**Questions and Answers**

**GFO-22-308**

**Decarbonizing Heating, Ventilation, and Air Conditioning Systems in Large Buildings**

**August 11, 2023**

**Disclaimer**

The following answers are based on California Energy Commission (CEC) staff’s interpretation of the questions received. It is the Applicant’s responsibility to review the Solicitation Manual and to determine whether their proposed project is eligible for funding by reviewing the Eligibility Requirements within the solicitation. The CEC cannot give definitive advice as to whether a particular project is eligible for funding, because not all proposal details are known.

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**General/Administrative**

**Q1.** I'm reaching out regarding the above project bidding on 9/15/23. Will the following information be provided on the website, GFO-22-308 - Decarbonizing Heating, Ventilation, and Air Conditioning Systems in Large Buildings?

1. Plan Holders list (list of companies who have requested bidding documents) and Pre-Bid Meeting Attendees List (via an Addendum)
2. Cost estimate or budget
3. Construction start/end date

**CEC:**

1. We do not have a list of companies that have downloaded the bid documents from the CEC website. There is a workshop pre-bid attendees list posted at: <https://www.energy.ca.gov/solicitations/2023-06/gfo-22-308-decarbonizing-heating-ventilation-and-air-conditioning-systems>.
2. Section I.D. of the solicitation manual identifies the funding available and the minimum and maximum award amounts for each group. It is up to each bidder to develop the budget for the research project using the forms in Attachment 7.
3. Section i.e. provides the estimated schedule for project start and end dates: January 20, 2024, and March 29, 2029, respectively. Projects cannot start until the agreement is executed by all parties. You can provide your estimated schedule in Attachment 6 based on your Scope of Work provided in Attachment 5. The construction start and end dates will vary by project and should be included in each project’s schedule.

**Q2.** I guess the list of TAC needs to be submitted in attachment 5 at the time of proposal. Am I right?

**CEC:** No. The Technical Advisory Committee (TAC) is a deliverable that is produced after the start of the grant. You do not have to submit a TAC list with your proposal.

**Q3.** We respectfully request that the application deadline be extended beyond the original date of 9/15/23 based on the changes and potential changes to the solicitation requirements that were discussed in the pre-application workshop. Where the solicitation currently indicates that projects in all Groups must meet the 100,000 square foot demonstration size requirement, the change described in the workshop to only apply the building area requirement to Groups 2 and 3 significantly impacts the process of screening and identifying candidate demonstration sites and solutions. In addition, the possibility that the solicitation will be expanded to allow new construction also fundamentally changes the nature of our potential proposals and demonstration sites. Not knowing the outcome of those major decisions until the first week in August poses significant risk in our planning and proposal development.

**CEC:** We have amended the solicitation to extend the deadline for application submission to October 20, 2023. See Addendum 1 of the solicitation manual at <https://www.energy.ca.gov/solicitations/2023-06/gfo-22-308-decarbonizing-heating-ventilation-and-air-conditioning-systems>

**Q4.** Given that Q&A Answers will not be provided until August 1, will there possibly be an extension of the submittal date?

**CEC:** Yes, we will extend the deadline until October 20, 2023.

**Q5.** Given that the clarifications from last week's presentation (e.g., that the 100k sf demonstration site requirement does not apply to Groups 2 or 3), and potentially changes posted in August in response to questions due today, we respectfully suggest that the proposals will better meet the GFO's goals if there more time was allowed before the September deadline. This is particularly true for Group 1, as finding the right fit of technology and demonstration is a major challenge within the specified timeframe.

**CEC:** We will extend the application deadline to October 20, 2023.

**Q6.** It would just be helpful to have a definition of commercial building, because, you know, all the food and beverage processors that we work with would consider their activities to be commercial.

**CEC:** See response to Question 25.

**Q7.** For Group 1 demonstration projects, is there a deadline for project construction, completion?

**CEC:** As the grant ends March 29, 2029, the project must be installed and operating in time to complete the 12 months of post installation measurement and verification, collect and evaluate the data, provide the interim deliverables, and prepare the final report prior to the project end date.

**Q8.** Could costs already incurred by an owner/applicant be eligible to account for the 20% match. For example, if they've already paid for pre-design, master planning, cost estimating, energy modeling, etc.

**CEC:** No, the funds must be spent during the grant term to be eligible to qualify as match.

**Q9.** There appears to be a mistake in the scoring criteria table in the solicitation manual.

The table describes the points available for each criterion, and minimum passing scores of 52.5 for criteria 1-4 and 70 for criteria 1-7. But the requirement for the third minimum passing score is not clear.

In one location, the minimum passing score is 70% of Criteria 8 for 35 points, but 70% of 5 points is 3.5 not 35. This would effectively make the Disadvantaged & Low-income Community a minimum screening requirement, rather than simply a scoring requirement.

In the second location, the minimum passing score is to be a function of the sum of criteria 1-8 for Group 1 projects (not just criteria 8). But 70% of 105 points is 73.5, not 35.

**CEC:** You are correct. There was an error in this part of the solicitation. Scoring criteria 1-7 are worth 100 points, and applicants must score 70 points to pass.

Additional preference points for match and disadvantaged/low-income communities will now be criteria 8 and 9, respectively, and they will total up to 15 points. The maximum preference points related to match funding will be 10, and the maximum preference points for projects in disadvantaged/low-income communities will be 5 points. These points will be added to the total score for applications that receive a passing score for criteria 1-7. Addendum 1 to the solicitation manual will be published that includes these corrections.

