



September 15, 2026

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 a.m.	1. Welcome and Agenda	Stacey Hobart
9:05 a.m.	2. Safety Minute	Stacey Hobart
9:10 a.m.	3. Introductions and Icebreaker	Stacey Hobart
9:20 a.m.	4. Review Draft Notes from June 18 MTAB Meeting	Stacey Hobart
9:25 a.m.	5. Foodservice Water Heating Systems Update	Sepideh Rezania and Ryan Meyer
11:25 a.m.	<i>Break (15 min)</i>	
11:40 a.m.	6. Ongoing Research for Second Tranche MTIs	Jeff Mitchell
12:00 p.m.	7. Public Comment #1	
12:10 p.m.	8. Application Update and Ongoing Policy Alignment	Smita Gupta

Agenda



Time	Agenda Item	Presenter
12:30 p.m.	<i>Lunch (40 min)</i>	
1:10 p.m.	9. Update on Phase I Idea Scanning and Next Idea Recommendations	Rick Dunn and Isaac Schultz
3:10 p.m.	Break (10 min)	
3:20 p.m.	10. Organizational Review Recommendations Planning and MTAB Meeting Format Activity	Lynette Curthoys and Kristen Van Kley
4:15 p.m.	11. Public Comment #2	
4:25 p.m.	12. Next Meeting and Next Steps	Stacey Hobart
4:30 p.m.	Adjourn	

Emergency Exits and Evacuation



Stairwells: Emergency stairwell access is down the main hallways and adjacent to the elevator banks on upper floors. Follow the illuminated green EXIT signs.

Designated Waiting Areas (DWAs) for individuals with mobility impairments are on the upper floors, located at the end of the hallway on the right, next to the door leading to the stairwell when facing the elevator banks.

Designated Assembly Zone: Safely exit the building and proceed northeast across the plaza toward the large, classical stone building, and to the **Sproul Hall South Lawn**.

3. Introductions and Ice Breaker

4. MTAB Meeting Notes



Draft MTAB meeting notes – 6/18
Organizational Review Report Webinar

5. Foodservice Water Heating Systems Update

Sepideh Rezania | Unrooz
Solutions

Ryan Meyer | West Monroe

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MTI Development/Deployment Process





Agenda

Item	Time
Initiative Background and Key Phase II Findings	80 minutes
Discussions	30 minutes
Wrap Up	10 minutes

Today's Goal: What We Want to Accomplish



1. Share relevant and key findings from our research
2. Share bill impact challenge and what we have looked at to date
3. Work together on what those findings mean for the direction of the initiative

Discussion Questions

1. Given the evidence to date, how should CalMTA proceed?
 - *Should we pause and monitor the market?*
 - *Should we maintain a light-touch role focused on removing key barriers?*
 - *Should we pursue targeted opportunities where conditions are more favorable?*
 - *Or should we consider another path?*
2. What market conditions or evidence should determine when CalMTA changes course?

Where We Started: Vision



By 2045, efficient electric water heating systems capable of **minimizing peak demand** are the water heating system of choice in both **new construction and existing foodservice facilities**. Positive experiences with hot water electrification also lead to increasing the sector's acceptance of full kitchen electrification.

- Foodservice Water Heating Systems Advancement Plan

December 2024

Restaurant Energy Use Intensity (EUI) Is High

Figure 27: Cross-CEUS Comparison of Electric EI by Building-type

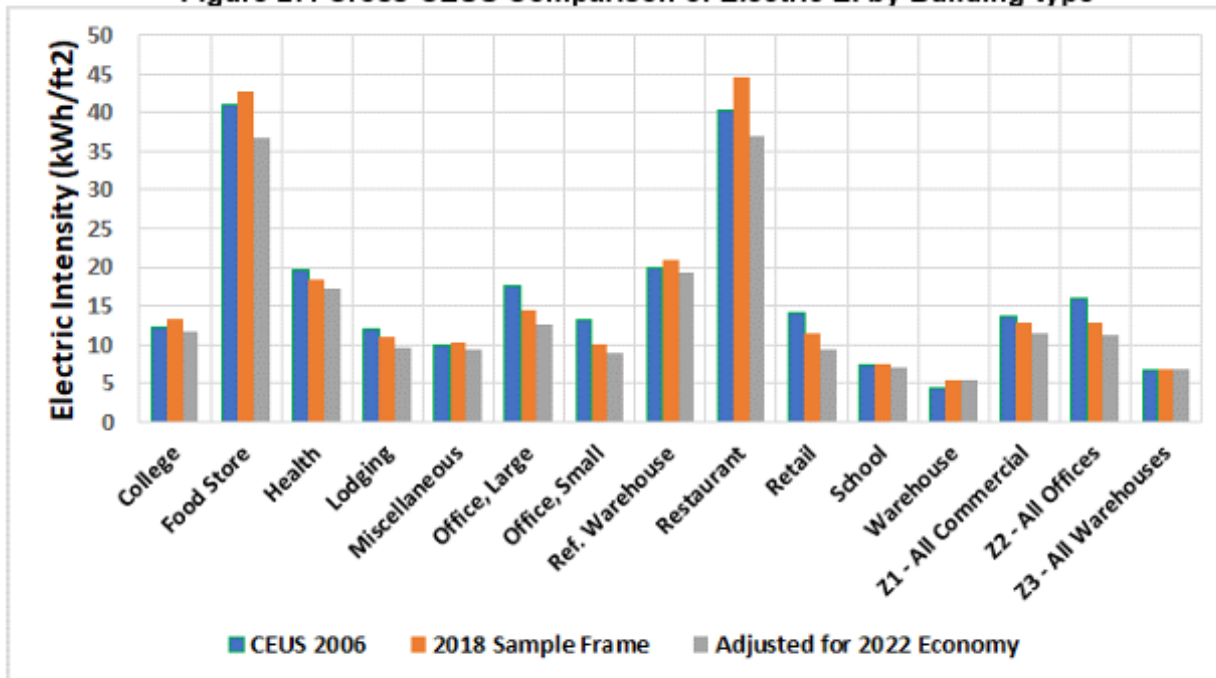
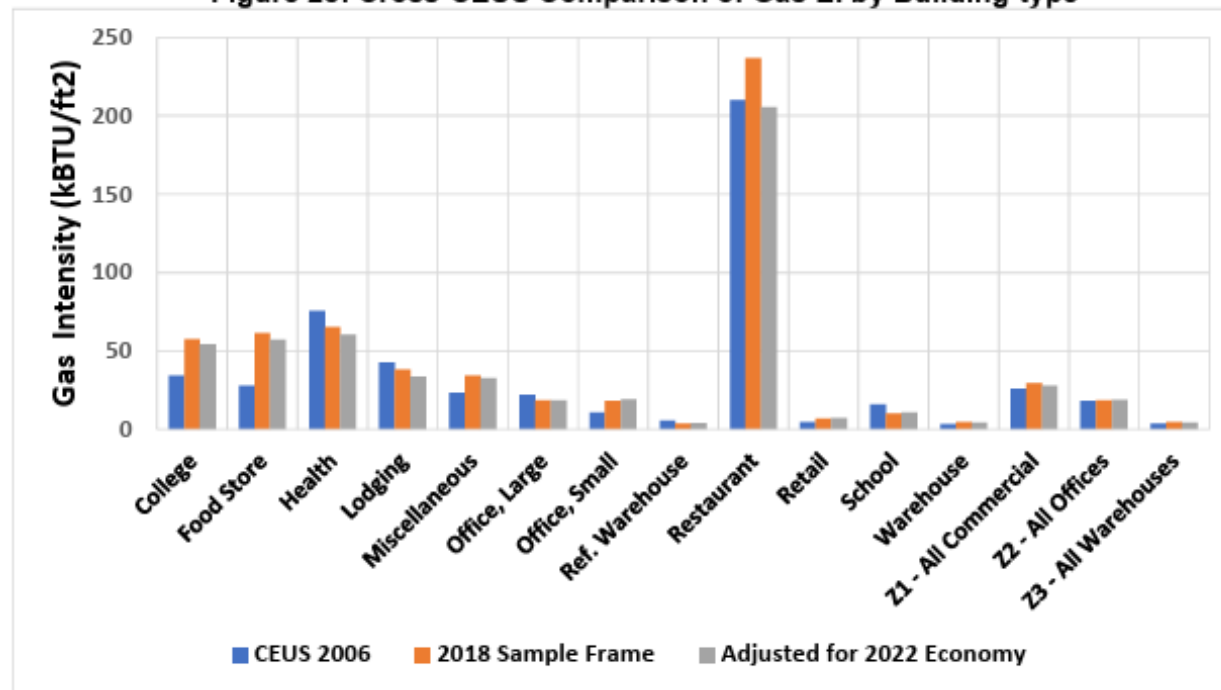


Figure 28: Cross-CEUS Comparison of Gas EI by Building-type



Source: 2022 CEUS and 2006 CEUS

Where We Started: Product Definition



Heat Pump Water Heaters: Electric HPWHs designed for commercial applications, with features to minimize electrical demand during system peak hours, which are typically high-use periods in commercial kitchens.

Combined heat pump systems: Systems that improve overall HVAC and water heating efficiency by providing simultaneous space cooling and water heating.

Hot water distribution system: Optimized pipe sizing and layout methods to minimize heat loss during distribution. This could include integration of decentralized (point of use) water heaters and eliminating/reducing reliance on recirculation pumps.

End-use equipment: Water-using equipment that reduces overall hot water demand, potentially including low-temperature or ventless dish machines.

What We Studied



Product Assessment

- Lab testing and model validation
- Site surveys
- Field study with New Buildings Institute (NBI)
- Energy modeling
- Bill impact analysis
- Codes and standards review

Market Characterization

- Foodservice operator survey
- Interviews with contractors, foodservice operators, foodservice associations, and manufacturers
- Policy and regulatory landscape review

This Is a Diverse Market



Distribution of Foodservice Establishments in California by Type and Ownership

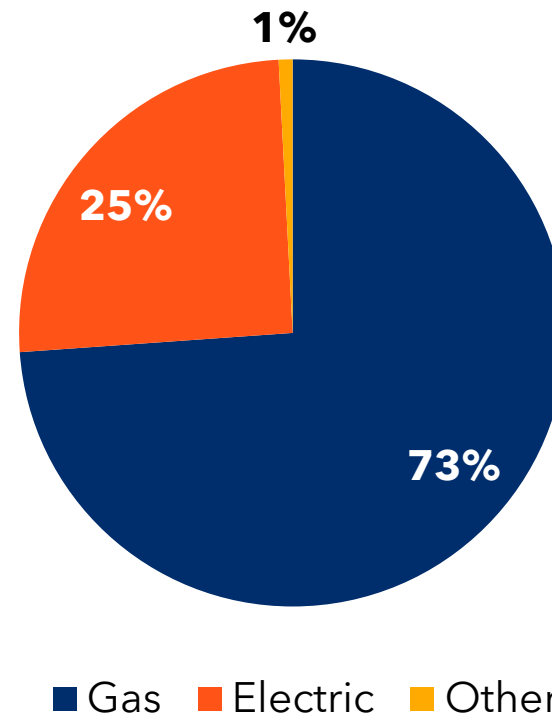
Ownership Type	Full Service	Quick Service	Cafe	Total (Percentage)
Small Independent	12,103	11,171	4,447	27,721 (34%)
Regional or Mid-Size Chain	15,947	15,989	4,188	36,124 (44%)
National or Large Chain	6,601	6,915	3,965	17,481 (21%)
Total	34,651 (43%)	34,075 (42%)	12,600 (15%)	81,326 (100%)

Source: U.S. Census Bureau. (2022). *County Business Patterns (CBP) Survey*.

Gas Is the Dominant Restaurant Water Heating Fuel Source



Water Heating Fuel Source – 2022 CEUS (n=2,899)¹



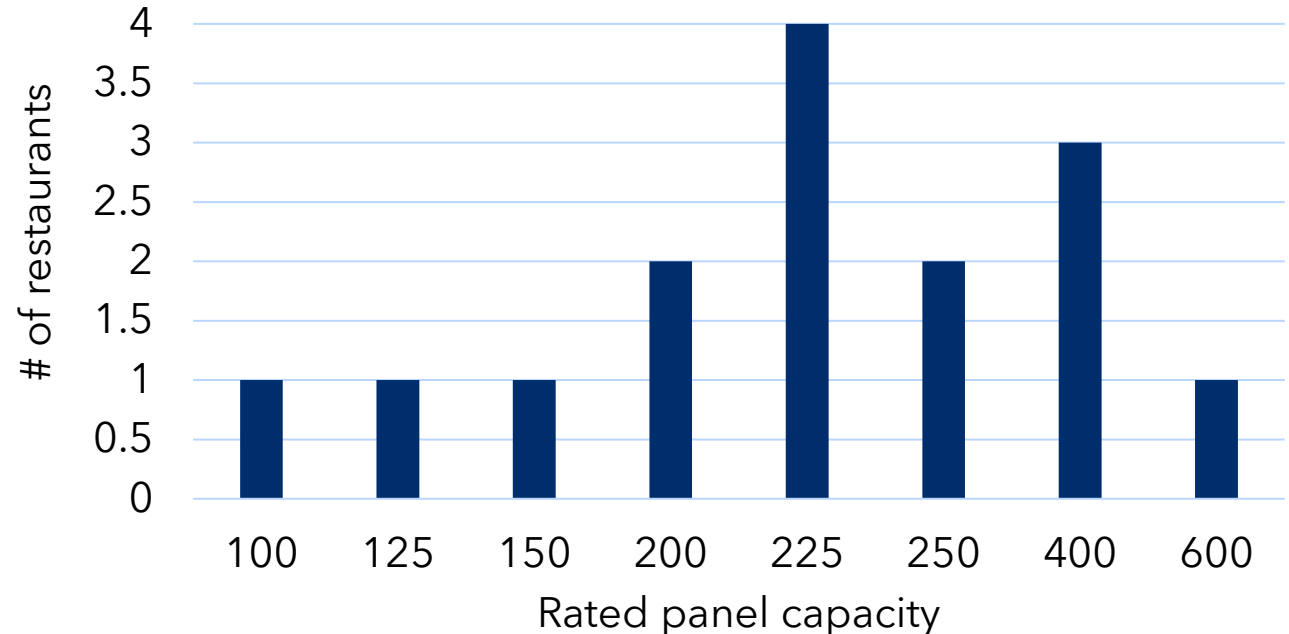
¹ Data collected 2018-2022, with most on-site data collection in 2019; majority of study data collected remotely or via survey

Gas-to-Electric Conversions Bring Additional Infrastructure Barriers



- Electrical capacity may remain a key infrastructure barrier
- Some space constraints exist for required ventilation, but they are less prevalent
- Recirculation pumps existed in 30%-40% of the sites

Site Survey - Panel Capacity in Foodservice Establishments (n=16)



CCDEH Barriers Are Real and Addressable



- The California Conference of Directors of Environmental Health (CCDEH) publishes "Guidelines for Sizing Water Heaters" in commercial foodservice facilities.
 - While the guidelines are not mandatory statewide in California, they are adopted by many jurisdictions as part of their mandatory health and safety code.

