January 19, 2024

MEMORANDUM

TO: Market Transformation Advisory Board (MTAB)

FROM: Jeff Mitchell, Principal, MT Development
Elaine Miller, Senior Manager, MT Strategy
Jennifer Barnes, Associate Director

SUBJECT: CalMTA Recommendations for Market Transformation Ideas to Further Develop with Advancement Plans (Batch 2)

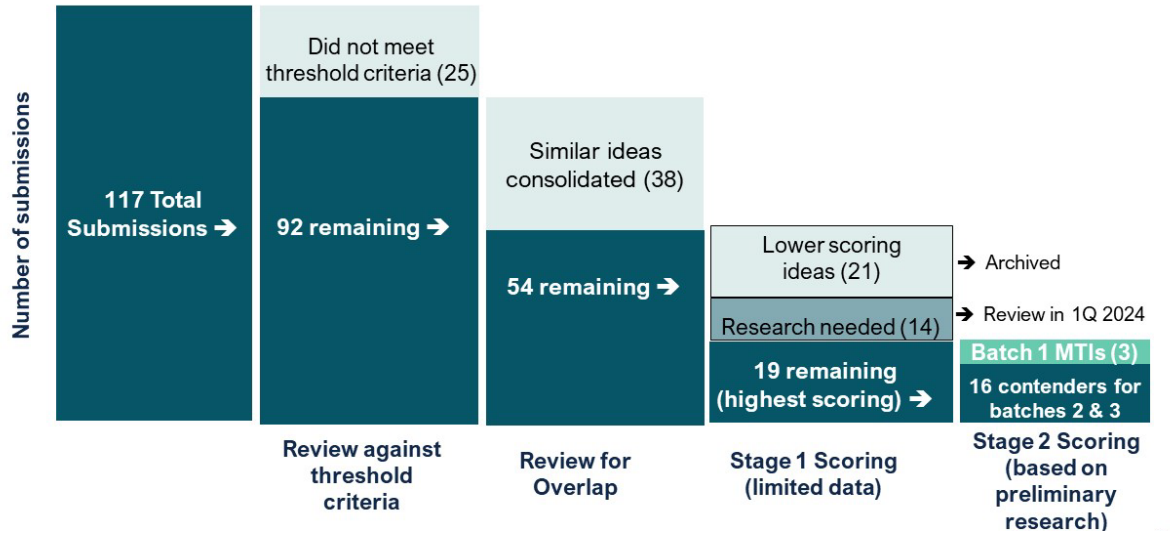
This memo provides CalMTA's recommendations for the second set of Market Transformation (MT) ideas to further develop through preparation of Advancement Plans.[1] It documents the selection process, the feedback provided by the MTAB, and CalMTA's response to this feedback. CalMTA appreciates the MTAB's input and expertise during the selection and design of market transformation initiatives (MTIs). MTAB has been instrumental in shaping the recommendations in this memo.

Context

CalMTA recently conducted a request for ideas (RFI) to collect market transformation (MT) ideas from interested industry stakeholders. This resulted in the submission of 117 ideas via a web-based process. The CalMTA team conducted a preliminary, Stage 1 scoring review on all the ideas and a second, more rigorous Stage 2 scoring review of the top 54 ideas.[2] The Stage 2 scoring process identified 19 high-scoring ideas to considered for further development. The Stage 2 scoring also identified 14 ideas that will be monitored for new research or changing market conditions that would strengthen the idea. The 21 ideas that received the lowest Stage 2 scores were archived for future consideration should market conditions change. This process is illustrated in Figure 1 below.

[1] An Advancement Plan identifies knowledge gaps on the idea and the research that will be conducted to fill those gaps to determine whether the idea is suitable to propose as a future Market Transformation Initiative (MTI).
[2] Further information on this process is documented in the CalMTA Stage 1 Disposition Report.

