California Energy Commission
February 12, 2025 Business Meeting
Backup Materials for Intertie Incorporated

The following backup materials for the above-referenced agenda item are available in this PDF packet as listed below:

1. Proposed Resolution
2. Grant Request Form
3. Scope of Work

[PROPOSED]

RESOLUTION NO: 25-212-03g

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: Intertie Incorporated

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-24-038 with Intertie Incorporated for a $1,400,900 grant. This agreement will validate the feasibility of a DC-fed HVAC system with brushless motors, operating within a controlled DC nanogrid alongside Intertie's solar-plus-storage solution in Clovis. The project aims to support California's energy goals for commercial buildings, including zero-net energy, zero-net grid impact, and zero carbon emissions; 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 February 12,2025.

AYE:
NAY:
ABSENT:
ABSTAIN:

Dated:

_____
Kristine Banaag
Secretariat

STATE OF CALIFORNIA
CALIFORNIA ENERGY COMMISSION

CEC-270 (Revised 01/2024)

GRANT REQUEST FORM (GRF)

A. New Agreement Number

IMPORTANT: New Agreement # to be completed by Contracts, Grants, and Loans Office.

New Agreement Number: EPC-24-038

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Harrison Reynolds
3. MS-:None
4. Phone Number: 916-776-0692

C. Recipient's Information

1. Recipient's Legal Name: Intertie Incorporated
2. Federal ID Number: 35-2569628

D. Title of Project

Title of project: Deployment and Demonstration of a Novel DC-Coupled HVAC Technology in the Central Valley

E. Term and Amount

1. Start Date: 2/28/2025
2. End Date: 12/29/2028
3. Amount: $1,400,900.00

F. Business Meeting Information

1. Are the ARFVTP agreements $75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 2/28/2025.
3. Consent or Discussion? Consent
4. Business Meeting Presenter Name: Jason Tancher
5. Time Needed for Business Meeting: N/A (consent).
6. The email subscription topic is: EPIC (Electric Program Investment Charge).

Agenda Item Subject and Description:

Intertie Incorporated. Proposed resolution approving agreement EPC-24-038 with Intertie Incorporated for a $1,400,900 grant, and adopting staff's recommendation that this action is exempt from CEQA. This agreement will validate the feasibility of a DC-fed HVAC system with brushless motors, operating within a controlled DC nanogrid alongside Intertie's solar-plus-storage solution in Clovis. The project aims to support California's energy goals for commercial buildings, including zero-net energy, zero-net grid impact, and zero carbon emissions.

G. California Environmental Quality Act (CEQA) Compliance

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

   If yes, skip to question 2.

   If no, complete the following (PRC 21065 and 14 CCR 15378) and explain why Agreement is not considered a "Project":

2. **If Agreement is considered a "Project" under CEQA answer the following questions.**
   a) Agreement **IS** exempt?

      Yes

      Statutory Exemption?
      Yes
      If yes, list PRC and/or CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

      PRC section number: None Public Resources Code, § 21080.35
      CCR section number: None

      Categorical Exemption?
      Yes

      If yes, list CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

      CCR section number: Cal. Code Regs., tit. 14, § 15301 ; Cal. Code Regs., tit. 14, § 15304 ;

      Common Sense Exemption? 14 CCR 15061 (b) (3)
      No

      If yes, explain reason why Agreement is exempt under the above section. If no, enter "Not applicable" and go to the next section.

      California Public Resources Code section 21080.35 states that the provisions of the California Environmental Quality Act (CEQA) do not apply to the installation of a solar energy system on the roof of an existing building. This project involves the installation of a solar energy system on the roof of an existing commercial building. Therefore, the project is not subject to the provisions of CEQA under section 21080.35.

      California Code of Regulations, title 14, section 15301 provides that projects which consist of the operation, repair, maintenance, permitting, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which have negligible or no expansion of existing or former use, are categorically exempt from the provisions of CEQA. This project involves the design, fabrication, and demonstration of a nanogrid-based, DC-fed HVAC system that leverages rooftop solar, battery storage, and DC hub technology to reduce grid impacts and carbon emissions. The design and fabrication as well as the demonstration will take place at existing facilities with negligible expansion of existing or former use. This project involves the minor alteration of existing facilities and the operation of mechanical equipment. Therefore, this project is exempt from the provisions of CEQA under section 15301.

