California Energy Commission
October 08, 2025 Business Meeting
Backup Materials for Tyfast Energy Corp.

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: Tyfast Energy Corp.

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-25-028 with Tyfast Energy Corp. for a $1,959,011 grant. This project will take place in San Diego County and further develop lithium vanadium oxide battery technology as applied to the electrification of heavy-duty off-highway equipment such as excavators and utility tractors, offering greater power and cycle-life and better operating temperatures than traditional lithium-ion battery technology; 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-25-028

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Jemar Roble Tan
3. MS-:None
4. Phone Number: 1-916-909-2540

C. Recipient's Information

1. Recipient's Legal Name: Tyfast Energy Corp.
2. Federal ID Number: 86-3848338

D. Title of Project

Title of project: High Performance Battery Packs Using Domestic Materials for Compact Off-Highway Machines

E. Term and Amount

1. Start Date: 10/29/2025
2. End Date: 8/31/2028
3. Amount: $1,959,011.00

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? Discussion
4. Business Meeting Presenter Name: Ayat Osman
5. Time Needed for Business Meeting: 10 minutes.
6. The email subscription topic is: Electric Program Investment Charge (EPIC)

Agenda Item Subject and Description:
Tyfast Energy Corp. Proposed resolution approving agreement EPC-25-028 with Tyfast Energy Corp. for a $1,959,011 grant, and adopting staff's recommendation that this action is exempt from CEQA. This project will take place in San Diego County and further develop lithium vanadium oxide battery technology as applied to the electrification of heavy-duty off-highway equipment such as excavators and utility tractors, offering greater power and cycle-life and better operating temperatures than traditional lithium-ion battery technology. (EPIC funding)
Contact: Lindsey Fransen

G. California Environmental Quality Act (CEQA) Compliance

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

   If yes, skip to question 2.

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, 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, 15301 Existing Facilities: provides an exemption from CEQA for the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing structures, facilities, mechanical equipment or topographical features involving negligible or no expansion of use beyond that existing. This project will conduct research, development, and manufacturing within already existing facilities with only minor interior alterations through the addition of small-scale fabrication equipment. There will be negligible or no expansion of existing use. Therefore, the project falls within section 15301 and will not have a significant effect on the environment.

Cal. Code Regs., tit. 14, Section 15306, Information Collection, exempts from CEQA projects that 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. The proposed project activities fall within these categories. For these reasons, the proposed project will have no significant effect on the environment and is categorically exempt under section 15306.

This project does not involve impacts on any particularly sensitive environment; 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 San Diego Campus	$ 0	**$**90,000

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
MSE Supplies LLC	**$**0	**$**214,499
MTI Corporation	**$**0	**$**176,200
Element Materials Technology Milpitas Inc.	**$**0	**$**64,600

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	$ 1,959,011

TOTAL Amount: $ 1,959,011

R&D Program Area: TIEB: EDMF

Explanation for "Other" selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #:

M. Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Haodong Liu

Address: 8909 Kenamar Drive, Suite 102

City, State, Zip: San Diego, CA 92121

Phone: 858-999-4944

E-Mail: haodongliu@tyfast.energy

2. Recipient's Project Manager

Name: Haodong Liu

Address: 8909 Kenamar Drive, Suite 102

City, State, Zip: San Diego, CA 92121

Phone: 858-999-4944

E-Mail: haodongliu@tyfast.energy

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-23-318
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: Jemar Roble Tan

Approval Date: 8/26/2025

Branch Manager: Anthony Ng

Approval Date: 8/28/2025

Director: Jonah Steinbuck *(delegated to Branch Manager)*

Approval Date: n/a

Exhibit A
Scope of Work
Tyfast Energy Corp.

