DOCKETED	
Docket Number:	23-ERDD-01
Project Title:	Electric Program Investment Charge (EPIC)
TN #:	253431
Document Title:	DRAFT SOLICITATION -Developing Next Generation, All Electric Heat Pumps Using Low Global Warming Potential Refrigerant
Description:	The purpose of this draft solicitation attachment is to solicit public feedback on the impacts of the requirements to consider funding electric heat pumps technologies that include water heating, combination water and space conditioning, and space conditioning systems using low GWP refrigerants for use in California.
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Organization:	California Energy Commission
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DRAFT SOLICITATION ATTACHMENT

Developing Next Generation, All Electric Heat Pumps Using Low Global Warming Potential Refrigerant

Proposed Electric Program Investment Charge Solicitation

No proposals are being accepted at this time. This is a draft solicitation attachment for project requirements re the research, development and demonstration of next generation electric heat pumps that use low Global Warming Potential (GWP) refrigerant. Do not design or submit proposals according to this DRAFT. The actual solicitation is subject to change.

The purpose of this draft solicitation attachment is to solicit public feedback on the impacts if the requirements. (See Section 5 for specific questions). Staff will accept comments submitted to the California Energy Commission (CEC) Dockets Unit or by email until January 26, 2023. (See Section 6 for additional details on how to comment.)

http://www.energy.ca.gov/contracts/index.html

State of California

California Energy Commission

December 15, 2023

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DO NOT DESIGN OR SUBMIT PROPOSALS ACCORDING TO THIS DRAFT
Comments are January 26, 2024**, at 5:00 p.m.**

I. INTRODUCTION

This document outlines the requirements under consideration for the Building Decarbonization Program's competitive grant solicitation, "Next Generation, All Electric Heat Pumps Using Low Global Warming Potential (GWP) Refrigerants".

This solicitation will consider funding 3 groups of electric heat pumps technologies that include water heating, combination water and space conditioning, and space conditioning systems using low GWP refrigerants for use in California. Each funded project will aim to accelerate the technology development of electric heat pumps that can use low GWP refrigerants (GWP < 150) while maximizing energy efficiency and equipment performance, maintaining cost-effectiveness and meeting customer needs.

II. ELIGIBILITY

This solicitation will have two groups that do not require the funded project groups to be demonstrated. However, the projects in group that require a demonstration can obtain additional scoring criteria points by showing the units can benefit disadvantaged or low-income communities.

III. FUNDING

The solicitation will be a one-phase solicitation which will consist of three groups with a funding breakdown to include a total of $9.175M in available funds.

IV. APPROACH AND TARGET METRICS

Group 1: Design and Test low voltage, High efficiency Heat Pump Water Heaters with low GWP refrigerants (TRL 3-4)

This group will target the development and testing of low GWP, cost-effective, 120V electric heat pump water heaters to address a critical gap in the US market that can be readily deployed, particularly in under-resourced communities. 120V electric heat pump water heaters are a relatively new product that is expected to have a high impact on electrification due to its lower voltage which may potentially reduce electric panel upgrades. However, the commercially available heat pump water heaters use standard refrigerants with higher GWPs, typically HFC134a, which is 1,430 times more potent than CO2 over a 100-year time horizon, thus leaving an opportunity to further the climate changing impact. Each eligible advanced/emerging technology must meet the technical requirements in Table 1, Target Metrics, and the following requirements:

- Use 120 V and refrigerants with a GWP ≤ 150.
- Stage of Development: Applied Research and Development (TRL 3-4). Equipment is not commercially available. Laboratory testing required, and applications with pilot testing at sites will be scored more favorably.

- Research team must include at least one heat pump water heating (HPWH) manufacturer.
- Include capability to control the unit to reduce load during the net peak periods.
- Laboratory tests and/or site demonstrations that show these units can benefit disadvantaged or low-income communities will receive additional points.

Group 2: Applied Research and Development of Combination Heat Pump for Domestic Hot Water (DHW) and Space Conditioning with low GWP refrigerants (TRL 3-5)

This group will target the research and development of an all-electric, integrated mechanical heat pump system that will deliver hot water and space conditioning in a modular unit. The intent is to expand upon efforts from two current EPIC projects (EPC-19-032 and EPC-20-023), to accelerate the expansion of integrated mechanical systems with one easily deployable package. The aim is to develop combined units that demonstrate energy efficiency and performance that are greater than operating separate units for retrofit applications.

Each eligible advanced/emerging technology must meet the following requirements:

- Design space conditioning and domestic hot water (DHW) heat pump systems combined into a single unit.
- Use refrigerants with GWP ≤ 150.
- Stage of Development: Applied Research and Development (TRL 3-5)
- Achieve energy and cost savings compared to individual space and DHW heat pumps.
- Demonstrate functionality for grid interactivity.
- Estimate maintenance costs and installation requirements that are competitive with individual space and DHW heat pumps.
- Provide energy consumption, reliability and operation similar to individual space and DHW heat pumps.
- Provide scalability for multiple applications, such as single-family, multifamily, and commercial building settings.
- Include capability to control the unit to reduce load during the net peak periods.
- Laboratory tests and/or site demonstrations that show these units can benefit disadvantaged or low-income communities will receive additional points.

