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23-ERDD-01 Retrofitting with Innovative Building Envelope Solutions Concept--Written Response for Request for Comment

Responses in attachment.

Additional submitted attachment is included below.

1. Are the requirements for all groups in Section IV.A feasible and reasonable for improving the value proposition of existing building envelope retrofits? If not, what modifications are recommended for CEC staff to consider and why?

   Yes, requirements for groups in section IV.A seem feasible.

2. Are there other envelope retrofit technologies not addressed in this concept that should be considered that could improve the value proposition for building retrofits?

   Interior high performance secondary windows are not specifically mentioned but are a solution for groups 3 and 4 and are excellent and scalable solutions that permit rapid deployable low cost whole window upgrades at a fraction of the cost of window replacement, especially new product solutions that have emerged in recent years. In addition, thin glass triple drop in insulated glass units have rapidly emerged as alternatives to replace glass in existing windows with higher performance low cost effective window upgrades at a fraction of the cost of window replacement. Advances in automated production equipment have now emerged to make this solution viable to the mass market as a low cost with proven solutions for the first time in 2024 and proven markets for the product enabled by this solicitation now represent the only barrier to deployment and widespread adoption.

3. The technologies in Groups 1 and 2 have a current payback expectation of less than seven years. Is having a seven-year payback reasonable to increase market adoption of the technology? If not, what would be a necessary payback period to increase adoption of the novel technology?

   Payback for both high performance secondary windows and drop in thin triple pane insulated glass units both have payback well within 7 years.

4. Should the groups include other existing building sectors, such as commercial, in addition to the residential sector, to address challenges and drive market adoption for building retrofits? If so, which sector(s) should be targeted first to lower cost and accelerate market adoption of technologies and why?

   Yes, the lower quality of envelopes (typically aluminum) and large quantity of buildings/openings and lack of a robust replacement window market for commercial buildings an ideal starting point for scalability. These buildings often have similar opening types as well, making deployment easier. Target should be medium- to large office buildings of pre-1980s vintage with single pane glazing and large window-to-wall ratios. New technologies and low cost easy to install high performance solutions have merged and are now available to address in a highly scalable ways this existing market opportunity for the first time.

Replacing existing insulated glass units with thin glass triples has the same opportunity to effectively provide the same solution where existing commercial windows have frames in better condition and air sealing conditions making glass replacement a more appropriate solution. Trin triple pane glass can now be made in .75" + openings allowing for a wide variety of conditions to be considered.

5. What are the biggest gaps/barriers/challenges to bringing costs down and improving market adoption of higher-performing products that are not sufficiently addressed in these proposed groups? What is needed to address these barriers and how could those potential solutions be better covered in this draft solicitation concept?

   By far, the biggest barrier to bringing down costs is simple market adoption and scalability. Local production and larger markets will quickly drive down costs. These solutions are already beginning to penetrate markets in the Northeast and costs are dropping or those markets based for these reasons already. Uniquely to address the question relative to California, lower costs are tied to demand in those specific markets. More progressive state and local building codes in other parts of the country, especially in the Northeast, are already driving down costs for solutions like those suggested here through much greater growing demand in the last in the past two to three years. Incentives and far more rapidly advancing energy codes in other regions (and final draft copies of Title 24 for 2025) are expected to further increase the gap as additional market drivers like Energy Star 7.0 for windows that went into effect in October 2023 and more progressive legislation like HB 23-1161 in Colorado are drawing investment and driving market changes more rapidly California currently—especially in building envelope market segments.

6. Does a sufficient manufacturer ecosystem exist that is willing and/or able to manufacture these high-performing novel technologies following a successful demonstration project? If not, what additional resources are needed or additional concerns need to be addressed in order to increase manufacturing capacity following a successful demonstration?

   Yes. At least four major new secondary window solutions with high performance solutions have entered the market and are available that didn't exist prior to the last several years. Two companies with national markets have emerged with highly automated thin glass production capabilities that didn't exist prior to 2024 with more emerging quickly as multiple equipment solutions entering the market right now. Multiple lines capable of producing thin glass insulated glass lines are being installed but none to my knowledge in California to date.

7. What would be the appropriate level of project funding for the work proposed in this draft concept, and why? Based on the level of funding, what would be the recommended number of demonstration sites for SF, MF, and manufactured homes?

   See response below regarding min-mobile factories with stated capacity and costs.

8. Are there building envelope retrofit technologies that do not currently meet the requirements of this solicitation concept that CEC should consider funding and why?

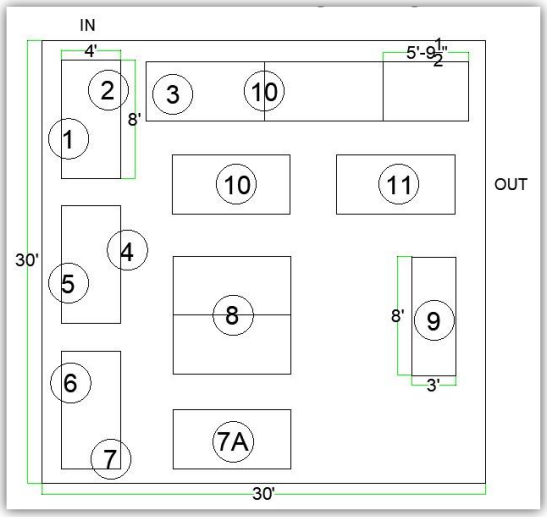
   See discussion above regarding high performance secondary windows and thin glass insulated glass units as drop in replacement units.

9. Please provide any other relevant comments regarding this solicitation concept draft

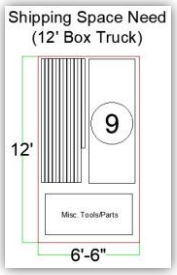
   The project inclusions as outlined in group 3 under table 3 should be included for all groups. Rapid prototyping ability, automation, and ease of fabrication/installation while benefiting disadvantaged communities should be a key focus. High performance secondary windows can uniquely be built in mobile manufacturing cells located near concentrations of projects to further lower costs and facilitate rapid commercialization.

   By way of example, such a mobile manufacturing location is outlined below that can be loaded in a truck and set up in any space on a temporary basis or permanent basis to facilitate manufacturing in 24 hours:

Mobile Factory Layout



- Lineals are cut and painted off-site
- Glass is cut off-site
- Entire production line can be broken down and loaded into 12' box truck for transport to any location in the country



Each mini-factory can be set up and produce 200 units a day with a workforce of three people. Mini-mobile factories can be set up in disadvantaged communities and facilitate bringing solutions to a wide local geography minimizing cost associated with freight and logistics delivery. Each factory can be set up with equipment for less than $10,000.