California Energy Commission
October 08, 2025 Business Meeting
Backup Materials for Lawrence Berkeley National Laboratory

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: 25-1008-XX

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: Lawrence Berkeley National Laboratory

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-25-027 with Lawrence Berkeley National Laboratory for a $3,121,313 grant. This project will develop CC-FLEX, an open-source software solution to transform three California college campuses into virtual power plants. The control system targets a chiller cooling plant, chilled water tank, battery energy storage system, EV charging stations, building thermostats, and combinations of these; 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 October 08, 2025.

AYE:
NAY:
ABSENT:
ABSTAIN:

Dated:

_____
Kim Todd
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-25-027

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Christian Fredericks
3. MS-:51
4. Phone Number: 916-776-0755

C. Recipient's Information

1. Recipient's Legal Name: DOE- Lawrence Berkeley National Laboratory
2. Federal ID Number: 94-2951741

D. Title of Project

Title of project: California Campus Load Flexibility: CC-FLEX

E. Term and Amount

1. Start Date: 10/22/2025
2. End Date: 2/28/2030
3. Amount: $3,121,313.00

F. Business Meeting Information

1. Are the ARFVTP agreements $75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 10/8/2025 .
3. Consent or Discussion? Consent
4. Business Meeting Presenter Name: Christian Fredericks
5. Time Needed for Business Meeting: 2 minutes.
6. The email subscription topic is: Electric Program Investment Charge

Agenda Item Subject and Description:

Lawrence Berkeley National Laboratory. Proposed resolution approving agreement EPC-25-027 with Lawrence Berkeley National Laboratory for a $3,121,313 grant and adopting staff's recommendation that this action is exempt from CEQA. This project will develop CC-FLEX, an open-source software solution to transform three California college campuses into virtual power plants. The control system targets a chiller cooling plant, chilled water tank, battery energy storage system, EV charging stations, building thermostats, and combinations of these. (Electric Program Investment Charge (EPIC) Program Funding) Contact: Christian Fredericks

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":

Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because:

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

a) Agreement **IS** exempt?

Yes

Statutory Exemption?
No

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

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, § 15303; Cal. Code Regs., tit. 14, §15306

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.

Cal. Code Regs., tit. 14, sect. 15301 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of existing or former use at the time of the lead agency's determination, are categorically exempt from the provisions of the California Environmental Quality Act (CEQA). The proposed project will consist of the integration and optimization of existing mechanical and electrical infrastructure such as chiller plants, thermal energy storage systems, battery energy storage systems, and EV charging stations. All activities are confined to the operation, repair, maintenance, and minor software-based alterations of these pre-existing systems, leveraging established Energy Management System platforms and control networks. The project does not propose new construction or physical expansion, and all modifications are designed to preserve existing use patterns while enhancing operational efficiency and load flexibility. Therefore, the project falls within section 15301 and will not have a significant effect on the environment.

Cal. Code Regs., tit. 14, sec. 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; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure, are categorically exempt from the provisions of CEQA. This project consists of installation of new sensors and

measurement devices on existing mechanical and electrical equipment. These devices provide and enhance existing data without altering the underlying infrastructure. All sensor deployments are non-invasive and leverage pre-installed systems such as chillers, TES units, and BESS assets to support the proposed VPP software solution. Therefore, the project falls within section 15303 and will not have a significant effect on the environment.

Cal. Code Regs, tit. 14, sec. 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 basic data collection and monitoring activities to evaluate infrastructure performance under varying operational scenarios. Research and experimental management efforts focus on testing software-driven control strategies and assessing their impact on energy flexibility. The project includes analyzing thermal and electrical storage utilization, load shifting potential, and system responsiveness to grid signals. For these reasons, the proposed project will have no significant effect on the environment and is categorically exempt under CEQA under section 15306.

This project does not involve impacts on any particularly sensitive environment; will not impact an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies; 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 sites are 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 to this project and this project will not have a significant effect on the environment.

