October 6, 2023

MEMORANDUM

TO: Market Transformation Advisory Board (MTAB)

FROM: Jeff Mitchell, Principal, MT Development
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SUBJECT: MT Ideas Moved to Stage 2 Scoring and Proposed First Batch MTIs

This memo provides an update on select market transformation (MT) ideas submitted during the request for ideas (RFI) process recently conducted by CalMTA. It gives an overview of the ideas that have advanced to Stage 2 scoring and discusses a preliminary review of the ideas proposed as "front runners." As detailed in this memo, front runners are those ideas that scored well and are more fully viable for near-term MT development than other leading ideas because of product readiness, high leverage, or other defined criteria.

This memo does not cover the full disposition of all MTI ideas collected in the RFI. A draft of the full "RFI Disposition Report" discussing the status of each idea submitted is expected to be released in late November. In addition, the front runner ideas expressed in this memo represent only the first batch of ideas to advance. CalMTA is planning on additional market transformation initiative (MTI) Advancement Plans to be developed during 2024 and 2025 to continue to build California's Market Transformation Portfolio.

Context

The recent RFI to collect MT ideas from interested parties resulted in 117 ideas being submitted via a web-based process and staff are now in the process of scoring each submission. A full MTI Plan, which is a comprehensive document covering items such as market characteristics, MT theory, implementation plan, metrics, anticipated savings, budget, and a plan for evaluating the MTI, will be developed over time for the highest ranked ideas. For some markets, development of these plans will take over a year; in others, CalMTA expects to have MTI Plans developed within 12 months.

The first batch of MTIs recommended here are options that scored well, and also have high leverage and known barriers and opportunities for rapid development. This will also allow

CalMTA to meet a milestone set forth in the California Public Utilities Commission (CPUC) decision (D.19-12-021) that calls for an Application to be filed and MTI Plans approved before implementation funding can be released and MTI implementation can begin. CalMTA also received feedback from several MTAB members during the April 19, 2023, meeting that they would like to see early deployment of at least an initial batch of MTIs, recognizing that other ideas may take more time to develop.

CalMTA is working to file an Application with full MTI Plans for these front runners by the end of 2024. The preliminary selection of front runners determined by the CalMTA team through the scoring process is discussed later in this memo.

MTI Submissions in Stage 2 Scoring

This section summarizes the MT idea submissions that have passed Stage 1 scoring and moved into Stage 2.[1] For Stage 2, the CalMTA team is taking a more rigorous look at the MTI opportunity including:

- the use of deemed or modelled impacts (energy savings, grid impacts, and GHG reductions),
- preliminary baseline market adoption, and
- total market adoption estimates and total system benefit (TSB) estimate.

In addition to estimating the above impacts, the team will complete a review of external program activity in the same market, develop a product definition, and a preliminary MT theory for each potential MTI in Stage 2. The external program review is conducted as a gating activity to ensure the submissions that move through the more rigorous Stage 2 development represent:

- unique program or policy activities,
- have the potential for incremental benefit, and
- represent opportunities for collaboration and mutual leverage with programs in the existing energy efficiency portfolio or plans for future code and standard adoption.

In many cases, multiple similar ideas were submitted by different proposers in the RFI. The team grouped those ideas together, and the information from all submissions in the group was considered while developing the MTI for scoring. The set of ideas in Table 1 below were moved to Stage 2 scoring. The white rows represent the individual MTI submissions, while the grey rows represent the combined MTI opportunity.

[1] For an overview of the MTI stages and phases, please see https://calmta.org/market-transformation-faq/