**Q10.** Section II.A.5 on Disadvantaged & Low-income Communities states that while preference points are available, it is not required for Group 1 sites to complete a demonstration with a DAC/LIC and/or Tribe: “While it is not required that Group 1 and Group 2 projects complete the demonstration within a DAC/LIC and/or Tribe, demonstration projects located and benefiting DACs/LICs and/or Tribes will be eligible for preference points under the scoring criteria for this GFO.”

Five preference points are available as described in scoring table. However, the minimum passing score requirement of 70% for this single criterion (3.5 points as you have noted) effectively makes it a prerequisite to have the demonstration be within a DAC/LIC/Tribe. I acknowledge there may be other creative ways to benefit disadvantaged communities to score points in this category, but this requirement effectively emphasizes this one criterion disproportionately compared to all of the other criteria. We have a potential demonstration site that unfortunately is not located within a DAC/LIC/Tribe, but that potentially fits the rest of the GFO objectives well. I don’t believe that we can reasonably score 70% of the points for this criterion to create a viable application without heroic measures that would otherwise distract from the technical aspects of our effort.

**CEC:** There was an error in the scoring criteria. Please see the response to Question 9 that explains the preference points available for disadvantaged and low-income communities.

**Q11.** Can you post the presentation slides?

**CEC:** They are posted on the solicitation website. [https://www.energy.ca.gov/solicitations/2023-06/gfo-22-308-decarbonizing-heating-ventilation-and-air-conditioning-systemshttps://www.energy.ca.gov/solicitations/2023-06/gfo-22-308-decarbonizing-heating-ventilation-and-air-conditioning-systems](https://www.energy.ca.gov/solicitations/2023-06/gfo-22-308-decarbonizing-heating-ventilation-and-air-conditioning-systemshttps%3A//www.energy.ca.gov/solicitations/2023-06/gfo-22-308-decarbonizing-heating-ventilation-and-air-conditioning-systems)

**Q12:** If we have demonstrations sites but not a technology in mind, is the best way to do that through the Empower Innovation website, or do you have a list of manufacturers?

**CEC:** Prospective applicants looking for partnering opportunities should register on the CEC’s Empower Innovation website: [www.empowerinnovation.net](http://www.empowerinnovation.net). Please refer to the PowerPoint presentation that is posted at the solicitation website: <https://www.energy.ca.gov/solicitations/2023-06/gfo-22-308-decarbonizing-heating-ventilation-and-air-conditioning-systems>.

**Funding**

**Q13.** Can you further define the match funds and CEC funds as it relates to the Grant amount and project costs?

**CEC:** Section I.D. of the solicitation manual lists the minimum and maximum grant amounts and the minimum match funds that must be provided by recipients. Section I.K. defines match funding and what is eligible.

The minimum match is 20% of the CEC requested funds. If you provide more than this minimum level of match, then you will receive additional points as indicated in Section IV.F., scoring criteria. These criteria provide additional points if you provide cash as match and if your match exceeds the 20% minimum.

For example, if you request $6 million dollars of CEC funding, you must provide 20% of this amount, or $1.2 million in match. You would then have $7.2 million towards completing your research project. Any match funding above the $1.2 million can be counted as additional match that would get additional points, as described in the response to Question 20.

**Q14.** Can this be combined with U.S. Department of Energy (DOE) funds?

**CEC:** Yes. DOE funds may be used as match for projects applying to this GFO if the DOE funds are secured, the work under the project with DOE is complimentary and relevant research to this GFO, and the complimentary work with DOE either has not yet started or will run concurrently with the CEC research. It’s the responsibility of the applicant to verify that the federal agency has no prohibitions or restrictions on using its funding as match.

**Q15.** Regarding the Match funding of 20%, does that have to be all cash, or can it be 50% cash, and 50% credit?

**CEC:** As indicated in Section I.K. of the solicitation manual, the match may be cash, in-kind service, or a combination of the two, with cash match being considered more favorably than in-kind contributions during the scoring phase (Section IV.F, scoring criterion 8)[[1]](#footnote-2). Credit cannot be used as match, because it is considered contingent funding and not under your control.

**Q16.** For the match funding, can we take 10% loan from a bank and provide 10% in kind service?

**CEC:** Cash or in-kind may be used as match, but a credit loan is not eligible for use as match. See also response to Question 15.

**Q17.** The grant has $20 million available, with $12 million set aside for Group 1. Group 1 projects must have a minimum project amount of $2 million. a) Is the "project amount" the estimated construction cost? b) What % of project cost would be benefited from the grant (e.g., for $10mil. Project that is awarded for this grant, what is the grant amount?), and c) What percentage of project costs will be covered by the grant?

**CEC:**

1. The total project cost is the total amount needed to complete the project identified in the Scope of Work. This can include construction cost and other costs indicated in Section III.C. of the solicitation manual and in the budget forms, Attachment 7.
2. It depends on the total project cost and the amount of grant funds you are requesting. The project cost includes both the CEC grant and pledged match amount. The CEC funds will only cover a portion of the project cost. For Group 1, projects will cost between $2 and $6 million, subject to CEC review and approval. The applicant must also provide a match of at least 20% of the CEC grant amount. Any project cost exceeding the CEC grant and required match must be provided as additional match by the applicant or other project partners.
3. If the total project cost is $10 million, and you are requesting a grant of $6 million, you will need to provide $4 million in match, $1.2 million of which will be the match required by the solicitation. The remaining balance ($2.8 million) must be provided by you and/or others on the team. This additional match amount could be eligible to receive preference points during project evaluation, as indicated in Section IV.F. In this example, the grant is providing 60 percent of the total project cost.