CCDEH Barriers Are Real and Addressable (continued)



- The CCDEH guidelines use a simplified calculation that works well for gas or electric resistance.
 - This calculation uses a fixed efficiency assumption for any electric water heater (heat pump or electric resistance), which leads to oversizing.
 - Proposed updates to the guidelines could be adopted as early as fall 2026 and address some of the issues.

Heat Pump Water Heaters Carry a Significant Upfront Cost



Unit Size	HPWH	Natural Gas Storage
50 gallons	~\$5,000	~ \$3,500
75 gallons	~\$7,000	~\$4,000
100 gallons (commercial grade @ 150 kBTU/hr)	~\$37,000	~\$17,000

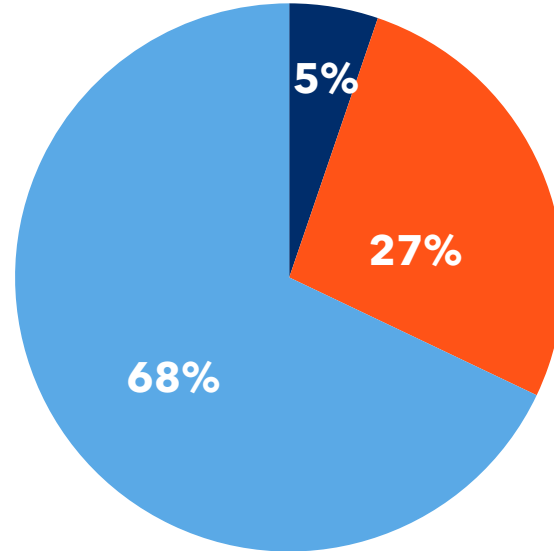
Note: Cost comparison does not include oversizing requirement to provide first hour rating.

Sources: California Technical Forum. (Accessed June 27, 2026). *Measure Characterization: Heat Pump Water Heater, Commercial, Fuel Substitution*. <https://www.caetrm.com/login/?next=/measure/SWWH027/07/>; California Technical Forum. (Accessed June 27, 2026). *Large Heat Pump Water Heater, Commercial and Multifamily, Fuel Substitution*. <https://www.caetrm.com/login/?next=/measure/SWWH028/08/>.

Water Heater Decisions Happen Under Pressure



Restaurant Operator Survey -
Triggers for Water Heater Replacement Decisions
(n=210)



- As a part of a scheduled or planned equipment replacement plan
- Only when it fails and cannot be repaired
- When it starts showing major issues

Federal Standards Create an MTI Limitation Mainly Within the Electric Consumer Market



Beginning in 2029, DOE efficiency requirements will transition **consumer electric resistance storage** water heater technology above 20 gallons to HPWHs.

Consumer Water Heater

Clear 2029 federal standards
will change the market.

Electric storage or
instantaneous ≤ 12 kW

Very small near-term HPWH
opportunity and impact on BMA

Residential-Duty Commercial

2029 rule has no effect.

- Electric instantaneous
 > 12 kW to ≤ 56.6 kW,
storage ≤ 2 gal
- No electric storage
category

No current federal efficiency
push

Commercial

2029 rule has no effect.

- Generally > 24 A or
 > 250 V
- No min. UEF change
- Electric storage regulated
on standby loss only (no
UEF) like minimum
efficiency.

Future opportunity to drive
standards

Future Landscape of Foodservice Will Change - Solar and Battery Requirements



2025 CA Title 24 prescriptive solar and battery requirements:

Increased prescriptive requirements for restaurants compared to 2022 CA Title 24

Impacts future energy consumption profiles and would change bill impact story – based on today's commercial rates

Geography Matters



Distribution of Foodservice Establishments in California by Region

Region	Residents	Full-Service	Quick-Service	Cafe	Total (Percentage)
Metropolitan LA and San Diego	16.3 million	17,544	19,448	6,946	43,938 (55%)
Greater Bay Area	9.2 million	8,402	6,309	2,775	17,486 (22%)
Rest of California	14.0 million	8,705	7,962	2,879	19,902 (25%)
Total	39.5 million	34,651	34,075	12,600	81,326 (100%)

Sources: U.S. Census Bureau. (2022). *County Business Patterns (CBP) Survey for Restaurant Populations*; U.S. Census Bureau. *Metropolitan and Micropolitan Statistical Area Population Totals and Components of Change: 2020-2025 for Residential Population Estimates*. <https://www2.census.gov/programs-surveys/popest/datasets/2020-2024/metro/totals/csa-est2024-alldata.csv>.

Air Quality Regulations Moving Slower Than Expected



- Statewide (CARB): Draft rules would phase in zero-emission water heater sales starting in 2030. Not yet finalized.
- Bay Area AQMD (Rule 9-6): Adopted zero-NOx requirements: 2027 for small units (under 75,000 Btu/hr) and 2031 for units from 75,000 Btu/hr to 2 million Btu/hr. A delay is under consideration for the small units to 2028, plus added exemptions and flexibility.
- South Coast AQMD (Rule 1146.2): Requires zero-NOx in new buildings from Jan. 1, 2026 for units up to 400,000 Btu/hr, excluding smaller units. Existing buildings follow on Jan. 1, 2029.

Higher Efficiency Does Not Always Translate As Lower Bills



- Heat pump water heaters can be ~4 times more efficient.
- In California, commercial electricity can cost substantially more than gas (5-8 times more).
- Replacing electric resistance with HPWHs in foodservice lowers bills.
- Replacing gas with HPWHs produces mixed bill impacts that vary by utility and location.

Bill Impacts Vary Substantially by Utility and Restaurant type

≈75% of California restaurants are in electric IOU territories.

Weighted Average Annual Bill Impact Across IOU Territory



Negative = savings | Positive = increase

Rates Lead to Bill Impact Diversity



Comparison of small commercial, simple rate structures as an example

Utility	Fuel	Rate Name	Summer Average (\$/kWh)	Winter Average (\$/kWh)	Annual Average (\$/kWh)	Lowest Price (\$/kWh)	Highest Price (\$/kWh)	Relative Spark Ratio
PG&E	Electricity	B1	\$0.41	\$0.37	\$0.39	\$0.36	\$0.47	7.45
SCE	Electricity	TOU-GS-1-E	\$0.31	\$0.27	\$0.29	\$0.19	\$0.65	3.95
SDG&E	Electricity	TOUA-P_S	\$0.41	\$0.38	\$0.39	\$0.32	\$0.58	7.88
Utility	Fuel	Rate Name	Summer (\$/therm)	Winter (\$/therm)	Annual (\$/therm)	Notes		
PG&E	Gas	G-NR1	\$1.75	\$1.98	\$1.85	Tier 1 (up to 4,000 therms/month)		
SoCal Gas	Gas	G-10/GN-10	N/A	N/A	\$2.15	First 250 therms/month		
SDG&E	Gas	GN-3	N/A	N/A	\$1.45	Tier 1 (up to 1,000 therms/month)		

Can Load Shifting Mitigate Bill Impact?



- Bill impacts are not due only to electricity consumption during peak periods.
- Hot water systems can provide some amount of load shifting; however, leveraging load shifting to mitigate bill impacts will have limited value under current rate structures.

Utility	Percent of Bill Impact in Peak Period
PG&E	38%
SCE	61%
SDG&E	8%

Incremental Impact Estimated to Be Smaller Than Initial Forecast



Item	FSWH Advancement Plan	Post-Research Estimates
Incremental Measure Cost	\$3,288	IMCs range from the value assumed in the advancement plan (for 50-gallon gas to 50-gallon HPWHs) to \$6,000 for replacement of 100-gallon gas tanks and more than double that for replacement of 75-gallon gas tanks with upsized HPWHs.
Bill Impacts	Not explicitly considered	Bill increases in most cases; range from \$1,000/year to \$5,000/year
Incremental MTI Lifetime Units	30,400	Likely substantially lower due to customer economics. If air quality regulations are implemented and enforced, associated market adoption would be counted as BMA.
TSB	\$216M • \$7M Energy • (\$79M) Grid • \$288M GHG	Phase II modeling not completed due to above findings, but it is reasonable to assume much lower incremental adoption and TSB.
TRC	2.04	TRC will be lower due to higher IMCs and lower incremental adoption resulting from higher first costs and energy operating costs.

Note: CalMTA put forecasting on hold based on product and market research findings; this slide is a qualitative analysis of likely impacts. CalMTA would require additional MTI investment to develop reliable, updated TSB and cost-effectiveness estimates.

Where We Go From Here

1. Given the evidence to date, how should CalMTA move this initiative forward?
 - *Should we pause and monitor the market?*
 - *Should we maintain a light-touch role focused on removing key barriers?*
 - *Should we pursue targeted opportunities where conditions are more favorable?*
 - *Or should we consider another path?*
2. What market conditions or evidence should determine when CalMTA changes course?

Individual Reflection



- What path are you most leaning towards?



Pause &
Monitor



Light
Touch



Targeted
Opportunities



Another
Path

- What is the main reason you are leaning that way?
- What should we watch for to change your view?

Questions and Discussion

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





6. Ongoing Research for Second Tranche MTIs

Jeff Mitchell | Senior Director,
MTI Development & Deployment

Agenda



- Context Setting
- CRAWs Demonstration(s)
Madison Elementary field study reporting and additional window demonstration planning
- CRTU Working Group and Demonstration
SMART RTU specification, Phase III recruitment, Madison Elementary heat-pump RTU site
- HPWH Demonstrations and Research
Split-system field study and flexible-voltage research
- Questions and Next Steps

CRAWS

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Madison Elementary Field Study



Aug 31

12 months of data
collection complete

October

Report drafted;
review cycles begin

December

Published to
CalMTA website

September

Data analysis

November

Report complete

CRAWS Demonstration Project



Goals:

- Generate real-world field data on CSW and VIG performance, because window-upgrade benefits are most compelling when experienced and socialized via case studies, as opposed to simply being modeled or estimated.
 - Aiming for 6 CSW and 2 VIG demonstration sites in Phase III
- Building owners' key purchase drivers are non-energy benefits (thermal comfort, noise reduction, resilience), and modeling alone gives only a directional indication of those.
- Demonstrate simplicity of installation.

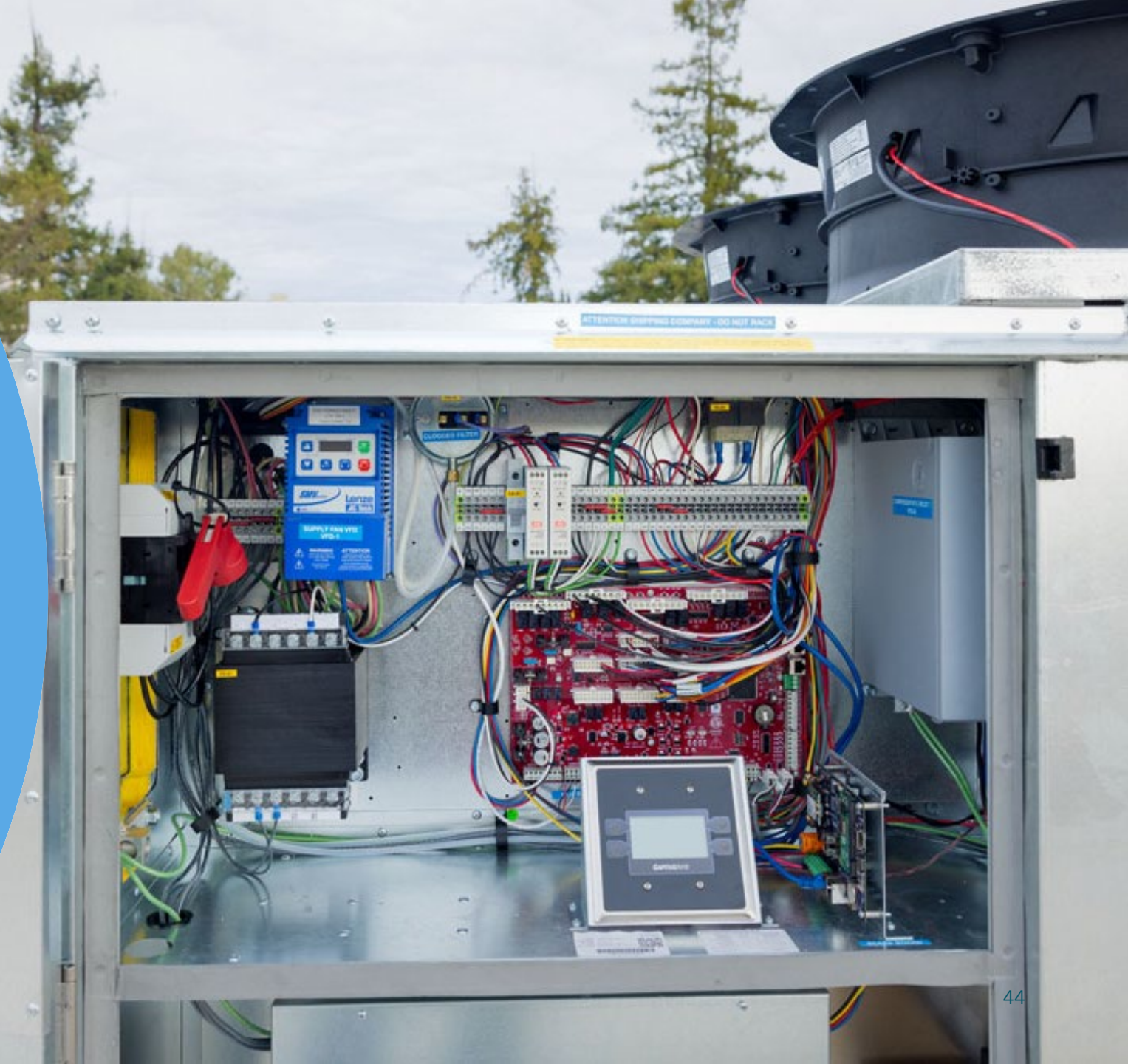
CRAWS Demonstration Planning



2026 Activities

- Locate and recruit sites where HVAC is being replaced, to evaluate HVAC/envelope interactions
- Engage Equity Sounding Board for potential leads in disadvantaged communities (DACs)
- Engage ESCOs where possible to evaluate the business model and financing factors
- Engage with manufacturers for product discounts

CRTU Working Group and Demonstrations



SMART RTU Collaborative



- **S**tart-up, **M**onitoring, **A**nalytics, **R**emote **T**echnology
- Key objective: building a specification that defines “SMART” RTUs – so utilities, contractors, and distributors can identify them for voluntary programs

Collaborative Snapshot

Aug 21

Kickoff hosted

28

Total attendees

8

OEMs represented

CRTU - RTUs at Madison Elementary



Project Overview

Install 8-16 RTUs at Madison Elementary.

