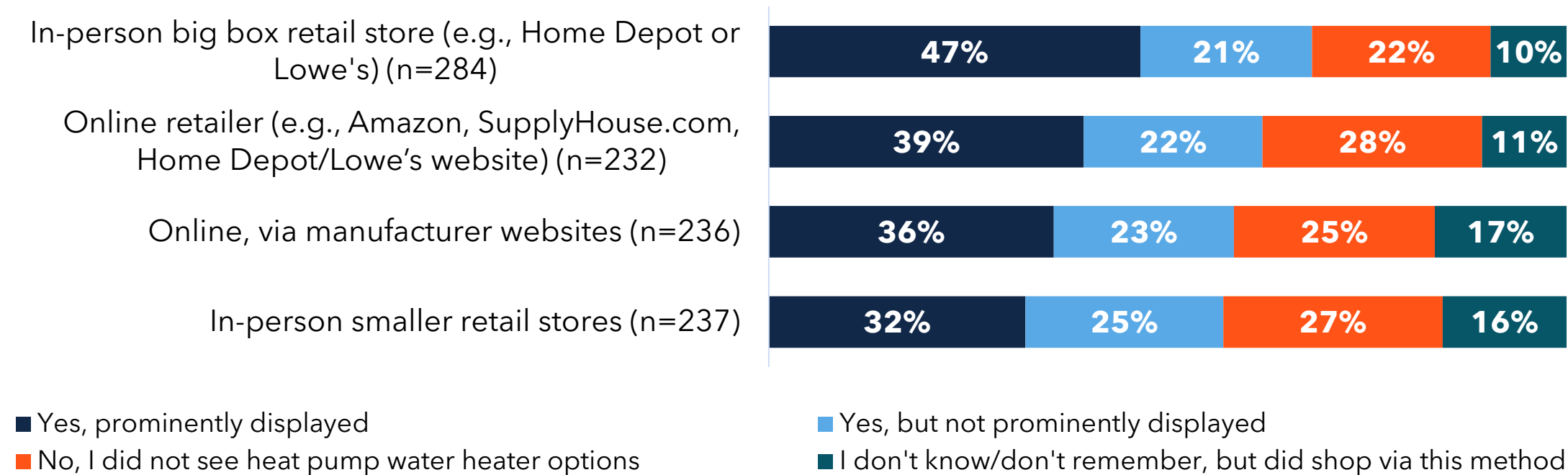
Installers perceive HPWH purchases are motivated by bill saving and health benefits



Source: CalMTA Installer Survey Q. B6. "In your experience, what are the most common reasons Customers choose a heat pump water heater?" Select all that apply. Note: Multiple responses allowed, and the sum may exceed 100%. (n=118)