Table 1: MT Ideas Moved to Stage 2 Scoring

MTI Group	MTI Submission Name	Idea #
Envelope	Commercial Windows	
	Single Pane Retrofit	0157
	Vacuum Insulated Glass (VIG)	0079
	Residential Windows	
	High Performance Windows	0010
HVAC	Portable / Window Heat Pumps	
	Portable / Window Heat Pumps	0097
	Micro Heat Pumps	0086
	Cold Climate Window and Portable Heat Pumps	0125
	Combination HVAC and Water Heating	
	Multi-function Heat Pump	0085
	Combination Heating, Cooling, Water Heat	0126
	Residential HVAC	
	Residential Variable Speed Heat Pump	0171
	HVAC Integrated Ventilation	
	Heat Pump Integrated Continuous Mechanical Ventilation	0081
	HVAC Policy	
	Policy Requiring all AC be sold as HP	0068
	Efficient Commercial Rooftop Units	
	Efficient Commercial Rooftop HVAC (ERTUs)	0116
	Unitary Packaged Heat Pump Systems for Light Commercial	0166
	Advanced Rooftop Controls	0124
	Advancing Smarter HVAC Controls in Small to Medium Commercial	0184
	Medium to Large Commercial Control Systems	
	Modernizing building automation system hardware	0149
Lighting	Streetlighting	
	Efficient Streetlighting	0105
	Networked Lighting Controls	
	Luminaire Level Lighting Controls	0120
	Procure Networked Lighting Controls for Multivendor Teams	0128
Plug Load/ Appliances	Smart Home	
	Smart Electric Panel	0080

	Residential EV Charging	
	Bi-directional EV Charging - Residential	0021
	EVSE Standards Roadmap	0175
	Commercial EV Charging	
	Bi-directional EV Charging - Fleet	0077
	Residential Appliances	
	Induction Ranges and Cooktops	0107
	Leveraging ESRPP for Equity	0115
Practices	Building Performance Standards	
	Building Performance Standards Accelerator MTI	0193
	Workforce Development	
	Work-based Learning to Achieve Equitable Climate Cool Schools	0146
Process	Foodservice	
	Foodservice Decarbonization	0165
	Induction Cooking Training Partnership	0174
	Elevating Food Service Tech Transformation	0183
Water Heating	Residential Water Heating	
	Residential Heat Pump Water Heaters	0194
	HPWH Exterior Enclosure	0145
	HPWH Installer Certification	0136
	HPWH Rapid Installer Expansion	0177
	Deployment of 120V HPWHs	0180
	Market Connections for Plug-in HPWH	0148
	Gas WH Buyback Program + Solar	0132
	Eco-Tech Apprenticeship Program	0153
	Commercial Water Heating	
	HPWH for Multifamily	0078
	Central HPWH for MF -Complete Kit Solutions	0113
	Load flexibility controls for HPWH Systems	0179
	Ultra-low GWP Packaged Systems w/TES	0108

Proposed Batch 1 MTIs

CalMTA has identified three front runner ideas, representing the first batch, that scored highly in Stage 1 and 2, and met the following criteria:

- Well-defined product definition, preliminary market transformation theory, and program logic

- Clear leverage points that are likely to be effective at producing market change
- A clear role for CalMTA
- Any needed research or pilot projects can be scoped and completed in a short timeframe

To identify these MTIs, the team conducted a cursory review of all ideas that were advanced to Stage 2 against the front-runner criteria (bulleted above) and selected nine MTIs for front-runner consideration. Then the team conducted a more systematic review of the potential MTI against the front runner criteria. In cases where there was not clear alignment with the front runner criteria and thus a strong case for inclusion in this first batch of Advancement Plans, the ideas were returned to the queue for further Stage 2 prioritization. Descriptions of the six ideas not moved to front runner status can be found on page 12 of this memo. Details on the three ideas advanced into Batch 1 appear immediately below in Table 2.

Table 2: Ideas Considered for Placement in Batch 1

IDEA #	MTI Name	Well Defined Product Definition & Target Market	MT Theory	Program Logic	Leverage Points	CalMTA Role	Timely Research
Batch 1 MTIs							
0097	**Portable/ Window Heat Pumps**	X	X	X	X	X	X
0107	**Induction Ranges and Cooktops**	X	X	X	X	X	X
0116	**Efficient Commercial Rooftop HVAC (ERTUs)**		X	X	X	X	
Other Leading Ideas Returned for Stage 2 Scoring							
0194	**Residential Heat Pump Water Heaters**	X	X	X	X		
0078	**Multifamily Heat Pump Water Heaters**		X	X			
0085	**Multi-function Heat Pump**	X	X		X	X	
0165	**Food Service Decarbonization**	X	X			X	

0171	**Residential Variable-Speed Heat Pump**		X	X	X		
0146	**Work-based Learning to Achieve Equitable Climate Cool Schools**			X	X		

As illustrated in the Table 2, one of the three MTIs proposed for inclusion in the first batch of MTIs does not address all front runner criteria. However, all three ideas possess strong MT theories, will provide long-term value to California, have a high likelihood of moving to Phase 3: Market Development, and offer a compelling rationale for starting Phase 2 activities in the first batch of MTIs. These three are described next.

