STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

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

A) New Agreement # EPC-21-016 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Michael Ferreira	51	510-364-8808

C) Recipient's Legal Name	Federal ID Number
Icarus RT, Inc.	81-4258881

D) Title of Project
Icarus Hybrid Photovoltaic/Thermal Solar Plus Storage Cogeneration System

E) Term and Amount

Start Date	End Date	Amount
2/14/2022	3/31/2026	$ 1,087,588

F) Business Meeting Information

☐ ARFVTP agreements $75K and under delegated to Executive Director

Proposed Business Meeting Date 1/26/2022 ☐ Consent ☒ Discussion

Business Meeting Presenter Michael Ferreira Time Needed: 5 minutes

Please select one list serve. EPIC (Electric Program Investment Charge)

Agenda Item Subject and Description:

ICARUS RT, INC.

Proposed resolution approving agreement EPC-21-016 with Icarus RT, Inc. for a $1,087,588 grant to conduct the first commercial demonstration of the company's 280-kW Quartet hybrid PV/thermal solar plus storage cogeneration system at the project site, and adopting staff's determination that this project is exempt from CEQA. The Quartet system extracts waste heat from PV panels using Icarus' proprietary heat extractors to improve PV performance while also converting the heat energy into hot water on-demand. The results of the proposed project will demonstrate several aspects of commercial readiness as well as produce real-world data on panel cooling, performance improvements, energy storage, and cost savings. (EPIC funding) Contact: Michael Ferreira.

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: PRC § 21080.35
     - ☐ Categorical Exemption. List CCR section number:
     - ☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section: The Icarus Quartet system extracts waste heat from PV panels to improve PV performance, collects and stores heat energy, and converts heat energy into hot water on-demand. The project will include an overhead parking canopy to install PV panels, heat extractors and solar thermal modules. The proposed project will be an installation of a solar PV/thermal project on an existing parking lot and roof. Trenching is necessary for new piping. Small bore piping will deliver hot water from the solar array to the building hot water heaters. The Police Department building already exists and is planning installation of additional solar PV. Senate Bill 226 (2011) exempts solar energy systems associated with building rooftops and parking lots from environmental review under CEQA. This CEQA exemption is contained in Section 21080.35 of the Public Resources Code.

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**
TBD - PV/Thermal Installation Contractor	$ 280,000
TBD - EV Charger Installation Contractor	$ 50,000

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	20-21	301.001H	$1,087,588

R&D Program Area: EDMFO: EDMF TOTAL: $ 1,087,588

Explanation for “Other” selection

Reimbursement Contract #: Federal Agreement #:

K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Alyssa Dugar
Address: 7710 Kenamar Ct
City, State, Zip: San Diego, CA 92121-2425
Phone: 832-816-6708
E-Mail: ADugar@icarusrt.com

2. Recipient's Project Manager

Name: Mark Anderson
Address: 7710 Kenamar Ct
City, State, Zip: San Diego, CA 92121-2425
Phone: 760-889-1327
E-Mail: Manderson@icarusrt.com

L) Selection Process Used

☒ Competitive Solicitation Solicitation #: GFO-20-301
☐ First Come First Served Solicitation Solicitation #:
☐ Non-Competitive Bid Follow-on Funding (SB 115)

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		Project Planning
3	x	Manufacture Components
4		Install 280-kW Quartet System
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
EPC	Engineering, Procurement, and Construction
Li-Ion	Lithium-Ion
PV	Photovoltaic
PV/T	Photovoltaic Thermal
RPS	Renewable Portfolio Standards
TAC	Technical Advisory Committee
TRL	Technology Readiness Level

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

A. Purpose of Agreement

The purpose of this agreement is to fund the installation and testing of a 280-kW Quartet System. The objectives of this project are to boost photovoltaic (PV) performance, collect and store thermal energy, generate hot water on-demand, and reduce greenhouse gas emissions for a host demonstration site in California. Results from this installation will validate the performance of the Quartet System, advance the technology to a technology readiness level (TRL) 9 and provide a minimum viable product for market launch in California.

[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

Solar PV technology continues to face limitations in efficiency and storage. PV panels convert less than 21 percent of incoming solar energy into electricity, dropping to 16 percent as they heat up during the day. The effects of the California Energy "Duck Curve" compounds panel inefficiency because solar production decreases in the evening when customer demand is at its peak. Insufficient energy storage prevents solar energy from meeting demand in the evenings, forcing utilities and consumers to rely on fossil fuel plants or expensive, environmentally challenging lithium-ion (Li-Ion) battery storage.