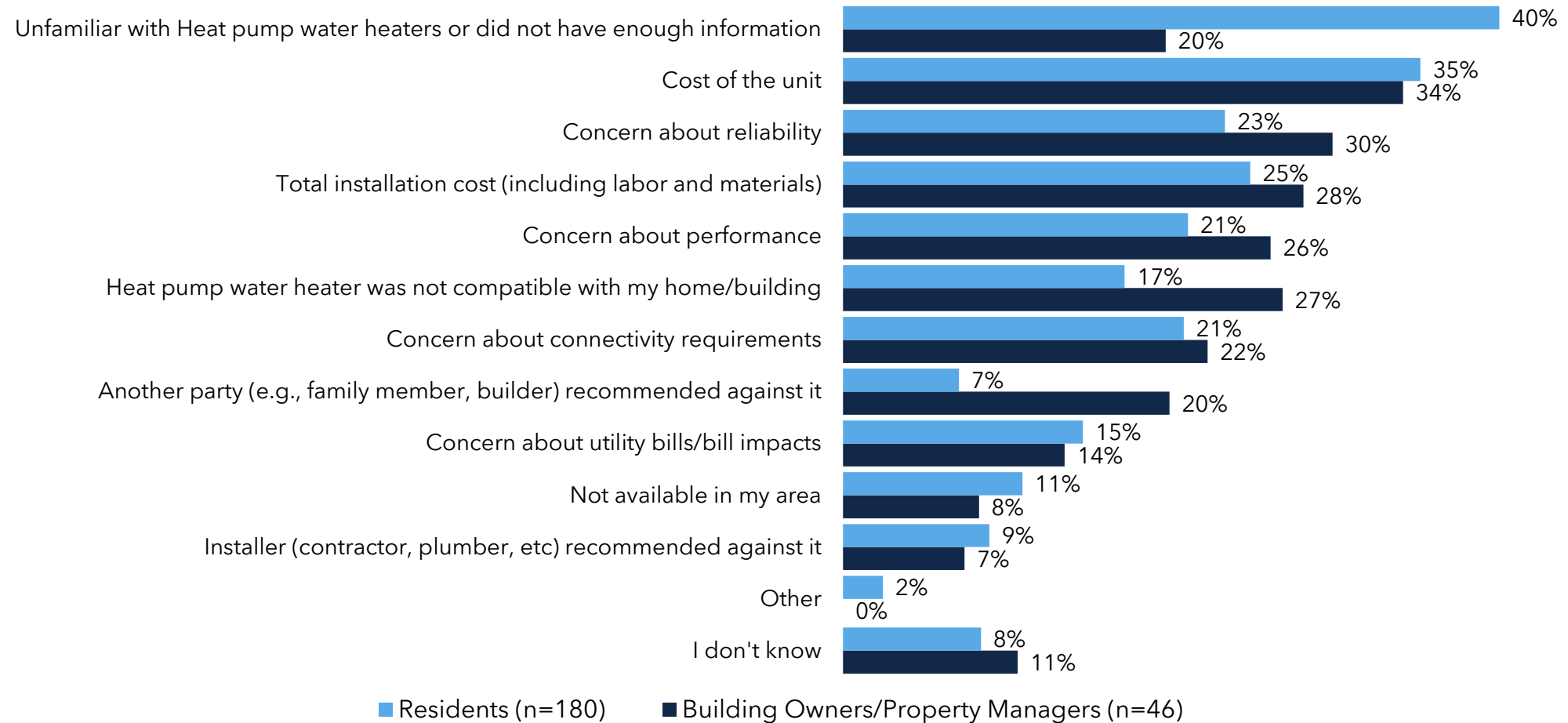
Product availability

One-quarter of customers do not see HPWHs when shopping for water heaters. HPWHs are less common at smaller retail locations.



