STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 12/2019) CALIFORNIA ENERGY COMMISSION

A) New Agreement # EPC-19-016 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Felix Villanueva	51	916-327-2206

C) Recipient's Legal Name	Federal ID Number
REGENTS OF THE UNIVERSITY OF CALIFORNIA ON BEHALF OF THE DAVIS CAMPUS-WESTERN COOLING EFFICIENCY CENTER	94-6036494

D) Title of Project
Affordable Near- and Medium-Term Solutions for Integration of Low GWP Heat Pumps in Residential Buildings

E) Term and Amount

Start Date	End Date	Amount
5/13/2020	3/31/2024	$ 1,916,306

F) Business Meeting Information

ARFVTP agreements $75K and under delegated to Executive Director

Proposed Business Meeting Date 5/13/2020 Consent Discussion

Business Meeting Presenter Brad Williams Time Needed: 5 minutes

Please select one list serve.

Agenda Item Subject and Description:

REGENTS OF THE UNIVERSITY OF CALIFORNIA ON BEHALF OF THE DAVIS CAMPUS-WESTERN COOLING EFFICIENCY CENTER. Proposed resolution approving agreement EPC-19-016 with The Regents of the University of California on behalf of the Davis campus for a $1,916,306 grant to develop and demonstrate next generation air to air heat pumps and microchannel polymer heat exchanger in single-family and multifamily residential buildings that utilize low global warming potential refrigerants, and achieve high efficiency and cost savings relative to other competing technologies, and adopting staff's determination that this action is exempt from CEQA.

G) California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?

   Yes (skip to question 2)
   No (complete the following (PRC 21065 and 14 CCR 15378)):

   Explain why Agreement is not considered a "Project":

2. If Agreement is considered a "Project" under CEQA:

   a) Agreement **IS** exempt.

   Statutory Exemption. List PRC and/or CCR section number:

   Categorical Exemption. List CCR section number: Cal. Code Regs., tit 14, § 15301 ; Cal. Code Regs., tit 14, § 15306

   Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section: The activities would include developing high efficiency low global warming potential heating, ventilation, and air conditioning (HVAC) heat pumps to be tested in an existing laboratory and installed or used in existing buildings, especially, residential buildings. The equipment and materials would include, but may not be limited to, heating, ventilation, and air conditioning units; paint; building energy controls (e.g., heating, cooling, lighting); and evaluation, measurement, and verification equipment (e.g., power meters, flow meters, sensors, and data loggers). The physical work would include installing this equipment. The project would not involve adding residential units or substantially enlarging buildings.

The above activities fall under two categorical exemptions. First, the operation, repair, maintenance, permitting, licensing, and minor alteration of existing public or private structures, facilities, and mechanical equipment, involving negligible or no expansion of use, falls under California Code of Regulations, title 14, section 15301. Second, the project includes data collection and analysis to be conducted in residential buildings and in existing laboratories of the grant recipient team. California Code of Regulations, title 14, section 15306 exempts basic data collection, research, experimental management, and resource evaluation activities that do not result in a serious or major disturbance to an environmental resource. The proposed project's data analysis activities will have no significant effect on the environment and fall within the categorical exemption of section 15306.

b) Agreement **IS NOT** exempt. (consult with the legal office to determine next steps)

Check all that apply

Initial Study

Negative Declaration

Mitigated Negative Declaration

Environmental Impact Report

Statement of Overriding Considerations

H) List all subcontractors (major and minor) and equipment vendors: (attach additional sheets as necessary)

Legal Company Name:	**Budget**
TRC Engineers, Inc.	$ 480,426
Yolo County Housing	$ 5,000
Eden Housing	$ 5,000
TBD - HVAC Contractor	$ 70,000
TBD - HVAC Contractor 2	$ 70,000
TBD- HVAC Contractor 3	$ 75,000
Rheem	$ 0 ; **($50,000 match)**
Dr. Parth Vaishnav	$ 0 ; **($12,000 match)**
	$

I) List all key partners: (attach additional sheets as necessary)