RTUs will include an app-based start-up and remote monitoring system.

Preliminary Research Objectives

- Evaluate usefulness of start-up app for contractors.
- Measure the RTU efficiency impact in classrooms with and without upgraded windows.
- Evaluate the integration of remote monitoring capabilities with school district staff.



CRTU - RTUs at Madison Elementary, cont.



Why Madison?

- Madison's 1-RTU per classroom makes for an excellent sandbox.
- Current window configuration allows for additional learnings that can be applied to both CRTU and CRAWs.
- Monitoring equipment is already in place.
- The existing year of baseline data will increase learnings and value.



CRTU Phase III Pilot Recruitment

Engage Equity Sounding Board for leads in disadvantaged communities (DACs)

- At least 65 (of 150) RTU installations will be in DACs to help CalMTA understand unique barriers.
- CalMTA will include a variety of commercial building types and climate zones in this study.

HPWH Demonstration Projects and Research



HPWH Focus

Continuing activities:

- Market actor engagement (manufacturers, retail programs, EE advocates)
- Continued market monitoring through Retail Products Platform and other data gathering methods
 - Major distributor is joining the program in Q4 2026

Two new HPWH projects:

- Split system HPWH field study
- Flexible voltage HPWH research

Goals of Split System Pilot



Perform independent field monitoring of 10-15 split system HPWHs to assess:

- Energy performance
- Savings
- User satisfaction
- Product performance
- Installation best practices
- Supporting commercialization
- Opportunities and risks associated with key target submarkets
- Building a skilled workforce around this technology

Manufacturers include A.O. Smith, Ecological, and Midea. Midea won NEEA's Hot Water Innovation Prize in August 2026

Goals of Flexible Voltage Research



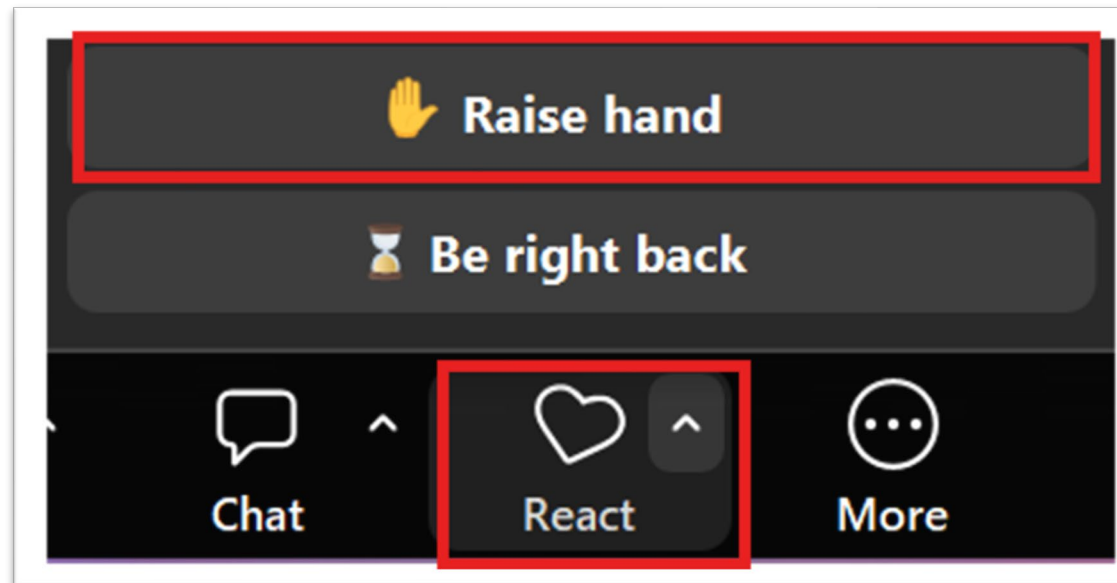
Perform surveys of installers and homeowners of flexible voltage HPWHs to assess speed and cost of installation, user satisfaction, and potential for easier gas conversion. Key research topics:

- 120 V ability to maintain hot water supply for larger households
- Whether flexible voltage allows for faster/simpler emergency replacement
- Relative costs and energy savings compared with conventional 120 V or 240 V HPWHs
- Rate at 120 V to 240 V conversion

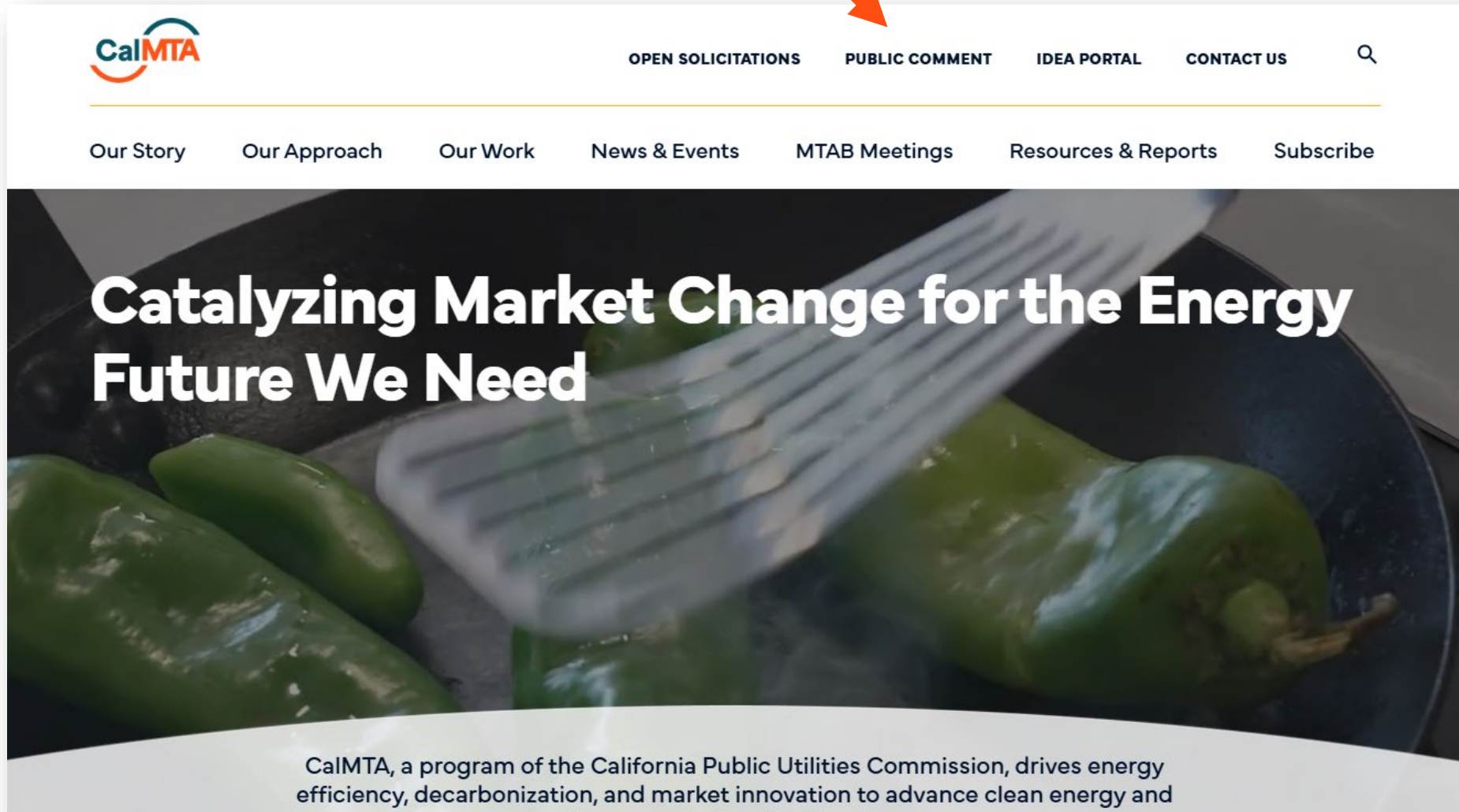
7. Public Comment #1



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



Public Comment #1



8. Application Update and Ongoing Policy Alignment

Smita Gupta | Principal, Policy

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Second Tranche Application - A.26-07-004

Initial Responses/Protest



Category	Parties	What It Means
Strong Support	NEEA, MN-CEE, TURN, NRDC, CEJA, CEDMC	Several influential organizations, including MT leaders, ratepayer advocate, environmental and equity organizations, and industry association, support approval of the three MTIs; several also support the Tier 2 advice-letter approval process for future MTIs.
Qualified Support	SBUA, SCE	Generally supportive or neutral-positive, but seeking further review of cost-effectiveness, small-business access, assumptions, forecasts, and program interactions
Targeted Concerns	PG&E, SoCalGas	PG&E challenges HPWH MTI differentiation and incremental benefits and suggests Tier 3 AL process for future MTI approval. SoCalGas raises cost-allocation for electrification MTIs and suggests future MTI approval through Application.
Sole Protest	Cal Advocates	Does not reject the MTIs on the merits at this stage but seeks fuller review of compliance with prior Decisions and guidance, budgets, forecasts, Tier 2 AL safeguards, and a longer schedule.

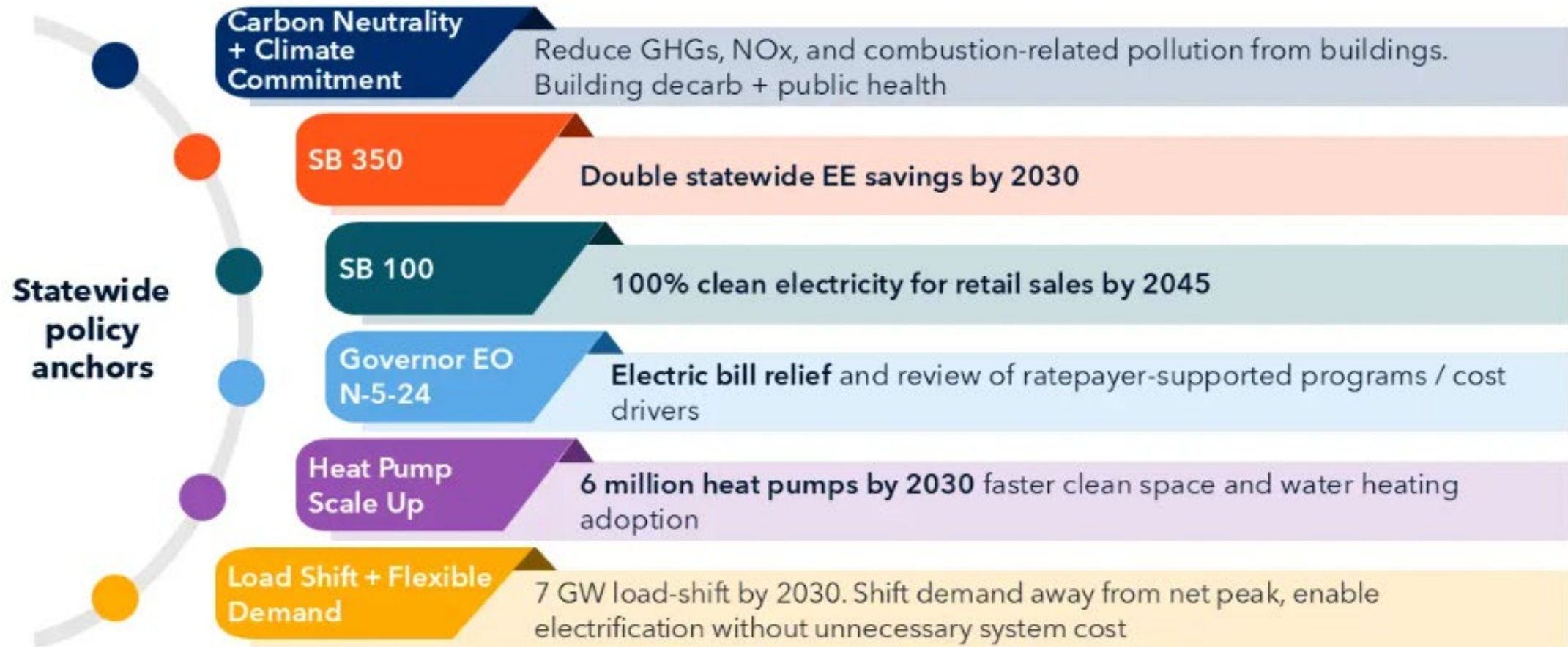
Draft Scope - PHC on September 11, 2026



MTI Approval <i>Issues 1-2</i>	Do the three MTIs comply with Commission requirements, target appropriate markets, and merit approval?
Market Impact <i>Issue 3</i>	Are interventions and targeted units reasonable and likely to transform markets and benefit ratepayers, including ESJ communities?
Coordination <i>Issue 4</i>	Do the MTIs avoid duplication/overlap with other EE programs?
Budget <i>Issues 5-7</i>	Are MTI deployment, administration, concept development, and cost allocations for electric/gas reasonable?
Cost-Effectiveness <i>Issue 8</i>	Do TSB, TRC, PAC, and SCT results support approval?
Procedural <i>Issue 9</i>	Should eligible future MTIs use a Tier 2 Advice Letter pathway?

Schedule goal - resolve application within approximately 12 months of filing.

MT supports CA policy goals



A wide-angle photograph of a mountain range with snow-capped peaks under a bright blue sky with wispy white clouds. The mountains are rugged and rocky, with patches of snow clinging to their slopes and peaks.