Figure 1. Disposition of Ideas from Request for Ideas process



Batch 2 Selection Process

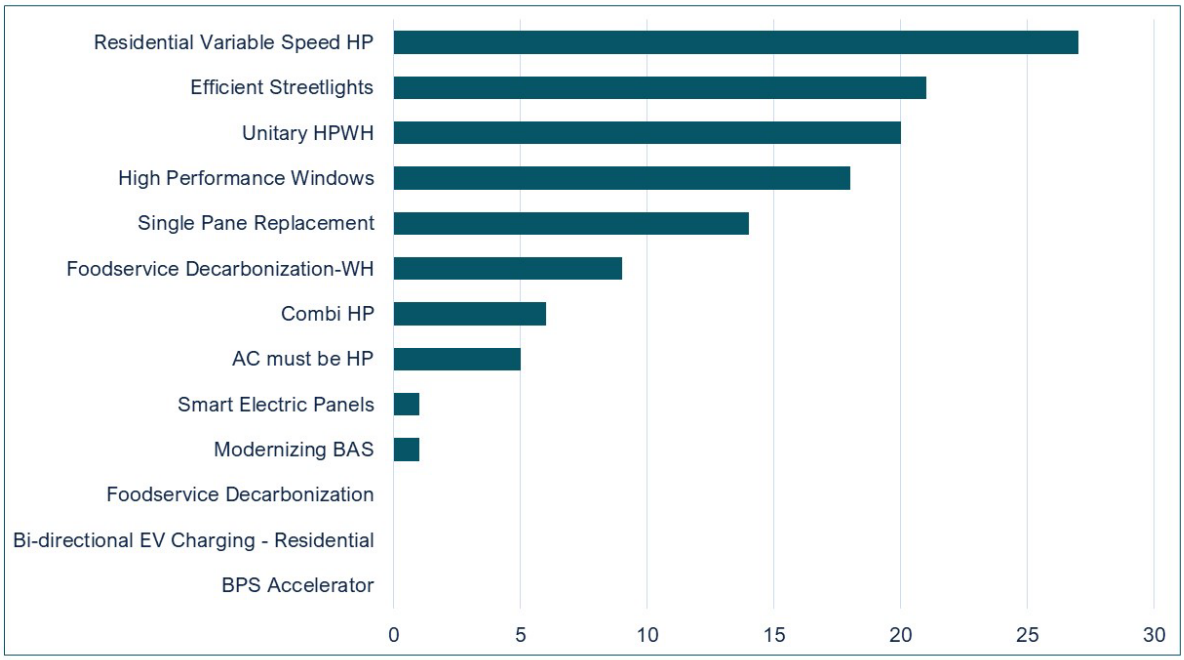
The development of Advancement Plans is being staged in 'batches' over time. A previous memo identified three ideas: induction cooking, portable/window heat pumps, and efficient RTUs (rooftop units). Development of those ideas, called "Batch 1," are being expedited to ensure that the CalMTA team can deliver at least one MTI plan by the end of 2024.[3] Ideas from the RFI that form "Batch 2" are the subject of this memo, and Batch 3 ideas will be developed during 2024.

The 19 ideas shown in the last bar in Figure 1 above were the set from which Batches 1 and 2 were drawn. CalMTA staff presented the 19 ideas to the MTAB, during a meeting on Nov. 30-Dec.1, 2023, to gather input and recommendations for which ideas to prioritize for further development. After each idea was presented and discussed, the MTAB members participated in an exercise to prioritize and rank them.[4] The total score for each idea was calculated by adding the votes for each, where an MTAB member's first ranked idea received five points, the second ranked idea received four points, etc. The final MTAB ranking of ideas is presented below.

[3] This first set of front runner ideas scored well, have well understood barriers and high leverage opportunities. This will 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 market deployment 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 set of MTIs, recognizing that other ideas may take more time to develop.

[4] The four ideas with the lowest Total Resource Benefit value estimated as part of the Stage 2 scoring were not included in the ranking exercise. These were bi-directional EV charging for fleet, LLLC + HVAC, heat pump integrated mechanical ventilation, and heat pump water heaters for multifamily.

Figure 2. MTAB Prioritization of MT Ideas for Further Development



During the discussion of the ideas, MTAB members recommended that food service decarbonization (encompassing both food service equipment and water heating) be considered as two separate ideas: one as initially proposed by CalMTA and a second idea that included only food service water heating. The MTAB members believed that transforming the market for food service water heating had a higher likelihood for success than transforming the market for other food service equipment and wanted the option to consider these separately.