California Code of Regulations, title 14, section 15303 provides that projects which consist of construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure; and the installation accessory (appurtenant) structures including garages, carports, patios, swimming pools, and fences, are categorically exempt from the provisions of CEQA. This project involves the installation of a 35 kW rooftop solar system, a 186 kWh battery energy storage system, and DC hub technology, amounting to small new equipment being installed at an existing facility. The solar array will be installed on the rooftop of an existing building, and the battery energy storage system will be installed approximately ten feet from the existing building, to be connected to the building via minor trenching or conduit along existing fencing, amounting to the installation of small, accessory (appurtenant) structures. Therefore, this project is exempt from the provisions of CEQA under section 15303.

California Code of Regulations, title 14, section 15305 provides that projects which consist of the minor public or private alterations in the condition of land, water, and/or vegetation which do not involve removal of healthy, mature, scenic trees, including minor trenching and backfilling where the surface is restored, are categorically exempt from the provisions of CEQA. This project involves the installation of a battery energy storage system to be connected to an existing facility either by minor underground trenching of ten feet or less or by conduit along an existing fence. No trees will be removed, and the trenching will be backfilled and the surface restored. Therefore, this project is exempt from the provisions of CEQA under section 15305.
California Code of Regulations, title 14, section 15306 provides that projects which consist of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource are categorically exempt from the provisions of CEQA. This project involves research and information and data collection regarding the performance of a nanogrid-based, DC-fed HVAC system powered by solar and battery storage. No serious or major disturbance to an environmental resource will occur. Therefore, this project is exempt from the provisions of CEQA under section 15306.

California Code of Regulations, title 14, section 15311 provides that projects which consist of the construction or replacement of minor structures accessory to (appurtenant to) existing commercial facilities are categorically exempt from the provisions of CEQA. This project involves the installation of a 186 kWh battery energy storage system, a minor structure, on the premises of and appurtenant to an existing commercial facility. Therefore, the project is exempt from the provisions of CEQA under section 15311.

This project does not involve impacts on any particularly sensitive environment; does not involve any cumulative impacts of successive projects of the same type in the same place that might be considered significant; does not involve unusual circumstances that might have a significant effect on the environment; will not result in damage to scenic resources within a highway officially designated as a state scenic highway; the project site is not included on any list compiled pursuant to Government Code section 65962.5; and the project will not cause a substantial

adverse change in the significance of a historical resource. Therefore, none of the exceptions to categorical exemptions listed in CEQA Guidelines section 15300.2 apply.

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

No

If yes, answer yes or no to all that applies. If no, list all as “no” and “None” as “yes”.

Additional Documents	Applies
Initial Study	No
Negative Declaration	No
Mitigated Negative Declaration	No
Environmental Impact Report	No
Statement of Overriding Considerations	No
None	Yes

H. Is this project considered “Infrastructure”?

No

I. Subcontractors

List all Subcontractors listed in the Budget (s) (major and minor). Insert additional rows if needed. If no subcontractors to report, enter “No subcontractors to report” and “0” to funds. **Delete** any unused rows from the table.

Subcontractor Legal Company Name	CEC Funds	Match Funds
Fresno County Rural Transit Agency	$ 50,000	$0
Hodges Electric, Inc.	$ 80,000	$0
LAWRENCE ENGINEERING GROUP	$ 25,000	$0
Valley Air Conditioning & Repair, Inc.	$ 75,000	$0

J. Vendors and Sellers for Equipment and Materials/Miscellaneous

List all Vendors and Sellers listed in Budget(s) for Equipment and Materials/Miscellaneous. Insert additional rows if needed. If no vendors or sellers to report, enter “No vendors or sellers to report” and “0” to funds. **Delete** any unused rows from the table.

Vendor/Seller Legal Company Name	CEC Funds	Match Funds
TBD	$70,000	$0
California HVAC Supplier	$65,700	$7,500
TBD #3 - Electrical	$107,500	$35,000
TBD - Concrete	$20,000	$0
TBD-Miscellaneous	$0	$10,000

K. Key Partners

List all key partner(s). Insert additional rows if needed. If no key partners to report, enter "No key partners to report." **Delete** any unused rows from the table.