**Q18.** a) Can you please provide clarity on California's spending requirement of the project and cost share funds? b) Does the primary technology have to be sourced in California?

**CEC:**

1. Section 1.L of the solicitation manual provides information on what funds spent in California means.
2. No, the primary technology does not have to be sourced in California. However, projects will be scored based on the percentage of CEC funds that will be spent in California as indicated in Section IV.F.

**Q19.** Can the 20% match requirement include 10% cash and 10% in kind?

**CEC:** Yes. Please see response to Question 15.

**Q20.** As I understand, the $6 million maximum for Group 1 is the maximum state fund that will be available for a project and a minimum 20% of that $6 million must be provided as matching fund by the project-host. This means that the total project cost is then $7.20 million. Am I right?

**CEC:** If you request $6 million in CEC funds, and the required minimum match is 20% ($1.2 million), then the minimum total project cost is $7.2 million. However, you may provide match above the 20% minimum if you estimate a higher total project cost. Please see responses to Questions 17 and 13.

**Q21.** Can you use match funds to pay for a thermal energy storage system if it complements the heating, ventilation, and air conditioning (HVAC) system being paid for with State funds?

**CEC:** Yes, for Group 1, if the project meets the requirements in Section I.C. Also, a thermal energy storage system may provide additional capacity beyond the capacity required for the heat pump in Section I.C. and be part of the CEC-funded system solution if the following requirements are met: the low GWP heat pump is at least 100 tons, and the system meets at least 25% of the building’s peak heating load with an electric heat pump or heat recovery chiller serving at least 100,000 square feet.

No, for Groups 2 and 3, since the match must directly support the innovative technology being developed under this grant and not a separate system.

**Eligibility**

**Q22.** Would public customers, such as city or K - 12 school districts, be eligible?

**CEC:** Yes, provided the projects meet the requirements of Section I.C. For Group 1, this includes a demonstration at a building or aggregate of buildings totaling over 100,000 square feet and the ability to meet at least 25% of the peak building heating load with the advanced electric heat pump or other low carbon system. The demonstration site(s) must be located in one or more of the Investor-Owned Electric Utility (Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric) service territories.

**Q23.** We are new to CEC programs. Group 3 topics appear to be for high-risk, high-payoff new technologies. May we ask a few questions related to Group 3: a) Can companies outside California receive funding as a subrecipient? b) How about a National Lab in California as a subrecipient?

**CEC:**

a) Yes, companies outside of California may be subrecipients. Please note that projects will be scored based on the percentage of CEC funds spent in California, as indicated in Section IV.F., scoring criteria 6.

b) Yes, a National Lab in California may be a subrecipient.

**Q24.** Are commercial manufacturing facilities eligible for this grant?

**CEC:** Commercial buildings meeting the requirements of Section I.C of the solicitation manual are eligible. Manufacturing facilities are not eligible. The CEC has separate programs for industrial and food processing facilities. These include:

* Industrial Decarbonization and Improvements to Grid Operations Program (INDIGO) – [Industrial Decarbonization and Improvement of Grid Operations - INDIGO | California Energy Commission](https://www.energy.ca.gov/programs-and-topics/programs/industrial-decarbonization-and-improvement-grid-operations-indigo)
* Food Production Investment Program: [Staff Workshop on Food Production Investment Program (ca.gov)](https://www.energy.ca.gov/event/workshop/2023-04/staff-workshop-food-production-investment-program)
* Periodic research solicitations offered through the Electric Program Investment Charge program and the Gas R&D program. Subscribe to the CEC’s mail list to be notified: [Subscriptions (ca.gov)](https://www.energy.ca.gov/subscriptions)

**Q25.**  Could you explain why the Eligibility requirements note that the solicitation "is open to all public and private entities" and food and beverage processing facilities are major users of heat recovery chillers and heat pumps?

**CEC:** The focus of this solicitation is commercial buildings, and any public or private entity can apply with a proposal on HVAC decarbonization solutions for buildings that meet the requirements of this solicitation. Commercial buildings are those covered by the state’s Title 24 building energy efficiency standards and include a wide variety of nonresidential building types such as high-rise multifamily, offices, retail, restaurants, campuses, and hospitals. For programs related to food and beverage processing facilities, see response to Question 24.

**Q26:**  Regarding building types, is the solicitation limited to existing buildings, or does it include new construction?

**CEC:** The GFO is limited to existing buildings only. See response to Question 40.

**Q27.** Are buildings on college campuses eligible for this grant?

**CEC:** Yes, assuming this question applies to Group 1 and the projects and buildings meet the requirements of Section I.C.

**Q28.** We are from UCLA that is under LADWP. Are we ineligible to apply to this program?

CEC: You are eligible to apply as a recipient for a grant. However, under Group 1, any demonstration at a building located on the UCLA campus would be ineligible. For Groups 2 and 3, testing may occur in a laboratory (which may be on the UCLA campus or elsewhere within or outside IOU service territory) or in a commercial building located in an IOU service territory. See also responses to Questions 29, 38, and 40.

**Q29.** To be clear, the demonstration building must receive electric service from an IOU, and not from a Municipal Utility?

CEC: For Group 1, all demonstration buildings must be in an IOU electric service area, but they don't have to purchase electricity from an IOU. For instance, entities purchasing electricity from Community Choice Aggregators are eligible to serve as demonstration sites under EPIC, because these entities are located in an IOU service area. For Groups 2 and 3, research projects may be completed in a laboratory not located in an electric IOU service area. However, if Groups 2 and 3 will be testing equipment in an actual commercial building (i.e., the intended environment for the end use), the building must be located in an electric IOU service area. Measurement and verification of developed project hardware is required regardless of where the project is demonstrated or tested.