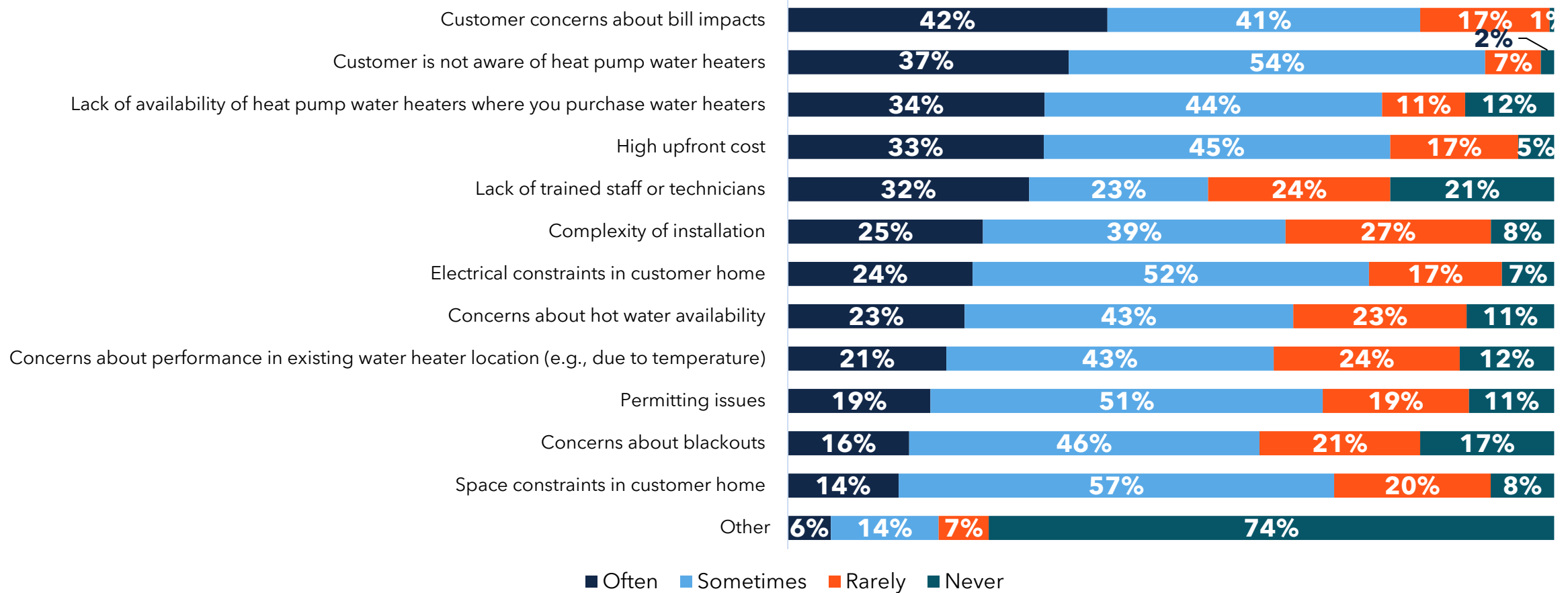
CalMTA Residential Survey Q. B10. "When shopping for a water heater, did you notice heat pump water heater options displayed?" (n=346).