Name	**Portable /Window Heat Pumps**
Sector(s)	Existing single-family & multifamily residential
Portfolio Priorities	
☒ Equity ☐ WE&T ☒ Energy Savings ☐ Grid Benefits ☒ GHG Reductions	
Product Definition	
Portable and window heat pumps (aka micro heat pumps) are affordable, self-contained consumer products that provide efficient heating and cooling for small spaces ranging from a single room to a whole apartment. They are similar in shape and size to typical window and portable AC products -- but use inverter technology that allows for variable speed operations providing more efficient cooling in the summer and heating in the winter. They can be self-installed, plugged into a 110v outlet, and have a cooling capacity of up to 18,000 BTUs. CalMTA will promote units that can still provide heat when the outdoor air temperature is below 41F, include air filtration, use low GWP refrigerants, and incorporate controls to allow the units to be grid-responsive in the future.	
Preliminary Market Transformation Theory	
Existing multifamily and smaller households often suffer from higher energy burdens and greater exposure to poor air quality.[2] This market needs an efficient and affordable electric alternative to resistance and gas space heat while also providing air conditioning, and air filtration, which will improve air quality. Many consumers in this market purchase inefficient space heaters and window A/C units to supplement their heating and cooling needs and buy separate air filtration products during fire or poor outdoor air quality events.	

[2] Socioeconomic Disparities of Low-Cost Air Quality Sensors in California, 2017–2020 | AJPH | Vol. 112 Issue 3 (aphapublications.org)

Efficient portable and window heat pumps with up to 18,000 BTUs capacity are now available and can be self-installed. Some units include air filtration and could have controls for possible grid-interactive capability. Barriers to widespread adoption include overall product category availability, high cost, lack of awareness, efficient product differentiation and insufficient number of models that include air filtration or are grid enabled.

Key market interventions will start with manufacturer engagement to understand their product mix and assess the opportunity to influence the next generation of products to include air filtration and grid connectivity. At the same time, CalMTA will need to engage other regions that are targeting this technology like NYSERDA, Consortium for Energy Efficiency (CEE), and NEEA to push for product alignment, build market scale, and influence DOE test procedures and ENERGY STAR specifications. This in turn will ultimately influence manufacturer production and promotions.

Once more products are available and there is a clear mechanism for product differentiation -- that will allow consumers to assess and trust the product's possible energy impacts -- CalMTA will partner with existing retail platforms such as ENERGY STAR's Retail Products Platform[3] (ESRPP) to push for stocking and promotion of portable/window heat pump products. CalMTA will also work to leverage existing California multifamily, weatherization, and climate resilience programs[4] to encourage inclusion of this product in program offerings.

The pathway from ENERGY STAR specification to retailer and local program engagement to increased market share and price declines will lead to more effective DOE standards. Over the long-term, once standards are in place, consumers will only be able to purchase portable/window heat pump technology when they look to purchase backup air conditioning or resistance heating. Products qualifying for this initiative will also provide air filtration to enhance indoor air quality and be grid enabled, if cost is not prohibitive.

Possible Leverage Points

- National partnerships with aligned organizations (NYSERDA, ENERGY STAR, CEE) to create greater scale, and demonstrate augmented demand to manufacturers
- Energy efficiency retail platforms like ESRPP and programs operated by California IOUs (like Southern California Edison's online marketplace) that can help create awareness and demand
- Existing California programs targeting limited income multifamily, small, single family and climate resilience programs to help tackle cost and awareness barriers with Environmental and Social Justice communities

CalMTA Role

[3] ESRPP is a nationwide collaborative midstream initiative of ENERGY STAR that includes 16 program sponsors, retail partners, and the EPA.