**Technical**

**Q30.** We are interested in potentially proposing a project under Group 3 (Other Advanced HVAC Technologies). Our project will involve developing and testing lab-scale prototypes with the goal of advancing the technology from TRL 3 to TRL 4 or 5, consistent with the program goal for Group 3. Would projects under Group 3 be exempt from the commercial building demonstration requirement? We would appreciate your clarification on this matter.

**CEC:** Yes, Group 3 projects are exempt from the commercial building demonstration requirement; the technology may be tested in a lab or a commercial building, as indicated in Section I.C. of the addendum.

**Q31.** We have a 4,000 square foot commercial building; does it qualify for this grant?

**CEC:** A 4,000 square foot building will not qualify for Group 1, since the minimum square footage required is over 100,000, as described in Section C of the solicitation manual. However, there are no square footage requirements for Groups 2 and 3.

**Q32.** We are new to CEC programs. Group 3 topics appear to be for high-risk, high-payoff new technologies. May we ask a few questions related to Group 3: a) Would technologies not listed or mentioned in the topic description be considered? b) Will a technology with a current technology readiness level (TRL) 2-3 and to be advanced to TRL 4 through the proposed project be considered for funding?

**CEC:**

1. Yes. Technologies not listed could be considered, if they meet the requirements of Group 3, such as using zero global warming potential (GWP) refrigerants, being at least TRL 3 at the start of the project, and progressing at least one TRL by the end of the project in 2029.
2. The TRL must be no lower than 3 at the start of the project and must advance at least one level by the end of the project.

**Q33.** a) We wanted to ask a question about buildings served by a central utility plant. Does the funding opportunity cover buildings connected to a central utility plant that may receive hot water from the central plant, or is the opportunity strictly meant for standalone buildings that provide their own heating and cooling?

b) Also, if a facility has a central plant that provides service to multiple buildings (for example, a community college campus) with an aggregate square footage over 100,000 square feet, would the facility be allowed to apply for a decarb project at the central plant and the connected buildings?

**CEC:**

a) Yes. Group 1 projects that are connected to a central plant and meet the requirements in Section I.C. of the solicitation manual are eligible.

b) Yes. Applicants can apply for HVAC technologies, such as those described in Section I.C. of the solicitation manual, for both the central plant and the affected buildings.

**Q34.** A new novel technology with design and processes to harness the

said energy in abundance and produce electrical and mechanical power without using any fuel and water. If we can prototype our equipment for the power generator to produce the said electrical power, then abundant power can be available throughout the earth. Our technology would provide high power density - say 50 megawatt power generators with a total weight not exceeding 20 tons and volume not exceeding 6 meters x 4 meters x 3 meters.

Since the equipment will be able to run continuously, we feel that it will in one

sense serve the purpose of long-duration energy storage with resilience and reliability and not just in Low-income Communities and Native American Tribes but also throughout California. The new low-cost power generator can be ramped up within certain ranges and also it will provide air conditioning and refrigeration at the same time. The power generator system cools the outside air while extracting heat from it to generate the electrical power. In addition, such abundant power can be used with established technology to produce large amounts of green hydrogen by splitting water. We are submitting the patent for the said technology. We want to submit a project proposal for funding with the objective: to prototype our above-mentioned technology for an ambient power electrical generator 50 Kilo-volt-amperes -250 Kilo-volt-amperes that should run continuously at least for 30 days (24x7) without any fuel and water. After the 30 days' run a small amount of cryogen not exceeding 10 liters may have to be refilled for the generator to run again for 30 days. Then use a fraction of the cool air (20%) produced during the said power generation (the cool air exits from the power generator after producing the power) to cool a large space (150000 sq. feet x 20 feet height) and see the time it takes to cool by 45 degrees F from outside 120 F to 75 F inside. Our estimate of the maximum time is 3 hours. Then use a fraction of the power to run a water-heating system to heat the space by 45 degrees F (from 30 F to 75 F) and see the time it takes. Our estimate is about 6 hours. All these power generation, cooling and heating will be done without the use of any fuel and solar panel or wind turbine and thus virtually with zero cost for the energy source. There is zero emission and zero GWP. We expect the said heating and cooling to be done in an hour. It is a completely new novel technology invented by us. It does not require any fuel of any type. It does not need any solar panel or wind turbine. It has a high power density. The said generator will not need a space more than 2mx1.5mx1.5m. Even though our new technology is quite unheard of in the energy circle yet, we strongly believe that the above objectives will meet and may even surpass the overall goals of the California Energy Commission in the above solicitation GFO-23-308. Is it OK if our start-up company submits a proposal combining points 1,2 and 3 with the above objectives for the commission to consider for funding for the solicitation?

**CEC:** We are not at the position to advise you on whether you should apply for this solicitation. It is up to your team to determine if your technology meets the requirements in the solicitation manual. However, your described project appears to be primarily a power generation project with the ability to provide some air conditioning and refrigeration. We are not funding power generation projects in this solicitation, since the focus is on developing decarbonization solutions for HVAC systems for large commercial buildings.

