MTAB Meeting Notes

May 6, 2026
Hybrid (In-Person and Virtual) Meeting

Welcome & Agenda

Stacey Hobart opened the meeting with a review of the meeting agenda and MTAB member introductions, including two new members: Jillian Rich from the Sacramento Municipal Utility District (SMUD) and Abhilasha Wadwha from the California Public Utilities Commission (CPUC). She celebrated MTAB's third anniversary and asked MTAB members to share their hopes for the next three years.

She then asked MTAB members for any comments regarding draft notes from the previous meeting (3/25). There were none.

Commercial Replacement and Attachment Window Solutions (CRAWS) Market Transformation Initiative (MTI) Plan Overview

Nick Fiore presented an overview of the CRAWS MTI, including the market opportunities and potential benefits, target audience for CRAWS adoption, and strategy to promote a cost-effective "envelope first" approach to building decarbonization. Rick Dunn shared an overview of the non-energy benefits (NEBs) associated with CRAWS technology and the impact for building owners, financial institutes, and utilities. MTAB questions and comments included:

- Customer willingness to pay is not necessarily a quantitative benefit but does relate to the viability of the MTI. To determine how valuable NEBs are, CalMTA will need to confirm they are relevant to building decision-making from an analytic/cost-effectiveness or strategic perspective.
- While the MTI strategy should absolutely leverage and seek to take advantage of the NEBs opportunity to promote adoption, the TRC cost-effectiveness test is indifferent to ratepayer subsidies. The PAC test might better reflect NEBs if it's true that the ratepayer subsidy is lower than it would be otherwise. NEBs are critical to conveying the value proposition of CRAWS products but their value to utilities is less clear.
- The impact of NEBs on customers' willingness to purchase CRAWS products is important and good to see, but are contractors willing to sell these products instead of a full replacement?
    - Rick replied that value propositions vary for distinct market segments and that the contractor value proposition will likely evolve over time – it will be important not just to define the core value proposition for contractors but also determine when and how to share it.

- Benefits messaging should also capture the relative time and operational impact of CRAWS products. Installation of a secondary window could be completed by contractors in one day but a full window replacement could take weeks or longer and would require the building to be empty.
- Are the NEBs associated with CRAWS products more significant than with other MTI technologies? Why are they such a critical focus here?
    - Rick clarified that appliances and other products tend to get replaced more frequently than windows, so the decision-making process focuses on which appliance to purchase. With windows the baseline is often doing nothing at all, so the NEBs are critical to inspiring action.
- The ecosystem of strategic energy management (SEM) programs could be tapped into, as NEBs would factor into this. CalMTA might want to also consider adding the benefit of moisture control.
    - Rick agreed and noted that that California Energy Commission (CEC) and CPUC are both pursuing research into how to quantify and potentially assign monetary value to NEBs.
- The Energy Trust of Oregon found that SEM program participants had a higher rate of investment in capital energy projects, so this is likely a good market to address. Building a viable new retrofit market is the definition of market transformation, so this MTI is exciting.

Nick walked through identified market barriers and challenges for the CRAWS MTI, which CalMTA will seek to address. This was followed by Rick presenting the product definition of commercial secondary windows (CSW) and vacuum-insulated glass (VIG). MTAB feedback included:

- Replacement measures are often included in plans for required building upgrades. Because windows typically aren't, the capital isn't allocated and there may not be money available to invest in them.
- The one disadvantage of CRAWS products compared to full window replacement is that it does not address thermal losses associated with the frame itself.
    - Rick acknowledged this issue but noted secondary windows can help with frame losses because these products are sealed around the existing frame, not just attached to the glass, they create an insulation bubble around the frame and do reduce thermal losses.
- Since the MUSH market is a target for this MTI, this may include many historical buildings that are over 50 years old. Are there specific benefits for this segment?
    - Rick affirmed that because historical buildings are typically prohibited from full window replacement there has been a lot of early success in this segment.
- From a customer perspective, maintenance training and warranties for these products will go a long way in building trust and potentially demand since it would mitigate concerns about equipment failure and should be built into the installation process.