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
The Regents of the University of California on behalf of the Merced ampus	$ 299,382	**$**59,875
The Regents of the University of California on behalf of the San Diego campus	$ 499,992	**$**210,030
Bakersfield College	$ 235,339	**$**24,323
Olivine, Inc.	$ 400,262	**$**280,000
Alcorn Aire, Inc.	$ 65,000	

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
No vendors to report	**$0**	**$0**

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	24-25	301.001L	$ 3,121,313

TOTAL Amount: $ 3,121,313

R&D Program Area: ICMB: IAW

Explanation for “Other” selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: 101

M. Recipient’s Contact Information

1. Recipient’s Administrator/Officer

Name: Joanna Santoro

Address: 1 Cyclotron Rd

City, State, Zip: Berkeley, CA 94720-0001

Phone: 510 486-6824

E-Mail: jlsantoro@lbl.gov

2. Recipient’s Project Manager

Name: Donghun Kim

Address: 1 Cyclotron Rd MS90R3147

City, State, Zip: Berkeley, CA 94720-8028

Phone:

E-Mail: DonghunKim@lbl.gov

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-23-309
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

Item Number	Item Name	Attached
2	Exhibit B, Budget Detail	Yes
3	CEC 105, Questionnaire for Identifying Conflicts	Yes
4	Recipient Resolution	Yes
5	Awardee CEQA Documentation	Yes

Approved By

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

Agreement Manager: Christian Fredericks

Approval Date: 08/21/2025

Branch Manager: Cody Taylor

Approval Date: 08/29/2025

Director: Cody Taylor for Jonah Steinbuck

Approval Date: 08/29/2025

Exhibit A
Scope of Work
DOE-Lawrence Berkeley National Laboratory

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		VPP Operation Strategies
3	X	CC-FLEX Development
4		Pilot Testing Under Various Scenarios and CC-FLEX Enhancement
5		CC-FLEX Deployment, M&V, and Assessment
6		Workforce Development
7		Evaluation of Project Benefits
8		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
BESS	Battery Energy Storage System
CalFUSE	California Flexible Unified Signal for Energy
CAM	Commission Agreement Manager
CC-FLEX	California Campus Load Flexibility
CEC	California Energy Commission
CPR	Critical Project Review
DCS	District Cooling System
DER	Distributed Energy Resource
DR	Demand Response
EMS	Energy Management System
EV	Electric Vehicle
LSE	Load Serving Entity
MPC	Model Predictive Control
MOER	Marginal Operating Emissions Rate
MW	Megawattt
MWh	Megawatt hour
PV	Photovoltaic
Recipient	United States Department of Energy – Lawrence Berkeley National Laboratory
SCE	Southern California Edison
TAC	Technical Advisory Committee
TES	Thermal Energy Storage
UC Merced	The Regents of the University of California on behalf of the Merced campus
UC San Diego	The Regents of the University of California on behalf of the San Diego campus

[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.

Acronym/Term	Meaning
VPP	Virtual Power Plant

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the development of an integrated solution package for campus Virtual Power Plant (VPP) which integrates and predictively optimizes the central plant, a fleet of electric vehicle (EV) charging stations in combination with various other Distributed Energy Resource (DERs), and significant field deployment and demonstration efforts at UC Merced, UC San Diego, and Bakersfield College for assessing its cost-effectiveness and performance.

B. Problem/ Solution Statement

Problem

Many higher education campuses, including the University of California and Community Colleges, could offer a highly cost-effective solution to the goal. Thermal energy storage (TES), such as chilled water tanks or ice-storage tanks, is a viable option due to its prevalence in district cooling systems (DCSs) and the existing control infrastructure of their energy management systems (EMSs). Additionally, the rapid growth of EV charging stations on campuses, numbering in the hundreds or potentially thousands, creates new load flexibility opportunities. However, several practical barriers must be addressed to leverage these TES, EVs, and other large-scale DERs for grid needs. These barriers extend beyond technical challenges like cybersecurity, interoperability, communication failures, and prediction uncertainties.