Key factors for not choosing a HPWH: Lack of familiarity and cost



Source: California Residential Survey (n=180) and Building Owner/Property Manager Survey (n=46): "What factors prevented you from choosing a heat pump water heater?"
Select all that apply.

Installers perceive customers choose non-HPWHs due to bill impact concerns and lack of awareness

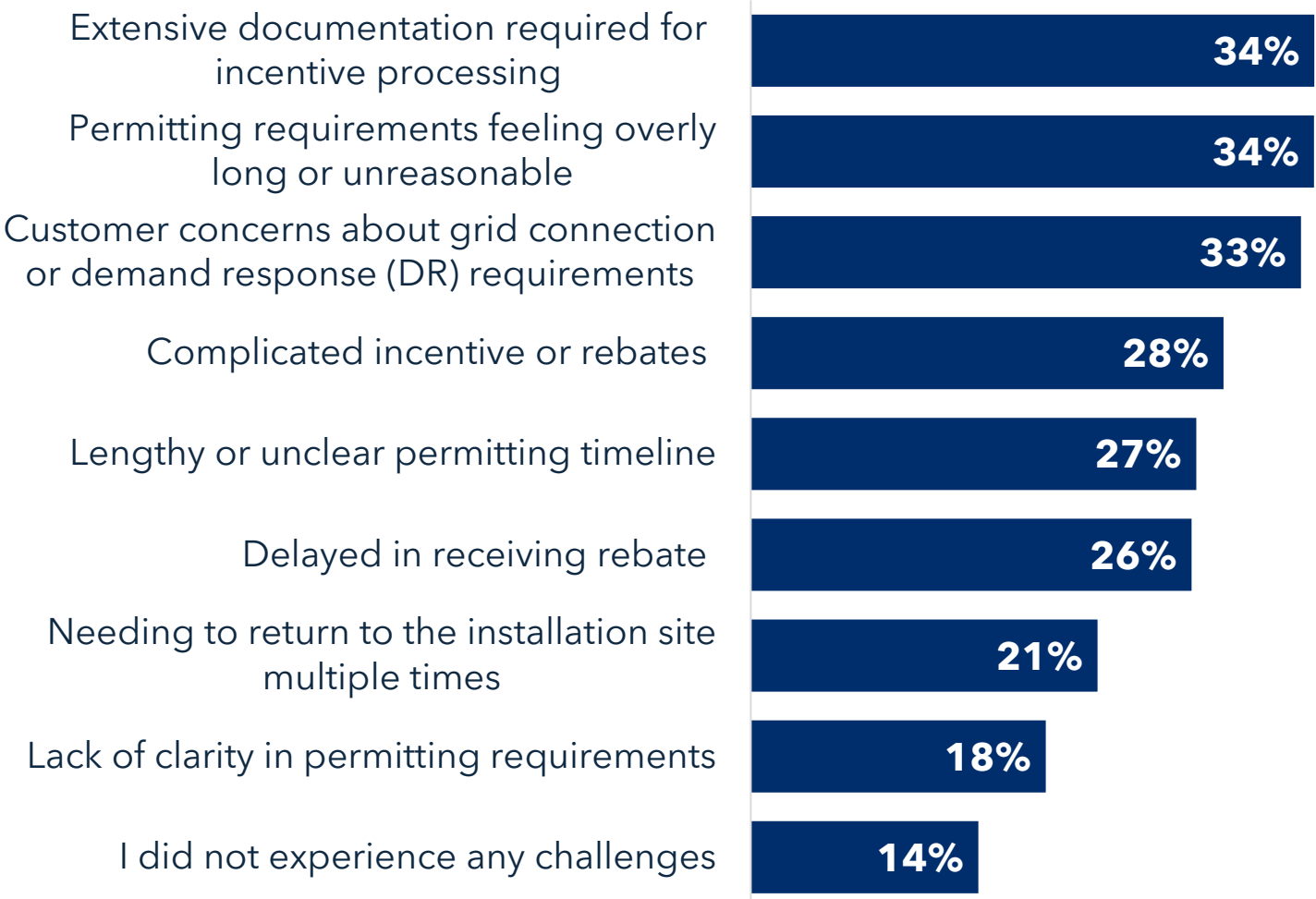


Source: CalMTA Installer Survey Q. B8. "Please indicate how frequently each of the following factors influences or contributes to customers' decision to install a water heater that is not a heat pump water heater?" (n=149)

Permitting and incentives

Most installers report challenges with HPWH permitting or incentives.

Source: CalMTA Installer Survey D4
 "Which, if any, of the following challenges have you experienced in installing heat pump water heaters? Select all that apply." (n=149)