**Q35.** My company developed an HVAC system for commercial buildings that can be powered directly with solar energy as well as from the grid. It’s part of a building-scale Direct Current (DC) microgrid that also includes DC lighting, information technology equipment, and electric vehicle charging. I previously led the Bosch group, which did a pilot project with the CEC focused on solar-powered DC lighting. We currently have pilot projects focusing on DC HVAC with the U.S. Department of Defense, but the low-cost technology has wide application in many other commercial building sectors such as retail. Solar-powered commercial HVAC may not fit to GFO-22-308 (correct me if I’m wrong), but please let me know if there is an appropriate contact person(s) at CEC I should keep updated on our DC microgrid activities.

**CEC:** GFO-22-308 cannot fund research associated with a DC microgrids. The CEC recently requested information on DC power systems, and the questionnaire can be found here: https://www.energy.ca.gov/programs-and-topics/programs/electric-program-investment-charge-epic-program/request-information. For information on this request, please contact Eric Ritter (eric.ritter@energy.ca.gov￼) or Liet Le (liet.le@energy.ca.gov). Additionally, the CEC’s EPIC 4 plan identified potential research in DC power systems (initiative 14) and nanogrid HVAC module development and demonstration (initiative 28). For more information on these initiatives, please contact Liet Le or Jason Tancher (Jason.Tancher@energy.ca.gov), respectively.

**Q36.** For Group 1, does CEC intend to keep operating pre-commercial equipment beyond the demonstration phase?

**CEC:** This will be up to the recipient. Section 14 of the CEC’s terms and conditions[[2]](#footnote-3) state that the “title to equipment acquired by the Recipient with grant funds will vest in the Recipient. The Recipient may use the equipment in the project or program for which it was acquired as long as needed, regardless of whether the project or program continues to be supported by grant funds. However, the Recipient may not sell, lease, encumber the property (i.e., place a legal burden on the property such as a lien), or transfer possession of it during the Agreement term without the CAM’s prior written approval.”

**Q37.** Good day, we have the following Group 2 questions for clarification:

1. Can multiple modular (smaller) heat pumps be combined to meet the 20-50 ton requirement for air source heat pumps?
2. Or is this GFO is seeking a single heat pump that meets all the load requirement?

**CEC:**

1. No.
2. Yes. This research will develop and test one of the following: a) an air-source heat pump from 20 to 50 tons, or 2) water-source heat pump of 100 tons or less. Group 2 is focused on a stand-alone unit that meets these requirements and includes a way to operate in heating mode or cooling mode by use of a reversing valve or some other way to switch operation from heating to cooling. We are not looking to install a heat pump-type water heater that provides cooling as a natural secondary product of the heat pump cycle or one that is commercially available today or will be in the very near future. As a reference, a CEC report entitled “Climate Appropriate Innovations for VRF Systems” describes an early prototype of a carbon dioxide and propane heat pump that could be developed to provide heating and cooling. The research for Group 2 could build on this type of research.

**Q38.** Demonstration site: Please confirm a field demonstration at a commercial building is not needed under Group 2.

**CEC:** For Group 2, field testing in a commercial building is preferred over laboratory testing, because the goal is to progress at least two TRLs by the end of the project. Measurement and verification of developed project hardware is required for any technology in Group 2, regardless of whether the testing is in the laboratory or at a commercial building site. Though the commercial buildings used for testing under Group 2 do not need to meet the square footage requirements of those for Group 1, the buildings must be in an electric IOU service area.

**Q39.** Under Group 2 Technical Merit, the following is stated – “Describes the demonstration building by providing information on the use, operating schedule, and both baseline and proposed annual energy use and operating cost ($/year in energy cost) of the existing HVAC system.” Please confirm that demonstration in an actual building is not needed.

**CEC:** Demonstration in an actual building is not needed for projects under Group 2. See also response to Question 38 and Section I.C. of the amended solicitation manual.

**Q40.** Per the solicitation manual, Q&A is expected to be released the week of August 1st. Some questions that greatly impact proposal development were raised in the workshop such as:

a) Whether Group 1 projects are strictly confined to retrofit sites or open to new construction?

b) Whether Group 1 projects are open to district heating and cooling system?

c) Whether the demonstration requirement applies to project Groups 2 and 3?

d) Given this timing, would the Commission consider an extension to the submission deadline?

**CEC:**

a) This GFO is limited to existing commercial buildings only.

b) Yes, a district heating and cooling system is acceptable if it meets the requirements of Group 1.

c) There are no building demonstration requirements for Group 2 or 3. See also response to Question 38.

d) Yes, we will extend the deadline until October 20, 2023.

**Q41.** Would an application for Group 1 with a solution that does not use a boiler, but uses thermal storage to make up for high load conditions be acceptable? The first line of Group 1 states:

“Develop and test large, hybridized or stand-alone heating and cooling systems (over 100 tons) that use a heat recovery chiller or heat pump during low load conditions and use boilers and chillers during high load situations.”

This seems to imply that a boiler has to be left in place. Then later it suggests that: “Additional features may include: Alternative electric hybrid heating loop with thermal storage with or without a back-up boiler.”

This line instead seems to suggest that boilers are not necessary. From a practical standpoint, the customer may want to remove gas completely from the building, and keeping the boiler would be an obstacle to the project.

**CEC:** Thermal storage coupled with an electric heat pump or heat recovery chiller would be an acceptable project. A boiler would be unnecessary, and the existing gas boiler could be removed. An all-electric installation is eligible if it meets the requirements in Section I.C. State funds cannot pay for new electrical infrastructure upgrades, demolition of existing equipment; or removal of research equipment after the post M&V period concludes; however, match funds incurred during the agreement term can be used for these expenses. For Group 1, the minimum low GWP heat pump requirement is at least 100 tons, and the system must meet at least 25% of the building’s peak heating load with an electric heat pump or heat recovery chiller serving at least 100,000 square feet. A thermal energy storage system may provide additional capacity beyond that required amount and be part of the CEC-funded system solution as long as the above requirements are met.