    - Rick agreed this would be important overall. CSW products are AERC-rated and have manufacturer warranties. For VIG products, there is no control over the frame and it is unclear who owns the warranty, which is one of the reasons CalMTA didn't model this technology as a component of the MTI at this stage.
    - VIG is more of an emerging technology than CSW. While there are engineering estimates for its efficiency gains, less is known overall and the products are not rated. In light of these risks, CalMTA will continue to validate the potential benefits of this technology if it's included in the MTI.

CRAWS: Market Adoption Forecast

Isaac Schultz provided an overview of the CRAWS adoption forecast model. MTAB comments and questions included:

- Will CalMTA distinguish between north-facing windows where glare is less of an issue? Robust data sets exist that could be purchased from companies that conduct 3D building modeling to narrow down to factors like this beyond the current estimates.
    - Isaac noted that in the current stage of MTI development, a larger-scale model that factors in building orientation and feeds into calculation of window area energy savings provides a sufficient basis.
    - Smita Gupta added that once the MTI moves into the market deployment phase, more granular data may be warranted and this will be explored.
- The rationale behind using DEER at this stage makes sense, as it's familiar and vetted by the CPUC, whereas more granular data sets are less familiar and may not be as trusted. More precision belongs in the implementation stage and using a data set that's familiar to the Commission and used in other active energy efficiency programs feels like a good conservative approach.
- CalMTA should consider how the pre-NAICs code and building type categorization in the pulled sample (from the California Commercial End-Use Survey [CEUS]) compares to the disposition and how any differences might impact CalMTA's findings. If the difference between modeled and corrected building types appears in published results, that could help the team understand areas of vulnerability.
- This market has been challenging for energy efficiency programs to address but it is very important, so it is worth waiting to attempt for more precision and keep moving forward with the current approach.
- Because MTI is looking at the entire stock, this modeling seems more like a retrofit market penetration model rather than a replacement market analysis that would look at a share of the stock. As a reality check, it would be good to know the rate of renovation on eligible buildings and whether CalMTA expects to get more than what would happen naturally.
    - Isaac said that this presentation would show the rate of expected installations against the baseline (without MTI interventions).
- Because this is a fuel-agnostic MTI, is SoCalGas's service territory included?

    - Staff committed to checking on this question. The response is included in these meeting notes for the record.
    - Response: In response to the question and discussion about subtracting impacts in non-IOU service territories, we reviewed and revised our methodology to include gas system impacts in gas IOU service territories that are served by POUs. See Appendix B, section 3.5 of the CRAWS MTI Plan for detailed documentation of the approach.
- Is the MTI's target growth rate looking to double the current trajectory?
    - Isaac confirmed that the MTI was targeting this significant acceleration.
- The non-MUSH growth rate is much closer to the MUSH growth rate than might be expected from the MTI's focus on MUSH market. What assumptions about spillover impact that?
    - Rick clarified that this growth won't occur at the same time. CalMTA expects the non-MUSH market to take off later and to still be below the MUSH market. A similar rate of uptake can occur over time but it will take longer to build the value proposition. For the non-MUSH market, statewide BPS might be a "stick" that complements the "carrot" of CRAWS benefits.
- The MTI is trying to accelerate adoption of this technology but it seems like the growth rate will start slowing down relatively early in the lifecycle, even as costs go down.
    - Isaac replied that this does not mean that adoption will stop but the cost impacts are different than other MTIs. The materials that go into manufacturing CRAWS are already widely available so the economy of scale is different.
    - Rick noted that while CSW material costs are unlikely to change significantly, labor costs likely will decline significantly through MTI workforce development efforts. For VIG, there are more opportunities for material cost reduction but less for labor costs, since glazers are already doing this work. Utility rates can help the value proposition but don't necessarily factor into this modeling.
    - Jeff Mitchell added that CalMTA will look into this more. In the adoption curve, the inflection point reflects the transition from the easier-to-reach market to the harder-to-reach market.
- Labor, materials, and mark-up are the primary factors that impact cost. MT often requires installers to go from a competitive premium to an innovation premium, which creates opportunity to drive cost down -- the MTI will need to figure out how to get them to do that.
- In its application, CalMTA should highlight strategies specific to the equity market/environmental and social justice (ESJ) communities and communicate the benefits CRAWS delivers to them.
- The MTI's long-term outcomes include increasing the number of municipalities that cite CSW in their planning, but this should occur earlier since amending climate action plans can take years.