Market Barriers and Insights

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Barriers to adopting HPWHs

Upfront cost

**Uncertain
bill impacts**

**Incentive
access**

**Fit in
existing
homes**

**Customer
awareness/
motivation**

**Contractor
awareness/
motivation**

Permitting

Availability

Market actor insights



Educate customers and contractors about the benefits of HPWHs



Offer stable and easy-to-access incentives



Share out best practices in permitting and installation



Ensure stability of programs and regulations



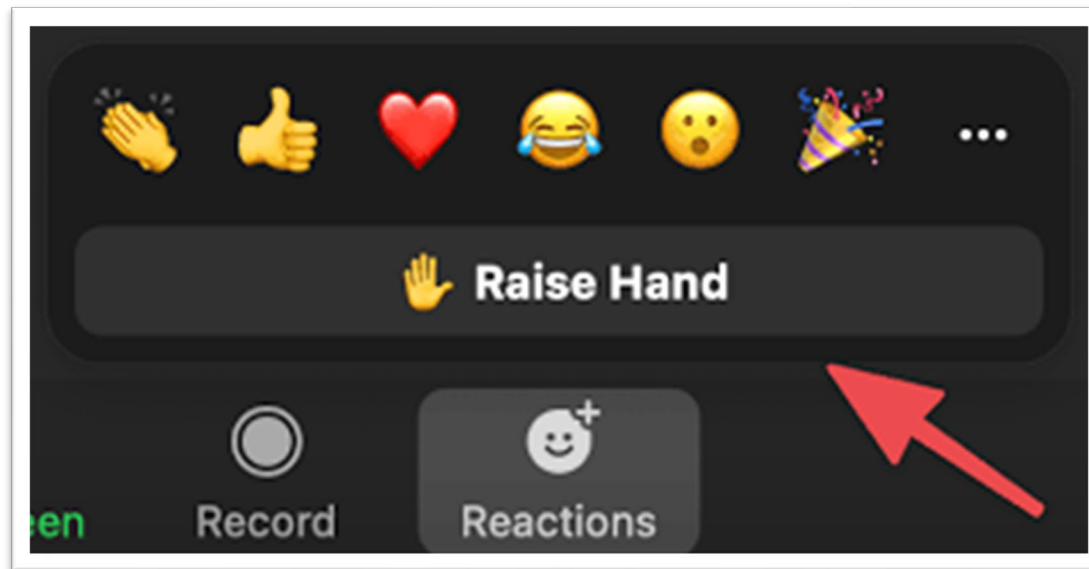
Leverage easier-to-install markets

Questions & Discussion

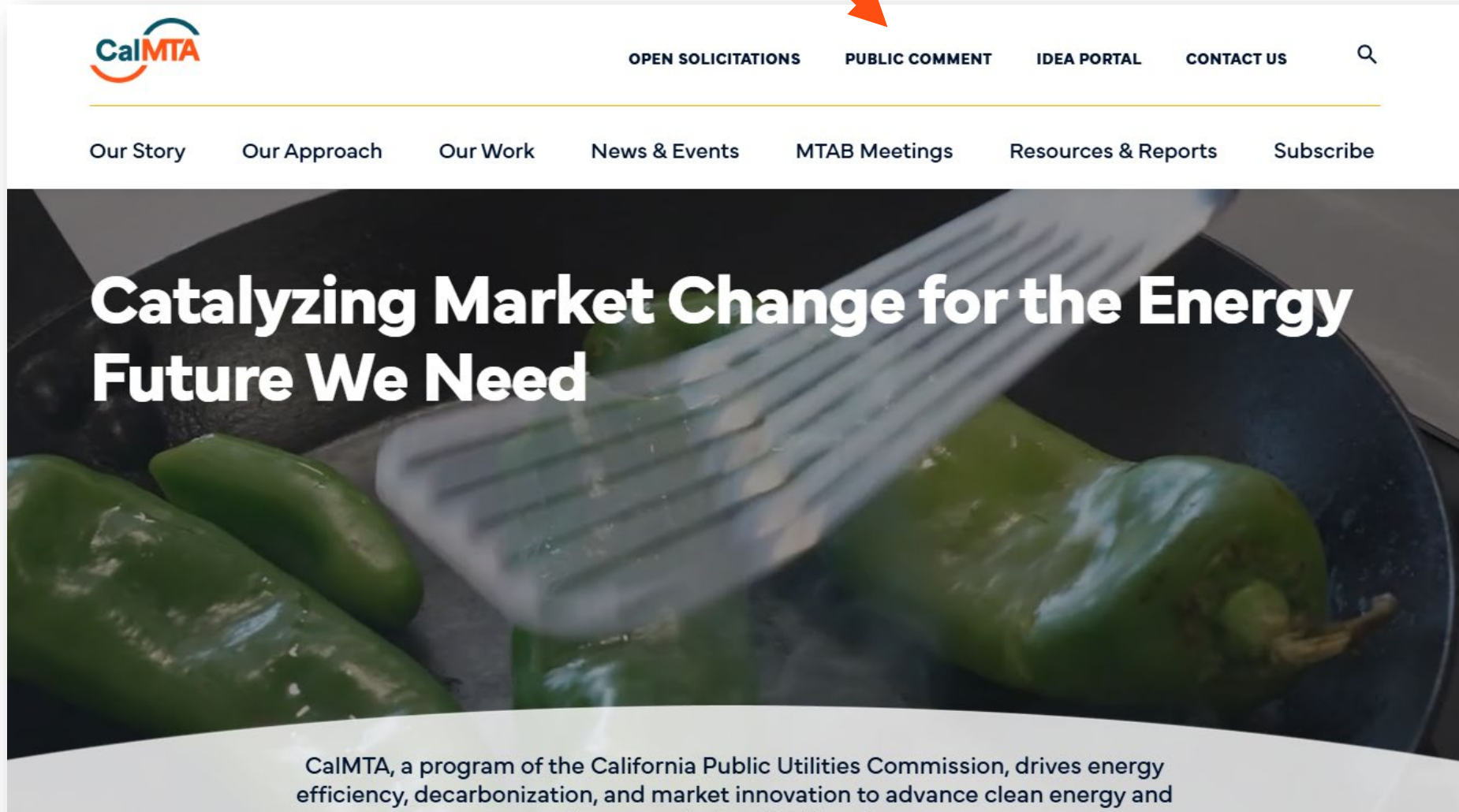
7. Public Comment



Raise your hand using the “Reactions” feature and we will allow you to unmute yourself.



Public Comment



Lunch
We will be back soon.