For central plants, one of the most significant issues is that most facility operators require maintaining controllability over their plants for safety reasons, necessitating human-in-the-loop operations. For EV charging stations, key barriers include the complexities of managing and coordinating charging patterns and potential adverse effects on the users, in addition to technical integration and infrastructure costs. Consequently, the need for human decision-making for central plants, the uncoordinated use of their DERs, and human disruptions often lead to grid-independent operation of their DCSs. This can negatively impact the grid by requiring increased demand response (DR) capacity during peak periods, and elevating ramping rates and renewable energy curtailment.

Solution

This project proposes California Campus Load Flexibility (CC-FLEX) as a solution to transform higher education campuses into VPPs. CC-FLEX consists of free, open-source software packages for optimization and analytics, along with a comprehensive workflow and guidelines for integrating this software with campus EMSs and other DERs. CC-FLEX targets (1) a chiller cooling plant and chilled water tank, (2) a battery energy storage system (BESS), (3) a fleet of EV charging stations, and (4) combinations of these, with or without on-site solar photovoltaics (PVs). With CC-FLEX, two VPP operational models would be possible:

- **Standalone VPP Operation Model**: Each campus operates as a standalone VPP, optimizing its own DERs. This model is suitable for dynamic signal-based VPPs (e.g., California Flexible Unified Signal for Energy (CalFUSE)), or simple VPP programs that facility operators can easily understand.

- **Multi-campus VPP Operation Model**: Each campus functions as a distributed asset within a larger vendor-operated VPP which could participate in more complex VPP programs or wholesale markets.

For the standalone VPP model, CC-FLEX acts as a site-specific optimal management system for the campus, with the additional capability of VPP program and wholesale market participation. The multi-campus VPP model aligns more with traditional VPP dispatch strategies.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to:

- Develop CC-FLEX, a solution to transform campuses into VPPs. CC-FLEX consists of free, open-source software packages for optimization and analytics, along with a comprehensive workflow and guidelines for integrating this software with campus EMSs and other DERs. CC-FLEX targets a chiller cooling plant and chilled water tank, a BESS, a fleet of EV charging stations and combinations of these, with or without on-site solar PVs.
- Significant deployment efforts at UC Merced, UC San Diego and Bakersfield College, demonstrating its cost-effectiveness and performance (totaling at least 5 megawatt (MW) DR capacity over a 5 peak hour window).
- Disseminate the CC-FLEX tools and findings for further adoption in collaboration with project partners.

Ratepayer Benefits:[2] This Agreement will result in the ratepayer benefits of:

- CC-FLEX will maximize campuses' utility cost savings and/or revenues and reduce the HVAC expert resources needed to adapt their central plant operations for grid needs. This will free up significant financial labor resources for campuses to address more urgent matters, such as equipment maintenance and retro-commissioning, extending asset lifespans, improving energy efficiency in plants and grids, and supporting grid-reliability.
- The freed-up financial resources will also enable campuses to maintain focus on education, redirecting funds back into student programs and resources, which distinguishes this project from other VPPs.
- By securing UC Merced's and UC San Diego's several MW of DR capacity and megawatt-hour (MWh) of load-flexibility resources, this project offers tangible solutions and helps defer costly grid infrastructure upgrades, ultimately reducing costs for ratepayers.
- Given the rapid proliferation of EV charging stations in the commercial building sector, CC-FLEX's ability to coordinate hundreds of EV chargers will provide technical solutions and benefits to them.
- The coordinated operation of multiple site DERs maximizes load flexibility, smooths the duck curve, and facilitates greater penetration of renewable PV, thereby increasing clean energy use.

[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).

- All of these factors contribute to a lower risk for outages and associated economic losses for businesses, supporting a reliable, sustainable energy future while minimizing ratepayers' economic burdens.