Group 3: Design and Demonstrate Electric Heat Pump Space Conditioning System with low GWP refrigerants (TRL 6-8)

This research will develop and demonstrate a heat pump system that delivers space conditioning using low GWP refrigerants. The intent is to complement another solicitation for

HVAC decarbonization for large buildings (GFO-22-308[1]), which focuses on systems between 10 to 50 tons in large commercial buildings. This group will focus instead on units less than 20 tons for commercial and residential buildings. Each eligible advanced/emerging heat pump technology project must meet the technical requirements in Table 1 and following requirements:

- Stage of Development: Technology Demonstration & Deployment (TRL 6-8)
- Use refrigerants with GWP ≤ 150.
- Address strengths/weaknesses of alternate refrigerant HVAC systems, including energy use and safety compared to traditional refrigerants currently in use.
- Include capability to control the unit to reduce load during the net peak periods.
- Research team must include at least one space conditioning heat pump manufacturer.
- Up to 20 tons in commercial and multi-family buildings, or up to 5 tons for single family residential buildings.
- All demonstration sites must be in disadvantaged or low-income communities and must show benefits to these communities.

TARGET METRICS

Metric	Baseline	Research Goal	Relevance
High efficiency, Electric Heat Pump Water Heaters with low GWP	Current heat pump water heaters with high GWP refrigerants (GWP≈1400 to 2000) at 120V or 240V	Similar or better operational efficiencies, cost, product life and maintenance requirements with low-GWP refrigerants GWP ≤150 using 120V and reduction in peak grid energy use	Using low GWP refrigerants typically results in lower efficiency, higher capital and operational costs, and may have different maintenance requirements than standard heat pump water heaters
Combination Heat Pump HVAC and Domestic Hot Water	Separate conventional HVAC and water heating	Similar or less total cost of ownership of combination heat pump with low-GWP ≤150 refrigerants and reduction in peak grid energy use.	Increases cost effectiveness

[1] https://www.energy.ca.gov/solicitations/2023-06/gfo-22-308-decarbonizing-heating-ventilation-and-air-conditioning-systems

heating with low GWP	equipment with high GWP refrigerants (GWP ≈1400 to 2000)		
Space Conditioning electric heat pump with low GWP	Current space conditioning heat pumps, with high GWP refrigerants (GWP ≈1400 to 2000)	Similar or better operational efficiencies, cost, and product life and maintenance requirements with low-GWP refrigerants GWP ≤150 and reduction in peak grid energy use	Using low GWP refrigerants typically results in lower efficiency, higher capital and operational costs, and may have different maintenance requirements than standard space conditioning heat pumps.

V. QUESTIONS FOR STAKEHOLDERS

CEC staff are seeking responses and comments to some (or all) of the following questions to shape the direction and scope of this solicitation:

1. What type of considerations should CEC consider ensuring participation and project success, and why? Please provide relevant comments regarding other considerations not explicitly listed above.
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?
3. What are the near-term and medium-term technical targets (e.g., costs, efficiency, ramp rate, emissions, etc.) to advance low GWP heat pump technologies to a higher TRL?
    a. What should be the starting and target TRLs for these groups?

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?
5. Should Group 1 in Section IV also include small commercial? If so, why?
6. Should Group 3 in Section IV narrow its focus? e.g., to only residential or only commercial. If so, which one and why?
7. Is four years a feasible project timeline? Are there any potential barriers or challenges in implementing the proposed projects?
8. Which end-use sectors, facilities, or communities are expected to be most positively impacted by these types of projects?

VI. WRITTEN COMMENTS

Comments on this Draft Solicitation document **are due by January 26, 2024, at 5:00 PM.**

Please submit comments to the CEC using the e-commenting feature by accessing the comment page for this docket at https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=23-ERDD-01. A full name, e-mail address, comment title, and either a comment or an attached document (.doc, .docx, or .pdf format) are mandatory. Please include "Low GWP Heat Pump Draft Solicitation" in the comment title. After a challenge-response test is used by the system to ensure that responses are generated by a human user and not a computer, click on the "Agree & Submit Your Comment" button to submit the comment to the CEC's Docket Unit.

Please note that written comments, attachments, and associated contact information included within the documents and attachments (e.g., your address, phone, email) become part of the viewable public record. This information may become available via Google, Yahoo, and any other search engines.

Interested stakeholders are encouraged to use the electronic filing system described above to submit comments. If you are unable to submit electronically, you may email your comments to: DOCKET@energy.ca.gov and include "Low GWP Heat Pump Solicitation Concept 23-ERDD-01" in the subject line.