8. Residential HPWH Logic Model & Market Transformation Theory

Alexis Allan| Contractor, Brio

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Approach to our time together

TOPIC AREA	Description
1. Lay of the land	• Overall timeline • Guiding principles that influenced strategy design • Working product description • HPWH Market Acceleration Summit
2. Foundational pieces of the Logic Model & MT Theory	• Market barriers • Opportunities • Long-term outcomes & impact
3. Intervention strategies	• Intervention strategies & key activities • Collaboration opportunities
4. Key outcomes	• What we expect to see in the market when successful
5. Discussion & questions	• Words of advice • Areas of concern or excitement

How we got here & next steps

- **Advancement Plan**
COMPLETED Q3 2024
- **Technology Assessment research**
ONGOING SINCE Q3 2024
- **HPWH Market Acceleration Summit**
AUGUST 27-28, 2025
- **Market Characterization research**
ONGOING SINCE Q4 2024
- **MTI Plan development**
ONGOING SINCE Q3 2025



Guiding principles that influenced theory

- Estimated timeline for Phase III – 2027
- Robust market with established technology
- Exploring for opportunities:
 - Where CalMTA can be additive and not create additional market confusion
 - That are well-suited for a market transformation organization

Proposed Market

Residential retrofit and new construction market

Where "residential" means an **in-unit** water heating device associated with:

- A single-family home
- A multi-family unit
- A mobile home

Product Description



Midea from Budget Heating & Air

Integrated units

- Combine the heat pump and the water storage tank into a single appliance.
- Have a similar structure to conventional storage water heaters.



Sanco2 from PlumbEStore.com

Split systems

- Separate the heat pump unit (compressor and evaporator) from the water storage tank.
- Separate storage tank provides flexibility in smaller spaces.



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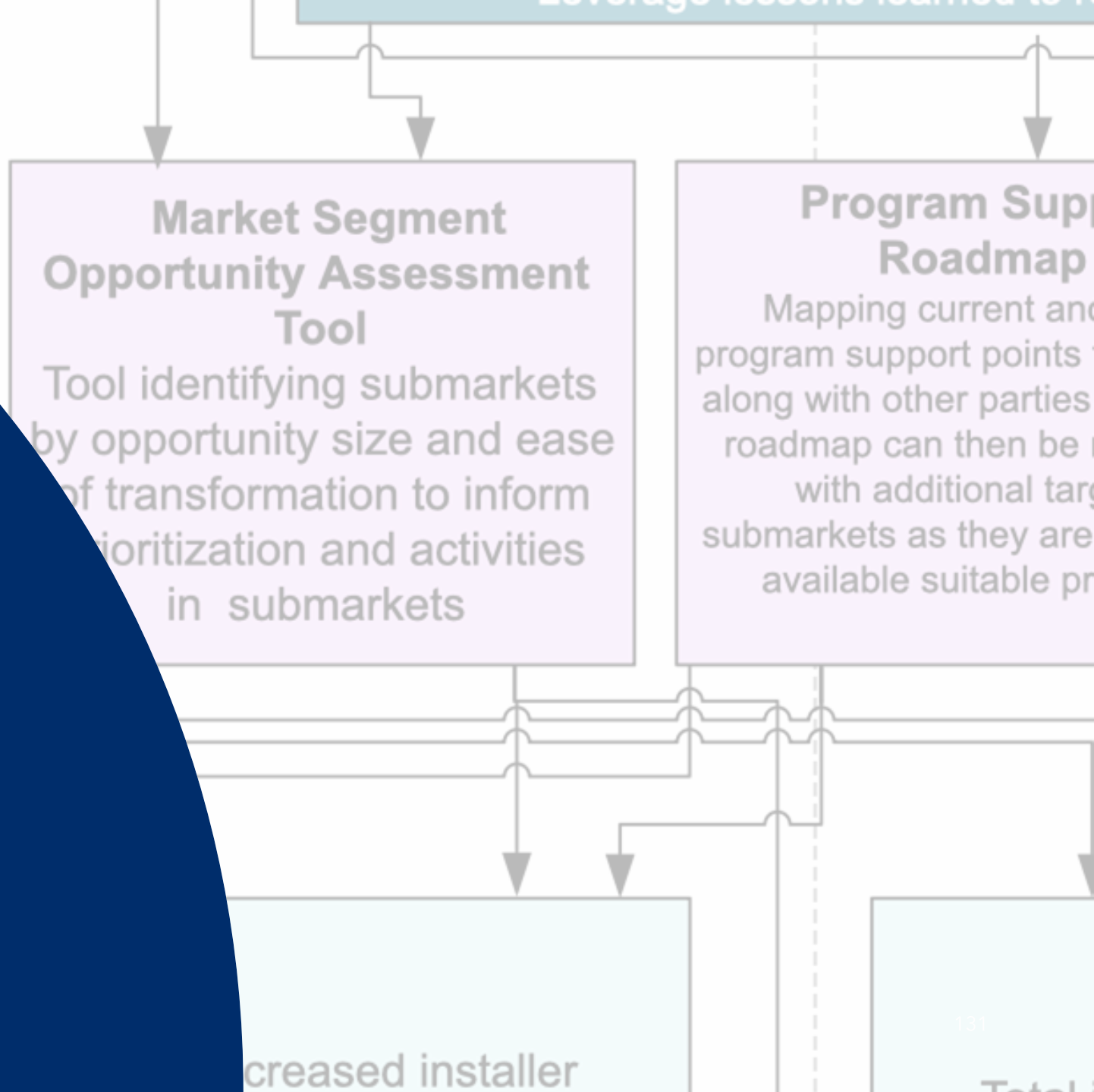
RESIDENTIAL HPWH