Key Partner Legal Company Name
No key partners to report

L. Budget Information

Include all budget information. Insert additional rows if needed. If no budget information to report, enter "N/A" for "Not Applicable" and "0" to Amount. **Delete** any unused rows from the table.

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	22-23	301.001J	$ 1,400,900

TOTAL Amount: $ 1,400,900

R&D Program Area: TIEB: Building Decarb

Explanation for "Other" selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

M. Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Alexander Mrlik

Address: 475 Coloma St Ste 190

City, State, Zip: Sausalito, CA 94965-3808

Phone: 415-567-0446

E-Mail: zander@intertie.com

2. Recipient's Project Manager

Name: Alexander Mrlik

Address: 475 Coloma St Ste 190

City, State, Zip: Sausalito, CA 94965-3808

Phone: 415-567-0446

E-Mail: zander@intertie.com

N. Selection Process Used

There are three types of selection process. List the one used for this GRF.

Selection Process	Additional Information
Competitive Solicitation #	GFO-23-308
First Come First Served Solicitation #	Not applicable
Other	Not applicable

O. Attached Items

1. List all items that should be attached to this GRF by entering “Yes” or “No”.

Item Number	Item Name	Attached
1	Exhibit A, Scope of Work/Schedule	Yes
2	Exhibit B, Budget Detail	Yes
3	CEC 105, Questionnaire for Identifying Conflicts	Yes.
4	Recipient Resolution	No.
5	Awardee CEQA Documentation	No.

Approved By

Individuals who approve this form must enter their full name and approval date in the MS Word version.

Agreement Manager: Harrison Reynolds

Approval Date: 1/1/2025

Branch Manager: *Yu Hou (for Anthony Ng)*

Approval Date: 1/2/2025

Director: Jonah Steinbuck

Approval Date: *(approval delegated to Branch Manager)*

Exhibit A
Scope of Work
Intertie Incorporated

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2	X	Complete Specifications for DC-fed HVAC Unit and HVAC PEM
3		Productize DC-FED HVAC Unit and HVAC PEM
4	X	Pre-demonstration Testing and Validation of DC-FED HVAC Unit and HVAC PEM
5		Design, Build and Commission Project
6	X	Performance Monitoring
7		Evaluation of Project Benefits
8		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
AC	Alternating Current
CAM	Commission Agreement Manager
CAN	Controller Area Network
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
DC	Direct Current
DC Bus	Power distribution system that uses DC voltage
EMS	Energy Management System
FAT	Factory Acceptance Testing
HVAC	Heating, Ventilation and Air Conditioning
MODBUS	A client/server data communications protocol
NEC	National Electric Code
PEM	Power Electronic Module
PRD	Product Requirements Document
PV	Photovoltaic
SEER	Seasonal Energy Efficiency Ratio
TAC	Technical Advisory Committee

[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.

Exhibit A
Scope of Work
Intertie Incorporated

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

A. Purpose of Agreement

The purpose of this agreement is to develop and demonstrate a DC-fed HVAC module powered by onsite DC-coupled solar PV and energy storage employing a novel DC hub architecture at a commercial building in Fresno County, CA.

The project will first demonstrate how a DC-fed HVAC module can be packaged using primarily off-the-shelf DC brushless motors and other components, and configured into an internal, highly controlled DC nanogrid that interfaces with the Recipient's existing DC-coupled solar-plus-storage product.

Problem/Solution Statement

Problem

California is challenged to reach its ambitious goal of having 50% of commercial buildings achieve zero-net energy (ZNE) by 2030. Since heating, ventilation, and air conditioning (HVAC) systems historically consume the most electricity in commercial buildings, optimizing these systems and integrating them with onsite solar PV can meaningfully advance the state's objectives. However, significant improvements in building efficiency and sizable integration of onsite renewable generation will be needed to meet ZNE goals.

Solution

The Recipient's power electronics module (PEM) technology connects DC devices, such as EV chargers and DC-fed HVAC, to a high-voltage DC bus connected to energy storage, DC-coupled solar, and a grid-tied bidirectional AC/DC converter sized to available grid capacity. Referred to as DC hub architecture, almost twice the amount of solar can be DC-coupled (versus AC-coupled) in DC hub architecture under relevant NEC codes. The proposed project shall productize a DC-fed HVAC solution, a continuation of the Recipient's strategic focus on standardizing, simplifying, and productizing its offerings to lower costs and improve scalability.