Accomplishing state goals: Achieving affordable decarbonization

Ram Narayanamurthy

The Buildings Blueprint



An Ambitious but Achievable Vision for the Buildings Sector in 2050

The National Blueprint is a plan to **reduce U.S. building GHG emissions 65% by 2035 and 90% by 2050** vs. 2005 while enabling net-zero emissions economy-wide and centering equity and benefits to communities.



Increase building energy efficiency

Reduce on-site energy use intensity in buildings 35% by 2035 and 50% by 2050 vs. 2005



Accelerate on-site emissions reductions

Reduce on-site GHG emissions in buildings 25% by 2035 and 75% by 2050 vs. 2005



Transform the grid edge

Reduce electrical infrastructure costs by tripling demand flexibility potential by 2050 vs. 2020



Minimize embodied life cycle emissions

Reduce embodied emissions from building materials and construction 90% by 2050 vs. 2005

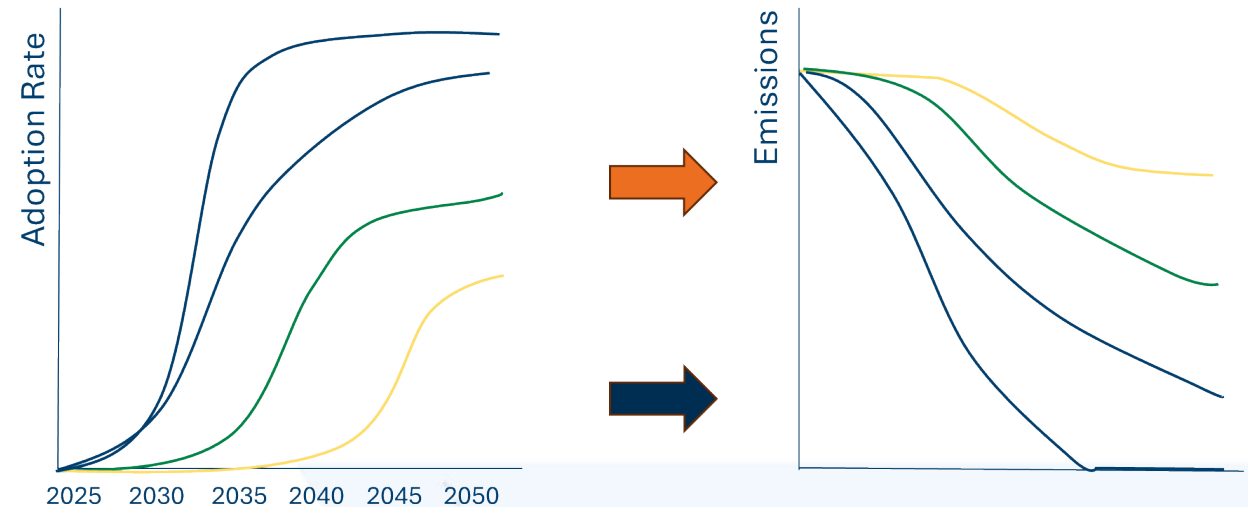
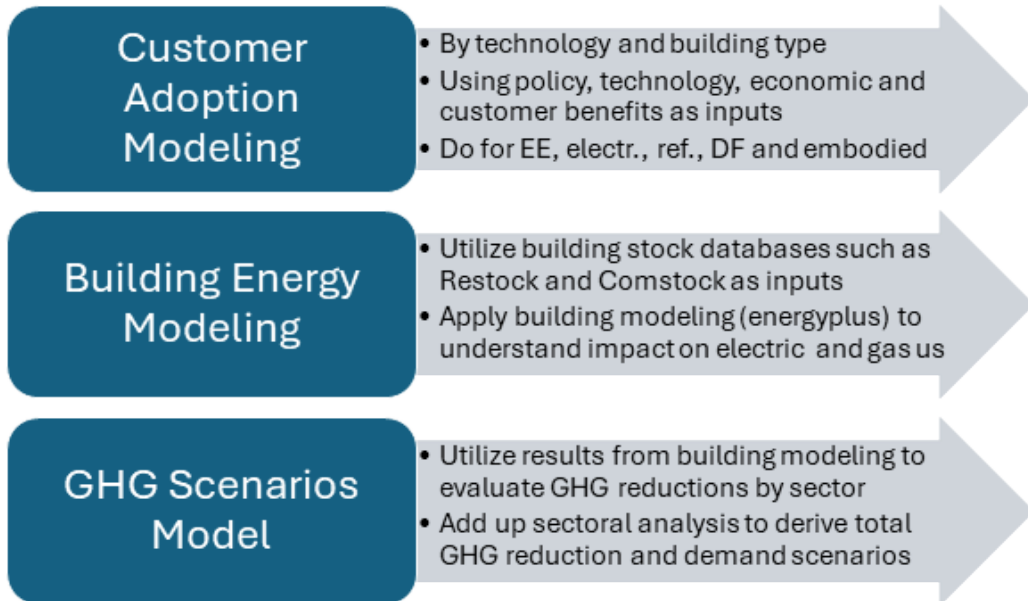


Cross Cutting Goals: Equity, Affordability, and Resilience

CA Building Decarbonization Strategy



- Develop a strategic analysis to outline scenarios for decarbonizing existing buildings
 - Integrate energy affordability and customer choice
 - Integrate different policy scenarios incl. program changes
 - Identify technology innovations for cost reductions and improved performance
- Outputs used for both electric and gas demand forecasting



Building Energy Action Plan: Key Recommendations



- Continue to prioritize funding for incentives to achieve GHG targets.
- Prioritize energy efficiency investments to improve affordability
- Increase equitable access to low-cost and zero-cost financing
- Strengthen alignment across agencies and levels of government
- Enhance Energy Code compliance strategies.
- Design Building Performance Standards for large buildings
- Implement an accessible home energy rating and labeling program
- Develop automated load flexibility programs
- Create market conditions to position heat pumps as the leading HVAC technology

California Heat Pump Partnership



- Substantive Market Transformation for HPs and HPWHs
- Major 2025-26 activities
 - Launched marketing campaign
 - Heat Pump week
 - Reducing permitting barriers
 - Technical Advisory Committee
 - Heat Pump count tracking
- Work on funding continuity

Campaign Highlights:
11 M–Social Media impressions
61,000+ - SIO contractors
~ 1M views – Ad campaign



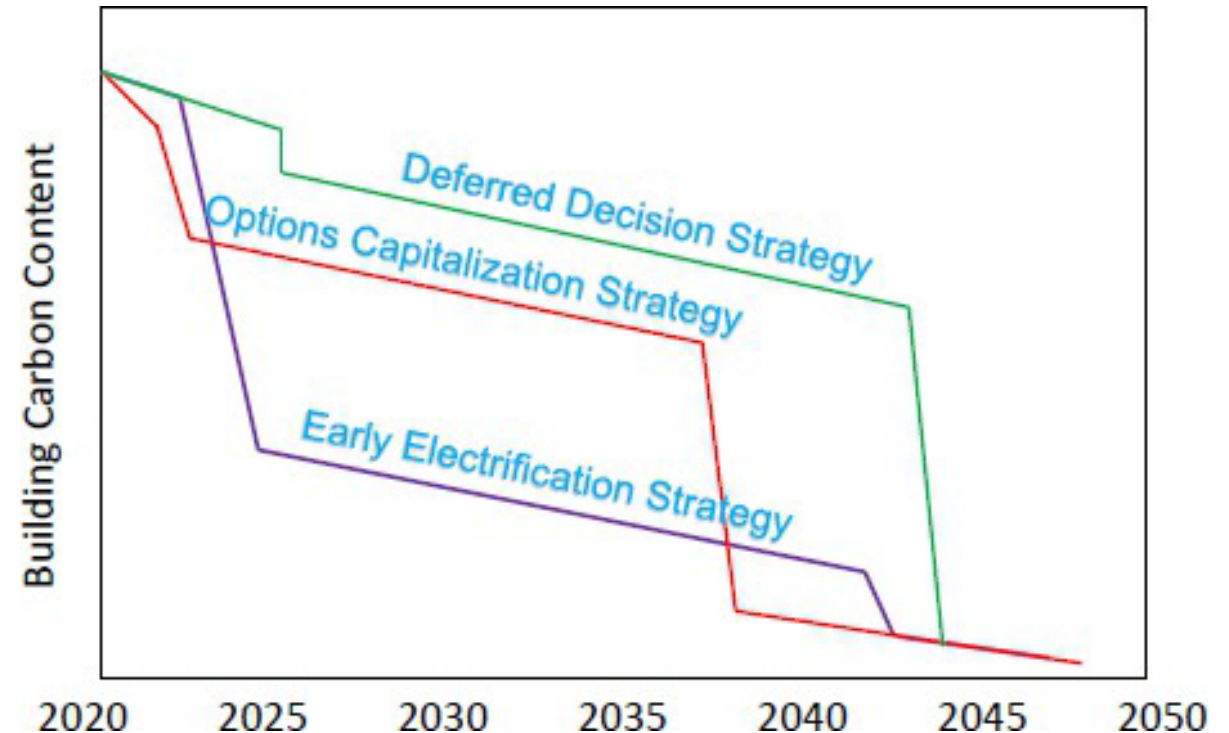
Building Decarb Pathways



- Affordability, increasingly defined as first cost, is front and center, especially in residential
- Commercial buildings have tailwinds with BPS and Building Standards for both efficiency and electrification, along with corporate net zero goals

Key achievements in last decade

- Building Standards have almost fully transitioned res. New construction to HPs, HPWHs
- Advancement in existing building code for HP baselines
- Benchmarking compliance has climbed above 70%



Market Transformation Wishlist



Residential:

1. Heat Pumps: Speed up AC – HP conversion through supply chain
 1. Focus on dual fuel controls
 2. Focus on warm climates
 3. Incentives for AC → HP
2. Weatherization investments – Secondary windows, air sealing, attic insulation
3. HPWH product transformation to cut install costs by 50%
4. Improve code compliance on gas heating and water heating

Commercial:

1. Heat Pumps:
 1. Contractor and distributor education on new code
 2. Increase dual fuel systems in supply chain
2. Support new technologies and incentive programs for retrocommissioning and continuous commissioning
3. Weatherization – Roof insulation incentives and curtain wall solutions

Lunch (40 min.)
We will be back soon.



9. Update on Phase I Idea Scanning and Next Idea Recommendations

Rick Dunn | Senior Manager, Emerging Technology

Isaac Schultz | Engineering Manager



2026 RFI Stage 1 and 2 Scoring and Advancement Candidates



Today's Agenda



- 1 Review Stage 2 scoring for advancement candidates.
- 2 Gather MTAB feedback and input.

MTI Development/Deployment Process

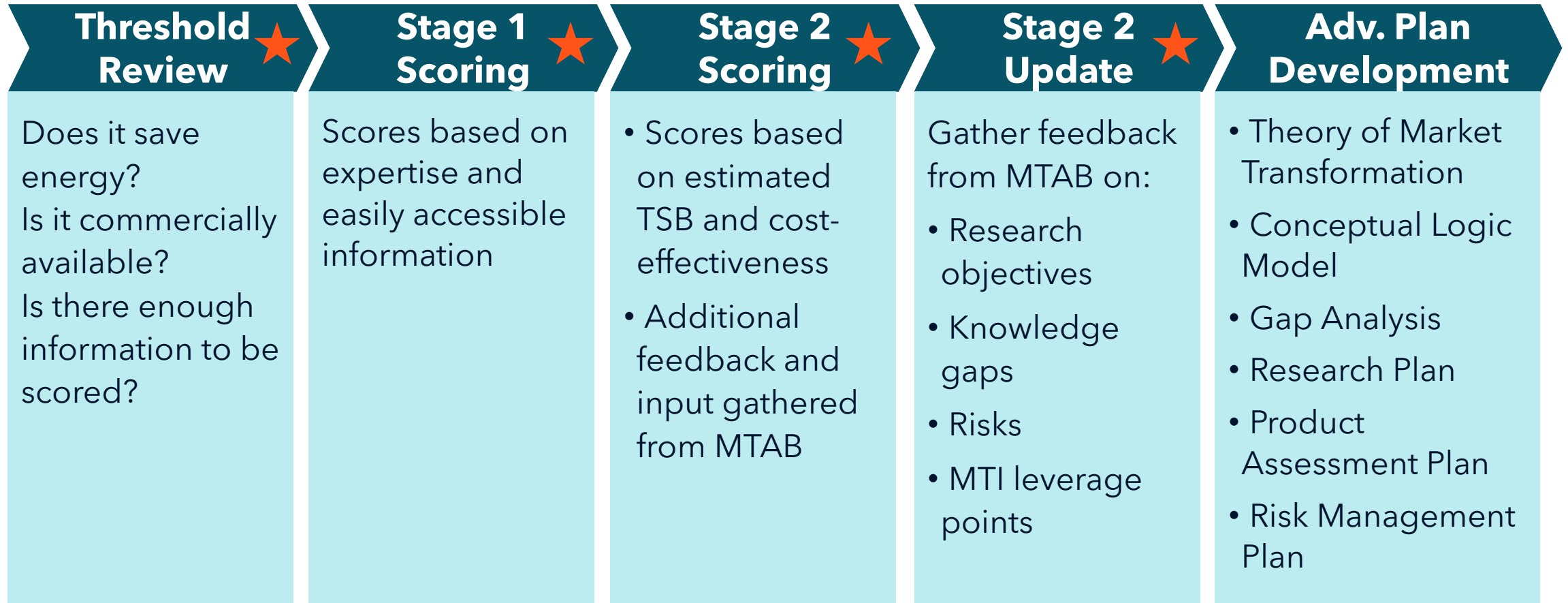




Phase I Overview



★ Today's Focus



For more background on the Phase I scoring process, please see section 2 of the [RFI 1 Disposition Report](#)

Stage gate

RFI Scoring Criteria



Category	Criteria
Total System Benefit (TSB) A single metric that encompasses energy savings, grid benefits and reliability, and GHG impacts (Stage 2)	Energy TSB
	Grid benefits TSB
	GHG impacts TSB
Product readiness An indicator of the supply chain maturity/product availability	Readiness
Participant cost/cost-effectiveness Assesses the overall estimated cost of the MTI against its benefits	Participant cost (Stage 1) PAC & TRC (Stage 2)
ESJ impacts (equity) Assesses whether the MTI will provide beneficial impacts to ESJ communities or leverage existing community resources in its execution	Beneficial ESJ impacts
	Partnership opportunities with ESJ communities
Non-energy impact Captures the benefits or impacts (in addition to energy savings and greenhouse gas emissions reductions) that the MTI will deliver	Non-energy impacts
MT alignment Ensures that the MTI aligns with key aspects of MT theory; presents a strong MT opportunity	Innovation characteristics
	Leverage points
	Sustained benefits



Review Stage 2 Scoring for Advancement Candidates

Today's Goals for Stage 2 Ideas



- Rationale for recommendations

- Communicate and solicit MTAB feedback on:

 - MTI vision, CalMTA role

 - Preliminary MT Theory (Conceptual MT Theory comes later in the Advancement Plan.)