Legal Company Name:

J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	18-19	301.001F	$1,916,306
			$
			$
			$

R&D Program Area: EERO: Buildings TOTAL: $ 1,916,306

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:

K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Camille Agnew
Address: 215 Sage Street Suite 100
City, State, Zip: Davis, CA 95616-7379
Phone: 530-752-4909
E-Mail: caagnewa@ucdavis.edu

2. Recipient's Project Manager

Name: Vinod Narayanan
Address: 215 Sage St Ste 100
City, State, Zip: Davis, CA 95616-7379
Phone: 530-752-9086
E-Mail: vnarayanan@ucdavis.edu

L) Selection Process Used

Competitive Solicitation Solicitation #: GFO-19-301
First Come First Served Solicitation Solicitation #:

M) The following items should be attached to this GRF

1.	Exhibit A, Scope of Work		Attached
2.	Exhibit B, Budget Detail		Attached
3.	CEC 105, Questionnaire for Identifying Conflicts		Attached
4.	Recipient Resolution	N/A	Attached
5.	CEQA Documentation	N/A	Attached

_____ _____
Agreement Manager **Date**

_____ _____
Office Manager **Date**

_____ _____
Deputy Director **Date**

EXHIBIT A
Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		Development and Lab Testing of Near-Term Solution
3	X	Development of Pilot-scale and Engineering-scale Microchannel Polymer Heat Exchanger
4		Engineering-Scale System Demonstration of Medium-Term Solution
5	X	Field Demonstrations
6		Modeling Ratepayer Impacts
7		Market Barriers and Commercialization Assessment
8		Evaluation of Project Benefits
9		Technology/Knowledge Transfer Activities
10		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
HX	Heat Exchanger
MPHX	Microchannel Polymer Heat Exchanger
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
GWP	Global Warming Potential
HSPF	Heating Seasonal Performance Factor
SEER	Seasonal Energy Efficiency Ratio
TAC	Technical Advisory Committee

II. PURPOSE OF AGREEMENT, PROBLEM/SOLUTION STATEMENT, AND GOALS AND OBJECTIVES

A. Purpose of Agreement

The purpose of this Agreement is to fund the development and demonstration of next generation heat pumps that utilize low (<750) or ultra low (<10) global warming potential (GWP) refrigerants, achieve high efficiency and cost savings relative to other competing technologies. This project will look at both near- and medium-term solutions for systems that safely utilize low- or ultra-low GWP refrigerants in multifamily and single-family homes.

[1] Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

B. Problem/ Solution Statement

Problem

The path to electrifying heating in California will require new advances in heat pump technology. The new technologies must achieve high efficiency in order to match the operating cost of furnaces that use relatively low-cost natural gas. There also must be a consideration about future regulations on the GWP of refrigerants which is expected to be limited to <750 by the California Air Resources Board in the next few years. In order for these new heat pump technologies to really make an impact on the California market, their cost must also come down relative to competing high efficiency heat pumps on the market today.

Solution

The recipient will develop, test, and demonstrate two approaches for solving the problem stated above. One approach will look at near-term solutions for next generation air-to-air heat pumps in collaboration with an industry partner. The industry partner has developed a novel compressor drive technology that utilizes lower-cost compressors to achieve high efficiency. The most efficient heat pump on the market are all variable capacity allowing significant improvements in efficiency when running at part load. These variable-speed compressors add significant cost to the equipment that can make the initial investment in efficient heat pumps too high for many consumers. The proposed technology will also be designed around a new refrigerant that has a lower GWP than the current standard refrigerant R-410A (<750). The recipient will demonstrate the air-to-air heat pump in two low-income housing communities located in different California climate zones. Ten homes will be retrofitted with the next generation heat pump and monitored to determine the installed performance of these systems. This will be followed by a robust tech-to-market effort that will work with various stakeholders to improve market adoption of these heat pumps after the project.