The Recipient is deploying such DC hub architecture in many commercial buildings, with demand primarily driven by economics. By dramatically lowering HVAC integration costs and deployment timelines, the product would make it possible for California to meet its commercial building ZNE goal by 2030 by compounding a 40% improvement in HVAC efficiency with double the amount of solar that can be connected.

B. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Design, build, and deploy modular DC-fed HVAC units that can be configured to provide conditioned air to a broad range of commercial building sizes.
- Design, build, and deploy modular HVAC PEM that integrates the DC-fed HVAC to a DC bus connecting DC-coupled solar plus storage.

- At the Recipient's power testing facility, complete pre-demonstration testing and validation of DC-fed HVAC units and HVAC PEM, connected to a DC hub.
- Meet the HVAC needs of a small commercial building in Fresno County using a 12-ton DC-fed HVAC system, comprised several 4-ton DC-fed HVAC units connected to DC-coupled solar plus grid-tied storage. Monitor and track its operational performance.
- Show how the project can provide California a scalable template for deploying DC-fed HVACs at existing and new locations by demonstrating the cost savings and reliability of the new HVAC technology applied to a proven DC hub architecture.

Ratepayer Benefits:[2]

This Agreement will result in the ratepayer benefits of greater electricity reliability and lower costs, by implementing more efficient HVAC, increased penetration of zero-carbon resources, higher grid utilization which frees up grid capacity for other electrification needs such as charging and increased electric reliability.

The project's DC-fed HVAC provides thermal energy using 50% less electricity thus lowering costs for ratepayers. The Recipient's DC hub enhances the reliability of DC-fed HVAC. The product can be installed in any location without requiring grid upgrades, which significantly lowers costs for ratepayers by deferring expensive utility upgrades. Further, by being able to opportunistically access the grid, the project will increase the site's load factor, thus increasing grid utilization, which lowers costs as more electricity can be distributed to end-use customers using the same infrastructure.

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 demonstrating a scalable approach that make it possible for the state of California to meet its ZNE goal by 2030. DC-coupled solar is increasingly utilized in utility-scale projects due to its cost and reliability advantages and is predicted to be the dominant commercial rooftop approach within 5 years. Fast charging is increasingly being DC-coupled to mitigate grid impacts. DC-coupling of HVAC in commercial buildings will similarly be adopted due to cost, safety and reliability advantages plus the ability to almost double the amount of solar without impacting the grid connection.

[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.

Exhibit A
Scope of Work
Intertie Incorporated

Agreement Objectives

The objectives of this Agreement are to:

- Validate the performance of a cost-effective, modular 4-ton DC-fed HVAC unit that has a minimum seasonal energy efficiency ratio (SEER) of 20 and multiple units can be connected in parallel to accommodate almost any size commercial building. Testing to be conducted in the Recipient's power laboratory.
- Demonstrate how productized DC Hub Combiners provide a reliable, safe, and cost-effective means for high voltage, high power DC distribution, as required by multi-charger, high power facilities.
- Demonstrate how the Recipient's DC Hub Combiner and PEM DC power management technologies provide modularity and help achieve more 'plug and play' installations for DC hub architecture.
- Deploy project that incorporates such DC power management technologies in a DC Hub Architecture to power three (3) 4-ton DC-fed HVAC units from a 656V Microgrid DC Hub that is powered by 35 kW solar, 186 kWh energy storage, and a 30 kW bidirectional AC/DC power converter.
- Operate Project controlled by the Recipient's local and cloud EMS with one centralized bidirectional power converter, programmed to only draw available ampacity from the main distribution panel, limited to 100A.

The language in Task 1 is standard for each agreement. Do not revise it.

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, and other CEC staff relevant to the Agreement. The Recipient's Project Manager and any other individuals deemed necessary by the CAM or the Project Manager shall participate in 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., Teams, Zoom), with approval of the CAM.