 - MTI leverage points

 - Phase II priorities

Disclaimers

TSB Approach



- TSB values were developed for Stage 2 scoring and selection.
- They are directional estimates to be used to rank and compare the relative value of each idea.
- They are preliminary estimates and are not intended to represent a level of achievable TSB.
- These values are statewide estimates and include IOU attribution.

Advancement Priorities and Considerations



- **High TSB** and ramp rate
- **MT alignment** - must be a good MT opportunity; should have a vision for how the market will respond to interventions and how savings will be locked in
- **Equity** - Not all ideas have a strong equity component, but this can tip the scales.
- **Incremental value** - Where can CalMTA add maximum incremental value to California's efficiency and decarbonization efforts?

Recommendations

Recommended for Advanced Plan Development:

Industrial Heat Pumps

Recommended for Additional Research:

High Performance Windows

Not Recommended for Advancement:

Calcined Clay Cement (LC3)

Stage 1 and 2 Scoring Comparison



Idea	Stage 1	Stage 2
0025 Industrial Heat Pump	5.54	6.99
0010 High Performance Windows	7.51	7.89

Scoring Summary: Stage 2

Idea #	Idea Name	TSB	TRC	PAC
0025	Industrial Heat Pumps	\$329 M	2.7	8.1
0010	High Performance Windows	\$206 M	0.74	5.7
Batch 1	Induction Cooking	\$537 M	1.12	14.36
Batch 2	CRAWS	\$629 M	1.31	19.2
Batch 3	CBEA	\$556 M	1.35	12.7

- *IHP and HPW values are Stage 2 scoring estimates.*
- *Induction and CRAWS values are from the respective MTI plans.*
- *CBEA values are from the Advancement Plan.*

IDEA-0025

Industrial Heat Pumps (IHP)



IHP Preliminary Product Definition



This MTI will focus on **Conventional Heat Pumps** (CHP) with an upper supply temperature of 80 C and on **High Temperature Heat Pumps** (HTHPs) with an upper supply temperature range up to 100 C.

Heat sources can be air, water, geothermal, waste heat from an industrial process, or recycled wastewater.

Steam Generating Heat Pumps (SGHP), having supply temperatures of 100 - 200 C, are included in the product definition, have lower technology readiness, and may require additional research to update adoption modeling and forecasting.



Preliminary IHP MTI Opportunity



- Industry ranks as California's second-most polluting sector, contributing 20% of its overall climate emissions.¹
- Process heat is responsible for ~50% of industrial facilities' energy consumption.
- California is home to the largest number of industrial gas-fired boilers in the country. Less than 5% of its process heating energy is from electricity.¹
- LBNL and CalNEXT estimate the total potential IHP heating capacity in CA is 1,051 MW for HTHPs and 1,069 MW for SGHPs.²
- Electrifying just low-temperature heat applications for only the largest emitting facilities within California could eliminate over 5.5 million metric tons of CO₂, equivalent to the emissions from 1.28 million cars driven for a year.¹

¹ ACEEE. (2025). *Unlocking Industrial Electrification in California*. <https://industriouslabs.org/archive/unlocking-industrial-electrification-in-California>.

² CalNEXT. (2023). *Industrial Heat Pump Market Study*.

Preliminary IHP MTI Opportunity (cont.)



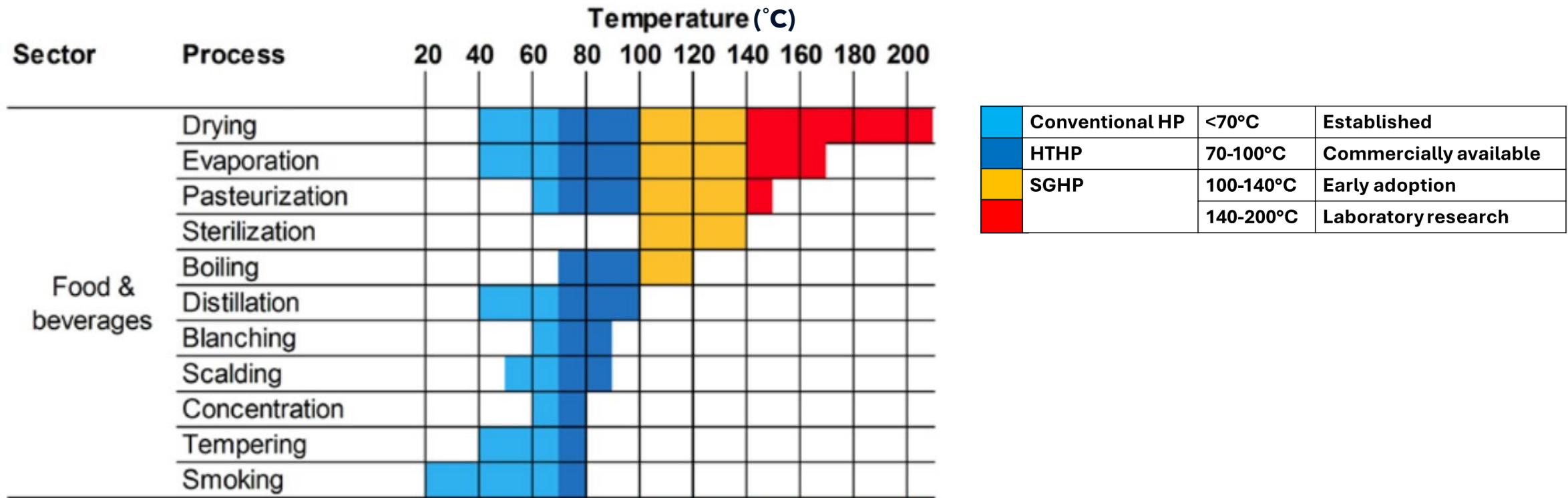
- IHPs for supply temperatures up to 100 C have a high state of technology readiness but low rates of adoption in the US.
- On average, IHPs are 3-5 times more efficient than comparable fossil-fuel-based heating equipment.
- Adoption in Europe and Asia is significantly higher, providing potential insights into market transformation strategies in California.
- ~90% of California's low-temperature (< 100 C) process heat potential is focused on just three sectors: Food & Beverage Processing (54%), Chemical Manufacturing (20%), Pulp & Paper (17%).¹ → Beachhead market candidates

¹ ACEEE. (2025). *Unlocking Industrial Electrification in California*. <https://industriouslabs.org/archive/unlocking-industrial-electrification-in-California>.

Markets and Applications



A focused look at the food and beverage market

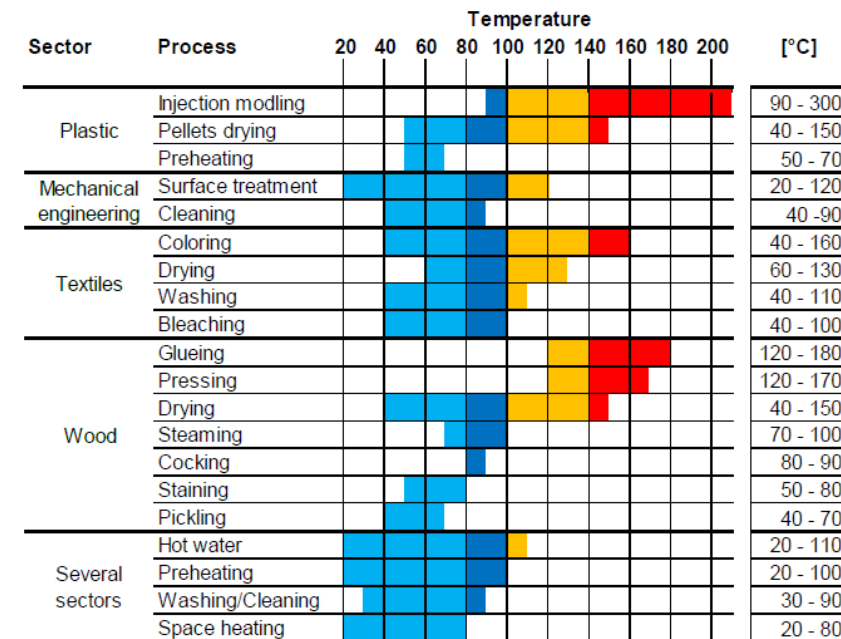
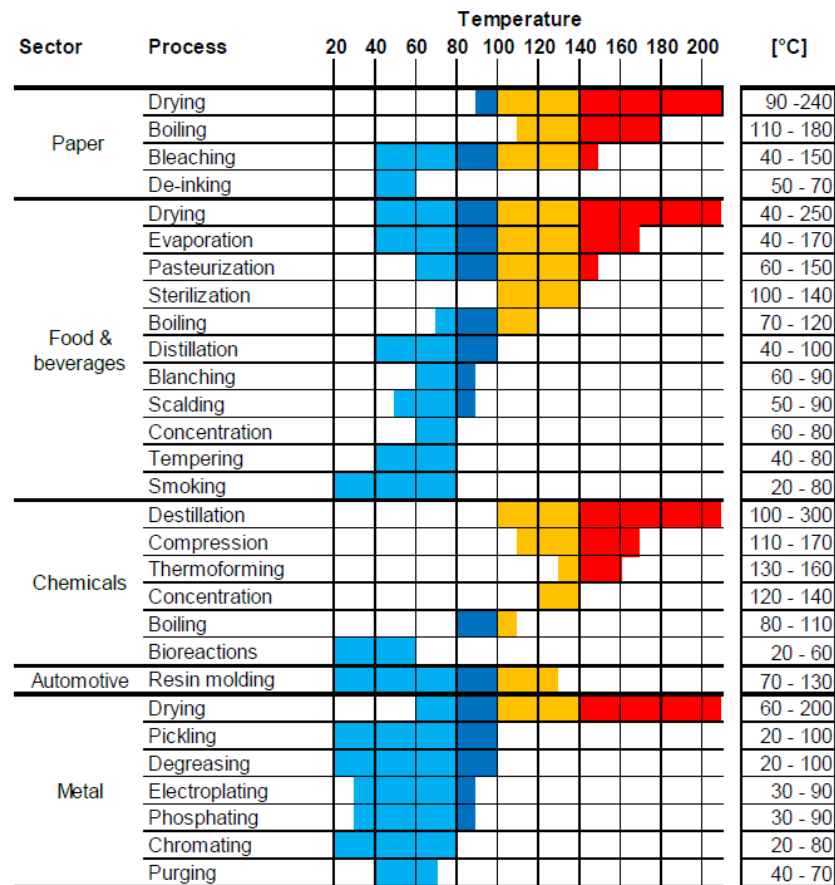


Arpaguous et. Al. (2017). *Review on High Temperature Heat Pumps*.

https://www.researchgate.net/publication/319664298_Review_on_High_Temperature_Heat_Pumps_-_Market_Overview_and_Research_Status

Markets and Applications

What markets and applications can be served by IHPs?



Technology Readiness Level (TRL):

Conventional HP	<70°C	Established
HHP	70-100°C	Commercially available
SGHP	100-140°C	Early adoption
	140-200°C	Laboratory research

HP > 140°C

Arpaguous et. al. (2017). Review on High Temperature Heat Pumps.

<https://www.researchgate.net/publication/319664298> Review on High Temperature Heat Pumps - Market Overview and Research Status

Beachhead Markets



What markets and applications can be served by existing equipment?

Application	Food Processing	Beer Production	Dairy	Automotive	Pharmaceutical & Biotech
Pasteurization: Controlled heating to kill pathogens and ensure product safety					
Clean in place: Heated water or solutions for automated cleaning of process equipment					
Drying: Removal of moisture from products using controlled low-to-moderate heat					
Hot process water: High-temperature water for use in industrial processes					
Sanitization water: High-temperature water used to sanitize food products and equipment					

Key Finding: Focus on applications within markets that are repeatable.

IHP MTI Vision

- Accelerate the adoption of Industrial Conventional Heat Pumps (CHP) and High Temperature Heat Pumps (HTHP).
- Create the foundation for the subsequent adoption of Steam Generating Heat Pumps (SGHP).
- Support IHP implementation at scale in both new and retrofit applications.
- Ensure that decarbonization benefits ESJ communities.
- Drive scale in domestic IHP manufacturing to reduce costs.

CalMTA Role for IHP MTI



We envision a role in addressing **technology**, **market**, and **financial** barriers.

- This MTI will develop interventions to overcome barriers relating to technology and applications validation, identifying beachhead markets and partnering with stakeholders to conduct demonstration projects relevant to CA industry.
- This MTI will increase market awareness, improve cost-effectiveness and supply chain robustness, and drive workforce development.

CalMTA Role for IHP MTI, cont.

We also envision a role informing interventions at the state level to address **policy and regulatory**-related barriers.

- This MTI will identify opportunities for rate structure, cap-and-invest, and refrigerant policy to help accelerate and increase market adoption.

Many of these activities are taking place today, but not in a coordinated manner and not necessarily with a focus on CA markets.

IHP Market Impact

When successful, this MTI will:

- Accelerate and increase beyond a baseline the adoption of IHPs with supply temperatures up to 100 C.
- Help inform the most effective policy structure to facilitate IHP adoption.
- Enable ESJ communities to receive the benefits of IHP adoption, including improved air quality.
- Lay the foundation for the expansion of IHP adoption into high-temperature (steam) applications >100 C.

IHP Barriers



- Technical: Custom designs, application optimization
- Market: Lack of domestic production and service
- Market: Workforce development and training for applications design, pinch analyses, maintenance
- Financial: Fuel-switching significantly increases operational costs.
- Policy: Refrigeration policy, uncertainty

Key

- Technical
- Market
- Financial
- Policy

IHP Opportunities and Leverage



- CEC INDIGO, FPIP investments to overcome technical barriers
- IHP Alliance, HTHP Symposium, and EPRI/Southern Company demonstration center to overcome technical and market barriers
- CA Cap-and-Invest, SB 943 to mitigate financial barriers
- Onsite solar, waste heat, thermal energy storage to mitigate financial barriers
- ACEEE to overcome market and policy barriers

Key

- Technical
- Market
- Financial
- Policy

Preliminary MT Theory



IF WE...