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		Design, Fabrication, and Scale-up of High-performance Pouch Cells
3	X	Design and Fabrication of High-performance 20 kWh Battery Pack
4		Third-party Safety and Abuse Testing
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
Ah	Ampere-hour
BMS	Battery Management System
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
kWh	Kilowatt-hour
LVO	Lithium vanadium oxide or $Li_3V_2O_5$
QC	Quality Control
SAE J2464	Society of Automotive Engineers J2464 - Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System Safety and Abuse Testing
SOC	State of Charge
TAC	Technical Advisory Committee
TRL	Technology Readiness Level
Recipient	Tyfast Energy Corp
UN 38.3	United Nations Manual of Tests and Criteria, Subsection 38.3

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 a high-performance battery pack using the Recipient's lithium vanadium oxide (LVO) technology that has been validated with third-party testing to deliver high-rate charge and discharge, extended cycle life, and the ability to cycle below freezing temperatures. The goal of these efforts is to fabricate a battery pack to

[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.

demonstrate the high-performance capabilities of the LVO technology to potential original equipment manufacturer customers developing off-highway compact equipment.

B. Problem/ Solution Statement

Problem

The electrification of off-highway equipment such as mini excavators, skid steer loaders, and utility tractors presents critical challenges and opportunities. These machines typically operate for 4-8 hours per day under high power demands and adverse weather conditions, making durability and performance essential. Current lithium-ion battery technologies using graphite anodes, primarily designed for passenger vehicles, fall short due to limited cycle life (about 1,000 cycles), slow charging times (about 60 mins), and inadequate operation in extreme temperatures (no charging below freezing). Diesel-powered equipment emits harmful pollutants and GHGs. Therefore, transitioning to electric equipment is critical for environmental and health benefits and helping achieve the California Air Resources Board's goals for 100 percent zero-emission drayage trucks by 2035, public buses by 2040, and medium- and heavy-duty vehicles by 2045. Achieving this transition requires innovative battery solutions that combine high power, long cycle life, and rapid charging with a low total cost of ownership, addressing the stringent needs of off-highway applications. The Recipient's novel LVO anode technology aims to meet these demands to help meet California's climate goals.

Solution

The Recipient's LVO anode technology is designed to provide a transformative solution for the electrification of off-highway equipment, addressing critical performance gaps in current lithium-ion batteries. Batteries made with these LVO anodes offer ultra-fast charging (less than 15 minutes to full capacity), exceptional cycle life (more than 10,000 cycles), and reliable operation across extreme temperatures (-40°C to +60°C) to meet demanding equipment applications in mini excavators, skid steer loaders, and utility tractors. Leveraging domestically sourced materials from industrial waste, the Recipient not only reduces environmental impact but also enhances supply chain security, positioning their LVO technology as a game-changer for the sustainable electrification of heavy-duty equipment.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Accelerate the commercialization of a new high-performance lithium-ion battery powered by the novel LVO anode capable of meeting the demanding operating requirements for electrified off-highway equipment.
- Increase the Technology Readiness Level (TRL) of the LVO technology from current TRL 5 with standalone pouch cells to TRL 7 with a 20 kilowatt-hour (kWh) battery pack.

Ratepayer Benefits:[2] This Agreement is intended to result in ratepayer benefits by accelerating the electrification of off-highway equipment and reducing dependence on diesel-powered

[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

machinery. By replacing diesel engines with zero-emission alternatives, the Recipient's LVO based batteries are intended to lower operating costs by up to 90 percent, saving businesses approximately $29,000 annually per machine, based on current fuel and electricity prices. This shift will also reduce harmful emissions, improving air quality and public health, especially in disadvantaged communities near construction and industrial sites. Additionally, the Recipient's use of domestically sourced materials from industrial waste aligns with California's sustainability goals, enhancing energy security while minimizing environmental impact. These innovations support the state's zero-emission transportation targets, fostering economic growth through green job creation and providing ratepayers with cleaner, quieter, and more cost-effective energy solutions.