  The Kick-off meeting will include discussion of the following:
  - The CAM's expectations for accomplishing tasks described in the Scope of Work;
  - An updated Project Schedule;
  - Terms and conditions of the Agreement;
  - Invoicing and auditing procedures;
  - Travel;
  - Equipment purchases;
  - Administrative and Technical products (subtask 1.1);
  - CPR meetings (subtask 1.3);
  - Monthly Calls (subtask 1.5)
  - Quarterly Progress reports (subtask 1.6)
  - Final Report (subtask 1.7)
  - Match funds (subtask 1.8);
  - Permit documentation (subtask 1.9);
  - Subawards(subtask 1.10);
  - Technical Advisory Committee meetings (subtasks 1.11 and 1.12);
  - Agreement changes;
  - Performance Evaluations; 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 may 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 may 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. A determination of unsatisfactory progress This may result in project delays, including a potential Stop Work Order, while the CEC determines whether the project should continue.

- 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(s)
- 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 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* organized by the tasks in the Agreement.

Products:

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

MONTHLY CALLS, REPORTS AND INVOICES

Subtask 1.5 Monthly Calls

The goal of this task is to have calls at least monthly between the CAM and Recipient to verify that satisfactory and continued progress is made towards achieving the objectives of this Agreement on time and within budget.

The objectives of this task are to verbally summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, to verify match funds are being proportionally spent concurrently or in advance of CEC funds or are being spent in accordance with an approved Match Funding Spending Plan, to form the basis for determining whether invoices are consistent with work performed, and to answer any other questions from the CAM. Monthly calls might not be held on those months when a quarterly progress report is submitted or the CAM determines that a monthly call is unnecessary.

The CAM shall:

- Schedule monthly calls.
- Provide questions to the Recipient prior to the monthly call.
- Provide call summary notes to Recipient of items discussed during call.

The Recipient shall:

- Review the questions provided by CAM prior to the monthly call
- Provide verbal answers to the CAM during the call.

Product:

- Email to CAM concurring with call summary notes.

Subtask 1.6 Quarterly 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 reporting period, 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. Progress reports are due to the CAM the 10th day of each January, April, July, and October. The Quarterly Progress Report template can be found on the ECAMS Resources webpage available at: https://www.energy.ca.gov/media/4691
- Submit a monthly or quarterly *Invoice* on the invoice template(s) provided by the CAM.

Recipient Products:

- Quarterly Progress Reports
- Invoices

CAM Product:

- Invoice template

Subtask 1.7 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 1.7.1 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 Products:

- Energy Commission Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.7.2 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 on Draft Final Report* 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 on Draft Final Report
- Draft Final Report
- Written Responses to Comments *(if applicable)*
- Final Report

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBAWARDS

Subtask 1.8 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. 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 application 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 application 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 1.9 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 1.10 Obtain and Execute Subawards and Agreements with Site Hosts

The goal of this task is to ensure quality products and to execute subrecipients and site host agreements, as applicable, required to carry out the tasks under this Agreement consistent with the Agreement Terms and Conditions and the Recipient's own procurement and contracting policies and procedures.

The Recipient shall:

- Execute and manage subawards and coordinate subrecipient activities.
- Execute and manage site host agreements, and ensure the right to use the project site throughout the term of the Agreement, as applicable. A site host agreement is not required if the Recipient is the site host.
- Notify the CEC in writing immediately, but no later than five calendar days, if there is a reasonable likelihood the project site cannot be acquired or can no longer be used for the project.
- Submit a letter to the CAM describing the subawards and any site host agreement needed or stating that no subawards or site host agreements are required.
- If requested by the CAM, submit a draft of each subaward and any site host agreement required to conduct the work under this Agreement to the CAM for review.
- If requested by the CAM, submit a final copy of each executed subaward and any site host agreement.
- If Recipient intends to add new subrecipients or change subrecipients, then the Recipient shall notify the CAM.