Proposed MTI Advancement

As a result of the discussion with MTAB, CalMTA proposes developing four of the top six ideas recommended by the MTAB as Batch 2. Each of these 4 MT ideas scored well in our Stage 2 scoring process and would broaden the reach of the MT ideas currently in Phase 2. Although two of these proposed MT ideas have a TRC below 1.0, we believe that it is reasonable to conduct research to further our understanding of potential costs and benefits. In addition, the scopes of two of the MT ideas -– Food Service Water Heating and Single Pane Replacement -– have been modified since their TSB and TRC values were initially calculated.[5] The four ideas recommended for Advancement Plan development include:

- Efficient Streetlights
- Residential Heat Pump Water Heating (HPWH)
- Single Pane Replacement (commercial buildings)
- Food Service Water Heating

[5] The scope modifications were a result of the MTAB recommendation to pursue only the water heating aspect of food service decarb and the CalMTA staff suggestion to include commercial secondary windows in the single pane replacement MT idea.

CalMTA does not recommend advancing two of the top six MTAB ideas to allow time to understand certain aspects of the ideas as follows:

- **High Performance Windows:** CalMTA wants to better understand the energy savings potential of high-performance windows in the California climate. Specifically, we need to understand the impact of triple glazing, possible future ENERGY STAR specifications, and the interplay with solar heat gain (SHG) requirements. In addition, initial TRC calculations were very low for windows. CalMTA recommends more research into current and potential future incremental costs for this measure prior to any significant program development activities.
- **Residential Variable Speed Heat Pump (HP):** The CEC recently proposed updates to 2025 Title 24 that would require heat pumps as the primary heating source for single-family buildings. CalMTA wants to monitor the progress of this CEC proposal to assess the likelihood of its adoption and how that would change the CalMTA approach to this market or any needs for additional interventions.

The four ideas recommended to further develop through Advancement Plans are described below. These will be discussed with MTAB at the January 25, 2024, meeting. Advancement Plans will be developed for each that move forward after that meeting. These plans identify the gaps in knowledge about the idea and the research that will be conducted to fill those gaps during Phase II: Program Development.

Name	**Residential Heat Pump Water Heating**
Sector(s)	Residential multi-family, existing, and new construction
Portfolio Priorities	
☒ Equity ☒WE&T ☒ Energy Savings ☒ Grid Benefits ☒ GHG Reductions	
Product Definition	
Residential Heat Pump Water Heaters (HPWHs) use a compressor-based heating system to extract heat from the air and use it to heat water, making them far more efficient than conventional electric water heaters, gas storage water heaters, and gas tankless water heaters. Since they are all-electric, they also generate significant emissions reductions when replacing gas water heaters. Nearly all residential HPWH products are "hybrid heat pump" models that also include electric resistance heating elements for backup heating. These heating elements improve recovery times in periods of high demand for hot water, but they draw about 10x the power of the heat pump, so it is important for HPWHs to be sized, installed, and controlled to minimize the use of resistance backup during periods of high demand on the electricity grid. This MTI will focus on increasing adoption of efficient, demand-flexible HPWHs in the residential replacement market. Products include both 120-volt and 240-volt options, in sizes ranging from 40 to 80 gallons, and must be ENERGY STAR qualified with a Uniform Energy Factor (UEF) of 3.3 and a sound rating below 50db. The MTI will also support products with connectivity and controls that can manage and optimize electricity demand, minimizing the use of backup electric resistance heating	

during periods of peak demand for electricity. Lastly, the MTI will support sizing and design strategies (such as integrated thermostatic mixing valves) that ensure the water heater can support energy storage and load shifting without posing a risk to consumers.

Preliminary Market Transformation Theory

Residential HPWHs represent a substantial grid and energy efficiency benefit to California's building sector and will support the achievement of the state's decarbonization goals. There are numerous statewide and national efforts targeting this technology focused on product components, training efforts, awareness building, mid-stream incentive programs, barriers and acceptance in environmental and social justice (ESJ) communities, as well as equipment and installation costs.

As a result of the existing energy efficiency and decarbonization efforts in the HPWH market, it is evident that there are many barriers to acceptance as the collective efforts of various industry actors may be creating more confusion and haven't yet overcome the major market barriers. In California alone, between investor-owned utility (IOU), California Public Utilities Commission (CPUC), and community choice aggregator programs there are at least 20 programs estimated to be targeting residential HPWH and a deeper exploration into other entities and programs would potentially uncover additional efforts. Yet, despite the robust efforts behind this technology, HPWHs still make up less than 2% of the water heater market and have been commercially available for nearly 15 years. Given the sheer quantity of HPWH programs that exist in a market so fraught with barriers, there is an opportunity for CalMTA to develop a HPWH Market Transformation Initiative (MTI) that focuses on creating and supporting a cohesive statewide market strategy.