Technological Advancement and Breakthroughs:[3] This Agreement is intended to lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy and climate goals by enabling the electrification of compact off-highway equipment. By overcoming the limitations of current lithium-ion batteries, such as slow charging times, limited cycle life, and poor performance in extreme temperatures, this project is intended to deliver high-performance battery packs capable of fully charging in under 15 minutes, lasting over 10,000 cycles, and operating reliably from -40°C to +60°C. These advancements directly support California's aggressive zero-emission transportation mandates, including the California Air Resources Board's goals for 100 percent zero-emission drayage trucks by 2035, public buses by 2040, and medium- and heavy-duty vehicles by 2045. By facilitating the widespread adoption of zero-emission workhorse machines, the project addresses the urgent need for sustainable solutions in the off-highway sector, reduces reliance on diesel, and significantly cuts greenhouse gas emissions and toxic pollutants. This would contribute to achieving the state's ambitious energy transition goals while fostering technological innovation, reducing operational costs, and improving environmental and public health outcomes for communities across California.

Agreement Objectives

The objectives of this Agreement are to:

- Design and fabricate larger format, high-performance pouch cells with a capacity of 20 ampere-hours (Ah) that achieve full charge time in less than 15 mins, deliver 10,000 cycles to 80 percent capacity, and safely charge down to -40°C.
- Design and fabricate a high-performance 60 V, 20 kWh battery pack using the larger format pouch cells while maintaining the performance characteristics demonstrated at the cell level.
- Perform third-party testing to validate safety of the large format 20 Ah pouch cells and validate performance metrics of the 20 kWh battery pack.

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.

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 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.
- 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 *(if requested by the CAM)*
- Draft Subawards *(if requested by the CAM)*
- Final Subawards *(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* for each TAC Meeting 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: DESIGN AND FABRICATION OF HIGH-PERFORMANCE POUCH CELLS

The goal of this task is to design, fabricate, and scale up the production of high-performance (more than 20 Ah) pouch cells with the capability for rapid charging (less than 15 minutes), an extended cycle life (more than 10,000 cycles), and reliable operation across a temperature range of -40°C to 60°C. The manufacturing scale-up will target a production rate of over 200 cells per week.

Subtask 2.1: Pouch Cell Design

The goal of this subtask is to design the specifications, materials, and components for high-performance pouch cells.

The Recipient shall:

- Identify design specifications and performance targets for pouch cells, including but not limited to:
  - Cell size (about 200 x 250 mm)
  - Cell capacity (20 Ah)
  - Full charge time (less than 15 minutes)
  - Cycle life to 80 percent capacity (more than 10,000 cycles)
  - Cycling temperature performance (-40°C to 60°C).
- Develop a robust tab design to handle high power requirements and minimize resistance during fast charge and discharge operations.
- Optimize electrode materials, focusing on the following:
  - LVO powder properties
  - LVO anode formulation
  - Selection of a high-rate and cycle life matching cathode
- Design and optimize electrode formulation to enhance the performance of the LVO anode to ensure:
  - High areal capacity[4]
  - Fast charge capability
- Screen and select separators that meet the thermal and mechanical stability requirements for high-power applications.
- Design and formulate an electrolyte tailored for:
  - Wide temperature operation (-40°C to 60°C)
  - Compatibility with the LVO anode.
- Submit a *Pouch Cell Design Memo* detailing the finalized specifications, material choices, tab design, separator selection, and electrolyte formulation. The memo will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the

[4] High areal capacity – The intent is to design and build battery electrodes containing a high fraction of battery active material to maintain high energy density.

due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.)

Products:

- Pouch Cell Design Memo

Subtask 2.2: Initial Pouch Cell Fabrication and Testing

The goal of this subtask is to fabricate the initial 20 Ah scaled pouch cells and conduct preliminary testing to validate design specifications and process scalability.

The Recipient shall:

- Scale up anode slurry preparation using an industrial planetary mixer to produce consistent electrode slurry batches.
- Implement roll-to-roll coating[5], targeting more than 100 meters per week with uniform electrode quality.
- Fabricate prototype cells, targeting around 20 large format pouch cells per week to validate design and assess manufacturing consistency.
- Conduct initial testing on large format pouch cells to evaluate:
    - Specific capacity
    - Fast charge capability
    - Performance evaluation across temperature range (-40°C to 60°C)
- Submit a *Pouch Cell Prototype Test Memo* summarizing the results of the initial testing and identifying any necessary design adjustments. The memo will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.)