Products:

- Letter describing the subawards needed, or stating that no subawards are required
- Draft subaward (if requested)
- Final subaward (if requested)
- Draft site host agreement (if requested)
- Final site host agreement (if requested)

TECHNICAL ADVISORY COMMITTEE

Subtask 1.11 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 1.12.
- 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 1.12 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 1.13 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 section of 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:

- Initial Project Benefits Questionnaire
- TAC Performance Metrics Summary
- Project Performance Metrics Results

Exhibit A
Scope of Work
Intertie Incorporated

TECHNICAL TASKS

TASK 2 – COMPLETE SPECIFICATIONS FOR DC-FED HVAC AND HVAC PEM

The goal of this task is to complete specifications for a DC-fed HVAC system capable of providing conditioned air to a commercial building that is approximately 8500 square feet. The DC-Fed HVAC system with sourced components shall be modeled and simulations shall be conducted to predict the cooling power performance over a range of temperature set points. The HVAC PEM specifications shall be developed to meet the power demands of a single HVAC and can be connected in parallel to serve a wide range of building sizes.

The Recipient Shall:

- Specify modular DC-Fed HVAC Unit Requirements (for Fresno building)
  - Determine unit rated cooling (btu), heating (btu) and airflow (cfm) capacities
  - Establish unit sizing of compressor/condenser and evaporative coils, fan motor
  - Assess advantages/disadvantages of centralized with ducting versus ductless mini-split depending upon commercial availability and install ability at site.
  - Assess DC Power supply requirements within HVAC DC nanogrid
  - Define HVAC control and communication objectives and system function, e.g. compressor/condenser control, temperature regulation, monitoring, etc.
- Determine HVAC PEM Specifications that integrates DC-Fed HVAC unit to DC coupled solar plus storage microgrid
  - Design pre-charge circuit to safely connect microgrid high voltage DC bus
  - Specify DC/DC converter that integrate HVAC unit DC nanogrid and HV DC bus
  - Define HVAC PEM communication protocols and control strategy (e.g. demand-based) to intelligently power HVAC Unit from microgrid DC bus
  - Define energy management system (EMS) control strategy and communication controls
- Develop *Technical Specifications for DC-Fed HVAC Unit*, including ensuring compliance with SEER rating.
- Complete simulations of heat exchange, air flow and other factors that predict the performance .
- Determine DC power requirements for sizing of HVAC PEM.
- Complete design and *Technical Specification for HVAC PEM* prototype that integrates DC-Fed HVAC unit to microgrid DC bus with objective of minimizing hardware development and validation time by maximally utilizing hardware.
- Evaluate varying sizes of microgrid components (e.g. installed DC solar capacity, storage size) to determine how effectively it meets the needs of HVAC demands for a range of commercial building sizes.
- Simulate the DC-Fed HVAC behavior under expected heating/cooling building load requirements for Fresno temperatures to predict efficiency in maintaining desired temperatures and model a *Performance Forecast*.
- Provide detailed *Description of EMS HVAC PEM Interface PRD*, including features, function, and technical requirements of microgrid.
- Prepare a *CPR Report #1* and participate in CPR meeting per Task 1.3.

Products:

- Technical Specifications for DC-Fed HVAC Unit
- Technical Specification for HVAC PEM
- Performance Forecast
- Description of EMS HVAC PEM Interface PRD
- CPR #1 Report

TASK 3 – PRODUCTIZE DC-FED HVAC UNIT AND HVAC PEM

The goal of this task is to productize a modular DC-fed HVAC in a standardized rooftop enclosure and integrate with an HVAC PEM that can be powered by a nominal 665VDC bus. The DC-fed HVAC shall to the greatest extent possible utilize off-the-shelf, proven components. The HVAC PEM shall leverage pre-charger circuitry, charger firmware modifications, and shall incorporate The Recipient's voltage match firmware that accepts a floating DC voltage input.

The Recipient shall:

- Procure off-the-shelf components and brushless DC motors properly sized to meet subsystem requirements of the DC powered heat pump, DC powered condenser, DC powered Blower and DC powered pump. Procure balance of plant including hydronic coils, expansion tanks, piping materials and electrical and controls.
- Finalize mechanical design of packaged DC-fed HVAC system with dimensions for fabrication, assembly of major components, location and sizing of DC-nanogrid power bus and communication hardware and firmware .
- Procure commercially available, UL-certified DC/DC power converter sized to meet DC power requirements of DC-fed HVAC.
- Develop firmware and software to integrate DC-fed HVAC devices: Heat Pump; DC brushless motors and sensors, and communicate using either Controller Area Network (CAN) 2.0A/B, modbus or other protocols with Intertie's EMS. Implement enhanced floating bus control algorithm into firmware to interface HVAC PEM with microgrid DC floating bus.
- Complete DC-Fed HVAC prototype memo. Test HVAC nanogrid functionality.
- Complete assembly of higher power Basic HVAC PEM Prototype inside NEMA enclosure with appropriate communication and power connection, disconnects and overcurrent protection
- Draft HVAC PEM PrototypeMemo
- Develop, EMS software interface for HVAC PEM.
- Draft EMS software interface for HVAC PEM Memo
- Design and fabricate DC-fed solar string interface that provides connection, safety and control functions to enable NEC approved rooftop DC-coupled solar PV.
- Draft DC-fed Solar String Interface Memo
-

Products:

- DC-Fed HVAC Unit Prototype Memo
- HVAC PEM Prototype Memo
- EMS Software Interface for HVAC PEM Memo
- DC-fed Solar String Interface Memo

TASK 4 – COMPLETE PRE-DEMONSTRATION TESTING AND VALIDATION

The goal of this task is to test and demonstrate the actual full-scale system in its intended operational environment. All of the functionality of the HVAC will be tested using DC power supplied from a microgrid that has nearly the same features as the project, namely DC-coupled solar, identical bidirectional AC/DC power converter, and Advanced PEM hardware.

The Recipient shall:

- Upgrade Intertie power electronics lab to accommodate expected power transfer from 665V DC microgrid bus to PEM HVAC
  - Complete test setup for prototype assembles. Conduct safety analysis and implement testing protocols for testing the power electronics. Complete electrical design with single line and three-line diagrams and submit for permitting and approvals.
  - Install cabling, conduits, OCPDs and safety switches necessary to connect battery system, DC Hub Combiner and HVAC PEM(s) & DC-fed HVAC(s)
  - Complete site testing, megger and continuity testing of high voltage DC bus connected to solar and storage
- Design, install and commission control and monitoring system for HVAC PEM
  - Develop new interface between HVAC PEM and Intertie EMS.
  - Build human machine interface for testing, monitoring and operation of HVAC PEM
  - Design and fabricate site controller with master battery management system, insulation monitoring system, network switch, uninterruptible power supply and low voltage control circuitry.
  - Install metering, check phase rotation to connect bi-directional AC/DC converter
  - Test and debug EMS communication with HVAC PEM
- Connect HVAC PEM to DC HV bus in laboratory microgrid
- Provision, commission, test and monitor single HVAC PEM and DC-fed HVAC, repeat testing for all units to be installed in project
- Develop Factory Acceptance Testing (FAT) Plan and Procedures for DC-fed HVAC and HVAC PEM.
- Complete Factory Acceptance Testing Results Memo of DC-fed HVAC and HVAC PEM, including challenges met and solutions applied.
- Prepare a CPR Report #2 and participate in CPR meeting per Task 1.3.

Products:

- Factory Acceptance Testing Plan and Procedures
- Factory Acceptance Testing Results Memo
- CPR Report #2

TASK 5 – COMPLETE ENGINEERING, PROCUREMENT, AND CONSTRUCTION (EPC) AND COMMISSIONING OF PROJECT

The goal of this task is to design, build, commission, and operate a 12-ton DC-fed HVAC system, comprised of DC-fed HVAC units and HVAC PEM units. The HVAC system will be powered by The Recipient's DC-coupled solar-plus-storage grid-tied microgrid that combines 186 kWh BESS, and a 30-kW central bidirectional AC/DC power converter, connected to the office building's electric panel via 100A/3P/208V circuit.