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

- Affordable VPP capacity: It provides a cost-effective method of securing DR capacity by leveraging and coordinating existing large-scale DERs without the need for costly new DER procurements. Additionally, the established campus EMSs can be directly utilized as VPP control infrastructure for central TES plants, reducing the complexity of data integration issues common in typical VPP approaches.
- Enhanced customer participation: CC-FLEX is designed to maximize site benefits with minimal human disruptions, thereby encouraging customer engagement.
- Unlocking underutilized campus DERs: For central plants, CC-FLEX guides facility operators on how to operate their plants, lowers their operational efforts, and helps them to understand the benefits and risks of their VPP participation, through its "suggestion-mode" with an analytics interface. This capability promotes and fosters their VPP participation, while preserving their controllability over the plants through enhanced comprehension, financial gains, and risk reduction. Together with the capability of coordinating various other DERs, it enables campuses to align their operations with grid needs and unlock significant load flexibility resources in California campuses.
- Enhancing grid operations through predictive control: With a time-varying rate (e.g., CalFUSE), CC-FLEX can help smooth demand profiles using the model predictive control (MPC) technology. This enhances grid operation and proactively reduces the risk of outages during peak hours rather than merely responding to emergency conditions.

Agreement Objectives

The objectives of this Agreement are:

- Minimal load reduction during peak hours (5 hour windows) and load flexibility size: At least a total of 5 MW during a peak five-hour window (e.g., 4 to 9 PM or 6 to 11 PM). This also leads to a minimum of 25 MWh of load flexibility (5 MW x 5 hours).
- Energy cost savings: 15% with a dynamic signal compared to the existing operation strategy
- Emission reduction with Marginal Operating Emissions Rate (MOER): 10% compared to the existing operation strategy. At least 1 metric ton of emission equivalent per day in total. Calculated using MOER signal (e.g., WattTime)
- Demand charge reduction: 10 %
- Target cost per DR capacity: $8/kilowatt for at least one central TES plant cases
- Payback period: Less than a year for at least one central TES plant cases

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

[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
DOE-Lawrence Berkeley National Laboratory

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 Commission Agreement Officer 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.

The Recipient shall:
- Review the questions provided by CAM prior to the monthly call
- Provide verbal answers to the CAM during the call.
- Provide call summary notes to Recipient of items discussed during call.

Product:
- Email CAM 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 <u>no permits</u> 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 goals of this subtask are to: (1) procure and execute subrecipients and site host agreements, as applicable, required to carry out the tasks under this Agreement; and (2) ensure that the subrecipients and site host agreements are consistent with the Agreement terms and conditions and the Recipient's own contracting policies and procedures.

The Recipient shall:
- Execute and manage subawards and coordinate subrecipients activities in accordance with the requirements of this Agreement.
- 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.
- Incorporate this Agreement by reference into each subaward.
- Include any required Energy Commission flow-down provisions in each subaward, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subaward terms.
- Submit a *Subaward and Site 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.
- If requested by the CAM, submit a final copy of each executed *Subaward* and any *Site Host Agreement*.
- Notify and receive written approval from the CAM prior to adding any new subrecipient (see the terms regarding subrecipient additions in the terms and conditions).

Products:
- Subaward and Site Letter
- Draft Subawards *(if requested by the CAM)*
- Draft Site Host Agreement *(if requested by the CAM)*
- Final Subawards *(if requested by the CAM)*
- Final Site Host Agreement *(if requested by the CAM)*

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 ensure 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 ensure 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:

- TAC Performance Metrics Summary
- Project Performance Metrics Results

IV. TECHNICAL TASKS

TASK 2 VPP OPERATION STRATEGIES

The goal of this task is to identify the most promising VPP scenarios and corresponding VPP operation strategies for both Standalone VPP and Multi-campus VPP operation models.

The Recipient shall:

- Develop and submit the *VPP Scenario and Operation Strategy Memorandum*, describing the selected VPP scenarios for both the Standalone VPP model and the Multi-campus VPP operation model, which may include but are not limited to:
    - Exploring diverse VPP scenarios involving grid signals, VPP programs, and wholesale markets. This may include, but is not limited to the Demand Side Grid Support Program, CalFUSE, and a suitable wholesale market.
    - Identifying the most promising VPP scenarios through a screening process considering several factors
        - Rules for VPP scenarios (e.g., eligibility requirements, participation process, and incentive structure)
        - Necessary communication data for each strategy
        - Required communication frequency (e.g., real-time market or day-ahead market)

        - DER system dynamics (e.g., slow dynamics for campus TES, faster dynamics for BESS)
        - Potential benefits and risks to campus, vendor, and grid
        - Coordination approaches between CC-FLEX and a vendor-VPP (for the Multi-Campus VPP model) and their complexity
        - Potential conflicts between the MPC framework and the data requirements from the grid or vendor VPP
    - Developing VPP strategies for each scenario.
    - Developing mixed scenarios/strategies that combine dynamic grid signals (e.g., for normal operation days) with VPP programs (e.g., for DR events).
    - Selecting at least three prioritized VPP scenarios for the Standalone VPP model, and one for the Multi-Campus VPP model.

