Commercial Replacement and Attachment Window Solutions (CRAWS) - Logic Model - Draft 11.06.2025

Barriers / Opportunities

- Awareness: Building owners are not aware of poor performing windows' impact on energy use even in mild climates; not aware of CSW, VIG and associated benefits
- High first cost relative to "do-nothing"; unfavorable ROI when HVAC benefits omitted
- Non-energy benefits are key driver, but not well-quantified
- High vacancy rate in commercial office space market reducing appetite for improvements
- CSW & VIG: immature supply chain
- VIG: no standard methodology to rate installed performance
- SB 48 and forthcoming CA policy on commercial building energy use and emissions reduction
- Meeting climate policy goals in pre-2000 buildings necessitates envelope improvement
- DOE, National Labs, GSA, CEC, REEOs (MN CEE) and utlities (ComED) testing and promoting window solutions

  CalMTA MTIs (CBEA and CRTU)
- Growing financial, technical and manufacturing investment in CSW and VIG manufacturing:

  DOE awards to Alpen ($5.9M for CSW) and LuxWall ($31.7M for VIG)
- BPS nationally is driving new financial and financing models for building upgrades (Green Banks, evolving ESCO models, C-PACE, on-bill financing) enabling windows to be bundled and financed with other measures.

MTI's Role

Strategic Interventions

Interventions with a focus on equity considerations

Leverage Strategic Interventions of CBEA & CRTU MTIs

CBEA interventions are aimed at catalyzing the entire ecoysytem of whole building energy efficiency, which creates favorable conditions for envelope upgrades.

Collaborate with CRTU MTI on field demonstrations that address HVAC and envelope simultaneously

In-field Demonstrations

Document energy and non-energy impacts of CSW and VIG in target markets;

Demonstrate installation simplicity

Include sites where HVAC is being replaced.

Engage ESCOs where possible.

Build "Envelope First" Business Case for Commercial Buildings

Bundle holistic energy benefits - efficiency, HVAC downsizing and peak savings - with monetized non-energy benefits of window upgrades; contrast with HVAC only approach to demonstrate favorable ROI; identify financing options.

Focus initially on owner-occupied MUSH market, hospitality and historic buildings

Awareness-Building with Strategic Partners and CA External Programs (SEM, Commercial Utility Programs, etc.)

Engage with organizations representing architects, design-build firms, building managers, HVAC installers, and commrecial real estate professionals to raise awareness of the problems and benefits associated with windows.

Engage with BPS hubs, utility commercial efficiency programs, ESJ organizations and ESCOs.

Industry Engagement for Technical Support and Demand Creation

Engage with DOE, AERC, national labs and energy efficiency organizations to prioritize research, develop VIG rating methodology, collaborate on lab and field-testing, establish ENERGY STAR category for CSW.

Develop simplified savings calculator to aid in estimating savings for recruitment purposes and showcasing the value proposition for window upgrades

Supply Chain Engagement for Product Enhancement and Workforce Development

Engage manufacturers to document and/or improve technology performance and durability; drive innovations to reduce material and installation costs and expand product feature set.

Incentivize submission of window solutions to AERC for energy ratings.

Demand-Side Marketing and Support: Awareness Building, Education and Financial Tools

Support manfuacturers in communicating the need for and benefits of window upgrades (i.e. Why Windows Matter) to the market.

Identify funding and financing resources

Market's Response

Outputs

- Aligned interventions and single points of contact for stakeholder engagement.

  CRAWS in CBEA playbook

  Documented alignment plans
- Field demonstration projects across both product categories and each MUSH market segment

  Field test reports documenting energy savings, NEBs, costs, value proposition, best practices and lessons-learned.
- Demand-side business case and case studies for each segment of the MUSH market, hospitality and historical buildings; expandlater to commercial office space

  Reflect unique ESJ considerations
- MOUs

  Market-actor specific materials that commuicate the value proposition for CRAWS and identify the role of and actions appropriate for each market actor to undertake in educating clients about the benefits of window upgrades.
- Research plans informed by results of field demostrations

  VIG rating body identified

  CSW savings calculator

  Training materials that HVAC professionals can use to train technicians and installers
- Product roadmaps, go-to-market plans and workforce development strategies

  Manufacturer engagement plans and deliverabales

  Schedule for AERC submissions
- Marketing plans w/ aligned partners; collateral

  Schedule of conferences and other market engagements

  Funding and finance resources, esp for ESJ

Outcomes

Short-Term (1-2 yrs)

- **Awareness** of problem, solutions and business case grows among:

  - CRE owners, operators
  - BPS Hubs, accelerators
  - MUSH market
  - ESCOs
  - Architects, specifiers
  - Utility EE programs
  - CBOs
  - HVAC installers
- CRAWS included in **TRMs**
- Utility **commercial EE programs** include CRAWS technology in list of measures
- **AERC** funding stable; commercial workgroup initiates VIG rating work.
- Manufacturers provide **installer** training and DIY installation resources
- Utility and ESCOs offerings reflect value of **NEBs** in determining incentives and financing terms

Med-Term (3-5 yrs)

- Municipalities include CRAWS as part of **climate / energy action plans**
- Utility commercial EE programs increasingly offer **incentives** for CRAWS products.

  Incentives offered for evaluating envelope as part of HVAC updates
- CRAWS increasingly **recommended** or **evaluated** by architects, design firms, ESCOs, CBOs, HVAC installers (i.e., specifier and influencer engagement increases)
- VIG rating method published

  Increase in number of manufacturers and products **rated** by AERC
- Increase in number of **suppliers** and **installers** selling CRAWS product
- **Adoption** of CRAWS technology grows in:

  - CRE Market
  - MUSH Market
  - ESCO project portfolios
- **Market Actors including Funding and Financing** entities are able to monetize NEBs and provide mechanisms for ESJ financing

Long-Term (6-10+ yrs)

- Increasing number of municipalities include CRAWS as part of climate / energy action plans
- Majority of market with single pane and double pane clear windows views CSW and VIG as standard product for improving overall building efficiency and a standard practice associated with HVAC sizing
- **By 2045, 50% of HVAC replacements or upgrades include envelope evaluation.**
- **ENERGY STAR** agrees to include CSWs
- Market penetration of CSW and VIG increase in target commercial building market sectors
- CA BPS (or similar policy) includes CSW and VIG in prescriptive and performance-based pathways as means to meet CA state efficiency and decarbonization goals.
- Increasing number of **funding and financing** pathways for CRAWS including ESJ solutions

IMPACT

By 2045, over 25% of the existing commercial building sector square footage that currently has single pane or double pane clear windows utilizes CRAWS technology in line with California's overall decarbonization targets.

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