The medium-term solution will advance the technology for air-to-water heat pumps by developing advanced microchannel plastic heat exchangers. Air-to-water heat pumps can be hermetically sealed in the factory significantly reducing the potential for refrigerant loss due to leakage or during field servicing and installation. They can also utilize ultra-low GWP refrigerants (i.e. R-290 with a GWP of 3) with low risk since the systems can be contained outside. Lastly, they provide the potential for load flexibility through integrated thermal storage which will be increasingly important as California electrifies space heating. Air-to-water heat pumps suffer from an inherent efficiency penalty when using a secondary loop for delivering the heating and cooling to the home. Improving the efficiency through advanced water-to-air heat exchangers made from cheaper materials will have a significant impact on the potential for these systems moving forward. This project will develop and test a full-scale heat exchanger in the lab to demonstrate the potential for these heat exchangers to reduce cost and improve efficiency of air-to-water heat pumps.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Develop, test, and demonstrate a 10 percent lower cost high-efficiency heat pump at 18 Seasonal Energy Efficiency Ratio (SEER) and 9.6 Heating Seasonal Performance Factor (HSPF) with low or ultra low GWP refrigerant, compared to competing high efficiency heat pumps on the market today; and
- Develop and test a high efficiency microchannel heat exchanger with 15 to 20 percent higher effectiveness of performance compared to conventional heat exchangers.

Ratepayer Benefits:[2] This Agreement will result in the ratepayer benefits by developing high efficiency heat pumps at lower cost and increased safety. The novel compressor drive technology allows lower cost components to be used to achieve variable capacity, improving efficiency of the heat pump at part load conditions. These advancements are necessary for wide-scale adoption of next generation heat pump technology in order to be competitive with standard furnaces since operating costs of furnaces are generally lower than standard efficiency heat pumps. This compressor drive technology will be utilized in both a near- and medium-term solution for improved heat pump technologies in this project. Electrifying space heating in California would have a significant impact on greenhouse gas emissions in the state by replacing burning of fossil fuels to heat buildings with electric heating systems.

Furthermore, as California transitions to low-GWP refrigerants, it will be necessary to consider the safety of alternative refrigerants that will likely have some mild flammability. The technologies developed in this project will incorporate safety features to ensure the equipment operating with a low-GWP refrigerant poses minimal risk to California residents. The medium-term solution will go a step further by investigating air-to-water heat pumps that can be factory sealed and completely contained outside the home. A secondary fluid (water/glycol) would then be used to deliver heating and cooling to the home. This solution has many benefits including: ability to use ultra-low GWP refrigerants (R-290), minimize refrigerant leakage, reduce installation costs, and allow for thermal storage and load shifting.

Technological Advancement and Breakthroughs:[3] This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by reducing the cost of high efficiency heat pumps and developing equipment that will meet the anticipated regulation that will limit the GWP of refrigerants to <750. Currently, high efficiency heat pumps demonstrate a 15-40 percent improvement over standard efficiency equipment[4] but come at a cost premium. This project will develop a low-cost compressor drive technology that can improve the performance of standard efficiency equipment by allowing for variable-capacity operation. Reducing capacity is the primary strategy that best-in-class equipment uses to improve performance due to improvements in heat exchanger and motor efficiency. This development will occur while also designing the equipment to operate with a low-GWP refrigerants which will ensure the solution is appropriate for the next generation of heat pump technologies.

Agreement Objectives

The objectives of this Agreement are to:

- Develop a high efficiency heat pump at 18 SEER and 9.6 HSPF using lower cost components;
- Obtain both lab and field performance data on a next generation heat pump technology;

[2] California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).

[3] California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

[4] Mahone, A. et al. "Residential Building Electrification in California". April 2019 https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf

- Advance the state-of-the-art in water-to-air heat exchangers for secondary loop applications by using a counter-flow design instead of the standard cross-flow design; and
- Improve market conditions for high efficiency heat pumps in California.

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V).** Products that require a draft version are indicated by marking **"(draft and final)"** after the product name in the "Products" section of the task/subtask. If "(draft and final)" does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, **"days"** means working days.