Furthermore, over 40 communities throughout California are already banning the use of natural gas in new construction. The high cost of electric water heating vs. natural gas water heating will raise electric bills for all Californian utility rate payers. Combined with higher time-of-use rates in the evenings when families are showering and washing dishes, the economic impact will disproportionally cripple lower income residents. Therefore, solutions that can heat water on-demand at a much lower cost than electric water heaters are necessary in California.

Finally, as electric vehicles (EV's) are becoming more popular, and as charging demand for EV's increases, the current grid and infrastructure are challenged to provide additional power for the charging stations. Adding additional commercial solar PV systems, and boosting PV system performance can alleviate additional reliance on the grid for EV charging.

Solution

The Recipient will demonstrate at-scale the potential of its Quartet hybrid photovoltaic thermal (PV/T) solar plus storage cogeneration system which boosts PV generation as well as captures, stores, and converts thermal waste heat from PV panels into hot water on-demand. Widespread adoption of the Quartet System will help overcome several barriers to achieving the state's statutory energy goals as well as benefit California investor-owned-utility ratepayers.

Proof of concept testing has demonstrated the Recipient's prototype heat extractor to cool PV panels by an average temperature of 18 °C which corresponds approximately to a 12 percent power generating boost. The Quartet System offers California utilities another tool to help meet renewable portfolio standards (RPS) goals on an accelerated timeline and with fewer panels. This will result in a net cost savings for commercial customers and utilities as well as reduce the footprint of solar on California's natural environments.

Additionally, the ability to generate hot water on-demand reduces demand on electricity for water heating during the evening and nighttime. This helps lowers the California "duck curve", improve grid reliability, and safety in the event of a Public Safety Power Shutoff. The Quartet System reduces reliance on natural gas for meeting peak demand.

Finally, the Recipient will install electric vechicle (EV) charging stations onsite with the Quartet System to demonstrate and measure use of additional daytime solar generation from a standard commercial PV array including the additional power generated due to the Icarus system boosting power output (performance) to power the EV charging stations, reducing reliance on the grid. The Quartet control system will manage the distribution of daytime power to the charging stations, automatically discerning the value of and demand for power at the charging stations, and routing power accordingly.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Install, test, and validate the performance and emission savings of a 280-kW Quartet System.
- Install up to 10 EV charging stations.
- Cool PV panels to boost their power performance.
- Collect and store waste heat.
- Generate hot water on-demand.
- Compare Quartet System performance to that of current solar plus storage systems.

Ratepayer Benefits:[2]

The Quartet System improves grid reliability by storing thermal energy recovered from solar PV panels and converts it to hot water on-demand. This helps reduce the grid demand for water heating and reduces ratepayers cost burden during peak demand periods. Additionally, this technology will lower the cost of solar plus storage projects by 50 percent which will accelerate their installation across the state, including in disadvantaged/low-income communities. Finally, microgrid generation reduces the need for long transmission and power lines, which in recent years have sparked devastating wildfires in California. The Quartet System will also make the air quality safer throughout the state by reducing CO_2 emissions by as much as 280 metric tons per year per 100-kW of the Quartet System installed. With the Quartet System, California will enhance the reliability of solar energy, lower the cost of solar plus storage, and improve grid safety to advance California's 100 percent RPS goals.

Technological Advancement and Breakthroughs:[3]

This Agreement will lead to technological advancement and breakthroughs to overcome the limitations of PV and energy storage technologies that are barriers to achieving California's statutory renewable energy goals. Additionally, this Agreement will provide for demonstrating the cost competitiveness of commercial hybrid solar PV/T systems plus storage systems against solar PV plus Li-Ion systems, driving adoption of this breakthrough technology.

The recipient's Quartet System will do this by generating additional power from a PV/T array through panel cooling and making use of the waste heat to generate hot water for the buildings it services. The recipient aims to successfully commercialize its hybrid PV/T solar plus storage cogeneration system. Once commercialized, the Quartet System will provide a cheaper and cleaner alternative to Li-Ion batteries. By replacing Li-Ion battery storage with thermal energy storage, California will reduce its demand lithium-ion batteries which are environmentally destructive due to mining and lack of a battery recycling infrastructure.

