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Harvest comments on EPIC Draft Solicitation on Developing Next Generation Heat Pumps Using Low GWP

Additional submitted attachment is included below.

Harvest

Harvest Thermal
663 Coventry Rd
Kensington, CA 94707

To: California Energy Commission

February 15, 2024

Re.: Harvest Thermal Response to CEC: Docket #:23-ERDD-01; TN Number: 253981

Harvest Thermal (Harvest) appreciates the opportunity to comment on this solicitation. Harvest is a California-based company that designs and manufactures the Harvest Pod smart controller that manages the SANCO2 heat pump water heater and tank as a thermal battery to shift electricity use from times when it is dirtiest and most expensive to times when it is cleanest and cheapest, while always delivering heating and hot water whenever occupants needed them.

As such Harvest already meets many if not all the requirements of Group 2 (Combination Heat Pump for Domestic Hot Water (DHW) and Space Conditioning with low GWP refrigerants) as expressed in this draft proposal. In these comments, we encourage CEC to refine the requirements to ensure proposals will help remove market barriers to broader market adoption of low-climate impacts combination systems, in particular energy cost reductions and specific needs of low-income and disadvantaged households.

1. What type of considerations should CEC consider to encourage participation and achieve project success, and why? Please provide relevant comments regarding other considerations not explicitly listed above.

CEC should refine the requirements to ensure the scope of the solicitation is very clear. In particular, we encourage CEC to clarify the following requirements:

- What is the definition of “package” in “integrated mechanical heat pump system … in one easily deployable package”: a single enclosure? Or a set of appliances with integrated controls but not necessarily integrated into a single enclosure? Leaving it as open as possible and performance-based rather than prescriptive would have a better chance of fostering innovation and yielding a low-GWP combination system with the best cost and performance characteristics.

- Space conditioning: is cooling a requirement? If required, is cooling also constrained to sub-150 GWP? Requiring sub-150 GWP cooling would de facto eliminate CO2 which cannot do comfort cooling efficiently. However, CO2 has unique capabilities for high efficiency water heating and thermal energy storage that make it an important solution in the combination system space. To not eliminate CO2, the solicitation would need to allow cooling with mid-GWP refrigerants such as R-32 and R-454B would be needed.

- R290/propane refrigerant solutions could potentially meet the solicitation requirements but face codes and standards constraints such as UL that hinder large scale deployment in the near-term.

- Are there minimum heating and cooling capacity requirements, these should be specified so applicants have certainty about the scope.

“Greater level of efficiency and performance than separate units installed in existing buildings” - The comparison baseline should be clarified:
- Electric HVAC and DHW heat pumps?
- What distribution: forced-air, radiant?
- Are the separate baseline systems also constrained to sub-150 GWP?

2. Are the GWP limits of 150 reasonable for the current state of the art systems? If not, why and what should the limit be? Do the three Project Groups in Section IV of this document address the primary objectives of expanding and improving heat pump technology? If not, why? Are there alternative pathways or priorities that should be considered?

There are tradeoffs between the various objectives of the solicitation: low GWP, low first cost, high efficiency, load-shifting/energy storage for grid peak load reduction, and scalability.

While the GWP<150 requirement is technically achievable, it restricts the solution space available to address other objectives, in particular efficiency and scalability.

We believe low-GWP is important and propane is likely a key long-term solution but it is not scalable in the near-term due to code restrictions in many states. Therefore we recommend that low-GWP be an optional criterion, not a requirement for this solicitation.

In addition, GWP is only one factor in the the climate impact of refrigerants used in heat pump: other factors include: 1) The quantity of refrigerant used; 2) Whether the refrigerant is field installed with higher risk of leakage or factory installed and sealed with lower risk of leakage; 3) Whether the refrigerant circulates throughout the building or is contained in an outdoor unit; 4) the duty cycle of the heat pump: the higher the duty cycle the higher the wear and tear and risk of leakage; and 5) The scalability of heat pumps: the faster heat pumps get adopted, the lower the climate impacts from fossil-fueled appliances. The solicitation should consider all these factors in pursuing lower climate impact heat pumps. A lower score on one of these criteria could be offset by a higher score on other criteria.

3. What are the near-term and medium-term technical targets (e.g., costs, efficiency, ramp rate, emissions levels) to advance low GWP heat pump technologies to a higher TRL?

First cost (equipment and installation costs) often start high with new technologies but may have high reduction potential with economies of scale and continued investment in cost reduction

engineering. Short-term first costs are not necessarily a good criterion to assess the market potential of a solution. First costs can be offset by incentives and tax credits in the early years of a new technology.

Efficiency (which is a key driver of operating costs) is more important. While efficiency also has potential for improvement over time, it is largely driven by the technology solution and more difficult to affect significantly within a particular technology pathway. We therefore recommend efficiency be an important near-term criterion.

Demand flexibility / load shifting capacity is also an important short-term criterion: in a highly renewable electricity grid with time-varying pricing, load shifting capacity is as important as efficiency for both grid and consumer energy costs.

Both efficiency and flexibility significantly impact market ramp and scalability because low operating costs can provide a short payback period, enabling rapid market adoption as happened with the leasing business models in rooftop solar.

4. Are the proposed levels of project funding for each group appropriate to achieve the desired outcomes? If not, why?
a. What would be the typical range of costs (e.g., capital costs) for the anticipated projects, and could projects leverage CEC funding to encourage private investments?
b. A minimum 20% match would likely be required with the funding levels listed above, and this requirement would be waived for projects sited in and benefitting Disadvantaged Communities (DACs) and Low-Income Communities (LICs). Is this sufficient to encourage DAC and LIC projects? If not, how could this be improved?

See response for question #9.

9. How could this solicitation encourage projects to more fully center equity and community engagement?

In order to more fully center equity, the solicitation should consider the specific barriers to adoption of heat pump technology in low-income communities:

- **Electric capacity constraints**: low-income households more often live in older homes with limited electrical capacity. This can increase the cost of heat pump installation creating a barrier to adoption. Low-power solutions such as systems with thermal storage and no backup element can reduce or avoid this barrier.
- **Space constraints**: low-income families more often live in multifamily units where space for heat pump equipment is constrained. Smaller form factor equipment such as slim hydronic air handlers can remove barriers to adoption in space-constrained applications.
- **High heating, cooling, and DHW loads**: low-income families more often live in older homes with poor energy efficiency leading to higher heating and cooling loads. Sufficient

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capacity to meet these higher loads is an important factor for equitable adoption. The same holds for DHW capacity: low-income housing units often have higher occupancy requiring higher DHW capacity.

In closing, we appreciate CEC's interest in supporting the development and market adoption of low-climate impact combination systems. We encourage CEC to adopt a performance-based approach to low climate impacts and make GWP an important scoring criterion but not a prescriptive requirement for the solicitation. We believe efficiency and load shifting capacity are essential criteria to enable adoption at scale.

Pierre Delforge
Head of Product and Operations
pdelforge@harvest-thermal.com