The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products

- Submit all data and documents required as products in accordance with the following Instructions for Submitting Electronic Files and Developing Software:

    - **Electronic File Format**
        - Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the Energy Commission's software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
- Text documents will be in MS Word file format, version 2007 or later.
- Documents intended for public distribution will be in PDF file format.
- The Recipient must also provide the native Microsoft file format.
- Project management documents will be in Microsoft Project file format, version 2007 or later.

o **Software Application Development**

Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up). Recommend 2010.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
- Microsoft SQL Reporting Services. Recommend 2008 R2.
- XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy Commission's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other Energy Commission staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

  The administrative portion of the meeting will include discussion of the following:
  - o Terms and conditions of the Agreement;
  - o Administrative products (subtask 1.1);
  - o CPR meetings (subtask 1.3);

- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
- An updated Project Schedule;
- Technical products (subtask 1.1);
- Progress reports and invoices (subtask 1.5);
- Final Report (subtask 1.6);
- Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
- Any other relevant topics.

- Provide an *Updated Project Schedule, List of Match Funds,* and *List of Permits*, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

Recipient Products:

- Updated Project Schedule *(if applicable)*
- Updated List of Match Funds *(if applicable)*
- Updated List of Permits *(if applicable)*

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

The goal of this subtask is to determine if the project should continue to receive Energy Commission funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the Energy Commission and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient, and may include the CAO and any other individuals selected by the CAM to provide support to the Energy Commission.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

EXHIBIT A
Scope of Work

The Recipient shall:

- Prepare a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

- CPR Report(s)
- Task Products (draft and/or final as specified in the task)

CAM Products:

- CPR Agenda
- List of Expected CPR Participants
- Schedule for Providing a Progress Determination
- Progress Determination

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
  - Disposition of any state-owned equipment.
  - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
  - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
  - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
  - "Surviving" Agreement provisions such as repayment provisions and confidential products.
  - Final invoicing and release of retention.

- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary *(if applicable)*
- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
  - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions, including a financial report on Match Fund and in-state expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report
The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:
- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM. *(See Task 1.1 for requirements for draft and final products.)*

Recipient Products:
- Final Report Outline (draft and final)

CAM Product:
- Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:
- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
  - Ensure that the report includes the following items, in the following order:
    - Cover page (**required**)
    - Credits page on the reverse side of cover with legal disclaimer (**required**)
    - Acknowledgements page (optional)
    - Preface (**required**)
    - Abstract, keywords, and citation page (**required**)
    - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
    - Executive summary (**required**)
    - Body of the report (**required**)
    - References (if applicable)
    - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
    - Bibliography (if applicable)
    - Appendices (if applicable) (Create a separate volume if very large.)
    - Attachments (if applicable)
  - Ensure that the document is written in the third person.
  - Ensure that the Executive Summary is understandable to the lay public.
    - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
    - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.

        - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
    - Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
    - Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
    - Include a brief description of the project results in the Abstract.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:
- Final Report (draft and final)
- Written Responses to Comments on the Draft Final Report

CAM Product:
- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:
- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

  If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:
    - A list of the match funds that identifies:
        - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
        - The amount of each in-kind contribution, a description of the contribution type

(e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.

- If different from the solicitation application, provide a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.

- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

- Match Funds Status Letter
- Supplemental Match Funds Notification Letter *(if applicable)*
- Match Funds Reduction Notification Letter *(if applicable)*

Subtask 1.8 Permits

The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
    - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
    - The schedule the Recipient will follow in applying for and obtaining the permits.

  The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

- Permit Status Letter
- Updated List of Permits *(if applicable)*
- Updated Schedule for Acquiring Permits *(if applicable)*
- Copy of Each Approved Permit *(if applicable)*

Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Subcontracts *(draft if required by the CAM)*

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
  - Technical area expertise;
  - Knowledge of market applications; or
  - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.

- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

The TAC shall:

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

Products:

- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

IV. TECHNICAL TASKS

TASK 2: DEVELOPMENT AND LAB TESTING OF NEAR-TERM SOLUTION

The goal of this task is to develop and test the performance of an air-to-air heat pump in the laboratory to develop performance maps of the system.

