



Commercial Replacement and Attachment Window Solutions Market Transformation Initiative

Appendix G: Risk Management Plan

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Introduction

This document details the potential risks that could negatively impact the Commercial Replacement and Attachment Window Solutions (CRAWS) Market Transformation Initiative (MTI) and CalMTA's plan to monitor and mitigate the risks. Additional information is included to establish the severity of the risk, likelihood of occurring, indicators that the risk is occurring, and assumptions around the possible mitigation approach. If the risk is designed with an “*”, then the risk is listed in Section 9 of the CRAWS MTI Plan as part of the summary of key risks that could impact this MTI.

Ongoing monitoring of market progress indicators (MPIs) and milestones will inform the team when risks are manifesting, to what degree, and which risk mitigation strategies should be undertaken.

To the extent reasonable, the risks are listed in the chronological order in which we expect them to become evident (assuming they occur), generally corresponding to the timing of CalMTA's planned strategic interventions.

For “Probability of Occurring” in the third column, CalMTA is defining:

- **High:** Through our research and discussion with market actors, CalMTA deems this risk having a high probability of occurring. The program needs to monitor closely and identify a solid backup plan with resources that can be deployed to mitigate the risk if it comes to fruition.
- **Medium:** This risk has a medium probability of occurring given what we know about the market. The MTI needs to track and have a plan to mitigate.
- **Low:** The probability of this risk occurring is low based on what's known about the market to date. It could have some impact on the need for resources and timing, so the MTI needs to track it.

For “Severity” in the fourth column, CalMTA is defining:

- **High:** If this risk plays out and our mitigation approach is unfeasible, then the success of MTI may be in jeopardy.
- **Medium:** This may have an impact on the timing or overall success of the MTI, but a solid mitigation approach exists, and the MTI will be able to pivot with more time or resources.
- **Low:** This level of risk will likely require a program intervention adjustment, but it will not jeopardize the timing or resources needed level.

Appendix G: Risk Management Plan: Commercial Replacement and Attachment Window Solutions

*CalMTA is a program of the California Public Utilities Commission (CPUC)
and is administered by Resource Innovations*



Table 1. Risk assessment



indicates possibility of greater impact on Environmental and Social Justice (ESJ) communities.

#	Risk	Probability of occurring	Severity	How will we know the risk is occurring?	Responsible & tracking	Mitigation approach
1	Unable to carry out combined HVAC/CRAWS pilots: Building owners do not agree to or see value in including CRAWS technology as part of HVAC upgrade/replacement resulting in lack of field data on combined benefits.	Low	Medium	Scheduled team meetings and engagement with building owners or HVAC designers during Commercial Rooftop Unit (CRTU) pilot design	Strategy Manager and Program Manager	In order to overcome the financial barrier to window inclusion in HVAC project scoping that building owners face, CalMTA can fund partial or whole window purchases. In lieu of real-world data from a combined HVAC/window pilot, we can utilize modeling approaches and existing savings calculators to estimate HVAC downsizing potential and operational savings. To ensure proportionate participation from ESJ communities, conduct early outreach in collaboration with Community Based Organizations (CBOs) and other ESJ advocacy organizations, similar to what was done for the Phase 2 pilot. The goal of this engagement would be to create awareness of pilot opportunities, identify potential demonstration sites, and build trust among ESJ decision makers.
2	Energy savings alone are insufficient to support an envelope first business case in California climate zones: Energy savings are primarily from HVAC cooling savings. Some buildings and certain climate zones may have insufficient HVAC savings to justify the investment in CRAWS technology.	High	Medium	Data from pilot studies	Strategy Manager and Product Management	Demonstrate CRAWS’s substantial non-energy benefits (NEBs) including thermal comfort, noise reduction, resilience, and increased asset value.



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#	Risk	Probability of occurring	Severity	How will we know the risk is occurring?	Responsible & tracking	Mitigation approach
						Negotiate bulk purchase or purchase commitments with manufacturers to drive down material costs. For commercial secondary windows (CSW), develop educated labor force to bring down installation costs. Demonstrate value of CRAWs technology in defining optimal pathways to meeting Building Performance Standards (BPS) targets.
3a	 Unable to sufficiently quantify NEBs: The first step in estimating the monetary value of NEBs is to utilize a standard method for quantifying or qualifying each NEB. A method will need to be identified or established for each NEB.	Low	Medium	Engagement with U.S. Department of Energy (DOE), national labs, utilities, and Program Administrators (PAs)	Strategy Manager and Market Research and Evaluation Lead	We will build upon current and past examples of NEB quantification from utility programs and other energy efficiency organizations to develop standard methods for NEB measurement.^{1,2,3} Where quantification cannot be achieved, we will utilize market actor interviews and surveys to develop qualitative estimates of NEBs. Since NEBs vary by building segment, we will focus early efforts on those segments where NEBs are more easily quantified while working to develop standard methodology for remaining building segments.