**Q42.** For large multifamily applications, e.g., multi-story large apartments or hotels (that we believe are considered commercial), distributed heat pumps can be both more efficient and solve the problem of additional physical space needed by heat pumps that replace boilers. For a proposal in Group 2, can the requirement of >20 ton be obtained by a distributed architecture of smaller HPs in a hydronic loop?

**CEC:** No. For Group 2, the purpose is to develop a new type of heat pump that uses ultra-low refrigerants with a GWP of 4 or less, such as carbon dioxide or propane. This research will develop and test one of the following: a) an air-source heat pump from 20 to 50 tons, or 2) water-source heat pump of 100 tons or less. The heat pump must be a stand-alone unit that can operate in heating mode or cooling mode (space heating and cooling) by use of a reversing valve or some other way to switch operation from heating to cooling. We are not looking to install a heat pump that is commercially available today or will be in the very near future. See also response to Question 37.

**Q43.** Are we correct in assuming that the use of the phrase "GWP of 0" includes any technologies that do not use refrigerants?

**CEC:** Any refrigerant with a GWP of 0 is allowed for Group 3. Group 3 must be a stand-alone innovative HVAC technology such as non-vapor compression cooling, solid state cooling, or other systems described in Section I.C. It could also be an innovative technology, such as an advanced efficient high-capacity heat pipe, that does not use electricity, or it could be a unique way to store heat energy for later use. However, the technology must be innovative, not be commercially available, have a TRL between 3 and 5 at the start of the project, and be able to progress at least one level by the end of the project.

**Q44.** Group 3: Personal comfort systems can be many times more efficient than traditional HVAC systems in providing thermal comfort. However, coefficient of performance (COP) may not always be a useful way to characterize their performance. For example, a personal comfort system may achieve its efficiency by providing heat or cooling in a very targeted way that uses far less overall energy than a traditional HVAC system even if the underlying technology has a relatively low COP. The research goal for personal comfort devices using < 100 watts is easily within reach. However, could a personal comfort device with a COP < 1 that uses far less energy than traditional HVAC meet the criteria for this funding?

**CEC:** The CEC cannot give definitive advice as to whether a particular project is eligible for funding, because not all proposal details are known. Projects being proposed must be at or above a COP of 1 to be eligible, and the burden is on the applicant to accurately portray how the proposed technology is superior to the state of the art.

**Q45.** For Group 3, is a demonstration in a commercial building required, or can the technology be demonstrated in a lab or other controlled environment?

**CEC:** Under Group 3, the technology can be tested in a lab or other controlled environment. See also the responses to Questions 37 and 40 and Section I.C. of the Addendum 1 to the solicitation manual.

**Q46.** Would it be appropriate to propose work that might help remove barriers to adoption of existing technology with TRL higher than 3-4?

**CEC:** No. The intent of the solicitation is to develop and demonstrate new innovative pre-commercial equipment/hardware solutions.

**Q47.** The Group 1 demonstrations are to be at TRLs of 6 to 8 but yet require heat recovery chillers or heat pumps using refrigerants with GWP of less than 10. There are virtually no heat pumps available for sale in the United States that are capable of providing heating hot water with such low-GWPs. Multistack is one option with R1234ze, but their modular products have a consistent track record of startup issues and failed installations. There is at least one carbon dioxide-based heat pump by Lync for domestic water heater applications, but its operating conditions are incompatible with heating hot water applications, and these units are extremely expensive because of the very high refrigerant pressure class. The lone low-GWP offering from the three large chiller manufacturers (Trane, Carrier, and York) are large centrifugal chillers of 120+ tons capacity. Though some of these can be installed for heat recovery duty, centrifugal chillers cannot operate at low load, high lift conditions due to surge issues and are not well suited for heat recovery operation except when more than 50% loaded. The positive displacement heat recovery screw chillers that would be optimally suited for the low load conditions targeted in Group 1 use R-134a or R-513A, which do not meet the solicitation’s GWP limits. Though the Energy Commission’s desire to motivate industry advancement in low-GWP equipment may be well intended, we believe that the Group 1 requirements are overly constrained and will effectively prevent the use of appropriate available solutions that are high efficiency, cost effective, and suited for low load conditions for large commercial heating systems. There simply is not enough time between the GFO posting date and the application due date for equipment manufacturers to change their offerings to meet the solicitation requirements. There are effectively no heat pumps offered in the U.S. that can meet these requirements, and the only heat recovery chillers that can are not suited for the intended application. We believe that the potential solutions for the Group 1 requirements are at TRL 5 or lower (products in development but not yet demonstrated). Please consider deleting the low-GWP requirement for Group 1 and focus the advocacy for heat pump advancements on Group 2 or make a weighted GWP be part of a scoring metric for evaluating different applications.

**CEC:** Based on past projects, equipment will most likely not be installed until 2026, when there may be more options available for low GWP heat pumps and chillers. These grants will not conclude until 2029. R-134a and R-410A will be prohibited starting January 1, 2024, for chillers and January 1, 2025, for heat pumps. Proposals must include reasonable estimates on what refrigerants paired with a given type of heat pump or heat recovery chiller may be available in two to three years’ time for purchase. It is up to applicants to explain why their estimates of future equipment availability are realistic based on their market research, discussions with heat pump manufacturers, and data from installations in Europe and Japan. This information must be included in the Project Narrative (Attachment 3), under Technical Approach. Also, any building identified as a demonstration site under Group 1 must have a suitable base load for a heat recovery chiller.