The Recipient shall:

- Complete site assessment to determine location and installation of solar, storage, other microgrid hardware, DC-fed HVAC units and HVAC PEMs.
- Complete engineering design phase
  - Prepare *HVAC Plan* that shows zones and zone thermal requirements
  - Prepare *Site Plan Memo* that shows location of solar and storage equipment and drawing views including plan, elevation and section .
  - Prepare structural engineering and planning for solar and battery energy storage system (BESS).
  - Complete electrical engineering and planning including electrical single and three line diagrams showing major components, AC & DC electrical distribution, interconnection to grid, circuit protection, metering and other components.
  - Obtain engineering stamped approval of engineering plans and submit plans to authority having jurisdiction.
- Complete permitting process including plan submission, plan reviews, request for changes, and issuance of Permit.
- Procure major components and all materials for solar and storage systems. DC-fed HVAC and HVAC PEM units
- Install DC-fed HVAC and HVAC PEM units.
- Install DC-coupled solar plus storage
  - Install rooftop solar array and connect to DC-fed solar string interface and DC/DC converter.
  - Install battery system and connect to DC bus.
  - Install DC-fed HVAC and HVAC PEM on roof or where specified by mechanical engineering design. Connect to DC bus.
  - Complete trenching, conduit installation, cabling installation (if necessary) from BESS to rooftop.
- Install AC-electrical including cabling, OCPDs and safety switches necessary to connect
  - Communications Install: metering and all monitoring equipment.
  - Connect bidirectional AC/DC power converter to Microgrid DC Hub and to site main panel.
- Complete site acceptance test and commission fully integrated HVAC and microgrid systems draft *Site Acceptance Test Memo*.
- Operate DC fed HVAC with coupled solar-plus-storage grid tied micro grid for 12 months and provide reporting on operations (Task 6).

Products:

- HVAC Plan
- Site Plan Memo
- Site Acceptance Test Memo

TASK 6 – OPERATING PERFORMANCE MONITORING AND REPORTING

The Recipient's on-premise and cloud EMS provides SCADA functionality for real-time monitoring, data acquisition, control, and operation of charging and microgrid facilities enabling further analytics. The overarching performance metric is how efficiently and effectively the DC-fed HVAC conditions the building space, and compares against the most relevant benchmark, CA Title 24 2023 SEER of 15 as required for AC-fed HVAC. Moreover, the project seeks to achieve zero-net energy and zero-net grid impact.

The Recipient shall:

- Record and analyze twelve months of operational data to measure the efficiency, effectiveness and ability of the DC-fed HVAC system to maintain desired building temperature over 12-month period ("DC-fed HVAC Performance")
  - Measure cooling & heating output delivered (btu) and energy consumed (in watt-hours). Calculate actual SEER performance by dividing colling/heating output by energy consumed.
  - Measure actual solar energy consumed by DC-fed HVAC every month. Calculate % of HVAC powered by solar.
  - Compare DC fed HVAC efficiency versus AC-fed HVAC
  - Monitor and track HVAC equipment availability and assess long-term reliability
- Draft *DC-fed HVAC Performance Memo*
- Assess economics of project's DC-Fed HVAC and cost competitiveness vis a vis AC-coupled systems through life-cycle comparison ($ per ton-hr). Make qualitative assessment of whether market segments exist (size, building type, etc.) where DC-fed HVAC has competitive advantage. Assuming production can be scaled, assess opportunity to reduce per-unit DC-fed HVAC costs.DC-Fed Metrics
  - Draft *DC-fed HVAC Competitive Assessment Memo*
- Assess impact of DC-fed HVAC on grid by monitoring and recording grid energy used for HVAC and incremental power required by HVAC. Monitor and record kWh consumed by bidirectional AC/DC converter to charge battery and DC bus and supply to DC-fed HVAC. Using project assessment and scaled-economics, estimate potential grid and energy reduction potential for DC-fed HVAC in California
- Complete *Quantified Impact of DC-fed HVAC on Grid Report*
- Prepare a *CPR Report #3* and participate in CPR meeting per Task 1.3.

Products:

- DC-fed HVAC Performance Memo
- DC-fed HVAC Competitive Assessment Memo
- Quantified Impact of DC-fed HVAC on Grid Report
- CPR Report #3

TASK 7 – EVALUATION OF PROJECT BENEFITS *(Mandatory task)*

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

Exhibit A
Scope of Work
Intertie Incorporated

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* by January 31st of each year. 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 and update the project profile on the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Project Profile on Energize Innovation fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Organization Profile on Energize Innovation fund*, including the profile link.

Products:

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

TASK 8 – TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES *(Mandatory task)*

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* 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.
- When directed by the CAM, develop presentation materials for a 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 and final)
- Summary of TAC Comments
- Project Case Study (draft and final)
- High Quality Digital Photographs

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.