¹ California Energy Commission (CEC) Order Instituting an Informational Proceeding (OIIP) 24-OIIP-03, March 2024. <https://www.energy.ca.gov/proceeding/order-instituting-informational-proceeding-non-energy-impacts-nei>.

² Market Rate Equity Segment Non-Energy Benefits Research Plan, ILLUME Advising, LLC & Industrial Economics, Inc.; prepared for SoCalGas, July 2025. https://pda.energydataweb.com/api/view/4183/CA%20Market%20Rate%20Equity%20Segment%20NEBs%20Study%20Research%20Plan%20v20250701_clean.pdf.

³ Non-Energy Impacts Approaches and Values: an Examination of the Northeast, Mid-Atlantic, and Beyond, Northeast Energy Efficiency Partnerships, June 2017. <https://neep.org/sites/default/files/resources/NEI%20Final%20Report%20for%20NH%20updated%2010.4.17.pdf>.



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3b	 Unable to determine monetary value of NEBs: If unable to estimate a monetary value for NEBs, it would negatively impact CalMTA's ability to build the business case for CRAWs technologies.	Medium	Medium	Interviews with building owners and Energy Service Companies (ESCOs)	Strategy Manager and Market Research and Evaluation Lead	Initially focus on NEBs that don't necessarily have to be monetized to convey value (e.g., thermal comfort, noise reduction and indoor air quality for owner-occupied buildings, increased occupancy rate for commercial office space, historical preservation, etc.). Continue to pursue more complicated monetization efforts (e.g., increased asset value for commercial office space) as market gains familiarity with CSW and vacuum insulated glass (VIG) and other barriers are overcome. Reinforce other elements of value stack including energy benefits, HVAC downsizing, and BPS compliance (fine avoidance) to reduce reliance on estimated monetization values.
4	Combined energy and NEBs are insufficient to establish compelling business case for beachhead markets: Modeling and measured savings from Northwest Energy Efficiency Alliance (NEEA) field studies indicate that energy savings alone, while significant, do not lead to return on investment (ROI) periods that align with building owner expectations. A value stack consisting of energy and monetized NEBs will be necessary to motivate the market to adopt CRAWs.	Low	High	Building owner/operator interviews and surveys	Strategy Manager and Market Research and Evaluation Lead	Continue work with manufacturers to bring down material costs. Develop local workforce including DIY install programs to bring down installation costs. Leverage forthcoming BPS policy and work of Commercial Building Efficiency Accelerator (CBEA) MTI to highlight optimal compliance pathways that include window retrofits.
5	 Combined energy and NEBs are insufficient to establish compelling business case for ESJ communities, which commonly have more limited access to financing and funding resources, potentially leaving these communities behind in the transition toward high-performance window technologies.	Medium	High	Building owner/operator interviews and surveys	Strategy Manager and Market Research and Evaluation Lead	Expand trusted messenger outreach to build awareness and to help us learn what makes for a compelling business case in ESJ communities. Continue work with manufacturers to bring down material costs.