THEN...

focus on beachhead markets where waste heat and simultaneous heating/cooling create a compelling value proposition...

we can establish a business case that will stimulate market demand that will in turn stimulate supply.

focus demand on a few high value, high volume applications that span multiple industries with a common set of performance specifications...

manufacturers will align production with a narrower market segment, reduce product configurations, and shorten lead times.

leverage industry partners to facilitate stable, flexible refrigerant policy...

we will reduce manufacturing risk and complexity, reduce costs, reduce GHG emissions, and broaden supply-side interest.

leverage CA and extra-regional stakeholder investment in beachhead market demonstration projects...

we will reduce risks/costs for early adopters and establish a performance database that will increase broad market confidence.

IHP TSB and TRC Estimates

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

IHP TSB and TRC Estimates Agenda



1. Overview of approach
2. Preliminary TSB & TRC results
3. Market adoption
4. Load shapes
5. Key inputs and sources
6. Future refinements to estimates

Overview of IHP Approach



Forecasting IHP installations over a 20-year
Phase III period

Two Scenarios

BMA - Baseline Market Adoption

TMA - Total Market Adoption

Two Types of IHPs

HTHP - High temperature heat pump

SGHP - Steam-generating heat pumps

Adoption Segmented by Industrial End Use

Estimated adoption varies by segment
(e.g., food processing, dairy)

Forecast Framework

Market Ceiling

Based on the technical potentials
identified in a 2023 CalNEXT report

Adoption Model

Logistic curves by segment and
technology

Outputs

TSB (PV 2027\$) and TRC/PAC ratios

IHP Preliminary Results Summary



TRC RATIO

(range reflects Low / Mid / High installed-cost scenarios)

2.7

central (mid-cost) estimate

range 2.1-3.6



PAC Ratio – 8.1

\$329M Total TSB

GHG TSB +\$329M

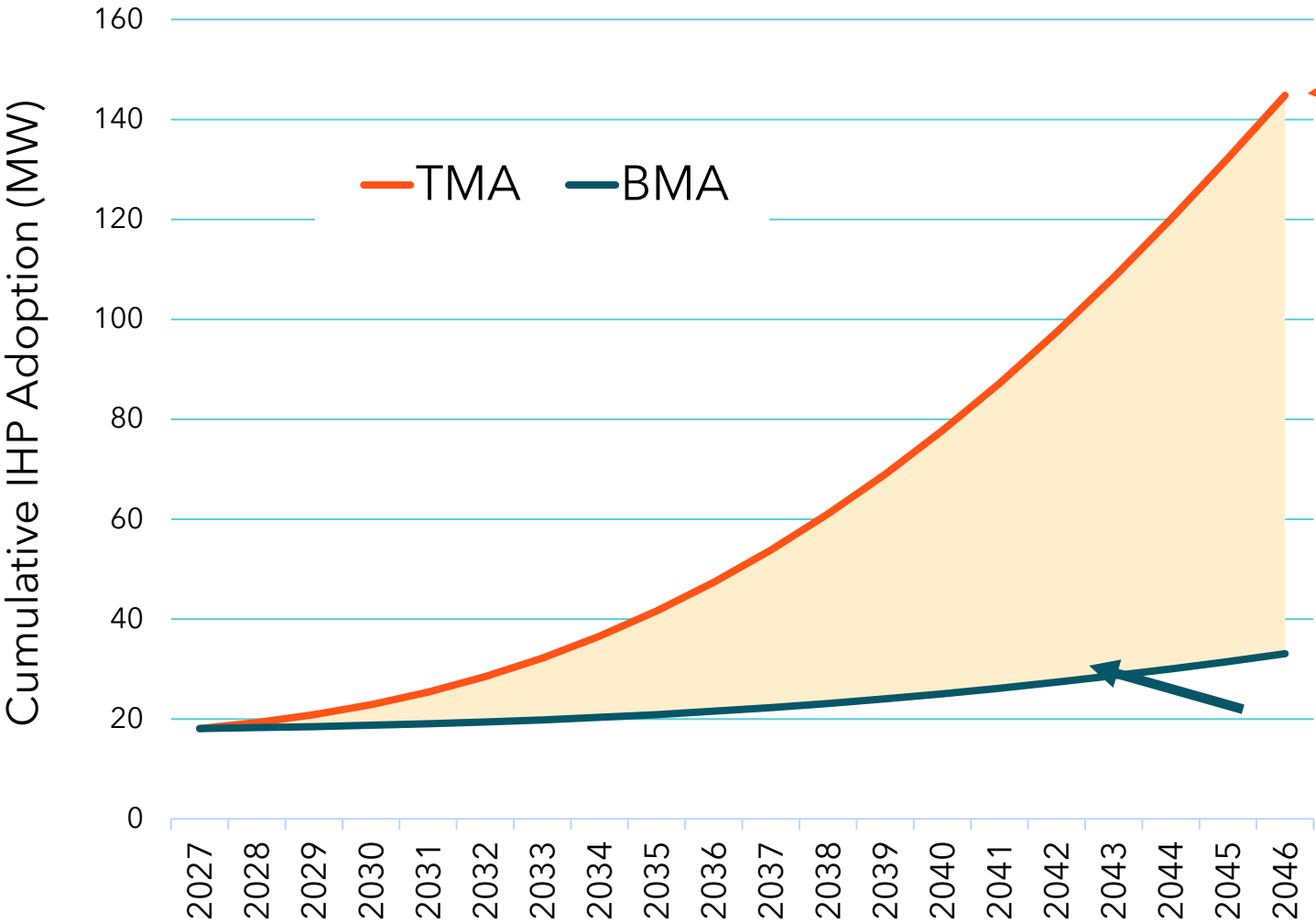
Energy TSB +\$27M

Grid TSB -\$20M

Refrigerant TSB -\$7M

Note: These results represent a Phase I estimate; a Phase II estimate will require additional effort and refinement to inputs and assumptions.

IHP Market Adoption Results Summary



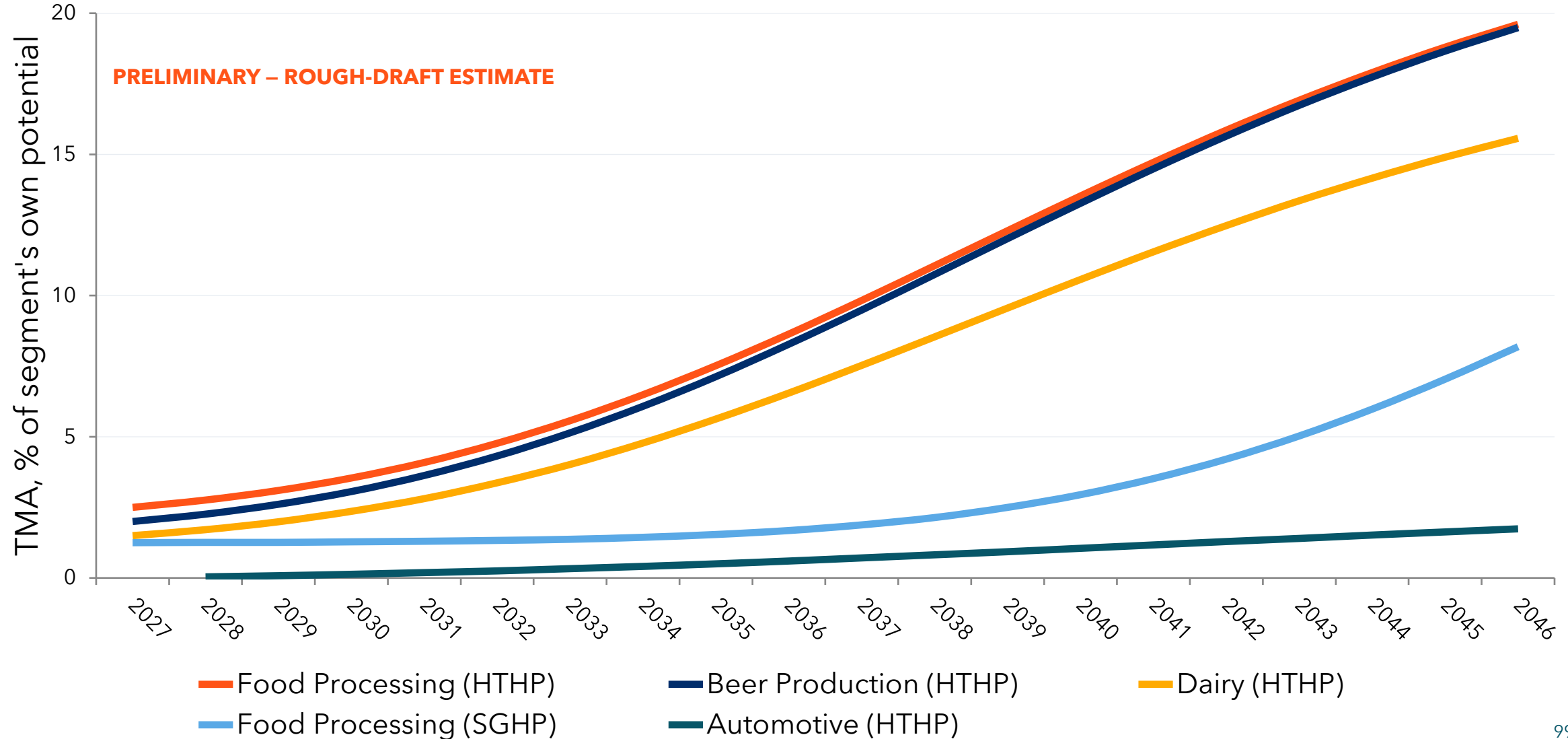
TMA Adoption: 145 MW
6.8% of potential by 2046

Incremental Adoption: 112 MW

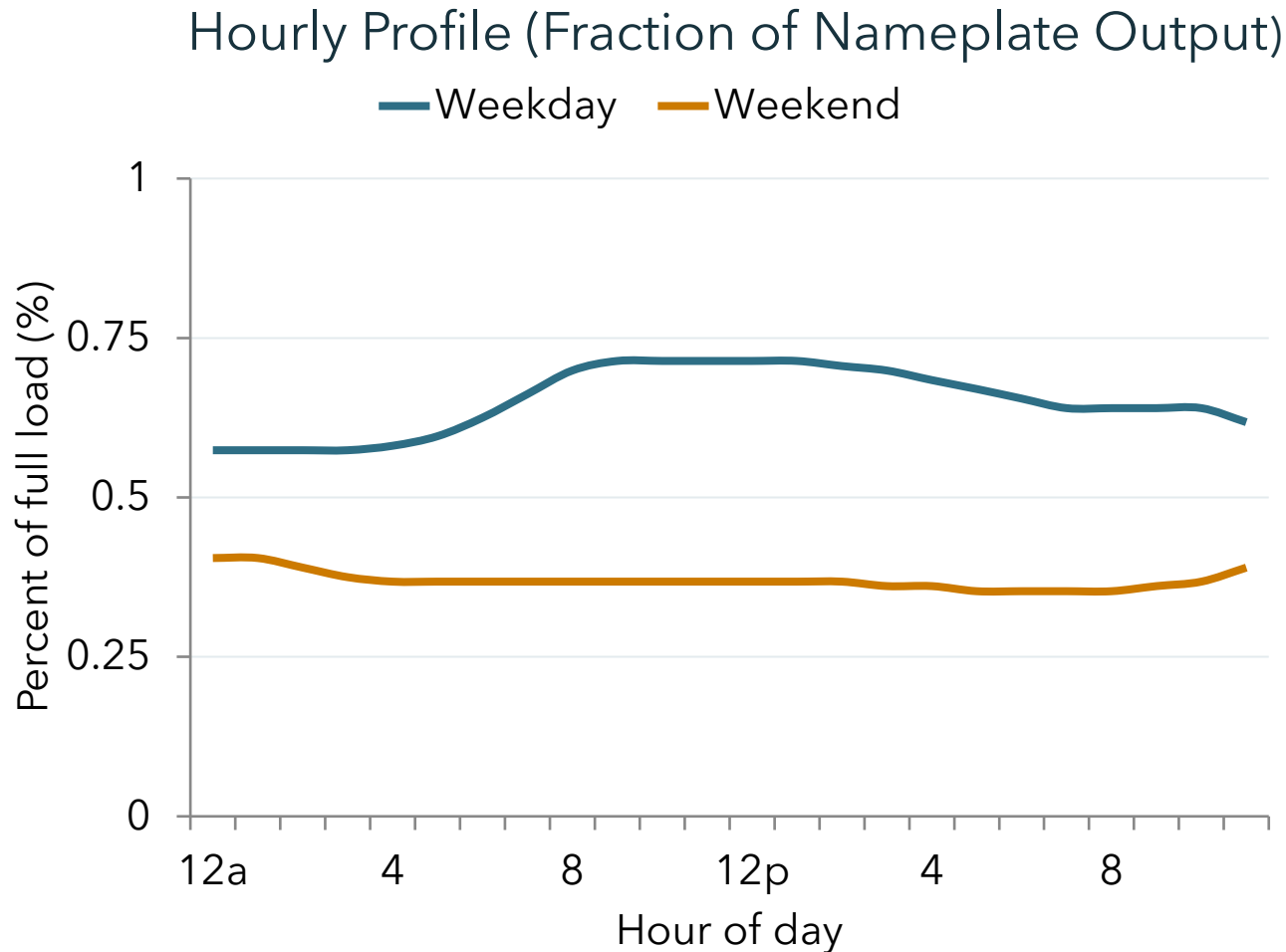
BMA Adoption: 33 MW
1.6% of potential by 2046

PRELIMINARY – ROUGH-DRAFT ESTIMATE

IHP Market Adoption by Market Segment (TMA Scenario)



Load Shapes - IHPs Typically Run All Day



What It Is

EPRI generic industrial process-heat profile

How It's Used

Same shape for IHP and baseline systems, only efficiency and fuel type varies

Limitations

- Missing seasonality - e.g., food processing loads vary by season
- Not based on full-year hourly energy simulations

Key Inputs and Sources



Input	Value
IHP equipment lifetime (EUL)	15 years
Utilization	5,000 effective full-load hours/yr
IHP installed cost (Low/Mid/High)	HTHP: \$1,000 / \$1,500 / \$2,000 per kW SGHP: \$1,400 / \$2,100 / \$2,800 per kW
Baseline cost	HTHP: \$250/kW · SGHP: \$400/kW (steam boiler)
Efficiencies	HTHP COP 3.0 · SGHP COP 1.8 · boiler 80%
MTI budget	\$50M nominal placeholder, front-loaded
Market ceiling and shares	CalNEXT 2023: 2,120 MW
Refrigerant	R134a lifecycle NPV \$155/kW, negative TSB component

Phase II Priorities



- Market characterization to identify/confirm barriers and leverage points
- Market and manufacturer engagement to identify beachhead markets, target applications, and performance specifications
- Streamlined pilot project(s) to explore inputs into value proposition and business case
- Develop preliminary baseline and market adoption curves



Gather MTAB Feedback and Input

IDEA-0010

High Performance Windows

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



HPW Preliminary Product Definition



This MTI will focus on high performance residential primary windows, for new construction and replacement, with a U-value of 0.22 or lower.