Products:

- VPP Scenario and Operation Strategy Memorandum (draft and final)

TASK 3 CC-FLEX DEVELOPMENT

The goal of this task is to develop CC-FLEX (a software package and integration workflow/guideline) that can cover DERs, including (1) a chiller cooling plant equipped with a chilled water tank, (2) a BESS, (3) a fleet of EV charging stations, and (4) combination of these, with or without on-site solar PV. The software package consists of five modules: decoupled MPC, integrated MPC, VPP operation strategy, semi-optimal control, and analytics modules.

Subtask 3.1 Development of Decoupled MPC Module

The goals of this subtask are to design the software architecture and identify a unified software platform for the CC-FLEX software package, and to develop a decoupled MPC module. This module will contain three separately developed MPCs for (1) a central plant with a chilled water tank with or without on-site PVs, (2) a BESS, and (3) EV charging stations, according to the architecture and software platform.

The Recipient shall:

- Develop and submit the *Decoupled MPC Module Technical Memorandum*, providing descriptions of the software architecture and MPC formulation, and user guides with simulation examples that include but are not limited to:
    - Determination of the software platform (e.g., Python) and an optimization platform that allows symbolic manipulation or a computational graph approach.
    - Designs of the software architecture for the five modules, including the configuration files required for each module. The software architecture design will focus on the automatic MPC generation from the decoupled MPC module.
    - Design of the CC-FLEX database (metadata and time series) and file management structure.
    - Develop the decoupled MPC module by programming the three previously developed MPCs according to the software architecture and platform.
    - Performing unit tests for the decoupled MPC module using previously developed simulation models.
- Prepare a *CPR Report #1* in accordance with Subtask 1.3 (CPR Meetings).
- Attend the CPR meeting.
- Present the CPR Report #1 and any other required information at each CPR meeting.

Products:
- Decoupled MPC Module Technical Memorandum
- CPR Report #1

Subtask 3.2 Development of Integrated MPC Module

The goals of this subtask are to develop the integrated MPC module to cover the combinations of (1) a chiller cooling plant equipped with a chilled water tank, (2) BESS, (3) a fleet of EV charging stations, and (4) on-site PV.

The Recipient shall:
- Prepare the *Integrated MPC Module Technical Memorandum*, including descriptions of the software architecture and MPC formulation, and user guides with simulation examples that include but are not limited to:
    - Automate the incorporation of all equality and inequality constraints defined in the decoupled MPC module using symbolic manipulation or computational graph technologies.
    - Develop a simulation model that contains all the above DERs.
    - Test the integrated MPC module using the simulation model.
    - Identify and resolve any potential conflicts and issues.

Products:
- Integrated MPC Module Technical Memorandum

Subtask 3.3 Development of VPP Operation Strategy Module

The goals of this task are to formulate VPP operation strategies within the MPC framework, test integration with the integrated MPC module, and incorporate these strategies into CC-FLEX as a module.

The Recipient shall:
- Prepare the *Technical Memorandum for the VPP Operation Strategy Module*, including descriptions of MPC formulations for VPP operation strategies and user guides with simulation examples. The draft version will include the Standalone VPP model, and the final version will include both standalone and Multi-campus VPP models. The modules may include but are not limited to:
    - Mathematically formulate VPP operation strategies identified in Task 2 as objective functions and constraints for both Standalone and Multi-campus models.
    - Automate the generation of tailored and operable MPC codes for specific DER systems, scenarios, and operation models.
    - Perform simulation studies of both Standalone and Multi-campus VPP models using the simulation model developed in Subtask 3.2 and review the simulation results.
    - Test the integrated MPC module using the simulation model and resolve any issues that occur.