Products:

- Pouch Cell Prototype Test Memo

Subtask 2.3: Increase Pouch Cell Fabrication

The goal of this subtask is to increase the number of pouch cells made weekly while maintaining consistent performance to meet battery pack cell count and performance requirements.

The Recipient shall:

- Increase roll-to-roll coating capacity to target more than 200 meters per coating run with high-quality, uniform electrode production.
- Enhance automated stacking and assembly techniques for efficient cell assembly, targeting a pouch cell fabrication rate of more than 200 cells per week.
- Develop a comprehensive fabrication plan to ensure cell-to-cell build and performance consistency, outlining the following:
    - Process flow

[5] Roll-to-roll coating – Roll-to-roll coating pertains to depositing a coating of material to an (unrolled) flexible substrate, then re-rerolling the resulting product. In this case, the roll-to-roll coating pertains to adding vanadium oxide material on copper foil current collectors for electrode fabrication.

  - Equipment requirements
  - Quality control (QC) measures
  - Production workflows
- Submit an *Increased Pouch Cell Fabrication Memo* summarizing the strategies, implementation steps, and outcomes of efforts to scale pouch cell manufacturing to more than 200 cells per week. The memo will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.) The memo will include, but not be limited to, the following: executive summary, fabrication process flow, production throughput and yield metrics, quality control and assurance measures, lessons learned, and next steps.

Products:
- Increased Pouch Cell Fabrication Memo

Subtask 2.4: Pouch Cell Performance Testing
The goal of this subtask is to conduct comprehensive performance, durability, and quality control testing on the scaled-up pouch cells.

The Recipient shall:
- Conduct full-performance testing to evaluate the following:
  - Capacity
  - Energy
  - Fast charge/discharge capability across the full temperature range (-40°C to 60°C)
- Evaluate long-term cycle life, performing extended cycling tests to validate a minimum of 10,000 cycles.
- Implement quality control (QC) procedures, including those for:
  - Internal resistance
  - Capacity consistency
  - Defect detection

Submit a *Pouch Cell Test Results and QC Summary* Memo detailing the outcomes of all testing and any deviations from target metrics. The memo will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.)

Products:
- Pouch Cell Test Results and QC Summary Memo

TASK 3: DESIGN AND FABRICATION OF HIGH-PERFORMANCE BATTERY PACK
The goal of this task is to design, fabricate, and validate the high-performance battery pack with a capacity of 20 kWh. The pack is aimed at delivering high-rate capability with 10C charge and

discharge rate[6]. The pack will integrate the high-performance pouch cells designed for rapid charging, long cycle life, and reliable operation across a temperature range of -40°C to 60°C.

Subtask 3.1: Battery Pack Design
The goal of this subtask is to define the design specifications and optimize the architecture for the high-performance battery pack.

The Recipient shall:

- Define pack configuration, including the number of cells in series and parallel to achieve desired 60V and 20 kWh energy.
- Develop the electrical components to handle a 10C charge and discharge rate, ensuring the pack can deliver high power output while maintaining voltage stability.
- Incorporate high-performance pouch cells from Task 2, optimizing the layout for energy density and minimizing internal resistance.
- Design thermal management system, incorporating cooling pads to manage heat dissipation during high-power discharge and rapid charging.
- Submit a *Battery Pack Design Memo* that will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.) The memo will include but not be limited to the following:
    - Finalized specifications
    - Electrical schematics
    - Mechanical layout
    - Tab design
    - Thermal management considerations
- Prepare a *CPR Report* and participate in a CPR meeting, per subtask 1.3.

Products:

- Battery Pack Design Memo
- CPR Report

Subtask 3.2: Component Sourcing and Fabrication
The goal of this subtask is to source and fabricate the necessary components for the high-performance pack assembly.