The HPWH MTI will establish a strategy that aligns existing efforts to create common goals, a strategic approach to market engagement, cost neutralization, and identify opportunities and processes to coordinate resources across program research, outreach, and education to accelerate the pace of HPWH adoption in California. This MTI will leverage intervention strategies primarily focused on facilitation, coordination, and long-term strategy design. It will build and support a mechanism for long-term coordination and collaboration with necessary and interested parties.

CalMTA will develop a long-term HPWH strategy that will:

- Identify long-term and short-term goals
- Prioritize efforts and align tactics with manufacturers, national efforts, and other market actors
- Identify shared market and program risks and create coordinated mitigation approaches
- Ensure the benefits of HPWHs are prioritized in ESJ communities
- Pool resources and explore: statewide awareness/acceptance building campaigns leveraging common messaging and tactics; common approaches and strategies to overcome installer acceptance; work force development needs; product development; localized code and installation barriers; etc.

The goal is not to replicate or replace the organizations already doing good work in California on HPWHs, but instead, to support coordination and ensure a longer-term strategy is guiding short term activities and efforts are connected, coordinated, and leveraged.

When successful, this MTI will equitably accelerate the pace of change, reduce market confusion on the direction and tactics of California's water heater work, and decrease overall costs required to move California's residential water heating stock to heat pump technology.

Possible Leverage Points

- Northwest Energy Efficiency Alliance (NEEA) has been actively engaged in transforming the residential water heating market since 2009, establishing and maintaining a product specification that is leveraged nationally and recognized by water heater manufacturers.
- New Building Institute's Advanced Water Heating Initiative (AWHI) is a national collaborative focused on building demand and educating the supply chain.
- ENERGY STAR's heat pump water heater program can be leveraged to create awareness and acceptance of the technology.
- Energy efficiency retail platforms, like the ENERGY STAR Retail Products Platform (ESRPP) and programs operated by the California investor-owned utilities (IOUs) (like Southern California Edison's online marketplace) could help create awareness and demand.
- California statewide programs aimed at accelerating adoption of HPWHs (i.e. TECH).
- California utility partners, community choice aggregators, community-based organizations, and public utilities. These partners are currently operating HPWH programs and CalMTA can learn from their efforts, research, and results. We will explore partnership opportunities to braid the individual work of these organizations with a larger statewide effort.

CalMTA Role

- Conduct research to map and identify synergies and gaps across statewide, local, and national efforts.
- Convene, coordinate, and facilitate statewide collaborative to design long-term (~10-year) strategy for HPWHs that aligns with California climate goals.
- Orchestrate the implementation of the 10-year strategy in partnership with other California programs.
- Track and monitor efforts and report on collective results.

2024 (Phase 2) Priorities

- Document and identify existing and upcoming programs/projects targeting HPWH in specific California markets including single-family, multifamily, manufactured housing, and additional demographics in ESJ communities.
- Coordinate outreach and engagement with program/project representatives and establish and maintain forum for collaboration.
- Conduct market characterization research and/or identify and leverage relevant research.
- Establish objectives and measurement approach for coordinated statewide intervention.
- Research and understand barriers specific to ESJ communities.
- Draft 10-year strategic plan aimed at accelerating adoption of HPWHs.