The Recipient shall:

- Complete development of the next generation heat pump.
- Prepare a *Memo on Next Generation Heat Pump Development* describing the status of heat pump development. This memo will include a description of compressor drive. developments and timeline for prototype system delivery to Recipient.
- Prepare a *Heat Pump Performance Test Plan* describing the lab test setup and test conditions for developing performance maps of the system.
- Receive a low GWP-based heat pump and install sensors for lab testing.
- Perform lab testing on the low GWP-based heat pump coupled with a central indoor air handler.
- Extract performance curves for different outdoor environmental conditions over a range of compressor speeds.
  Prepare a *Heat Pump Laboratory Test Report* that includes the results of the lab testing and associated performance maps for energy modeling and prepare copies for TAC members to provide feedback.

Products:

- Memo on Next Generation Heat Pump Development
- Heat Pump Performance Test Plan
- Heat Pump Laboratory Test Report (Draft and Final)

EXHIBIT A
Scope of Work

TASK 3: DEVELOPMENT OF PILOT-SCALE AND ENGINEERING-SCALE MICROCHANNEL POLYMER HEAT EXCHANGER

The goal of this task is to develop a pilot (1/6th scale) and engineering scale (2 ton) microchannel polymer heat exchanger (MPHX) to be used in a secondary loop with ultra-low GWP (<10) refrigerant for air to water heat pumps. The MPHX concept has been validated through modeling and lab-scale testing and is at the start of technical readiness level four. In this task, the heat exchanger (HX) will be scaled up in two stages and manufacturing methods and process-based cost models will be developed. The pilot scale MPHX will be fabricated using 3D printing as well as injection molding methods. These HX will be tested for mechanical integrity through pressure and temperature cycling. Process-based cost models will be developed for both manufacturing methods. The process modeling task will be assisted by a project partner who will be a consultant on the project and paid using cost-share funds. Based on mechanical integrity and cost from the process model, one manufacturing method will be selected for the engineering scale MPHX.

The Recipient shall:

- Develop a pilot-scale MPHX (1/6th scale) using both 3D printing and injection molding fabrication methods.
- Characterize the mechanical integrity of the pilot scale MPHX.
- Prepare a *Pilot-Scale MPHX Fabrication and Mechanical Testing Memo* that describes employed fabrication techniques and needed changes to the MPHX design to address fabrication constraints. Results of mechanical integrity testing will be presented in the form of time-series plots of MPHX internal pressure against time.
- Characterize the performance of the pilot-scale MPHX in a duct under a range of chilled and heated water temperatures, and air and water flow rates.
- Prepare a *Pilot-Scale MPHX Thermal Test Memo* based on the results of thermal testing of the heat exchanger. The memo will include plots of entering and exit temperatures of water and air in the pilot-scale MPHX at different flow rates. The measured data will be reduced further to present variation of pilot-scale MPHX thermal effectiveness against number of transfer units at different heat capacity ratios.
- Prepare a *Process-Based Cost Model Memo* for low-cost manufacturing of the MPHX using both 3D printing and injection molding methods. The cost model will further be used in developing a Production Readiness Plan at the end of the project (Task 10).
- Develop a design for a full-scale central coil MPHX prototype of a two-ton capacity unit based on the down-selected fabrication method.
- Prepare a *MPHX Development and Scale-Up Report* that describes design features, fabrication constraints and fabrication process and prepare copies for TAC members to provide feedback.
- Prepare a *CPR Report* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Pilot-Scale MPHX Fabrication and Mechanical Testing Memo
- Pilot-Scale MPHX Thermal Test Memo
- Process-Based Cost Model Memo
- MPHX Development and Scale-Up Report (Draft and Final)
- CPR Report #1

TASK 4: ENGINEERING-SCALE SYSTEM DEMONSTRATION OF MEDIUM-TERM SOLUTION
The goal of this task is to perform an engineering-scale demonstration of the performance of the MPHX when coupled to an air-to-water heat pump within a secondary loop under relevant operating conditions. The demonstration will be performed in relevant environmental conditions for cooling in Recipient's environmental chamber.