The Recipient shall:

- Source high-quality wiring and connectors capable of handling high currents at a 10C rate.
- Procure a Battery Management System (BMS) suitable for the LVO cell chemistry up to 60V pack configuration. The BMS is planned to be capable of monitoring the following:

[6] 10C charge and discharge rate – The current rate, or “C Rate,” of a battery can be calculated by dividing the charging or discharging current in amperes by the rated battery capacity in Ah. In this case, the 10C charge and discharge rate translates to the ability to charge and discharge the battery in less than 6 minutes by 80% of the cell capacity.

  - Voltage
  - Temperature
  - State of charge (SOC)
  - State of health
- Fabricate structural components, including pack casing and supports, using 3D printing or machine shop services for precision manufacturing.
- Integrate cooling pads into the pack design for effective thermal management during high-power operations.
- Acquire equipment, such as welding machines and spot welders, necessary for reliable and consistent cell connections.
- Submit a *Component Fabrication and Sourcing memo* documenting all sourced materials and fabricated components. The memo will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.)

Products:
- Component Fabrication and Sourcing Memo

Subtask 3.3: Initial Battery Pack Build and Test
The goal of this subtask is to build a test battery pack, approximately 1 kWh in energy, to validate the BMS, structural components, and thermal management design for the full-scale pack.

The Recipient shall:
- Assemble test battery pack at about 1 kWh energy capacity using high-performance pouch cells.
- Integrate BMS and structural components, validating the following:
  - Electrical connections
  - Mechanical integrity
  - Cooling system functionality
- Conduct a thermal behavior study to monitor temperature changes during charge/discharge cycles and assess thermal management effectiveness.
- Establish the performance relationship between individual cells and the mini pack (defined as a test battery pack at about 1 kWh energy capacity using high-performance pouch cells), analyzing the following:
  - Voltage stability
  - Capacity retention
  - Power output
- Submit a *Mini Pack Test Memo* that will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable].

The Recipient shall receive no additional funding to create two versions of this Product.) The memo will include but not be limited to the following:
  - Assembly process
  - Thermal behavior study results
  - Performance analysis results

Products:
- Mini Pack Test Memo

Subtask 3.4: Full Battery Pack Fabrication
The goal of this subtask is to fabricate a full-scale prototype pack with energy of 20 kWh using the validated design from Subtask 3.3.

The Recipient shall:
- Assemble a full-scale prototype pack with 60V nominal voltage and energy of 20 kWh.
- Integrate all electrical, structural, and thermal components, ensuring proper alignment and secure connections.
- Conduct assembly verification testing to check for the following:
  - Electrical continuity
  - Mechanical integrity
  - BMS functionality
- Enhance techniques for efficient pack assembly, targeting a 1-week timeline to complete a single battery pack build.
- Submit a *Full Battery Pack Fabrication Report* that will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.) The memo will include but not be limited to the following:
  - Assembly process
  - Challenges encountered
  - Design adjustments made (if any)

Products:
- Full Battery Pack Fabrication Memo

TASK 4: THIRD-PARTY TESTING
The goal of this task is to conduct comprehensive safety validation testing for the high-performance battery cells using both internal tests and independent third-party assessments. The tests will comply with United Nations Manual of Tests and Criteria, Subsection 38.3 (UN 38.3) and Society of Automotive Engineers J2464 - Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System Safety and Abuse Testing (SAE J2464) standards, ensuring the cells meet stringent safety and abuse testing requirements. Third-party testing will be conducted by reputable laboratories to guarantee unbiased results and establish market credibility.

Subtask 4.1: Third-Party Cell Safety Testing
The goal of this subtask is to validate the safety of the Recipient's high-performance pouch cells through comprehensive third-party testing, following UN 38.3 and SAE J2464 standards.