Agreement Objectives

The objectives of this Agreement are to:

- Install a new 280-kW Quartet System at the CVPD Headquarters.

[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).

- Install up to 10 EV charging stations under the new PV canopy installed with this project.
- Manufacture the recipient's proprietary heat extractor at scale.
- Cool PV panels by 20 °C or more with the recipient's heat extractor.
- Improve PV energy generation (kWh) by 12 percent or more.
- Generate up to 18,000 gallons of hot water (~50 °C) daily to the CVPD.
- Reduce CO_2 emissions by an average of 48 MT per month between PV efficiency boosting and hot water generation.

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).** All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations**.** All technical tasks should include product(s). 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 California Energy Commission's (CEC) 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.

The following describes the accepted formats for electronic data and documents provided to the CEC 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.
- Project management documents will be in Microsoft Project file format, version 2007 or later.

- **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 CEC'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 CEC 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:
- Terms and conditions of the Agreement;
- Invoicing and auditing procedures;
- Administrative products (subtask 1.1);
- 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 (subtask 1.5);
- Final Report (subtask 1.6);
- Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
- Any other relevant topics.

- Provide *Kick-off Meeting Presentation* to include but not limited to:
  - Project overview (i.e. project description, goals and objectives, technical tasks, expected benefits, etc.)
  - Project schedule that identifies milestones
  - List of potential risk factors and hurdles, and mitigation strategy

- Provide an *Updated Project Schedule, Match Funds Status Letter,* and *Permit Status Letter*, 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:
- Kick-off Meeting Presentation
- Updated Project Schedule *(if applicable)*
- Match Funds Status Letter (subtask 1.7) *(if applicable)*
- Permit Status Letter (subtask 1.8) *(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 CEC 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 CEC 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 CEC.

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 CEC, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

- Prepare and submit 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.
- 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* with 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)

CAM Products:

- CPR Agenda
- 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 CEC 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 procured equipment.
    - The CEC'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 copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

Products:
- Final Meeting Agreement Summary *(if applicable)*
- Schedule for Completing Agreement Closeout Activities
- All Final 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 quarterly *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 Funds 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. When creating the Final Report Outline and the Final Report, the Recipient must use the CEC 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 *Energy Commission Style Manual* provided by the CAM.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Energy Commission 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, Energy Commission 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)
- Submit a draft of the Executive Summary to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* received on the Executive Summary. For each comment received, the recipient will identify in the summary the following:
  - Comments the recipient proposes to incorporate.
  - Comments the recipient does propose to incorporate and an explanation for why.

- 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.
- Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments were not incorporated into the final product.

- Submit the revised *Final Report* electronically with any Written Responses to Comments within 10 days of receipt of CAM's Written Comments on the Draft Final Report, unless the CAM specifies a longer time period or approves a request for additional time.

Products:

- Summary of TAC Comments
- Draft Final Report
- Written Responses to Comments *(if applicable)*
- 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 CEC 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 CEC 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 CEC 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 each 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.
- 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, to the extent the TAC members feel is appropriate, 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.

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.
- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

Products:

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

Subtask 1.12 Project Performance Metrics

The goal of this subtask is to finalize key performance targets for the project based on feedback from the TAC and report on final results in achieving those targets. The performance targets should be a combination of scientific, engineering, techno-economic, and/or programmatic metrics that provide the most significant indicator of the research or technology's potential success.

The Recipient shall:

- Complete and submit the project performance metrics from the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.
- Present the draft project performance metrics at the first TAC meeting to solicit input and comments from the TAC members.
- Develop and submit a *TAC Performance Metrics Summary* that summarizes comments received from the TAC members on the proposed project performance metrics. The *TAC Performance Metrics Summary* will identify:
    - TAC comments the Recipient proposes to incorporate into the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
    - TAC comments the Recipient does not propose to incorporate with and explanation why.
- Develop and submit a *Project Performance Metrics Results* document describing the extent to which the Recipient met each of the performance metrics in the *Final Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
- Discuss the *Project Performance Metrics Results* at the Final Meeting.

Products:

- TAC Performance Metrics Summary
- Project Performance Metrics Results

IV. TECHNICAL TASKS

*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. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.*

TASK 2: PROJECT PLANNING

The goal of this task is for the Recipient to work with the selected Engineering, Procurement, and Construction (EPC) contractor and a host site to plan the project development. This will involve the Recipient's engineering team to work on plans, schematics, project scheduling, and other components necessary to finalize the engineering work.