    - Rick clarified that while outcomes reflect the final result, there are short-term activities that would start much sooner, including building awareness with municipalities.
- The value proposition for CRAWS needs to include some kind of guarantee/warranty, either beyond what manufacturers are currently offering or highlighting that warranty, to ensure no remediation will be needed and to mitigate risk/maintenance issues. Negative word of mouth can set the market back significantly and drive consumer pushback.
    - Rick agreed this was an important point. Influencing adoption of emerging technologies often requires working with manufacturers to assuage perceived risk. The current CSW warranties are about 2 years; if CalMTA finds out that is insufficient we can work to drive extended warranties. More work is required to understand what's needed for VIG and get manufacturers to warranty products that are installed in frames they don't own or make.
- Precision during the implementation stage may help strengthen the business case. The business case is more likely to pencil out where higher energy impacts are possible, which could depend on different climate zones, building orientations, etc., so when the averages that go into this forecast are "de-averaged," the technical potential of energy savings could look quite a bit different.
- Looking at the differential between MUSH and non-MUSH segments in 2047, how much of that is about it being harder to move the non-MUSH market and the barriers associated with buildings that are likely not owner-occupied?
    - Rick said that the non-MUSH market doesn't experience the associated energy savings if they're not paying the utility bills so it will really be about quantifying benefits like increased asset value, which will take longer to realize. For the MUSH market, benefits accrue on the first day.

Meet & Greet with Equity Sounding Board Member

Alicia Bohigian of Self-Help Enterprises, one of the eight active members on CalMTA's Equity Sounding Board, shared her background and experience participating in this group. MTAB members engaged in an informal discussion with Alicia based on her presentation.

Public Comment

No public comments were received.

CRAWS: TSB and Cost-Effectiveness

Isaac provided an overview of the process, inputs, and results of CalMTA's Total System Benefit (TSB) and cost-effectiveness calculations for the CRAWS MTI as well as sensitivity analysis findings. MTAB comments and questions included:

- CalMTA should explore whether any CRAWS products are included in existing custom projects. This is probably not significant but would be helpful to acknowledge.