Products:
- Technical Memorandum for VPP Operation Strategy Module (draft and final)

Subtask 3.4 Development of Backup Control Module

The goal of this task is to develop backup controls for events of failures, including long-term communication loss or optimization convergence failure.

The Recipient shall:

- Prepare the *Technical Memorandum for the Backup Control Module*, including descriptions of heuristic controls and user guides with simulation examples. The module will include but is not limited to:
    - Conduct a comprehensive review of existing literature on heuristic rules for chiller plants + TES (chilled water tank) with/without PVs, BESS and a fleet of EV charging stations.
    - Refine and enhance the algorithms by incorporating load predictions and benchmarking the characteristics of MPC decisions. Load predictions will be obtained from the decoupled MPC module.

Products:

- Technical Memorandum for Backup Control Module

Subtask 3.5 Development of Interface Module

The goal of this subtask is to develop an interface module for facility operators to set operation parameters, understand and evaluate the optimal operation schedule created by CC-FLEX, and anticipate savings. The module will analyze the optimal schedule and generate reports and visualizations using data processing, machine learning, and data visualization techniques.

The Recipient shall:

- Develop a *Technical Memorandum for the CC-FLEX User Interface Module* that describes the CC-FLEX interface and its functionality. The module will include but is not limited to:
    - Design an intuitive CC-FLEX User Interface that allows facility operators to interact easily with CC-FLEX.
    - Include interfaces in the User Interface to adjust various operation parameters, such as “suggestion-mode” and “auto-mode,” and limit the range of feasible DER operations and settings for safe operations (e.g., watchdog design).
    - Develop a dashboard on the User Interface to display the current system status (e.g., state of charge for BESS and/or TES), predicted load profiles, grid signals/events, optimal operation schedules, on-site solar generation, and associated state of charge of energy storage, generated by CC-FLEX.
    - Develop an analytics submodule that collects historical data, selects baseline data, and displays anticipated savings.
    - Develop a submodule to generate daily/weekly reports that include prediction accuracy and performance metrics.

Products:

- Technical Memorandum for CC-FLEX User Interface Module

Subtask 3.6 Development of Integration Workflows/Guidelines, and Software Disclosure and Management

The goals of this subtask are to develop step-by-step integration manuals for the correct installation and commissioning of CC-FLEX, and to release the CC-FLEX software package under a free-to-use, open-source license, while managing version updates.

The Recipient shall:

- Develop the *CC-FLEX Integration Manual* to provide step-by-step workflows and troubleshooting guides for completing the integration and commissioning process.
    - Develop training materials for CC-FLEX integration as part of workforce development (Task 6).
- Release CC-FLEX under a free-of-charge, open-source license.
    - Manage version updates using a version control tool.
- Provide publicly accessible *Git Repository Website Link* with a free-of-use and open-source license.

Products:

- CC-FLEX Integration Manual
- Git Repository Website Link

TASK 4 PILOT TESTING UNDER VARIOUS SCENARIOS AND CC-FLEX ENHANCEMENT

The goal of this task is to implement, identify problems, and enhance CC-FLEX under various scenarios through a comprehensive long-term study (at least 8 months) at UC-Merced's central plant and UC San Diego's BESS and EV charging station systems.

Subtask 4.1 Pilot Test Plan and Control Infrastructure Update

The goal of this subtask is to develop pilot test plans for the two sites to cover the various VPP scenarios identified in Task 2. This includes updating their control systems, including software replacement and additional sensor installations, if necessary, to complete the pilot test plans.

The Recipient shall:

- Develop a detailed *Site-Specific Pilot Test Plan*, which will include but is not limited to:
    - Description of the monitoring equipment and instrumentation to be used at each site.
    - Description of the key input parameters and output metrics to be measured.
    - Description of the VPP scenarios and operation strategies to be tested, as identified in Task 2.
    - Identification of the periods for testing each VPP scenario and the corresponding operation strategy.
    - Developing the analysis method and corresponding baseline operating conditions for each VPP scenario.
    - Substitute the existing MPC with the initial version of CC-FLEX.
    - Install additional sensors for pilot test implementation and analysis if necessary.
    - Perform functional tests to ensure that the upgraded control system with CC-FLEX works as desired.