MARKET ACCELERATION SUMMIT



Logic Model & Market Transformation Theory

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Vision for the future

- HPWHs play a central role in California achieving its heat pump goals.
- HPWHs are able to serve the majority of California housing stock.
- Majority of water heaters sold are heat pump water heaters
- HPWHs installed in California utilize lower GWP refrigerants and include load flexibility capabilities



Snapshot of Logic Model

**Barriers/
Opportunities**



**Strategic
Interventions**



Short, mid-, and long-term outcomes

IMPACT

**California meets statewide heat pump goals
and the majority of water heaters installed are
HPWHs**

Logic Model - Barriers

Customer value proposition and demand result in limited supply chain business case

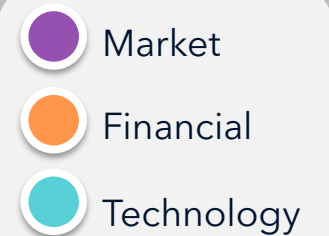
Complex product requirements that customers do not value

High costs (equipment and installation)

Some California housing stock is less than ideal for heat pump water heaters

Complex and inconsistent California program landscape and requirements for supply chain and customers

Key



Logic Model - Opportunities

Federal standard
requiring HPWH for
electric tanks > 20
gallon <120

California 2030 Heat
Pump Goal (and CA
Heat Pump
Partnership work

Key

-  Market
-  Financial
-  Technology

Logic Model - Interventions

Product Development & Match Making Technology to Housing Stock



Aggregate Market and Programs to Build Scale and Momentum by Submarkets



Statewide Operational Infrastructure Support and Development



Key



Intervention Strategy 1

Strategic product
development &
matchmaking
technology to
housing stock

1. Use research tools to assess California's housing segments
2. Match housing segments with existing equipment types and identify gaps
3. Support split-system technology development & adoption
4. Leverage existing training efforts to help installers confidently select the right equipment
5. Collaborate with manufacturers and energy efficiency programs to develop a product roadmap with pathways for lower GWP refrigerant options and solutions for equipment gaps.

Intervention Strategy 2

Aggregate
market and
programs to
build scale and
momentum by
submarkets

1. Coordinate with existing EE/ESJ programs on outreach, training, marketing, and incentives, using collective buying power to reduce equipment and installation costs and drive additional sales
2. In near term, prioritize easy-to-install markets (ex. existing electric, solar, propane, new construction, retail) to build installer confidence, strengthen business case and drive sales
3. Partner with manufacturers to decrease cost and engage supply chain leaders to champion HPWH adoption
4. Apply lessons learned and market experience enabling market actors to confidently expand into additional submarkets.