The U-value spec will likely require a triple-pane window, but the MTI does not expect to mandate specific technology to achieve the stated specs in order to accommodate technology innovations.

Previously on HPW...



Scored well in RFI-1, Stage 1 and 2

MTAB liked it, but TRC ambiguities existed; other ideas better fit at that time.

Rescored for RFI-2

MT Leverage downgraded due to NEEA pausing their HPW program. Other ideas better fit for portfolio; CBEA selected.



Previously on HPW, cont.



What's changed since RFI-2:

- eTRM HPW measure approved in May 2026
- MN ETA launched HPW program. Innovation prize for builder-grade HPW sponsored by coalition of partners – Nicor Gas (IL), Xcel Energy (CO), Minnesota's Efficient Technology Accelerator
- CRAWFS field demonstration validating that real savings > model predictions
- EUL: 30 years or more
- ConEd launching residential and multifamily HPW retrofit program

Preliminary HPW MTI Opportunity



- Nationally, windows account for ~4 quads of energy use each year. This represents ~200 Mt of CO₂ and costs homeowners more than \$50 billion each year.
- California represents ~15% of U.S. residential building stock and has over 5.5 million single-family detached homes built before 1990, most of which retain single-pane or double-pane clear windows.



Preliminary HPW MTI Opportunity, cont.



Per 2026 eTRM HPW measure package ([link](#)):

- Windows account for 30% to 45% of envelope heat transfer.
- The results from installing HPWs can provide meaningful savings for consumers and have reasonable incremental payback periods.
- However, HPWs have not been widely adopted in the residential market due to several factors, including high cost, limited awareness of the technology, and low frequency of window retrofits.

Preliminary HPW MTI Opportunity, cont.



- HPWs are fuel-neutral and offer gas and electric savings.
- As California pushes to electrify heating, an improved building envelope will help deliver greater thermal comfort, greater resiliency, reduced heat pump sizing, and recurring bill savings.
- HPWs offer peak load reduction and peak-shifting opportunities.
- Per the NEEA Habitat for Humanity case study, HPWs in new construction are not only cost-effective but potentially cost-saving, contributing to affordability goals.

HPW MTI Vision



Accelerate adoption of HPW in new construction and retrofit applications, reducing energy bills, increasing grid flexibility, and improving building resiliency during extreme weather and demand-response events.



CalMTA Role in HPW MTI

- It is well recognized that window replacements rarely occur, except when a window is broken.
- In new construction, affordability goals often lead to installation of minimally code-compliant windows, even when HPWs could be installed for little or no incremental cost.
- We envision a role in addressing technology, market, and financial barriers to alter the “do-nothing” behavior for retrofit and make HPWs a default selection in new construction.

HPW MTI Market Impact



When successful, this MTI will:

- Accelerate and increase beyond a baseline the adoption of HPWs in retrofit and new construction applications.
- Enable ESJ communities to receive the benefits of HPWs earlier than otherwise would happen and with lower financial impacts to rent and utility bills.
- Contribute to the accelerated adoption of heat pumps by reducing energy bills.
- Contribute to a robust and flexible grid by delivering peak load reductions and peak-shifting capability to utilities.

HPW Barriers



- Market: consumer awareness of energy and non-energy benefits
- Market: builders and installers unaware of value-proposition
- Market: limited domestic supply of HPW
- Financial: higher market pricing for HPW despite only modest incremental manufacturing costs for energy benefits
- Technical: uncertainty about product performance / durability

Key

- Technical
- Market
- Financial

HPW Opportunities and Leverage



-  DOE's Partnership for Advanced Windows (PAWS) providing technical and market support to drive adoption of HPW
-  Innovation prize for builder-grade, low-cost HPW sponsored by Minnesota's Efficient Technology Accelerator, Nicor Gas, and Xcel Energy
-  New California eTRM HPW measure package
-  ConEd launching residential and MF HPW retrofit program
-  ENERGY STAR v.7 driving awareness of and demand for HPW

Key

-  Technical
-  Market
-  Financial

Preliminary MT Theory



IF...

THEN...

we drive awareness of real-world energy and non-energy impacts of HPWs...

we will dispel the myth that windows do not matter in mild climates and increase market commitment to exploring solutions.

we develop a cohesive strategy for addressing envelope upgrades and heat pump adoption...

we will bring down the capital and operational costs of electrification.

we bring down the upfront costs of HPWs via innovation prizes and manufacturer engagement...

we will further reduce financial barriers for new construction and retrofit markets.

we demonstrate via field studies the energy and non-energy benefits, installation ease, and durability...

we will have a compelling value proposition for "envelope first" strategies for new construction and retrofit applications.

HPW TSB and TRC Estimates

HPW TSB and TRC Estimates Agenda



1. Overview of approach
2. Draft TSB & TRC results
3. Measure definition and savings estimates
4. Cost data
5. Market adoption

HPW Overview of Approach



Forecasting residential HPW installations over a 20-year Phase III period:

Two Scenarios

BMA - Baseline Market Adoption

TMA - Total Market Adoption

Measure Scope

Includes HPWs installed in multifamily- and single-family homes, both existing and new construction

High Degree of Uncertainty

More research will be required to increase confidence in cost-effectiveness estimates.

Forecast Framework

Measure Type

Modeled as a normal replacement measure

Adoption Model

HPW installations are estimated as a % of total annual window sales.

Outputs

TSB (PV 2027\$) and TRC/PAC ratios

HPW Preliminary Results Summary



TRC ratio: 0.4 – 1.1
PAC ratio: 5.7

Total TSB \$206M

GHG TSB \$141M

Grid TSB \$32M

Energy TSB \$33M

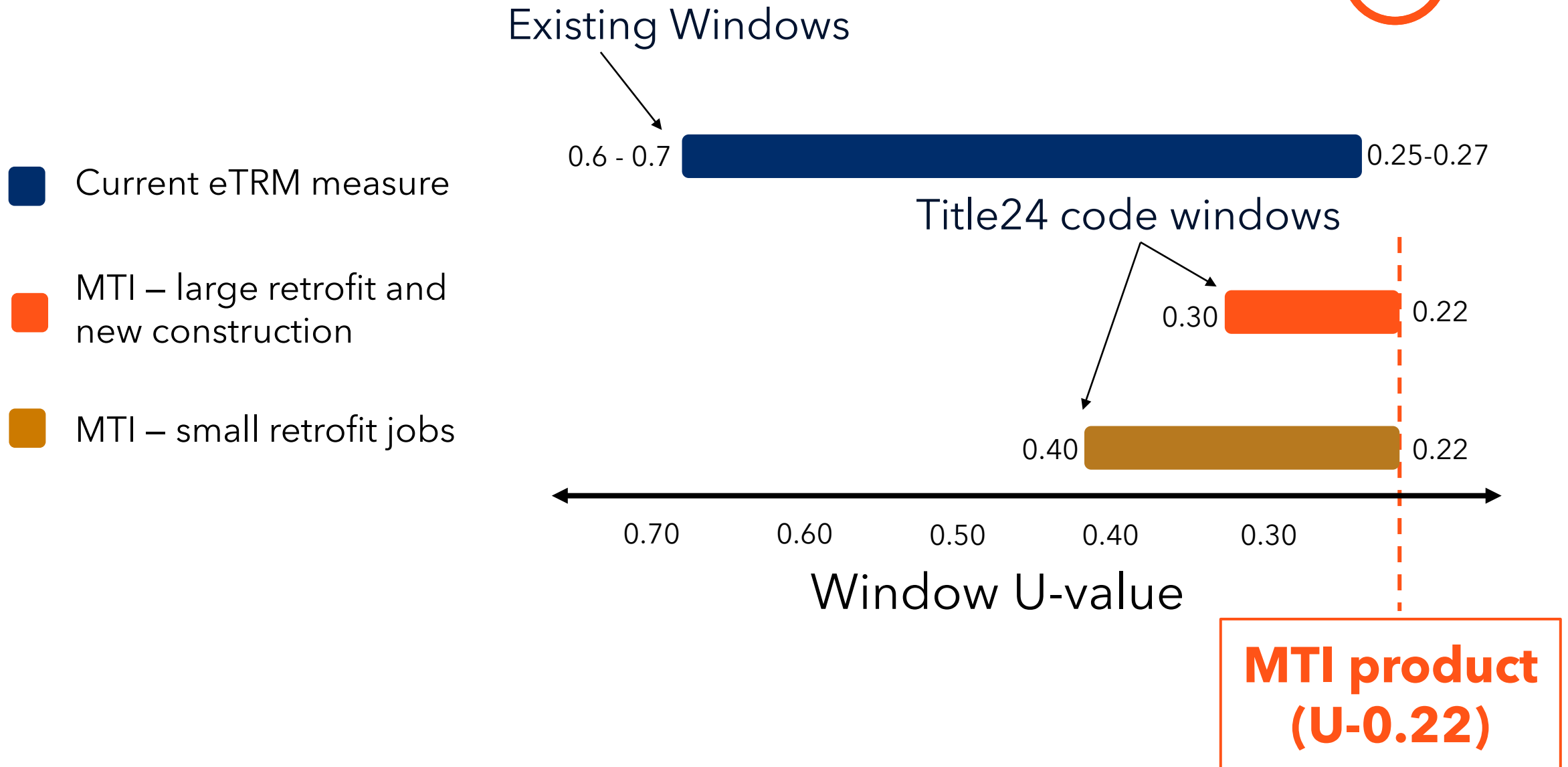
**TSB results w/ 30-yr EUL*

Preliminary TRC Estimates

		Preliminary TRC Estimates		
		High	Mid	Low
EUL	40 yr	0.49	0.81	1.14
	30 yr	0.45	0.74	1.04
	20 yr	0.37	0.61	0.85
		Cost Range		

NOTE: These results represent a Phase I estimate, a Phase II estimate will require additional effort and refinement to inputs and assumptions.

MTI Measure vs. Current eTRM Measure



MTI Measure vs. Current eTRM Measure, cont.



Modeling the MTI measure as normal replacement means energy savings and costs are **incremental to current code.**

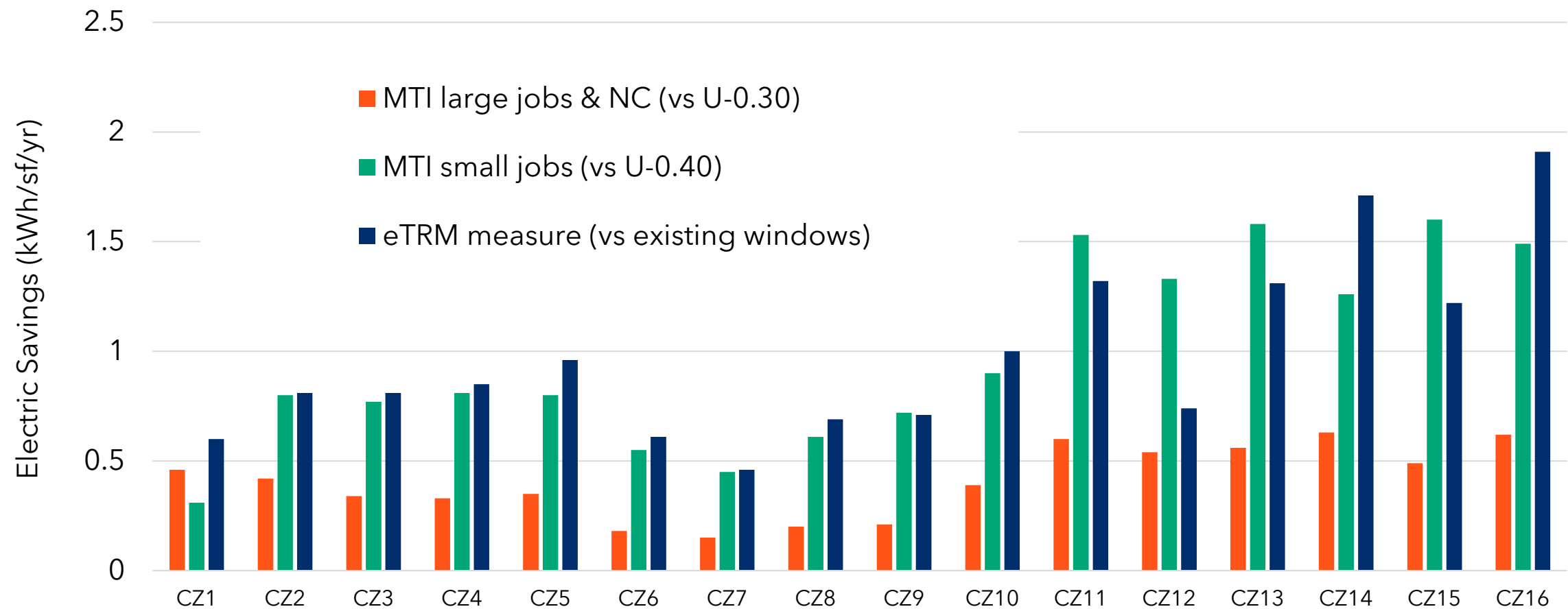
Code is less strict for smaller (< 75 total sq. ft.) retrofit jobs.

The eTRM measure compares against existing windows, and includes the full window cost.

The higher cost leads to TRC values well below 1.0



Preliminary Savings Estimates for MTI vs. eTRM Savings



Current MTI estimates assume 25% of retrofit installations are "small jobs."

Preliminary Savings Estimates for MTI vs. eTRM Savings, cont.