The Recipient shall:

- Engage a third-party testing laboratory to conduct independent safety tests on the pouch cells.
- Submit a batch of 40-50 pouch cells for third-party evaluation, ensuring a statistically significant sample size representative of production quality.
- Conduct UN 38.3 Standardized Safety Tests, including:
    - Thermal Test: Cycle the cells between high and low temperature extremes to evaluate thermal stability.
    - Vibration Test: Subject the cells to vibration to simulate transportation stresses.
    - Shock Test: Apply mechanical shock to assess the structural integrity of the cells.
    - External Short Circuit Test: Conduct a short circuit test at 100 percent SOC using less than 10 megaohms external resistance, monitoring for abnormal heat generation or failure.
    - Impact Test: Simulate mechanical abuse by applying impact force, assessing structural robustness and internal damage risk.
    - Overcharge Test: Charge the cells to 200 percent SOC or 50 percent beyond the voltage limit to test for thermal runaway risk.
- Conduct SAE J2464 Abuse Testing, including:
    - Nail Penetration Test: Insert a nail through the cell to induce an internal short circuit, evaluating the cell's ability to handle catastrophic damage without fire or explosion.
    - Crush Test: Apply compressive force to the cells to simulate severe mechanical abuse and assess structural integrity.
    - Thermal Ramp Test: Gradually increase the cell temperature to identify the onset of thermal runaway and evaluate the thermal stability.
- Submit a *Third-Party Cell Safety Test Memo*, including detailed test results, analysis, and compliance verification with UN 38.3 and SAE J2464 standards. The memo will be 5-10 pages and include figure, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.)

Products:

- Third-Party Cell Safety Test Memo

Subtask 4.2: Third-Party Battery Pack Testing
The goal of this subtask is to evaluate the performance of the 20 kWh battery pack and implement QC measures.

The Recipient shall:

- Conduct comprehensive performance testing, measuring the following:
    - Capacity
    - Power output

  - Charge/discharge efficiency
  - Temperature stability across the full operational range (-40°C to 60°C).
- Evaluate high-rate charge/discharge capability, testing the pack at a 10C charge/discharge rate to validate power input/output and thermal management.
- Evaluate long-term cycle life, performing extended cycling tests to validate a minimum of 5,000 cycles.
- Implement QC procedures, including tests for:
  - Voltage consistency
  - Internal resistance
  - Defect detection
- Submit a *Battery Pack Performance Testing and QC* Memo that will be 5-10 pages and include figures, graphics, and an executive summary for a non-technical audience. The memo will not disclose any confidential information. (There may also be a confidential version of this memo with some confidential information. This possibility is under discussion between the CEC and the Recipient and will be resolved prior to the due date for the Product [i.e., deliverable]. The Recipient shall receive no additional funding to create two versions of this Product.) The memo will include but not be limited to:
  - Test results
  - QC findings
  - Recommendations for improvements (if any)

Products:

- Battery Pack Performance Testing and QC Memo

TASK 5: EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

- Complete *the Initial Project Benefits Questionnaire*. The Initial Project Benefits Questionnaire shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Complete the *Annual Survey* 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 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 6: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to conduct activities that will accelerate the commercial adoption of the technology being supported under this agreement. Eligible activities include, but are not limited to, the following:

- Scale-up analysis including manufacturing analysis, independent design verification, and process improvement efforts.
- Technology verification testing, or application to a test bed program located in California.
- Legal services or licensing to secure necessary intellectual property to further develop the technology
- Market research, business plan development, and cost-performance modeling.
- Entry into an incubator or accelerator program located in California.

The Recipient Shall:

- Develop and submit a *Technology Transfer Plan* that identifies the proposed activities the recipient will conduct to accelerate the successful commercial adoption of the technology.
- Present the draft *Technology Transfer Plan* to the TAC for feedback and comments.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the Draft Technology Transfer 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 *Technology Transfer Plan* to the CAM for approval.
- Implement activities identified in final *Technology Transfer Plan*.
- Develop and submit a *Technology Transfer Summary Report* that includes high level summaries of the activities, results, and lessons learned of tasks performed relating to implementing the Final Technology Transfer Plan. This report should not include any proprietary information.
- When directed by the CAM, develop presentation materials for an CEC- sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the 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:

- Technology Transfer Plan (draft and final)
- Summary of TAC Comments
- Technology Transfer Summary Report (draft and final)
- High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the Project Schedule Excel spreadsheet.