Name	Foodservice Water Heating
Sector(s)	Commercial Food Service
Portfolio Priorities	
☒ Equity ☒ WE&T ☒ Energy Savings ☐ Grid Benefits ☒ GHG Reductions	
Product Definition	
Medium-duty electric commercial water heaters with the ability to meet the unique hot water demand, delivery/recovery rate, and water temperature requirements of the foodservice industry offer significant emissions reductions and energy savings relative to the incumbent gas water heating technology used in most commercial kitchens. This MTI will support adoption of ENERGY STAR-certified, medium-duty commercial electric water heaters that are designed, configured, and controlled to optimize electricity use and allow demand flexibility. Additional opportunities to improve efficiency of electric water heating systems include: 1) integrated multi-function heat pump systems that provide simultaneous space cooling and water heating; and 2) heat recovery systems that capture waste heat from kitchens and dishwashing machines to pre-heat water or reduce overall hot water demand. The final specification may include requirements around sound level, footprint, and the use of low or ultra-low global warming potential (GWP) refrigerants.	
Preliminary Market Transformation Theory	
This MTI envisions a future state where commercial kitchens utilize electric water heating equipment to provide all required service water heating needs. This covers all foodservice facilities including restaurants, corporate cafeterias in office spaces, institutions, healthcare, schools, universities, and grocery stores. The commercial foodservice sector has the highest energy intensity of all commercial building types, consuming up to five times more energy per square foot than other commercial buildings. Roughly 28% of all commercial sector natural gas use is from restaurants and food stores as documented by the California Commercial End-Use Survey in 2006 across an estimated 93,300 commercial food service facilities operating in California.[6] As a result of decarbonization goals and regulatory pressures, there is a need and opportunity to establish a cohesive pathway for accelerating the market shift from gas to electric foodservice equipment. However, transitioning commercial kitchens from gas to electric across all appliances may result in significant upfront and ongoing costs. Specifically targeting water heating will allow CalMTA to explore carbon reduction strategies that may be applicable across broader commercial kitchen appliances while focusing on an end-use that provides a stronger value proposition to business owners. To reach and influence the target market this MTI will engage the supply chain and industry to increase the stocking, sale, awareness, training of available equipment while working with manufacturers to influence the development of new products.	

[6] Itron, Inc. 2006. *California Commercial End Use Survey*. Prepared for the California Energy Commission. CEC-400-2006-005.

Possible Leverage Points
• Partnerships with relevant California entities and programs such as the IOUs' Food Service Technology Centers and California Energy Wise. • Alignment with organizations such as the National Association of College and University Food Services, Foodservice Equipment Distributers Association, the North American Association of Food Service Equipment Manufacturers, the National Restaurant Association, the Manufacturers Agents Association for the Foodservice Industry, and/or the Restaurant Facility Management Association. • Partnership with California statewide and regional water heating programs. • Partnerships with national collaboratives such as the Advanced Water Heating Initiative.
CalMTA Role
• Conduct research to characterize the market, identify barriers, and support development of a complete market strategy. • Work upstream with manufacturers on product specifications that better meet the water heating needs of the foodservice market. • Engage wholesalers to enhance product availability and participate in midstream promotions. • Provide detailed research and training to bring awareness to the products, market, and value proposition. • Support standards programs (state and federal) with data and market research.
2024 (Phase 2) Priorities
• Market characterization study to research existing market structure, product flow, practices, and barriers. • Research current product availability and specifications inclusive of low and ultra-low GWP refrigerants, demand response capabilities, heat recovery, and required performance. • Conduct pilot activities to test market delivery and barrier removal strategies.

Name	**Efficient Streetlighting**
Sector(s)	Municipal
Portfolio Priorities	
☒ Equity ☐ WE&T ☒ Energy Savings ☐ Grid Benefits ☒ GHG Reductions	
Product Definition	
There are several ways to reduce the amount of energy consumed by streetlights, including more efficient luminaires and ballasts, design strategies that reduce the lighting intensity (while still ensuring driver and pedestrian safety), and advanced control strategies that allow lights to be dimmed or turned off in response to various inputs. This MTI will focus on LED streetlights with high (90+) Color Rendering Index (CRI) with dimming controls and automatic and/or controllable, regulation of light based on time, schedules, human presence, traffic, and/or weather. It will also support design and management practices that are tailored to the needs of local communities, enabling further energy and cost savings.	

Preliminary Market Transformation Theory

This MTI envisions 95% of streetlights in California have been upgraded to the latest generation of high-efficacy LEDs with high (90+) Color Rendering Index (CRI), allowing further reductions in wattage without compromising safety.

In California, roadway streetlights in a municipality or county are typically owned by investor-owned utilities (IOUs), the municipality, or a mix of both. Streetlighting can account for as much as 50% or more of a municipality's or county's energy bill, while retrofits or replacements to LED can result in savings in excess of 60%. There are currently an estimated 1.6 million streetlights in California that could be targeted for increased efficiency.