The Recipient shall:

- Solicit proposals from EPC contractors via a qualified request for proposal process.
- Evaluate proposals, interview candidates and select the winning EPC contractor.
- Coordinate project planning with EPC contractor and the host site
- Provide *Project Engineering Report* to CAM that may include, but is not limited to:
    - Abridged or detailed Project Schedule
    - Finalized schematic designs, engineering plans and cost estimates for Quartet System and EV charger installation.

Products:

- Project Engineering Report

TASK 3: MANUFACTURE QUARTET COMPONENTS

The goal of this task is select a qualified company to fabricate the Recipient's proprietary heat extractor panels, storage tanks, and monitor and control system. Once fabricated, these components will be delivered to the project site for installation. The two arrays will require approximately 700 heat extractors, 19 storage tanks and 19 control systems.

The Recipient shall:

- Obtain quotes from contract manufacturers via a qualified request for proposal process.
- Evaluate proposals, candidates and select a component manufacturer.
- Provide *Fabrication Update Report* to CAM that may include, but is not limited to, a summary of the evaluation process and a description of the planned manufacturing process of the heat extractors, storage tank, and monitor and control system.

Products:

- Fabrication Update Report

TASK 4: INSTALL 280-KW QUARTET SYSTEM

The goal of this task is to install the 280-kW Quartet System and up to 10 EV charging stations.

Subtask 4.1: Install and Test PV Canopy and Heat Extractors

The goal of this task is to install the 280-kW PV Canopy and Heat Extractors. The recipient's proprietary heat extractors will be installed to the back of all the PV panels prior to installation. System piping for coolant flow will also be installed during installation. During this process, the project team will troubleshoot the extractors to optimize panel cooling and heat extraction.

The Recipient shall:

- Create a *PV Canopy and Heat Extractor Testing Plan* that includes:
  - The tests being conducted
  - Critical metrics being validated
  - Measurement tools for testing of the PV/T array in accordance with the testing plan
- Produce *PV Canopy and Heat Extractor Installation and Testing Completion Memo* documenting the completion of the installation and results of testing.
- Complete *CPR Report #1* and attend CPR meeting per Task 1.3.

Products:

- PV Canopy and Heat Extractor Testing Plan
- PV Canopy and Heat Extractor Installation and Testing Completion Memo
- CPR Report #1

Subtask 4.2: Install and Test Energy Storage Tank and System

The goal of this task is to install and test the energy storage tanks used to store the thermal energy from this PV/T array.

The Recipient shall:

- Create a *Energy Storage Tank and System Testing Plan* that includes:
  - Measurement tools for testing
  - The tests being conducted
  - Critical metrics being validated
- Install the manufactured storage tanks
- Test the tanks in accordance with the testing plan and troubleshoot to ensure the tanks are reporting acceptable data and performing optimally.
- Produce *Energy Storage System Installation and Testing Completion Memo* documenting the completion of the energy storage system installation and results of testing, including any challenges and how they were resolved.

Products:

- Energy Storage Tank and System Testing Plan
- Energy Storage Tank and System Installation and Testing Completion Memo

Subtask 4.3: Install and Test Monitor and Control System

The goal of this task is to install and test the recipient's proprietary monitor and control system which will operate the Quartet System.

The Recipient shall:

- Create a *Monitor and Control System Testing Plan* that includes:
  - Measurement tools for testing

  - The tests being conducted
  - Critical metrics being validated
- Install the monitor and control system.
- Test the monitor and control system in accordance with the testing plan and troubleshoot to ensure the system reports data accurately and controls the system optimally.
- Produce a *Monitor and Control System Installation and Testing Completion Memo* documenting completion of the monitor and control system and results of testing. Include any challenges encountered and how they were resolved.

Products:
- Monitor and Control System Testing Plan
- Monitor and Control System Installation and Testing Completion Memo

Subtask 4.4: Install and Test EV Charging Stations
The goal of this task is to install up to 10 EV charging stations.

The Recipient shall:
- Create an *EV Charging Station Testing Plan* that includes:
  - Measurement tools for testing
  - The tests being conducted
  - Critical metrics being validated
- Install the charging stations and test their performance to ensure proper function.
- Produce *EV Charging Station Installation and Testing Completion Memo* documenting the completion of the EV charging station installations and results of testing.