**Q48.** The Group 1 description includes a low GWP refrigerant requirement (defined as <= 10 GWP), but it is unclear if this applies to all of the potential solutions described in Table 1. For example, does the low GWP requirement apply to the "Hybrid electric" solution that combines a heat pump and uses an existing boiler plant for backup/high load hours, or to the "Alternative electric hybrid heating loop" that uses a heat pump and thermal storage?

**CEC:** The low GWP requirement applies to the new electric heat pump or the new heat recovery chiller equipment. An existing boiler is assumed to use gas and not a refrigerant. A new boiler, installed as part of a potential overall solution and paid for with non-CEC dollars, does not use a refrigerant. A thermal storage system is assumed to not use a refrigerant.

**Q49.** Similarly, does the <10 GWP requirement apply to all new heat pump equipment in the new design? For example, if a system adds a low GWP centrifugal chiller for heat recovery, but also adds an air source heat pump (refrigerant > 10 GWP) for periods when there is insufficient heat recovery available to heat the building, would that comply with the requirements of the GFO?

**CEC:** Any equipment paid for by the CEC grant must comply with the GWP requirement stated in the solicitation manual, if applicable (see response to Question 61). This includes a separate air source heat pump used when insufficient heat recovery is available to heat the building. In addition, the heat pump that is the focus of the research must meet all requirements, including GWP, regardless of whether it is procured using CEC funds or match funds. However, if match funds or other non-CEC funds are used to purchase an additional heat pump (i.e., supplemental to the one that is the focus of the research and used for heat recovery purposes), then that heat pump may use a refrigerant with a higher GWP. Please also refer to California Air Resources Board Final Regulation Order on refrigerants.[[3]](#footnote-4)

**Q50.** Can the >100 ton constraint in Group 1 be met by a combination of a low GWP heat pump and new thermal storage? If so, are there constraints on the number of hours the combined heat pump plus storage system must operate at this 100 ton capacity?

**CEC:** For Group 1, the minimum low GWP heat pump requirement is at least 100 tons, and the system must meet at least 25% of the building’s peak heating load with an electric heat pump or heat recovery chiller serving at least 100,000 square feet. A thermal energy storage system may provide additional capacity beyond that required amount and be part of the CEC-funded system solution as long as the above requirements are met.

**Q51.** For Group 1, to the best of our knowledge there are no air source heat pumps that meet the combined constraints of >100 tons, <10 GWP refrigerant, and TRL 6-8. This essentially excludes several of the proposed solutions in Table 1 and means that only research projects using low GWP water-source heat pumps (i.e., a large 'heat-recovery' chiller) will comply with all of the constraints.

**CEC:** See response to Question 47. The solicitation manual has been amended to allow Group 1 to start at TRL 5.

**Q52:** How are you defining large building?

**CEC:** As indicated in Section I.B., for purposes of this solicitation, a large building is one that is over 100,000 square feet and is served by a hot water or steam distribution system for heating and a central chiller system.

Also, see Question 25 for the definition of commercial building.

**Q53:** Clarification: are all three Groups subject to 100,000 square foot building requirement?

**CEC:** Only Group 1 is subject to the 100,000 square feet building requirement.

Groups 2 and 3 can be completed in a laboratory or in a commercial building. See responses to Questions 38 and 40, and the revised Section I.C. in Addendum 1 to the solicitation manual.

**Q54:** We make a passive cooling technology. How do you view facade materials?

**CEC:** Façade materials are not eligible for this solicitation. This solicitation focuses on technology advancements in HVAC systems for large commercial buildings.

**Q55:** Recognizing that GWP values span orders of magnitude, and can be less than 1, why the small difference in GWP requirement between Group 1 and Group 2? (GWP≤10 versus GWP≤4).

**CEC:** Group 1 allows a broader range of refrigerants with a GWP of 10 or less. The HVAC technologies in this Group are more mature than those in Group 2. Group 2 projects, with a GWP of 4 or less, may include the development of stand-alone ultra-low GWP heat pumps, such as those using propane, carbon dioxide, or ammonia.

**Q56:** Will Group 3 consider life cycle assessment analysis?

**CEC:** It could be included in your proposal in the technical merit section. This can be part of your benefits write-up for the technology, but the focus must be on technology innovation in the form of new hardware that is being developed and tested, even though it will be at an earlier stage of research.

**Q57:** Does the Energy Commission require both 100,000 square feet for the building and 100 tons of cooling for the unit?

**CEC:** Yes, for Group 1. The building or aggregate of buildings must total at least 100,000 square feet and must install at least a 100 ton system. Also, the 100 ton system must meet at least 25% of the building peak heating load.

**Q58.** For Group 1 it was mentioned that the project would need to be a "demonstration project". Can you define a "demonstration project"?

**CEC:** For the purposes of this solicitation, it is project located in an actual commercial building in an electric IOU territory that will be the site where the advanced HVAC technology will be installed. The project must meet the requirements of Section I.C. of the solicitation manual, such as including independent measurement and verification of the performance and savings of the technology for at least 12 months pre-installation and 12 months post installation. The demonstration project will be governed by the tasks identified in the Scope of Work (Attachment 5), Schedule (Attachment 6) and Budget (Attachment 7)

**Q59.** Will buildings under Group 3 be exempt from demonstration building requirements?

**CEC:** Yes. See also responses to Questions 40 and 45.

**Q60.** Does the project under Group 3 need to be a complete system or a proposal for a critical subsystem of a commercial HVAC system that drastically reduces the carbon footprint of the system. Is this acceptable?