- Newly approved measure packages usually come before inclusion in programs -- where did the CSW measure package come from?
    - Jeff replied that CalNEXT developed this measure package so there may be intentions to include it in programs, but this is to be determined.
- As programs are rolled out with measures that have new approved workpapers, sometimes the real-world values are different and the Program Administrator (PA) needs to adjust based on actuals. Does CalMTA have a plan for corrective action if the TRC/TSB isn't what we anticipate now?
    - Jeff said that as the MTI moves into market deployment and gathers real-world data, models will be updated and reported to MTAB. The numbers presented now will not be the numbers shared in 10 years, but starting with this conservative number is a good approach.
- Since CalMTA doesn't know if the true TRC is above or below 1.0, it would be viewed positively if CalMTA can argue that this estimated TRC is on the low-end and that the odds of overperforming are better than the odds of underperforming.
- The risk assessment in each MTI Plan isn't necessarily a corrective action plan but looks at variables that could be different in reality, which seems to be well addressed.
- As a qualitative rationale, the CPUC is very interested in advancing measures that don't increase grid demand and CRAWS would fall into that category. The decarbonization proceeding also includes a directive to pursue strategies that avoid panel/infrastructure upgrades. CalMTA may want to analyze load-shedding/peak-shifting potential, even if that was estimated at a high level.
- Why do lower CSW costs not take the TRC above the base case?
    - Isaac replied that as product cost decreases, more end-use customers are able to adopt the technology, resulting in larger initial total market potential. However, this expanded market pool also includes additional load shapes and scenarios that offer a lower return-on-investment to the end-use customer. The lower incremental cost per unit leads to higher adoption and higher TSB, but the total incremental costs to the customer increase at a higher rate than the total TSB, resulting in a lower overall TRC.
- A 30-year estimated useful life (EUL) seems extremely feasible and seems to significantly impact TRC, so modifying the product definition seems worth considering.
    - Jeff agreed that CalMTA would explore this and that the current 20-year EUL aligns with the approved eTRM, which is the source of most available data.
- The sensitivity analyses seem to indicate the success of this initiative is relatively immune to market variables – the TRC estimate holds up over a range of circumstances.
- If BPS takes effect, it would likely drive demand and supply will follow, so there might be some intersection between this and the lower product cost scenario. CalMTA may want to explore what that looks like.

- The CEC's first round of BPS standard-setting will likely be more akin to benchmarking and won't fully kick in for eight years or so.
    - Rick said that the later timeline for actual BPS implementation is somewhat accounted for but CalMTA will continue to dig in deeper and adjust timelines as needed.
- Are changing electrical/gas rates factored into this analysis?
    - Isaac replied that they were not since CRAWS products do not directly consume fuel of any sort.
- Sensitivity analyses demonstrate that the two ways to provide the greatest incremental benefit to the MTI are technology-related (30-year EUL) and lower measure cost (significant increase in adoption).
- Capturing VIG cost but not benefits in this modeling is a hedge but accommodates some unusual considerations and could be a beneficial hedge.
    - Rick noted that the incremental spend for VIG is modest overall. The work to get VIG ready to model is largely led by national labs – and the benefits could be notable.
- Extending the EUL should also factor in savings reductions due to product degradation.
    - Rick replied that CalMTA has talked to manufacturers about this. Most savings come from low-E films, so even if the U-value goes down, savings should stay relatively constant for well beyond 30 years.

CRAWS: Appendix F: Evaluation Plan

Jun Suzuki walked through the process used to develop the CRAWS Evaluation Plan and the proposed market progress indicators (MPIs). MTAB feedback included:

- Looking at the total sales goal for the state and not just the sales claimed by the MTI, how much of an increase is this over baseline?
    - Jun replied that the current baseline is near zero so most of this would be incremental.
- In thinking about market indicators, it would be challenging but impressive to get HVAC-only upgrades to include windows first -- perhaps CalMTA could conduct sensitivity analysis to see the impact.
- The influence of NEBs on decision making is very different than quantification of NEBs, so these shouldn't be conflated -- they may be linked but not sure how often.
- CRAWS is a favorite MTI and there's a strong desire for it to succeed, but some of the MPIs may not fully demonstrate the success of the MTI or could prove too difficult to back up. The medium-term outcome of ESCOs recommending CRAWS feels hard to achieve, for instance, as getting salespeople to do something different can be very challenging.
- As access to this data becomes more available and adoption increases, CalMTA could look at what's actually happening in building energy consumption.