As a geographically well dispersed asset throughout municipalities, streetlighting can serve as a platform to leverage the Internet of Things (IoT) technology to help create an infrastructure for smart cities enabling wireless broadband connectivity. Streetlights can create additional local government service opportunities for smart parking, traffic monitoring, weather monitoring, EV-charging, voice broadcasting, interactive digital signage, and air quality monitoring.

Several barriers exist that inhibit the municipality's ability to install efficient streetlights and access these benefits including financial strain, not owning the streetlights, and incomplete information on available cost-effective options for older decorative models. These barriers disproportionately impact ESJ communities as the financial strain makes any action on efficient streetlights extremely difficult.

Establishing standards, processes, and financial resource information for IOUs and municipalities to rapidly convert high-wattage or outdated streetlight technologies to LED, or to switch out older generation LEDs to newer LED technologies, will spur market adoption. Education for municipalities on the variety of loans, financial tools and ESCO partnerships will also contribute to market growth. These in turn will create energy savings and make funds available for other pressing local government community needs.

The MTI will work with municipalities and other market actors to refine and establish streetlight design assessment resources and tools. These tools and resources will allow municipalities to take a more proactive and customized approach to streetlight design and conversion that will increase energy efficiency and provide other benefits. In addition, this MTI will engage the supply chain to streamline streetlight procurement and influence educational efforts for designers and installers, especially for decorative or historical lighting, which can be more challenging.

Possible Leverage Points

- Building on past California and current national program experience that has supported streetlight municipalization.
- Partnership with the California Streetlight Association (CALSLA), California League of Cities, and other organizations to help spread information on the benefits of LED conversion and municipalization.
- Exploration of other organizations that can be partnered with including but not limited to the International Dark-Sky Association, Connecticut Conference of Municipalities (CCM), Massachusetts Area Planning Commission (MACP), and New York Power Authority (NYPA).

CalMTA Role
• Engage with municipalities to provide information on the benefits and options related to LED streetlight conversion, financial resources and municipalization. • Engage with manufacturers and distributors to provide more comprehensive information on available retrofit options related to decorative and historical streetlighting. • Support the creation of a mutually beneficial and ongoing streetlight ownership program between municipalities and IOUs that offers tools and resources for municipalities to access. • Support the integration of streetlight control technologies by IOUs into existing tariffs to allow municipalities to take full advantage of savings.
2024 (Phase 2) Priorities

• Market characterization research to:
  ○ Quantify remaining non-LED streetlights, by ownership type, and streetlights and conversions that took place over 10 years ago in the state of California.
  ○ Investigate barriers to efficient streetlight conversion and the market interventions most likely to overcome those barriers.
  ○ Map the decision-making process associated with streetlight conversion decisions.
  ○ Investigate gaps in product/technical information and resources that would increase investment in efficient streetlights, if they were readily accessible.
• Market research to:
  ○ Understand IOU efforts to integrate streetlight control technologies into existing tariffs for municipal benefit.
  ○ Gain market insights from supply market actors and relevant partner organizations.
  ○ Understand municipal experience of ownership and current market desire for municipalization as an option.
  ○ Investigate the methods used in California and around the nation by municipalities to create positive streetlight municipalization conditions.

Name	Single Pane Replacement
Sector(s)	Commercial
Portfolio Priorities	
☒ Equity ☒ WE&T ☒ Energy Savings ☒ Grid Benefits ☒ GHG Reductions	
Product Definition	
Single Pane Replacement (SPR) utilizes the unique properties of vacuum-insulated glass (VIG) to increase uptake and investment in commercial retrofits, especially for buildings with single-pane glass. SPR involves the use of ultra-high-performance VIG with a nominal thickness of ¼" to ½" and an insulating R-Value of R-10 to R-15. VIG replaces a ¼" single pane glass (typical R-1) in existing commercial frames and improves thermal performance of the glass by a factor of 5-10x. To reach these efficiency levels, VIG manufacturing replaces the gas layer in a typical dual pane insulated glass unit with a thin vacuum layer. It replaces traditional rubber spacers and seals around	

the edges of the glass with miniature, 250-micron tall pillars distributed across the center of the glass to maintain the glass spacing, and a glass hermetic seal around the edges to maintain the vacuum. VIG creates a thermal barrier between the outside and inside air of a building and there is no convection between the glass panes as the vacuum displaces the air/gas which is required for convection to occur. Conduction exists at each pillar and the perimeter seal; however, performance is enhanced by as much as 500% over double pane insulating glass with one-third the thickness.