The Recipient shall:

- Prepare an *Engineering-Scale Medium-term Solution Test Plan Memo* that describes the test conditions and lab setup of the medium-term solution.
- Perform system demonstration of an air-to-water heat pump coupled to an engineering-scale MPHX developed in Task 3 for a range of outdoor air temperatures and load conditions.
- Prepare an *Engineering-Scale Medium-term Solution Testing Report* that will discuss the results of the lab test including coefficient of performance capacity, and energy use at a range of temperature conditions and prepare copies for TAC members to provide feedback.

Products:

- Engineering-Scale Medium-term Solution Test Plan Memo
- Engineering-Scale Medium-term Solution Testing Report (Draft and Final)

TASK 5: FIELD DEMONSTRATIONS
The goal of this task is to install the next generation air to air heat pumps in 10 homes over two California climate zones and evaluate the performance relative to the baseline.

The Recipient shall:

- Develop a *Field Measurement and Verification Plan* that describes the how the installed heat pumps in the demonstration sites will be monitored, measured, and verified to be operational and achieving the energy savings, cost savings and other benefits.
- Develop materials and meet with residents (as needed) to inform them of the project, recruit and advise them on what to expect.
- Maintain an open line of communication between field study participants, housing staff, and researchers to identify and resolve any issues or questions that may arise.
- Conduct a baseline survey with research participants to document occupant experience and satisfaction with existing heating/cooling equipment.
- Install monitoring instrumentation in 10 homes and collect up to nine months of baseline performance data.
- Prepare *Memo on Analysis of Baseline Performance* that describes the baseline performance of the currently installed heating, ventilating, and air conditioning units at each of the 10 homes.
- Install next generation heat pumps in 10 homes.
- Prepare *Memo on Field Installation Process and User Feedback* that describes the installation process of the next generation heat pumps in the 10 homes and resident feedback.
- Monitor performance for at least nine months including winter and summer months to collect post-retrofit performance data.
- Conduct a post-retrofit survey with research participants to document occupant experience and satisfaction with the experimental heat pumps.

- Prepare *Memo on Customer Satisfaction Survey Results* that describes the residents' satisfaction on the next generation heat pumps.
- Analyze field data and evaluate energy and emissions impacts.
- Generate *Field Test Results of Next Generation Heat Pump Report* that describes the quantitative and qualitative results collected during the measurement and verification activity and compare the actual performance achieved in the 10 homes with those identified in Agreement Goals. Prepare copies for TAC members to review and provide feedback.
- Prepare a *CPR Report* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Field Measurement and Verification Plan
- Memo on Analysis of Baseline Performance
- Memo on Field Installation Process and User Feedback
- Memo on Customer Satisfaction Survey Results
- Field Test Results of Next Generation Heat Pump Report (Draft and Final)
- CPR Report #2

TASK 6: MODELING IMPACTS TO CALIFORNIA RATEPAYERS

The goal of this task is to use an energy modeling tool to assess the performance of the next generation heat pump in multiple building types in each of the California climate zones. These models will be used to evaluate the impact that the new heat pump technology would have on California ratepayers.

The Recipient shall:

- Model the system performance in prototypical single- and multifamily residential homes in each of the 16 California climate zones
- Compare the annual performance of the next generation heat pump to standard heat pump and standard air conditioner paired with natural gas furnace
- Determine the energy use, energy cost, and greenhouse gas emissions resulting from each HVAC system for each building type in each California climate zone.
- Prepare report on *Next Generation Heat Pump Modeling Results* that describes the energy and carbon emission impacts to California ratepayers related to the next generation heat pump that will be made available at the end of the project

Products:

- Next Generation Heat Pump Modeling Results

TASK 7: MARKET BARRIERS AND COMMERCIALIZATION ASSESSMENT

The goal of this task is to describe the barriers to market readiness and adoption, as well as assess the opportunities for commercialization.