    - Jeff acknowledged that the models used to estimate impact don't always reflect real-world conditions due to variance in building stock.
- In looking at PA program data, is this inclusive of meter-based analysis/normalized metered energy consumption (NMEC) analysis to look at actual reductions in energy use? And then will evaluations assess how close we are to that estimate?
    - Rick said that the MTI is not seeking to evaluate measure-/user-specific energy savings as a milestone.
    - Jeff noted that MTI demonstration projects will help produce real-world savings estimates to refine these models. The PA program data component is referencing the fact that savings claimed by other programs are subtracted out from the incremental savings to avoid double-counting.
- As data becomes available during market deployment and adoption increases, it may be worth examining what is actually happening in terms of building energy consumption or energy intensity.
- What PA programs will be a key source of data for the evaluation?
    - Jeff clarified that this would be any relevant data reported in the California Energy Data and Reporting System (CEDARS), which may show up in different ways (e.g., non-metered energy savings or program cost data) but should be able to be backed out by CalMTA in the needed format. CalMTA is focused on deemed savings.
- If CalMTA does have the bandwidth to conduct its own M&V, it might be good to look at more accurate meter-based analysis instead of deemed. The CPUC has made this happen for other implementers.
- Does CalMTA intend for any CRAWS work to ultimately end up in the statewide codes and standards major alterations track?
    - Rick said that the magnitude of the renovation triggers code already and there are already Title 24 requirements for renovations of a certain size.
    - Jeff added that MT usually ends with a lastingness mechanism, which is often locking it in as a code or standard. For this particular measure, the target market is about 14% of the overall market so CalMTA considers the desired outcome one in which CRAWS is standard practice for the scenarios where the economic benefits are strongest. BPS or other policies may arise that open up the opportunity to lock this in in some way.
- Major alterations would typically already include window upgrades, but maybe there's a conversation to be had with the CEC while CalMTA is at this conceptual level – is there a midpoint where a certain code has been triggered that is not major alterations? In the early stage of LED promotion, some aspects were not captured in major alterations but still triggered code through factors like light fixture changes. Maybe CRAWS falls in a similar spectrum before major alterations.
- Targeting inclusion in climate action plans feels out of place. CRAWS products may be better suited to 5-10-year plans used to steer capital investments, since climate action

plans rarely get down to the measure-specific level. CalMTA may want to look at the state architect's office, campus master plans, CalGreen, or reach codes instead.

- NMEC is a very difficult tool for capturing real-world building energy performance and it is not desirable to burden the MTI with a modeling problem. Energy savings are always going to be modeled, and it seems better to refine and build on modeling and currently available data than pursuing NMEC.
- Installer training should happen sooner – it's important to ensure these products are installed properly and in a way that's noted by manufacturers right from the start. Does CalMTA assume there will be some activity around CSW in 2027 while waiting for the CPUC decision to enable 2028 to be an effective measurement milestone (testing awareness in 2027 before measuring it in 2028)?
    - Jeff replied that CalMTA is assessing what's possible in the interim phase now, but the 2029 milestones reflect the impact of activities that would begin sooner.
    - Lynette Curthoys added that CalMTA is trying to solve the challenge of having initiatives in Phase II longer due to the required application process vs. Advice Letter and the associated budget impacts for the second tranche of MTIs.
    - Rick clarified that 2029 is the measurement/evaluation point and not when activity starts. Manufacturers have been willing to engage sooner but proof of concept is still needed for large-scale action. CalMTA is hoping tee things up so once the demand signal is there, manufacturers can hit the ground running.
- Custom programs offered by the IOUs or other PAs could potentially manage or co-pay for installation management.
- The exit strategy for this MTI still needs to be clarified. Deeming technology into a BPS would be very difficult to implement and faces a lot of potential political opposition.
- Could the PAs or CalNEXT do something to provide a market assist that encourages manufacturers to spend more on business development while CalMTA is waiting for CPUC approval?
- Rather than, or in addition to municipal climate action plans, CalMTA should consider specifying BPS requirements that will drive adoption of CSW.