SPR with the VIG solution provides fuel neutral savings and reduces HVAC load by as much as 40% in heating driven climates and 20% in cooling driven climates. The reduced load then provides an easier pathway for commercial building owners to convert from conventional HVAC systems to heat pump systems at reduced electrical load.

Alternatives to replacing existing glass with VIG include Commercial Secondary Windows (CSW). CSWs attach to the interior or exterior of the existing window, creating an additional insulating layer and offering options for solar control via low-E films. CSWs are available as single pane and double pane attachments. CSWs provide a lower level of thermal improvement compared to VIG replacements, but still significantly reduce HVAC load, are a more mature technology, less expensive and, like VIG replacements, can be installed without opening the façade or disrupting occupants.

Preliminary Market Transformation Theory

Windows are responsible for about 10% of energy use in buildings and influence end uses that comprise 40% of building energy use. Although windows compose only 8% of a typical building's surface area, they represent 45% of thermal energy transmission through the building envelope[7]. The target market for this MTI represents over 75% of California's 3.2 million existing commercial buildings built between 1965 and 2000. The state did not mandate double pane glass until 2000, so many of these buildings have inefficient, single pane glass that needs replacement if these buildings are to be successfully decarbonized. Yet replacing windows is a very expensive proposition for building owners and involves extensive tenant disruptions. Most commercial building owners choose to upgrade the HVAC or improve roof insulation and leave the envelope alone due to a 40-50 year return on investment (ROI). Thus, despite their significant impact to energy use and occupant comfort, single-pane windows are replaced at a rate of only 1% per year.

The market for tackling poor performing windows with VIG and other secondary glazing products is growing but this technology still faces some significant barriers. In addition to the initial high cost of tackling inefficient commercial windows, market awareness is low. Most architects, building façade engineers and the glazing community are largely unaware of the products or the benefits. A third key barrier is the lack of a sufficient product and system (façade level) testing, certification, and documentation system. SPR with VIG will require robust engineering capability that includes building energy modeling to define ROI, structural requirements, pricing estimates, and waterproofing guidelines to mitigate any water and air infiltration issues when a renovation occurs.

CSWs have similar challenges as well, but because they don't replace the existing glass, structural and waterproofing considerations don't apply. Energy modeling may still be required to determine ROI

[7] Partnership for Advanced Window Solutions at U.S. Department of Energy

and/or utility incentives. Numerous CSW brands and models have already been rated by the Attachments Energy Rating Council (AERC).

This MTI will take advantage of growing awareness that poor performing, commercial windows need to be addressed if existing buildings are to be successfully decarbonized. A key leverage point will be the rise of commercial building performance standards that compel building owners to reduce their buildings' energy use, or face penalties. These building performance standards currently exist in several California municipalities and recent legislation will support the development of a statewide building performance standard.[8] A second strategy will be to leverage aggregators in the commercial building market which includes organizations like the American Institute of Architects (AIA), the Building Owners and Management Association (BOMA), energy service companies (ESCOs), and large commercial portfolio managers to build market awareness on VIG's and CSWs' extensive benefits and business case. The business case for the SPR VIG and CSW process includes:

- Reduced replacement schedule by 66%
- Reduced installation cost by 50%
- Reduced HVAC tonnage needs
- Improved window performance beyond current Title 24 requirements
- Eliminates the need for tenant displacements
- Reduced embodied carbon relative to a full window replacement
- And, guaranteed operational savings.

A third strategy will be to work with the National Fenestration Rating Council (NFRC) and other industry partners to build the needed testing, certification, and documentation systems for VIG. (CSWs, because they are an attachment product rather than replacement products, are rated by the AERC). A fourth strategy will be to engage local utility programs to offer incentives to help bring down the cost in the near-term.

Growing demand will drive fabricators to invest in VIG manufacturing equipment and more commercial glazing manufacturers will enter the market. With increased adoption and thus, increased manufacturing capacity, the price will decline. As the price declines coupled with the benefit of the easier installation process that does not impact tenants, the market will begin to shift to VIG and the rate of single-pane window replacement will increase.