Products:
- EV Charging Station Testing Plan
- EV Charging Station Installation and Testing Completion Memo

Subtask 4.5: Integrate Quartet System to the Building
The goal of this task is to connect the PV/T array, energy storage tanks, the control system, EV charging stations and test its performance when integrated to the CVPD. The project team will test and troubleshoot to ensure the Quartet System operates optimally to meet the demands of the CVPD. At the conclusion of this testing, the 280-kW Quartet System and charging stations will be considered operational and finalized.

The Recipient shall:
- Create a *Building Integration Testing Plan* that includes:
  - Measurement tools for testing
  - The tests being conducted
  - Critical metrics being validated including performance of Icarus Quartet System to manage and provide renewable solar power to the EV Charging Stations (i.e., demonstrate reduced grid reliance to provide power to the Charging Stations)
  - Test results of the EV Charging Stations and the Icarus Quartet System in accordance with the testing plan

- Prepare *Building Integration Completion Memo* documenting the completion of the systems being integrated with the building that may include but is not limited to:
  - Connect the sub-systems to assemble the 280-kW Quartet System including:

- PV/T Array
- Energy storage tanks
- Monitor and control system
- EV charging stations

Products:

- Building Integration Testing Plan
- Building Integration Completion Memo

TASK 5: EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

- Complete *the Initial Project Benefits Questionnaire*. The Initial Project Benefits Questionnaire shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Complete the *Annual Survey* each year by January 31st. The Annual Survey includes but is not limited to the following information:
  - Technology commercialization progress
  - New media and publications
  - Company growth
  - Follow-on funding and awards received
- Complete the *Final Project Benefits Questionnaire*. The Final Project Benefits Questionnaire shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete the project profile for the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- Update annually, at a minimum, the project profile for the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund) annually by January 31st.
- If the Prime Recipient is an Innovation Partner on the project, complete the organizational profile for the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, update annually, at a minimum, the organization profile for the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund) by January 31st.

Products:

- Initial Project Benefits Questionnaire
- Annual Survey(s)
- Final Project Benefits Questionnaire
- Documentation of Project Profile on EnergizeInnovation.fund
- Documentation of Organization Profile on EnergizeInnovation.fund

TASK 6: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to ensure the technological learning that resulted from the demonstration(s) is captured and disseminated to the range of professions that will be responsible for future deployments of this technology or similar technologies.

The Recipient Shall:

- Develop and submit a *Project Case Study Plan (Draft/Final)* that outlines how the Recipient will document the planning, construction, commissioning, and operation of the technology or system being demonstrated. The *Project Case Study Plan* should include:
  - An outline of the objectives, goals, and activities of the case study.
  - The organization that will be conducting the case study and the plan for conducting it.
  - A list of professions and practitioners involved in the technology's deployment.
  - Specific activities the recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
  - Presentations/webinars/training events to disseminate the results of the case study.
- Present the *Draft Project Case Study Plan* to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the *Draft Project Case Study Plan*. This document will identify:
  - TAC comments the recipient proposes to incorporate into the *Final Technology Transfer Plan*.
  - TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit the *Final Project Case Study Plan* to the CAM for approval.
- Execute the *Final Project Case Study Plan* and develop and submit a *Project Case Study (Draft/Final)*
- When directed by the CAM, develop presentation materials for an CEC- sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California CEC.
- 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.

Products:

- Project Case Study Plan (Draft/Final)
- Summary of TAC Comments
- Project Case Study (Draft/Final)
- High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

RESOLUTION NO: 22-0126-9d

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: ICARUS RT, INC.

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-21-016 with Icarus RT, Inc. for a $1,087,588 grant to conduct the first commercial demonstration of the company's 280-kW Quartet hybrid PV/thermal solar plus storage cogeneration system at the project site. The Quartet system extracts waste heat from PV panels using Icarus' proprietary heat extractors to improve PV performance while also converting the heat energy into hot water on-demand. The results of the proposed project will demonstrate several aspects of commercial readiness as well as produce real-world data on panel cooling, performance improvements, energy storage, and cost savings; and

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

CERTIFICATION

The undersigned Secretariat to the CEC 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 January 26, 2022.
AYE:
NAY:
ABSENT:
ABSTAIN:

_____
Liza Lopez
Secretariat