[4] Climate resilience is a general term for initiatives that support regions and communities that are highly vulnerable to fire and weather events. For example, during an exceptional heat or cold snap, these programs may distribute portable AC or heating units to vulnerable households to help them cope with the climate event.

- Engage large statewide retailers to enhance product availability and participate in midstream promotions
- Coordinate with both national and statewide consumer-facing weatherization, resilience, and limited income programs to provide incentives to help bring entry costs down
- Work upstream with manufacturers on product specifications that include air filtration, grid capabilities, and low GWP refrigerants
- Support standards programs (state and federal) with data and product availability for final transition to portable/window heat pump technology for target markets

2024 (Phase 2) Priorities

- Market characterization study to research existing multifamily and small single-family HVAC market
- Research current product availability and specifications inclusive of natural refrigerants, air filtration, and grid capability
- Engage ENERGY STAR on product category and specification development process and priorities
- Research possible local program leverage to add portable/micro heat pumps to current programs
- Discuss with retailers product availability and possible program features

Name	**Induction Ranges and Cooktops**
Sector(s)	New & replacement in single-family & multifamily residential

Portfolio Priorities

☒ Equity ☐ WE&T ☒ Energy Savings ☐ Grid Benefits ☒ GHG Reductions

Product Definition

Induction ranges and cooktops use electromagnetic induction to heat cookware directly. Unlike traditional gas or electric stoves, which heat the burner, and the burner in turn heats the cookware, induction stoves work by directly heating the cooking vessel. They save energy through instant, direct, and efficient heat transfer, and provide precise temperature control. They do not emit noxious gases that contribute to reduced indoor air quality. Induction cooktops are available on combined stove/oven units, as a cooktop installed in a countertop, or as portable plug-in countertop units.

Preliminary Market Transformation Theory
Gas ranges are the most prevalent cooking method in California single-family and multifamily units with over 70% market share. When households choose electric or decide to electrify, consumers need affordable and efficient, electric options. Induction cooking has been available for several years with most major manufacturers offering models, but the product has yet to be widely adopted. For many years gas cooking has been marketed as offering a superior cooking method so consumer awareness on the benefits of induction cooking is low. In certain communities there are also cultural barriers associated with the move away from gas to electric. High initial costs need to be addressed with induction stoves still currently priced as a premium product with many additional features that add to the price but do not improve efficiency. In some cases, induction may require an outlet and/or panel upgrade as well. To accelerate the adoption of induction cooking, key interventions include driving greater product availability and awareness through retail partnerships and programs that already target multifamily and single-family decarbonization. CalMTA will engage manufacturers to develop lower-priced models that include induction but without premium add-on features, and collaborate with direct install programs to demonstrate to manufacturers that there is a market for more affordable products. Engagement with ENERGY STAR to support the emerging ENERGY STAR Residential Cooking Products V1.0 specification will be a key action. This MTI could also couple a retail push with a manufacturer co-marketing partnership and Inflation Reduction Act (IRA) incentives and tax credits. Long-term diffusion will occur as more affordable, ENERGY STAR labeled products are available and understanding and awareness of induction's benefits grow. As California moves towards further decarbonization, affordable induction options will become the first choice for efficient electric cooking in the majority of single and multifamily homes. Lastly, the MTI would align with the California Air Resource Board's (CARB) efforts to push for the sale of only zero-emission appliances along with possible federal standards that improve the efficiency of electric cooktops, effectively ensuring induction cooking as the standard cooking appliance in homes.
Possible Leverage Points
• Energy efficiency retail platforms like ESRPP and programs operated by California IOUs (like Southern California Edison's online marketplace) that can help create awareness and demand • Engage ENERGY STAR specification process to encourage development of a label for electric stoves and ranges. • Engage current programs targeting improved indoor air quality for ESJ communities to build awareness and demand

- Leverage IRA and utility program funding, especially those targeting limited income and multifamily

CalMTA Role

- Engage with leading manufacturers in partnership with other regions targeting affordable induction stoves
- Engage with existing retail platforms
- Engage ENERGY STAR process to drive specification for electric product
- Support standards programs (state and federal) with data and product availability