Products:

- Site-Specific Pilot Test Plan

Subtask 4.2 Pilot Testing and CC-FLEX Enhancement

The goal of this subtask is to conduct pilot testing at UC Merced and UC San Diego facilities according to site-specific pilot test plans, identify unforeseen problems, and enhance CC-FLEX under various scenarios.

The Recipient shall:

- Execute the Site-Specific Pilot Test Plan (Subtask 4.1) to assess the operation and performance of the CC-FLEX system at each pilot site for at least 8 months. The facility team will include but is not limited to:
    - Implement CC-FLEX using either the auto-mode or suggestion-mode, and regularly monitor site operations.
    - Provide feedback and report issues to the Research & Development team via email (for urgent matters), an online survey form, and regular meetings.
- Develop an online survey form (e.g., Google Form) to record facility operators' perception and feedback, and prepare the *Pilot Test Lessons-Learned Memorandum*, which will include but is not limited to:
    - Resolve any reported and identified issues.
- Prepare the *Pilot Test Enhancement and Pre-assessment Memorandum*, which describes the identified problems, solution approaches using the online survey results, and pre-assessment results for each VPP scenario. The draft version focuses on the Standalone VPP models, while the final version includes both VPP models. The models will include but are not limited to:
    - Pre-assess the performance of the CC-FLEX system. Depending on VPP scenarios, the performance index will include load reduction during peak hours, site peak power, daily energy costs, emissions, and revenues.
    - Resolve any reported and identified issues and re-perform the tests.

Products:

- Pilot Test Lessons-Learned Memorandum
- Pilot Test Enhancement and Pre-assessment Memorandum (draft and final)

TASK 5 CC-FLEX DEPLOYMENT, M&V, AND ASSESSMENT

The goals of this task are to deploy CC-FLEX, plan and execute M&V plans for the three sites (Bakersfield College, UC San Diego, and UC Merced), verify the comprehensiveness of the CC-FLEX Integration Manual, and analyze the performance, including cost-effectiveness.

Subtask 5.1 Execute Contracts and Control Infrastructure Update

The goals of this subtask are to confirm the availability of three testing sites and their committed DER capacities, execute any agreements necessary to secure these sites, retrofit control infrastructures for Bakersfield College, and report the costs associated with any upgrades needed to implement CC-FLEX.

The Recipient shall:

- Prepare and provide the S*ite Readiness Verification Document* (e.g., Copy of Contract, Lease Agreement, Memorandum of Understanding) for each site.
    - Reach an agreement with the manager of all testing sites regarding the project timeline, types of DERs, their DR capacities reserved for the project, and equipment and additional sensor installations.
    - Identify any necessary upgrades such as sensors, communication devices, and accessories required to implement CC-FLEX for Bakersfield College according to the CC-FLEX Integration Manual.

- Prepare the *Site Control Infrastructure Retrofit Memorandum* that documents, for each demonstration site, the costs associated with revising their EMS logics, equipment procured (including model and vendor name), and completion of system installation which will include but is not limited to:
    - Track the technical requirements (e.g., protocol used, modeling requirements, operational impacts) for integrating each technology
    - Procure, install, and commission the identified devices.
    - Upgrade their EMS logics according to the CC-FLEX Integration Manual.
    - Integrate with the Load Serving Entities (LSEs) for meter data sharing.

Products:
- Site Readiness Verification Document
- Site Control Infrastructure Retrofit Memorandum

Subtask 5.2 Site-Specific Measurement and Verification Plan
The goal of this subtask is to develop a detailed M&V Plan for all testing sites.

The Recipient shall:
- Develop detailed *Site-Specific Measurement and Verification (M&V) Plans* for all testing sites, including but not limited to:
    - Describe the monitoring equipment and instrumentation to be used at each site.
    - Describe the key input parameters and output metrics to be measured.
    - Describe the VPP scenarios to be tested for the Standalone model, as defined in Task 2.
    - Develop the analysis method and corresponding baseline operating conditions for each VPP scenario.
    - Arrange test periods for the VPP scenarios in both VPP operation models.
    - Store historical data from pre-project operations for each site. For central chiller TES plants, store at least one year of historical data stored in EMS.
    - Develop and calibrate engineering models for cases where finding good baseline data is difficult.