Intervention Strategy 3

Statewide
operational
infrastructure
support and
development

1. Develop/support a coordinated statewide system for water heater sales and data collection with supply chain and program partners
2. Share anonymized data with market and EE partners to inform resource allocation and program design
3. Collaborate with programs to create consistent, accessible marketing tools and messaging
4. Align supply chain messaging to ensure consistent customer experience
5. Coordinate with EE programs to align on and conduct research.

Theory of market change

IF

If a shared statewide product roadmap is developed AND paired with increased sales

If we aggregate program efforts and target specific submarkets to build momentum and sell more HPWH

THEN

then manufacturers will have clear incentive to support product roadmap driving new form factors and lower GWP refrigerants

then installer experience and acceptance of the technology will increase and a business case will become evident

Theory of market change

IF

If installer have a positive experience and accept the technology

If certain tools and operational infrastructure are shared across programs

THEN

then installation efficiency will improve and installation costs for customers will decline.

then market partners will experience more consistency and a strengthened business case.

When we're successful

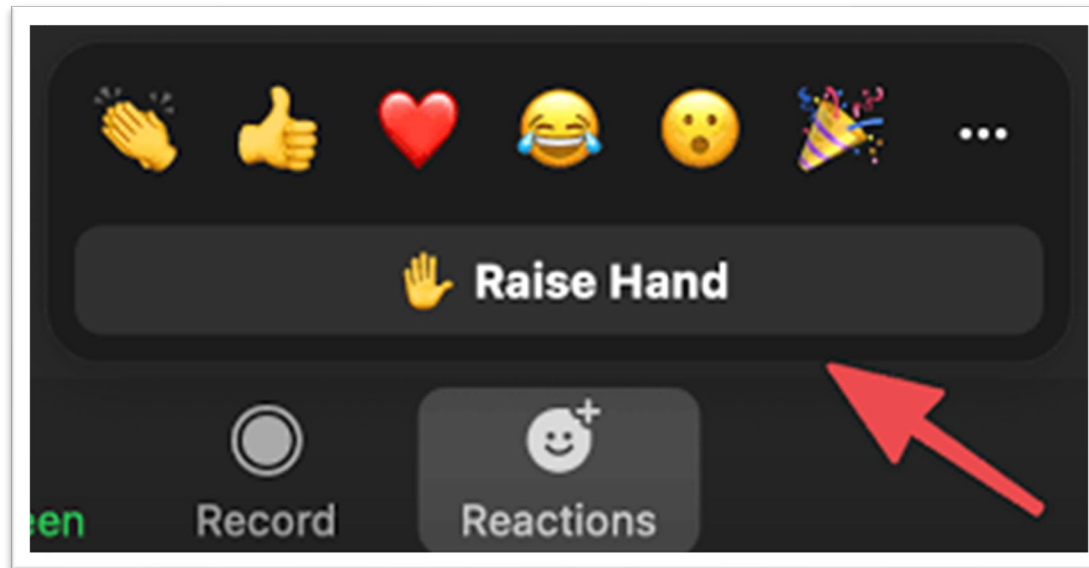
- Greater diversity in type (form factor) of product being installed
- Greater diversity in manufacturers with significant market share in CA
- Installers feel confident recommending HPWH
- Data is supplied, used, and valued by programs/partners and market actors
- See consistent messaging on HPWH and their benefits
- Greater alignment across programs strengthening market actor business case
- Increased diversity in how water heaters are sold and installed
- Cost barriers are lessened
- Pathway exists and is adopted to support lower GWP refrigerants
- Equipment installed is ready for DR
- HPWHs reach market tipping point

Questions & Discussion

9. Public Comment



Raise your hand using the “Reactions” feature and we will allow you to unmute yourself.



10. Next Meeting & Next Steps

CalMTA is a program of the California Public Utilities Commission and is administered by Resource Innovations.

Upcoming MTAB meetings



	Thurs., Jan. 29, 2026	Thurs., March 5, 2026	Wed., March 25, 2026
Time	Between 9 AM – 5 PM	Between 9 AM – 5 PM	9 AM – 1 PM
Location	Hybrid (In-person & virtual) Oakland, CA	Hybrid (In-person & virtual) Oakland, CA	Virtual – Zoom

Transformative Energy Solutions for the public good

Market transformation is a proven approach that works to remove market barriers so that energy efficient, equitable, and climate-friendly approaches become the new standard practice for all Californians.

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