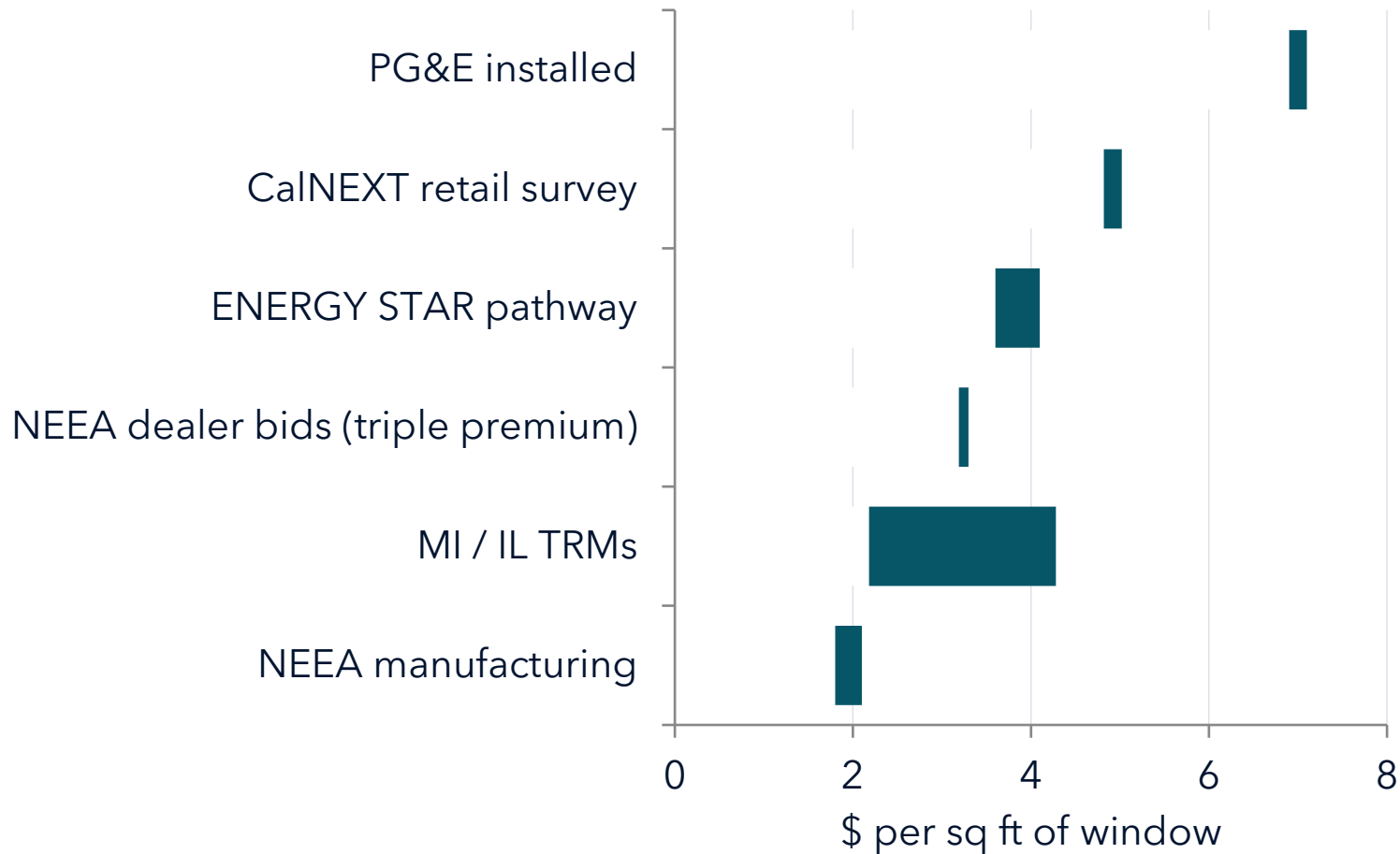


- Preliminary savings for small retrofit jobs are comparable to eTRM measure savings.

Large jobs and NC have lower savings due to stricter code.

- Limitations on savings estimates:
 - Early modeling done only for a SF home (one vintage, no MF, no NC)
 - Field study for CRAWFS MTI showed that actual savings were higher than shown by energy models.

Incremental Measure Costs Vary by Data Source



Modeled Cost Cases:

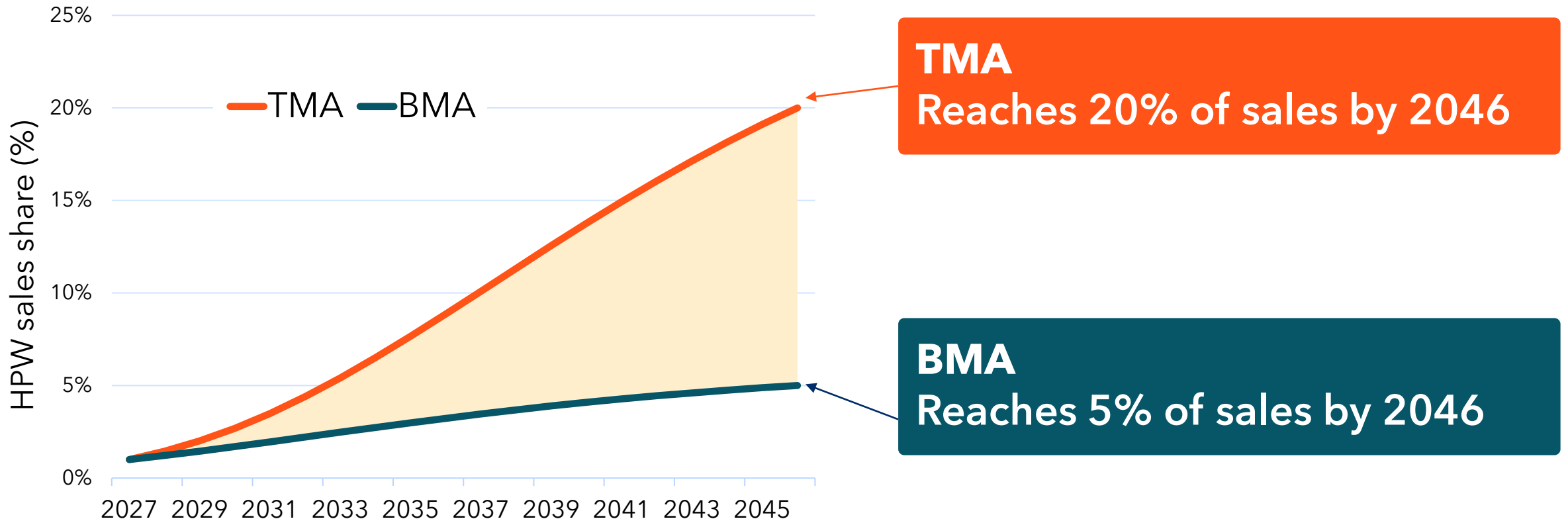
- Low = \$3.25/sf (NEEA bids)
- Mid = \$4.92/sf (CalNEXT retail)
- High = \$7.00/sf (PG&E installed)*
**includes labor cost*

Further research is required to determine an accurate incremental cost for HPW vs. code baseline.

HPW Market Adoption: Window Markets Move in Decades, Not Years



Share of annual CA window sales meeting MTI HPW spec



HPW Adoption Measured in Windows, Homes, and Stock



Incremental = TMA minus BMA, cumulative 2027-2046 – calculated from the adoption curves

7.8M

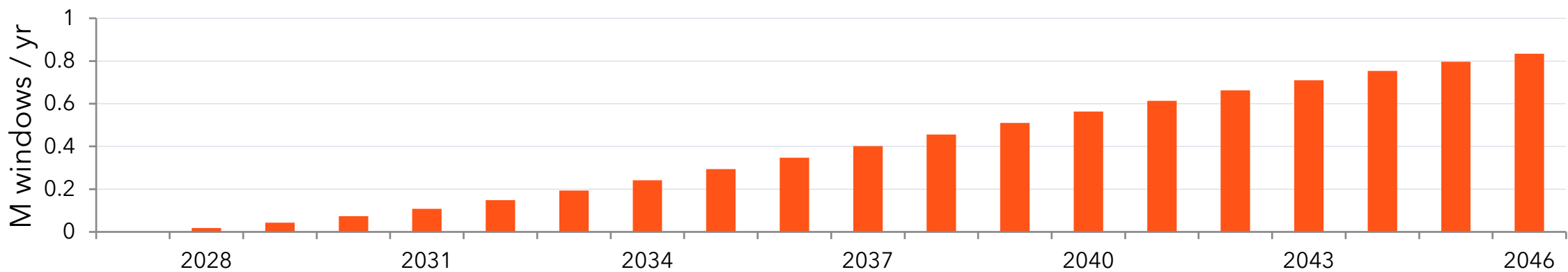
incremental window
installations

~740,000

homes upgraded
(at 10.5 windows/home)

+5.4%

of California’s ~13.5M homes
upgraded over MTI lifetime



Next Steps for HPW

- Significant work has been performed by other MT and energy efficiency organizations to generally characterize the HPW market and explore barriers, opportunities, and market interventions.
- This existing body of knowledge has been leveraged to develop current TSB and TRC estimates.
- Yet, additional California-specific knowledge gaps remain that need to be resolved to refine and update TSB and TRC and better inform the potential for advancement.

HPW Research Priority



Focused field or lab study to determine actual energy savings, having learned from CRAWs that actual savings can exceed modeled savings

Oct 2026

Develop research plan:
research objectives,
timeline, budget



Dec 2026

Share research
plan to MTAB



A large orange circle with a white border, containing the white number "2".

2

Gather MTAB feedback and input

Break (10 min.)
We will be back soon.



10. Organizational Review Recommendations Planning and MTAB Meeting Format Activity

Lynette Curthoys | VP Market Transformation

Kristen Van Kley | Senior Manager, Marketing &
Communications



Refine MTAB Meeting Structure and Strategic Engagement

Recommendation: Consider ways to refine the structure of MTAB meetings to reduce review burden and focus the MTAB's guidance and discussion on the most critical issues.

Refining MTAB Meeting Structure

Discovery and Planning



Completed

- ✓ CalMTA Organizational Review Report
- ✓ MTAB meeting audit (2025 – 2026 meetings)
- ✓ MTAB member survey
- ✓ Working group formation

Upcoming

- MTAB meeting restructure activity
- Working group develops recommendation
- Recommendation shared at next MTAB meeting
- Implementation in 2027

Refining MTAB Meeting Structure what We Know



Strengths

- MTAB members are subject matter experts committed to CalMTA's mission.
- Members receive materials to review in advance of the meetings.
- Meetings are well-facilitated and productive.
- Strong retention among MTAB members

Opportunities

- Volume of material to review can be large.
- Members find virtual meetings to be less valuable.
- More strategic discussion, strategic breakout discussions
- 50% presentation/50% discussion

Small Group Exercise

Reimagining MTAB Meetings



Exercise Overview:

- Work in small groups to review one past MTAB meeting and today's meeting to identify:
 - What worked well
 - Areas of improvement
- Using the example meetings, develop practical recommendations to help shape the future structure of MTAB meetings.

GOAL:
Make MTAB
meetings more
strategic, engaging,
and focused.

Small Group Exercise

Reimagining MTAB Meetings



Recall the **March 25, 2026 MTAB Meeting:**

- Virtual via Zoom
- Agenda fully devoted to *Idea to Initiative* Part 3 for Residential HPWH
 - MTI Plan overview
 - Evaluation Plan
 - Market Adoption Forecast

Small Group Exercise

Reimagining MTAB Meetings



Discuss the meetings from these perspectives:

Content



Preparation



Engagement



Outcomes



Overall



Small Group Exercise

Reimagining MTAB Meetings



Develop and prioritize your group's **top 3-4 recommendations** for improving future format of MTAB meetings. Be prepared to share:



Recommendation

**What should change?
What should stay?**



Rationale

Why is it important?



Impact

**How will it improve
future meetings?**

Report out: Each group will assign a reporter to share their recommendations.

We will be back at 3:55 p.m.

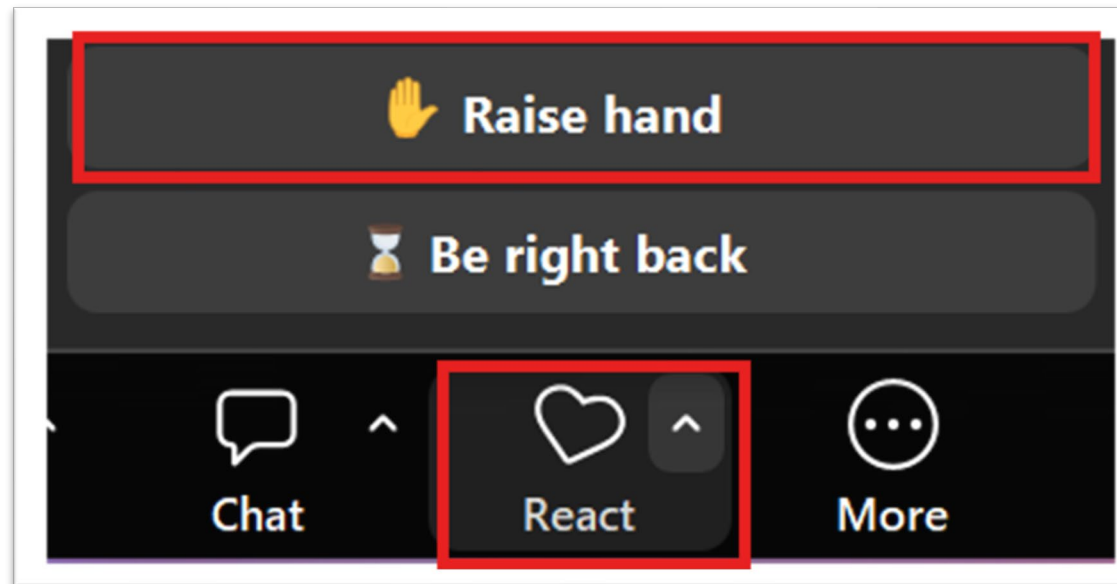


Report Outs and Discussion

11. Public Comment #2



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



12. Next Meeting & Next Steps



	December 2026	February 2027
Time	TBD	TBD
Location	Virtual - Zoom	In-person, location TBD

Programs Partners Webinar: Presenting Implementation Plan for Room Heat Pumps – Week of October 19

3rd Quarter Activity Report Webinar – Tuesday, October 27 @ 10:00 a.m.

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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