2024 (Phase 2) Priorities

- Market characterization study to understand manufacturers, channels and identify additional leverage points
- Cost and feasibility study to understand price of efficiency components verses current premium priced product
- Discuss product availability and possible promotion with retailers
- Develop customer messaging on benefits of induction cooking

Name	**Efficient Commercial Rooftop HVAC (ERTUs)**
Sector(s)	Small & medium existing & new commercial buildings

Portfolio Priorities

☒ Equity ☒ WE&T ☒ Energy Savings ☒ Grid Benefits ☒ GHG Reductions

Product Definition

Roof Top Units (RTU) are forced-air systems that package the evaporator, condenser coils, fans, and heating components into a single unit to serve a building's heating, cooling, and ventilation needs. Three main design improvements addressing supply efficiency, heat recovery, and an improved shell can deliver 10–40% energy savings beyond today's minimum efficiency RTUs. Greater savings and grid benefits can be achieved through the addition of advanced controls strategies.

The energy savings components that enable this system to save energy may include:

A. Insulated RTU box (to R-12)
B. Low leakage dampers
C. Increased heat pump efficiency
D. Use of energy or heat recovery (E/HRV)

When combined, items A and B deliver a 2-10% energy use reduction compared with the current federal standard. Further efficiency can be achieved if A and B are combined with either C or D, resulting in a 12-40% energy reduction.

Preliminary Market Transformation Theory

At least 25% of commercial buildings in California use RTUs for HVAC needs, most commonly in low-rise, small- to medium-sized buildings. While federal standards regulate the mechanical components in RTUs, they don't include heat recovery, or address shell losses. Efficiencies addressing these features can now be captured using a rating developed by CSA Group, a leader in standards development, in collaboration with NEEA, the Natural Resources Canada, and other industry and efficiency experts. Today these design features are typically only available in premium RTUs, which are a small portion of this commoditized, cost-competitive market.

There is currently a national collaborative engaging in this market through a tiered specification approach. The tiered requirements provide both prescriptive and performance paths. The Consortium for Energy Efficiency (CEE) is currently expanding this specification to include heat pump RTUs (HP RTUs).

This is a complex market with a variety of barriers. On the design side, manufacturers and the supply chain are either unaware or do not value the tiered specification that has been developed and so do not have a mechanism to differentiate efficient RTUs with superior whole box efficiency. There is also limited product availability for the light commercial replacement market. Additional barriers include first cost, lack of building owner/operator awareness of products and features that deliver efficiency, and contractor knowledge and experience specifying and installing systems with these advanced designs and controls.

Possible key interventions to tackle the physical design improvements will include manufacturer engagement on affordable product availability and utilization, and development of a California-appropriate tiered rating system that supports better equipment design and purchase decisions. We will need to build awareness of efficient and controllable RTU's value proposition by partnering with distributors and manufacturer representatives to drive adoption among contractors and building representatives. Support will include education on the value proposition, marketing, and training partnerships in addition to initial midstream incentives to motivate the supply chain to promote and sell efficient and controllable RTUs. Finally, this MTI will need to leverage state and federal codes, as well as voluntary and federal standards to increasingly require RTU efficiency measures and achieve the long-term goal of all RTUs meeting the higher efficiency specification.

This MTI envisions a future state in which the market values the improved performance that these premium RTUs offer when installed in small- and medium-sized commercial buildings,

including both control-based and physical/design improvements to the equipment. Over time, premium HP RTUs will be best practice in this commercial building segment.
Leverage Points
• Engage current RTU manufacturers in partnership with other organizations like NEEA and MN CEE to advocate for design and manufacturing changes to address product availability • Regional distribution networks offer a leverage point for midstream incentives, education and marketing to market actors • Leverage trade associations on both the supply side (e.g., American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)) and demand side (e.g., Building Owners and Management Associations (BOMA)), to build skills, awareness and demand • Leverage voluntary federal standards to achieve product differentiation
CalMTA Role
• Engage with manufacturers to ensure efficiency design enhancements • Collaborate with other regions on national voluntary standards that include low GWP refrigerant requirements • Develop and deploy education and training through trade partnerships to build capability and awareness of both top tier RTUs and control enhancements • Engage California emerging tech and codes and standards programs to develop product roadmaps for product design and control strategies
2024 (Phase 2) Priorities
• Research design enhancements and energy efficiency opportunity. (i.e., gas, hybrid, HP and electric only). • Market characterization study to understand California market and key market actors • Cost study to understand cost of efficiency design and control features