The Recipient shall:

- Compile existing literature on the market for heat pumps in California, including previous studies from Investor-owned Utilities (IOUs), Sacramento Municipal Utility District (SMUD), Northwest Energy Efficiency Alliance (NEEA), Department of Energy (DOE),

American Council for an Energy-Efficient Economy (ACEEE), Natural Resources Defense Council (NRDC), and Energy and Environmental Economics (E3).

- Conduct interviews with key stakeholders such as distributors, contractors/installers, utility staff, and researchers (e.g., NRDC, New Building Institute, E3, DOE) who have studied these technologies previously and include their insights on the research completed in this agreement to overcome barriers to market adoption.
- Conduct a holistic analysis of the barriers to market readiness and adoption, including technical, practical, economic, behavioral, and policy-related factors that influence the supply of and demand for heat pumps for heating and cooling, drawing on the information collected
- Develop *Report on Obstacles and Opportunities on the Path to Market* that summarizes the barriers to market readiness and adoption, including the technical, practical, economic, behavioral, and policy-related factors that influence the supply of and demand for heat pumps for heating and cooling in California. The report will consider how the advanced heat pump technology developed in this agreement can overcome the obstacles presented by existing heat pump technologies

Products:

- Report on Obstacles and Opportunities on the Path to Market

TASK 8: EVALUATION OF PROJECT BENEFITS

The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:

    - <u>For Product Development Projects and Project Demonstrations:</u>
        - Published documents, including date, title, and periodical name.
        - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
        - Greenhouse gas and criteria emissions reductions.
        - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
        - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.

- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Additional Information for Product Development Projects:
  - Outcome of product development efforts, such copyrights and license agreements.
  - Units sold or projected to be sold in California and outside of California.
  - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
  - Investment dollars/follow-on private funding as a result of Energy Commission funding.
  - Patent numbers and applications, along with dates and brief descriptions.
- Additional Information for Product Demonstrations:
  - Outcome of demonstrations and status of technology.
  - Number of similar installations.
  - Jobs created/retained as a result of the Agreement.

o For Information/Tools and Other Research Studies:

- Outcome of project.
- Published documents, including date, title, and periodical name.
- A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
- The number of website downloads.
- An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
- An estimate of energy and non-energy benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.

- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

Products:

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

TASK 9: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES
The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

The Recipient shall:

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
  - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
  - A description of the intended use(s) for and users of the project results.
  - Published documents, including date, title, and periodical name.
  - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
  - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
  - The number of website downloads or public requests for project results.
  - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- High Quality Digital Photographs
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

TASK 10: PRODUCTION READINESS PLAN
The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

EXHIBIT A
Scope of Work

The Recipient shall:

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
  - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
  - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
  - The estimated cost of production.
  - The expected investment threshold needed to launch the commercial product.
  - An implementation plan to ramp up to full production.
  - The outcome of product development efforts, such as copyrights and license agreements.
  - Patent numbers and applications, along with dates and brief descriptions.
  - Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

RESOLUTION NO: 20-0513-7e

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: REGENTS OF THE UNIVERSITY OF CALIFORNIA ON BEHALF OF THE DAVIS CAMPUS-WESTERN COOLING EFFICIENCY CENTER

RESOLVED, that the State Energy Resources Conservation and Development Commission (CEC) adopts the staff CEQA findings contained in the Agreement or Amendment Request Form (as applicable); and

RESOLVED, that the CEC approves Agreement EPC-19-016 with The Regents of the University of California on behalf of the Davis campus for a $1,916,306 grant to develop and demonstrate next generation air to air heat pumps and microchannel polymer heat exchanger in single-family and multifamily residential buildings that utilize low global warming potential refrigerants, and achieve high efficiency and cost savings relative to other competing technologies, and adopting staff's determination that this action is exempt from CEQA; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the CEC.

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the CEC held on May 13, 2020.

AYE:
NAY:
ABSENT:
ABSTAIN:

_____
Cody Goldthrite
Secretariat