#	Risk	Probability of occurring	Severity	How will we know the risk is occurring?	Responsible & tracking	Mitigation approach
						Develop local workforce including DIY install programs to bring down installation costs. Support programs through bulk purchase agreements in target regions to bring down material and labor costs for ESJ communities. Leverage work of CBEA MTI to promote policies that limit rent impacts and expand access to financial resources and ESJ-focused funding opportunities.
6	Unable to establish methodology for rating VIG for Single Pane Replacement (SPR) by Attachment Energy Rating Council (AERC) or National Fenestration Rating Council (NFRC). Without a rating, building designers and owners cannot receive full credit for the performance of VIG for SPR when demonstrating compliance with energy codes, and uncertainty surrounding performance limits the amount that utilities can allocate in incentives	Low	High	Engagement with DOE, AERC and/or NFRC	Product Manager	Work with national laboratories and DOE to establish rating process within DOE. Precedence exists from other rating/approval process associated with other federal agencies (e.g., Environmental Protection Agency (EPA)). Engage with DOE and manufacturers to establish self-certification process with documented methodology and verification criteria.
7	Manufacturers don't submit products for AERC or NFRC rating. Ratings for CSW and VIG are necessary to give market actors confidence that CRAWs will deliver the expected energy savings and allow utilities to offer incentives.	Low	High	Engagement with manufacturers, AERC and NFRC	Strategy Manager and Product Manager	Inform manufacturers of higher incentives for rated products. Provide financial support to manufacturers to mitigate costs of AERC certification process. Preferentially promote AERC-rated products to PAs.
8	 California external energy efficiency and whole building decarbonization programs don't include CRAWs technologies in commercial and ESJ measures. Limited field data, low awareness of benefits, and uncertainty about	Medium	Medium	Engagement with PAs	Strategy Manager and Program Manager	Support program inclusion through field data and market support (e.g., manufacturers, BPS hubs, CalNEXT electronic Technical Reference Manual windows measure, CBOs, existing low-

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	cost-effectiveness may result in limited CRAWs inclusion in energy efficiency programs.					income program implementers, marketing support, etc.). Support programs through bulk purchase agreements in target regions to bring down material and labor costs for ESJ communities.
9	 California external energy efficiency programs don't offer incentives for envelope evaluation as part of HVAC upgrades. Limited field data, low awareness of benefits, and uncertainty about cost-effectiveness may result in limited interest amongst energy efficiency programs in incentivizing building envelope performance during planned HVAC upgrades, bypassing the opportunity for HVAC downsizing.	Medium	Medium	Engagement with PAs	Strategy Manager and Program Manager	Utilize data from field studies to demonstrate incremental energy savings, grid flex benefits, and peak-shifting delivered by combined HVAC/window upgrades. Collaborate with CBEA and CRTU MTIs-and BPS Hubs-to build momentum for holistic strategies that optimize the impact of investment in whole-building upgrades. Collaborate with financial market actors to establish incentives for building owners/operators to include envelope evaluations as standard practice during large scale retrofits (via more attractive financial terms, lower fees, promotional rates, etc.).
10	 California external energy efficiency programs don't offer incentives for CRAWs projects. Even when successfully educating market actors about the benefits and affordability of CRAWs, early adopters may still require incentives to overcome perceived risks of an unfamiliar technology.	Medium	High	Engagement with PAs	Strategy Manager and Program Manager	Same mitigation approach as risk #9.
11	Municipalities don't include CRAWs in climate action plans (CAPs). Municipalities update their CAPs infrequently, and on varying timelines, so getting CRAWs in within the timeframe of the MTI is out of our control. CAPs also may not stipulate specific measures for	High	Low	Engagement with municipal policy makers	Strategy Manager and Program Manager	Utilize data from field studies to demonstrate incremental energy savings delivered by combined HVAC/window upgrades. Support program inclusion through data and market support with manufacturers, BPS hubs,

#	Risk	Probability of occurring	Severity	How will we know the risk is occurring?	Responsible & tracking	Mitigation approach
	reducing energy consumption, so getting CRAWs named in CAPs might be challenging.					CalNEXT windows measure, CBOs, and marketing support.
12	Unable to achieve viable ESCO/financier business model for financing window upgrades. Although CRAWs are significantly less expensive than a traditional full window replacement, the costs may often require external funding and financing. If ESCOs and other financing organizations don't see a pathway to ROIs that align with their business models, they will not offer the financing terms needed to enable CRAWs uptake in the market.	Medium	Medium	ESCO interviews	Strategy Manager and Market Research and Evaluation Lead	Engage with ESCOs and other green financiers to develop accommodating financing mechanisms using field test data and quantification of NEBs to better demonstrate the business opportunity and financier business case. Leverage interventions of CBEA and CRTU MTIs to engage with ESCOs and other financiers to build the business case for holistic building upgrades that bundle longer-term ROI measures such as windows with shorter-term ROI measures such as HVAC.
13	 Financing mechanisms like green banks, green leases, and Commercial Property Assessed Clean Energy (C-PACE) offer insufficient funding for window upgrades. Even if ESCOs and other financing organization offer financing packages and terms that work for them, the terms (e.g., interest rates, funding caps) may be insufficient to fully fund a CRAWs project leaving building owners to close the gap with internal capital.	Medium	Medium	Engagement, interviews with ESCOs and other financing market actors	Strategy Manager and Market Research and Evaluation Lead	The value stack for building owners includes energy savings, monetized NEBs, HVAC downsizing opportunities, and BPS compliance (fine avoidance). Where finance mechanisms recognize the value of only some of these benefits, we will emphasize the other value streams to reinforce the business case for owners to include windows in long-term capital planning. Develop strategies for staged window upgrades to spread the cost out over time. Engage with manufacturers and supply chain partners to bring down the capital cost and installation costs of windows. Develop DIY training programs for facilities staff to eliminate third party installation costs.