Ideas Returned for Final Stage 2 Prioritization

Ideas that did not have clear alignment with the front runner criteria and a strong case for inclusion in this first batch of Advancement Plans were returned to the queue for consideration in Batch 2 or 3. The rationale for each is given below.

1) Residential HPWH. Residential heat pump water heaters (HPWHs) were not included in the first batch of MTI Advancement Plans for two primary reasons: 1) there is a federal rulemaking process happening now that may impact the direction of the initiative. CalMTA felt it prudent to wait for that process to resolve prior to designing an MTI Advancement Plan; and 2) there is significant related program activity currently in California, and staff needs additional time to understand the market activity and specifically if there is a clear role for CalMTA.

Next steps are to monitor federal activity and begin coordinating with California stakeholders to determine if there is a role for CalMTA.

2) Multifamily HPWH. Multifamily heat pump water heaters were not included in the first batch of MTI Advancement Plans for two primary reasons: 1) much like residential HPWH, there is significant program activity currently in California, and CalMTA needs additional time to understand the market activity and whether there is a clear role for CalMTA; and 2) there are competing approaches to efficient multifamily water heating design (central and distributed) and staff would like to review these approaches in more detail before crafting a preliminary MT theory.

Next steps are to begin coordinating with California stakeholders to determine if there is a role for CalMTA.

3) Multi-function Heat Pump. Although a promising emerging technology to accelerate decarbonization of residential new and existing homes, multifunction heat pumps were not included in the first batch. A multifunction HP is a complex, new system with few manufactures at this point and requires additional product validation. More lengthy research is needed to confirm the technology's benefits and how best to intervene in the supply chain.

Next steps are to coordinate with others already working on this technology (CalNEXT, SMUD, and PG&E) and then develop a robust research plan to investigate both the technology and possible MT interventions.

4) Foodservice Decarbonization. Foodservice decarbonization makes for an interesting market transformation opportunity but was not included in the first batch of MTI opportunities due to the diversity of the market, the complexity of the known barriers, and the lack of proven market leverage points.

Next steps are to review existing research and revisit during the Stage 2 scoring process for potential inclusion in a future batch of MTI Advancement Plans.

5) Residential Variable-Speed HP. A residential variable-speed heat pump MTI would transition the market to require variable speed/capacity heat pumps in the place of single speed. Due to existing programs as well as codes and standards activity related to residential heat pumps, CalMTA needs additional time to understand the benefits of variable speed heat pumps in the California climate and the specific role for CalMTA.

Next steps are to monitor program activity and begin coordinating with California stakeholders to determine if there is a role for CalMTA.

6) Work-based Learning to Achieve Equitable Climate Cool Schools. Climate Cool Schools is an interesting potential MTI that combines a cohort-based SEM model with workforce development. Staff was not able to articulate a clear mechanism to lock in this behavior and needs to dedicate resources to develop a plausible program strategy.

Next steps are to dedicate resources over the next few months to craft a program strategy and estimate potential program impacts.

Next Steps

After reviewing the three proposed front runners with MTAB, the team will develop individual MTI Advancement Plans for them. These plans will be reviewed at the November 30th MTAB meeting. In addition, we will review the MTI Advancement Plans with key stakeholders, provide opportunity for formal comment from MTAB members, and solicit public comment. All input will be reviewed, considered, and incorporated into the plans as much as possible.

In addition, work will continue to evaluate top-scoring ideas from the RFI solicitation. A recommendation for additional ideas to pursue (in addition to these first front runners) will be discussed with MTAB at the November 30 meeting in a draft RFI Disposition Report. The RFI Disposition Report will include the scoring framework, RFI outreach, summary of MTI ideas received, idea scoring and recommendations. It will also have attached Advancement Plans for the three front runners.