Products:
- Site-Specific M&V Plans

Subtask 5.3 Test CC-FLEX
The goal of this subtask is to actively control the CC-FLEX systems for all sites according to the Site-Specific M&V Plan.

The Recipient shall:
- Execute the Site-Specific Measurement and Verification Plan (Subtask 4.1) by testing the operation and performance of the CC-FLEX system on each pilot site for at least 12 months.
- Develop a *Control Strategy Testing Report* to document the results of the tests, including but not limited to:
    - Apply the VPP scenarios to each site.
    - Implement and monitor the CC-FLEX system performance for at least 12 months according to the Site-Specific M&V Plan.
    - Collect surveys from facility operators during the testing.

Products:

- Control Strategy Testing Report (draft and final)

Subtask 5.4 Analyze and Document Results

The goal of this subtask is to analyze the project results.

The Recipient shall:

- Prepare a *System Performance and Impact Report* to document the site performance and the cost-effectiveness, including but not limited to:
    - Assess the performance of the CC-FLEX system based on the Site-Specific M&V Plan.
    - Analyze the environmental and cost-effectiveness on an annual energy model (8760 hours).
    - Evaluate the cost-effectiveness of the CC-FLEX systems for Bakersfield College using both the Site Control Infrastructure Retrofit Memorandum for the CC-FLEX integration costs and the performance test results for all sites.
- Prepare a L*essons Learned Technical Memorandum* to document the findings from deployment by summarizing both the Pilot Test Lessons-Learned Memorandum (Subtask 4.2) and the online survey results in Subtask 5.3.
    - Develop processes, reports, and tools to provide VPP enrollment and operational status visibility to local LSEs so that they can rely on the solution as a reliable grid resource.

Products:

- System Performance and Impact Report
- Lessons Learned Technical Memorandum

TASK 6 WORKFORCE DEVELOPMENT

This task aims to develop a workforce capable of integrating the CC-FLEX software with campus central plant EMS by creating and piloting the CC-FLEX curriculum on top of an existing EMS program, led by Bakersfield College.

The Recipient shall:

- Develop a CC-FLEX curriculum from the CC-FLEX Integration Manual developed in Task 3.6, the curriculum will include but not limited to:
    - Installing the CC-FLEX software package on a server (e.g., a desktop computer on campus)
    - The process for site inspection and EMS integration with the CC-FLEX server and/or other software platforms for communicating with, e.g., grid signals, a vendor VPP
    - The process for commissioning, troubleshooting, and adjusting operational settings
    - General strategies of central plant management in response to various grid needs, including VPP dispatch strategies
- Prepare the *CC-FLEX Curriculum Development and Dissemination Repor*t including but limited to:
    - Incorporating the CC-FLEX curriculum as a sequential course following the Bakersfield College's National Coalition of Certification Centers program (as a

prerequisite) and piloting this new course at Bakersfield College's Delano campus
    - Hold workshops to disseminate education modules for wider awareness
    - Host a workshop for campus stakeholders, including facility operators, managers, and faculties with other campuses from University of California, California State University and California Community Colleges.
- Develop *Market Adoption and Commercialization Plan*, including but not limited to, strategies for disseminating the CC-FLEX tools and findings to further engage other campuses beyond this project, identification of potential adopters, their target markets, a value proposition grounded in project outcomes, business models, and a go-to-market strategy.

Products:
- CC-FLEX Curriculum Development and Dissemination Report (draft and final)
- Market Adoption and Commercialization Plan

TASK 7: 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* 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 EnergizeInnovation.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 EnergizeInnovation.fund*, including the profile link.

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 8 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* 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

ATTACHMENT 1 - PROJECT SCHEDULE

Exhibit A
Scope of Work
DOE-Lawrence Berkeley National Laboratory

Please see the attached Excel spreadsheet.