**CEC:** Group 3 projects must be stand-alone systems that include innovative hardware, and the HVAC system must not be commercially available.

**Q61.**  Is there a cut off for the GWP rating?

**CEC:** Yes, As indicated in Section I.A. of the solicitation manual:

* Group 1: GWP of 10 or less
* Group 2: GWP of 4 or less
* Group 3: GWP of 0

**Q62.** Would a building over 100,000 square feet qualify where 70% is office space and 30% is a data center?

**CEC:** Yes.

**Q63.** There are very few air to water heat pumps available in the US that have GWPs less than 10 at a scale appropriate for 100,000 square feet commercial buildings.

Propane is rarely available in the US. So, that mainly limits the offerings to carbon dioxide systems, which are limited and very expensive. Would you consider raising the GWP requirement to effectively allow for the use of air source heat pumps?

**CEC:** No. Please see response to Question 37.

**Q64.** Technical Merit. It asks for description of the Demonstration building by providing information on the use operating schedule and baseline and proposed annual energy use operating cost of the existing HVAC system.

**CEC:** This information is only required for Group 1.

**Q65.** Will Group 3 consider other technologies, such as better insulation for the building envelope?

**CEC:** No. See response to Question 43.

**Q66.** Does demonstrating occupant centric controls retrieving feedback from occupants in real or near real time for optimizing HVAC operation qualify under the scope of Group 3?

**CEC:** No. This solicitation focuses on technology advancements in HVAC systems for large commercial buildings.

**Q67.** Is a large commercial thermal energy storage solution eligible?

CEC: For Group 1, the minimum low GWP heat pump requirement is at least 100 tons, and the system must meet at least 25% of the building’s peak heating load with an electric heat pump or heat recovery chiller serving at least 100,000 square feet. A thermal energy storage system may provide additional capacity beyond that required amount and be part of the CEC-funded system solution if the above requirements are met.

**Q68.** What is the tonnage requirement for Groups 2 and 3?

**CEC:**

Group 2: This research will develop and test one of the following: a) an air-source heat pump from 20 to 50 tons, or 2) water-source heat pump of 100 tons or less.

Group 3: There is no tonnage requirement.

**Q69.** Is 1234yf on the refrigerant table correct? Says non-flammable, but it’s an A2L mildly flammable per ASHRAE standard.

**CEC:** The presentation has been corrected to note that A2L is mildly flammable.

**Q70.** Are all Groups required to demonstrate a unit that provides 25% of peak load for a 100,000 square foot building? This may be difficult for a TRL 3 type demonstration unit. The requirement seems out of scale with the TRL targets for the project.

**CEC:** The requirement of providing at least 25% of peak building design heating load with an electric heat pump or heat recovery chiller only applies to Group 1. The TRL for Group 1 is TRL 5-8, and this will be indicated in Addendum 1 to the solicitation manual.

**Q71.** Is a floor area of 100,000 square feet a mandatory requirement to be eligible for the demonstration project?

**CEC:** Yes for Group 1, and this square footage can be met by a single building or by the aggregate of multiple buildings if served by a central system. See also response to Question 33.

Groups 2 and 3 do not include square footage requirements.

**Q72.** We understand that projects under Group 3 deal with technologies at TRL 3 or 4. They will not be ready for demonstrations in large commercial buildings (over 100,000 square feet and currently has a hot water or steam heat distribution system). Would projects under Group 3 be exempt from the commercial building demonstration requirement?

**CEC:** Yes. See response to Question 40.

**Q73:** Under Group 2, are multiple modular (smaller) heat pumps okay, or is CEC seeking a single heat pump that meets all the loads?

**CEC:** Yes, multiple modular heat pumps are eligible if each meets the tonnage requirements for Group 2. These are: a) for an air-source heat pump, 20 to 50 tons, or 2) for a water-source heat pump, 100 tons or less. Please note that for Group 2, researchers must develop a new type of heat pump using ultra-low GWP refrigerants with a GWP of 4 or less, such as carbon dioxide, propane, or ammonia. The equipment must be a stand-alone unit that can operate in heating mode or cooling mode by use of a reversing valve or some other way to switch operation from heating to cooling. The equipment must not be a commercially available heat pump.

**Q74.** Is it acceptable to select a demo facility that is smaller than 100,000 square feet but with high-enough loads to meet the GFO criteria?

**CEC:** Projects under Group 1 are required to be at least 100,000 square feet.

Groups 2 and 3 can be completed in a laboratory or in a commercial building, with no size requirements. See responses to Questions 38, 40, and 29, and the revised Section I.C. in Addendum 1 to the solicitation manual.

**Q75.** Will Group 3 consider other technologies, such as better temperature insulation for the building envelope, which can double the temperature insulation?

**CEC:** No.

1. An addendum will be posted to indicate that criteria 8 is match funds and criteria 9 is disadvantaged and low-income communities. [↑](#footnote-ref-2)
2. [EPIC GRANT STANDARD TERMS AND CONDITIONS (ca.gov)](https://www.energy.ca.gov/sites/default/files/2023-06/EPIC_Grant_Ex_C_Standard_General_TCs_revised_06-15-23_ada.pdf) [↑](#footnote-ref-3)
3. [Final Regulation Order (ca.gov)](https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2020/hfc2020/frorevised.pdf) [↑](#footnote-ref-4)