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						Leverage work of CBEA MTI to identify and expand access to ESJ-focused financial resources and funding mechanisms.
14	 Manufacturers slow to develop sales distribution and local installer networks, including ESJ businesses. Driving scale and reducing supply chain and installation costs requires developing local distribution and installer networks, eliminating dependence on expensive direct-to-consumer models.	Low	Medium	Manufacturer engagement and interviews	Product Manager, Strategy Manager, and Market Research and Evaluation Lead	Engage with manufacturers to identify potential sales/distribution partners and include them in field tests to demonstrate business opportunity. Provide incentives to regional sales/distribution partners for development of marketing plans and lead generation. Continue to work with ESJ training centers, technical schools, community colleges, and pre-apprenticeship trade programs to develop local installation workforce. CalMTA to fund workforce development and training programs for installers in collaboration with CBOs.
15*	Awareness and education campaigns fail to change mindset of architects, designers, and building owners and operators. Overcoming awareness barriers are relatively easy, but if field data and case studies are insufficient to create a value proposition and support a business case amongst influencers (architects and designers) and owners/operators, then market demand will remain muted.	Medium	High	Market actor and building owner interviews and surveys	Strategy Manager and Market Research and Evaluation Lead	Conduct in-depth market actor interviews to better understand reservations and objections to utilizing CRAWWS technology. Determine if barriers are cost-related (can be offset by incentives while cost reduction strategies are implemented), product performance-related (can be mitigated by manufacturer engagement to implement product enhancements) or financing related (can be mitigated by working with ESCOs and other green financiers to develop more accommodating financing mechanisms).

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						Leverage forthcoming BPS policies to supplement "carrot" of energy and NEBs.
16	Statewide BPS not implemented in California. A statewide BPS and the anticipated energy and emissions reductions would trigger the market to consider building upgrades that they might not otherwise consider or plan for. Absence of this "stick" would put more pressure on success of the carrots (energy and NEBs) to support the business case.	Low	Medium	California Energy Commission (CEC) engagement	Strategy Manager and Program Manager	Leverage <i>regional</i> BPS and municipal climate policies as the "stick" to accompany the "carrot" of energy savings and NEBs.
17	ENERGY STAR® does not create a category for CRAWs. ENERGY STAR is a well-recognized, respected, and influential program for both residential and commercial products. Having CSW included in ENERGY STAR would help overcome barriers associated with awareness and performance and support development of tiered incentives. Lack of an ENERGY STAR category and rating for CSW would put more pressure on other interventions to resolve the awareness and performance barriers.	Medium	Low	Engagement with EPA	Strategy Manager and Program Manager	Utilize data from field studies and develop market segment-specific case studies to build awareness and demonstrate product performance. Collaborate with AERC and NFRC to promote qualifying products. Develop tiered incentives based on AERC/NFRC ratings.
18	CRTU and/or CBEA MTIs do receive Phase III approval. Without CRTU and CBEA MTIs, CRAWs would be unable to leverage strategic interventions that are building the business case for holistic building upgrades and/or inclusion of envelope assessment during planned HVAC upgrades. This would place more pressure on the CRAWs-specific interventions to create that value proposition.	Medium	Low	MTI plans are not approved	Program Manager and Strategy Manager	CRAWs MTI to take lead on select strategic interventions identified in CBEA and CRTU MTIs. Utilize existing data from CBEA and CRTU Phase I and II research to adjust CRAWs interventions as dictated by market response. CRAWs to engage with BPS hubs, CEC, and regional policy makers to ensure windows are included in prescriptive and performance-based pathways.

The roles listed under the column "responsible & tracking" will be on point to track and identify if the risk is something that needs attention. The team will then work to deploy the appropriate mitigation strategy.



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