Over time, as building performance mandates cover more existing buildings throughout California and awareness of the impact poor performing windows have on the entire electrification transition, SPR with VIG will become the standard practice in dealings with single-pane poor performing windows. Decisionmakers will be aware of the benefits, utilities will offer incentives to help drive down costs, a clear specification and rating will be in place, and the rate of single-pane retrofits will increase. CSWs, due to their lower cost and existing AERC ratings, may act as a bridge solution until VIG barriers can be fully addressed.

[8] SB 48 requires the California Energy Commission (CEC) to use the data from California's existing building energy benchmarking and transparency law to develop a strategy to decarbonize California's large existing buildings.

Possible Leverage Points
• Growing local and possible statewide building performance standards. • Statewide demand and supply aggregators and influencers like BOMA, ESCOs, AIA, and building owners with portfolios of buildings. • DOE's and Partnership for Advanced Window Solutions (PAWS) collaborative and national lab research. • Window industry aggregators: NFRC and AERC. • Rocky Mountain Institute (RMI) and other building tools that work to help building owners navigate the transition for existing commercial building to high performance and net zero. • Federal dollars targeting schools to address extreme temperatures.
CalMTA Role
• Engage national industry aggregators and manufacturers to build the needed testing, certification, and documentation systems. • Engage broader window replacement market with a possible tiered approach to dealing with poor performing windows. • Engage with PAWS to ensure that energy modeling and research efforts reflect the needs of California's building types and climate zones. • Develop pilots at targeted buildings and build the business case for SPR with VIG. • Build awareness of business case with industry demand and supply aggregators. • If needed, deploy trainings targeting glazers with CSW and VIG installation practices.
2024 (Phase 2) Priorities
• Conduct a market characterization study of current practices and products targeting commercial buildings with single-pane windows. • Scan market for current California projects to determine if more pilots are needed in certain building types. • Conduct product assessment on the VIG option versus other possible methods of dealing with poor performing windows like CSWs. • Engage manufacturers on product availability.

Portfolio Characteristics

Developing a robust portfolio of ideas will be an important consideration as CalMTA conducts Phase II activities in 2024. In addition to selecting individual MTIs, CalMTA needs to consider how the entire portfolio of selected ideas will perform compared to strategic goals. This is not unlike a financial portfolio where investments with higher risks and rewards are mixed with lower risk and reward investments to manage risk. After discussions with the MTAB, CalMTA identified characteristics of the MTI portfolio that will be important to monitor -- even though not every MTI will address or perform well against every characteristic. Key portfolio characteristics for both the Batch 1 and 2 ideas are shown in Table 1 below.

Table 1. Characteristics of proposed MTIs in Batch 1 & Batch 2

Idea Name	Batch	Sector	Ramp Rate/ Timing	ESJ	WE&T
Foodservice Decarbonization - Water Heating	2	Comm	Long	Med	Med
Streetlight Efficiency	2	Muni	Med	Med	Low
Single Pane Replacement (SPR) Windows	2	Comm	Long	Med	High
Residential Heat Pump Water Heaters	2	Res	Short	High	High
Portable/Window Heat Pumps	1	Res	Long	High	Low
Induction Stoves and Cooktops	1	Res	Long	High	Low
Efficient Rooftop Units (ERTUs)	1	Comm	Med	Low	High

The current ideas address the commercial, residential, and municipal sectors, but none of the current ideas primarily target the industrial or agricultural sectors. This is a gap that CalMTA aims to address in future idea selections.

Ramp rate is an estimate of how long the idea will likely take to begin generating market impacts. The current set of ideas includes residential heat pump water heaters, which will likely generate savings quickly, but most of the ideas have a medium or long-time horizon meaning, the impacts will take years to accrue.

Lastly, the ideas provide strong coverage across environment and social justice (ESJ) communities as well as opportunities for workforce education and training (WE&T). The assessment of WE&T is driven by both the presence of an WE&T opportunity and the size of the installer market in question.

Next Steps

CalMTA will discuss the selection of the four ideas proposed in Batch 2 and described in this memo with the MTAB in January 2024. Based on MTAB feedback, CalMTA will finalize the Batch 2 recommendations and develop Advancement Plans. Drafts of those Advancement Plans will be delivered to the MTAB for review in June 2024.