Application Overview

Smita Gupta shared a high-level summary of the contents and strategy for CalMTA's second application requesting CPUC approval of MTIs for market deployment. MTAB feedback included:

- CalMTA should clearly convey the benefits of each MTI beyond TRC, particularly those with lower TRC estimates, such as the potential impact of CRAWS in schools.
- The significant GHG reduction benefits estimated for the second tranche of MTIs seems important for the CPUC to consider.
- Affordability continues to be a major concern for the CPUC, so application messaging should address the ways these MTIs improve consumer/ratepayer affordability. There

are different ways of talking about why this is worthwhile for ratepayers to fund and it is important to make that pitch.

- Looking at the cost compared to the TSB, the investment seems relatively small in terms of immediate impacts, especially given the scale of what things cost in California. Part of the messaging should communicate that the minor investment yields very large benefits over time, and that's the value of MT.
- The application should capture the myriad benefits of these MTIs when describing the second tranche's value: there are system benefits, customer/individual participant benefits, non-participant benefits, etc. Having a portfolio that increasingly touches more customer segments is valuable for buy-in, so telling the story of expanding beyond residential MTIs and building a diverse, well-balanced portfolio will be important.
- With regard to CRAWS, the office sector is in crisis and owners/developers are likely to triage buildings into bins: the smaller ones they can convert to residential, another bin that they will try to make competitive, and another bin that will be abandoned.
- Owners will be looking for low-cost ways to stay competitive or make properties suitable for residents. CRAWS can be that solution and help "rescue" buildings that might otherwise be abandoned, which creates a kind of public value.
- This tranche brings in the cross-sectoral value of going beyond just residential and commercial and focusing on the MUSH market brings in public institutions that are cash-strapped. It creates a way to invest in municipalities and communities with a strong equity component and provide value there.
- Specific to CRAWS, the MTI represents an opportunity that could otherwise be truly lost. While the measure obviously saves energy, if somebody is going to upgrade an HVAC system there is a chance to prompt building owners to ask to have the envelope evaluated at that time. Maybe the contractor won't sell it yet, but if the building owners know how to ask for that evaluation and look at things simultaneously then the MTI does reduce impact on the grid. It's been really hard to make window programs pencil out as resource acquisition programs and there are so many barriers, but windows are one of the best enabling measures to help reduce the impact of other energy consumption in buildings.

Public Comment

No public comments were received.

Next Meeting & Next Steps

Stacey shared CalMTA's plan for the remaining scheduled meetings in 2026.

The meeting was adjourned.

Attendees

MTAB Members

Mary Anderson, Pacific Gas & Electric
Cyane Dandridge, SEI
Hayley Goodson, TURN
Fred Gordon, Context Consulting
Jeff Harris, Northwest Energy Efficiency Alliance
Peter Miller, Natural Resources Defense Council
Christie Torok, California Public Utilities Commission

Participating Staff & Consultants

Lynette Curthoys, CalMTA/Resource Innovations
Rick Dunn, CalMTA/Resource Innovations
Nick Fiore, CalMTA/Resource Innovations
Smita Gupta, CalMTA/Resource Innovations
Stacey Hobart, CalMTA/Resource Innovations
Jeff Mitchell, CalMTA/Resource Innovations
Isaac Schultz, CalMTA/Resource Innovations
June Suzuki, CalMTA/Resource Innovations

Guests

Don
Arambula, DAC
Alicia Bohigian, Self-Help Enterprises
Rob Bohn, PG&E
Sazi Bugay, Summit Appliance
Paul Campbell, ICF
Julie Cantor, MCE
Brianda Castro, Central California Asthma Collaborative
Deepti Dutt, Energy Solutions
Maureen Guttman, Energy Solutions
Randall Higa, SCE
Aubrie Hunt, Sonoma Clean Power
Martin O'Gorman, Summit Appliance
Emily Pelstring, CPUC
Stephen Selkowitz, Lawrence Berkeley National Laboratory
Jeff Staller, West Monroe
Allegra Steenson, Pacific Northwest National Laboratory
Simpson Tanner, Energy Solutions
Gabriel Taylor, California Energy Commission