California Energy Commission
August 13, 2025 Business Meeting
Backup Materials for Enzinc Inc.

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: 25-0813-11a

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: Enzinc Inc.

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

RESOLVED, that the CEC approves agreement EPC-25-007 with Enzinc Inc. for a $1,619,248 grant. This project in Oakland will develop and demonstrate an advanced zinc electrode to enhance the performance of nickel zinc, zinc manganese, and zinc-air batteries for stationary storage applications, while also optimizing the manufacturing process to reduce costs and support future scalability; 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 August 13, 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-25-007

B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Bryan Lee
3. MS-:43
4. Phone Number: 916-776-0786

C. Recipient's Information

1. Recipient's Legal Name: Enzinc Inc.
2. Federal ID Number: 27-0756346

D. Title of Project

Title of project: Advanced zinc electrode to enable rechargeable alkaline zinc batteries for a more resilient grid

E. Term and Amount

1. Start Date: 9/1/2025
2. End Date: 12/22/2028
3. Amount: $1,619,248.00

F. Business Meeting Information

1. Are the ARFVTP agreements $75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 8/13/2025
3. Consent or Discussion? Discussion
4. Business Meeting Presenter Name: Bryan Lee
5. Time Needed for Business Meeting: 5 minutes
6. The email subscription topic is: Electric Program Investment Charge (EPIC)

Agenda Item Subject and Description:

Enzinc Inc. Proposed resolution approving agreement EPC-25-007 with Enzinc Inc. for a $1,619,248 grant and adopting staff's recommendation that this action is exempt from CEQA. This project in Oakland, California, will develop and demonstrate an advanced zinc electrode to enhance the performance of nickel zinc, zinc manganese, and zinc-air batteries for stationary storage applications, while also optimizing the manufacturing process to reduce costs and support future scalability. (EPIC funding) Contact: Bryan Lee

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 ;

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 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alternations 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).

This project includes the development, testing, and validation of an advanced electrode for zinc batteries. The development will take place at existing facilities in Oakland, CA and Richmond, CA. Enzinc has permits to operate both sites. Additional testing and validation will occur at existing facilities at the Center for Environmental Research & Technology at the University of California, Riverside campus. The scope of this project does not introduce any significant changes to the way these sites operate compared to normal course of business and will not create any new waste streams.

The project 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; does not involve any cumulative impacts of successive projects of the same type in the same place that might be considered significant; does not involve unusual circumstances that might have a significant effect on the environment; will not result in damage to scenic resources within a

highway officially designated as a state scenic highway; the project site is not included on any list compiled pursuant to Government Code section 65962.5; and the project will not cause a substantial adverse change in the significance of a historical resource. Therefore, none of the exceptions to categorical exemptions listed in CEQA Guidelines section 15300.2 apply 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
Center for Environmental Research & Technology of University of California, Riverside	$ 250,000	**$22,680**

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
Octet Scientific	**$0**	**$75,000**
Community Resources for Science	**$15,000**	**$5,000**
Factor Growth, LLC	**$50,000**	**$0**

Center for Advanced Materials Characterization in Oregon (CAMCOR), University of Oregon	**$0**	**$35,000**
EquipX Inc.	**$7,600**	**$1,900**
Neware Technology LLC	**$0**	**$25,000**
Biologic-Logic SAS	**$0**	**$60,000**
Associated Pacific Machine Corp.	**$6,400**	**$1,600**
Sonitek Corporation	**$0**	**$25,000**
Co-Efficient Precision Engineering Inc.	**$0**	**$25,000**
SFX Laser California LLC	**$19,800**	**$36,200**
Grillo-Werke AG	**$0**	**$13,300**
TBD (Materials & Miscellaneous)	**$9,000**	**$11,000**
Sigma-Aldrich Corporation	**$7,200**	**$4,800**
McMaster-Carr Supply Company	**$44,200**	**$18,800**
TBD (Materials & Miscellaneous)	**$3,096**	**$2,064**
Richmond Promise, Inc	**$0**	**$15,000**
McWilliams and Son, Inc. dba California Tool and Die	**$4,000**	**$1,000**
MSE Supplies LLC	**$0**	**$5,000**
TBD (Materials & Miscellaneous)	**$4,000**	**$1,000**
TBD (Materials & Miscellaneous)	**$4,000**	**$1,000**

K. Key Partners

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

Key Partner Legal Company Name
No key partners to report

L. Budget Information

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

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	24-25	301.001L	$ 1,619,248

TOTAL Amount: $ 1,619,248

R&D Program Area: ESTB: ETSI

Explanation for “Other” selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

M. Recipient’s Contact Information

1. Recipient’s Administrator/Officer

Name: Michael Burz

Address: 1301 S 46Th St

City, State, Zip: Richmond, CA 94804-4600

Phone: 303 312 4780

E-Mail:mburz@enzinc.com

2. Recipient’s Project Manager

Name: Mike Galluzzo

Address: 1301 S 46Th St

City, State, Zip: Richmond, CA 94804-4600

Phone: 603 247 8112

E-Mail: mgalluzzo@enzinc.com

N. Selection Process Used

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

Selection Process	Additional Information
Competitive Solicitation #	GFO-23-317
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: Bryan Lee

Approval Date: 6/20/2025

Branch Manager: Reynaldo Gonzalez

Approval Date: 6/27/2025

Director: Johan Steinback delegated to Branch Manager

Approval Date: 6/27/2025

Exhibit A
Scope of Work
Enzinc Inc.

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		Measurement and Verification Plan and Systems Level Requirements
3	x	Gen2 Electrode Process Development
4		Battery Cell Development and Testing
5	x	Battery System Integration into Microgrid Test Bed
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
Gen2	2nd generation
KPI	Key performance indicator
LAB	Lead acid battery
LiB	Lithium-ion battery
LCOS	Levelized Cost of Energy Storage
NiZn	Nickel zinc
STEM	Science, Technology, Engineering, and Mathematics
TAC	Technical Advisory Committee
ZnMn	Zinc manganese
Zn-air	Zinc air

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 advanced zinc electrode (Gen2) for high performance nickel zinc (NiZn), zinc manganese (ZnMn), and zinc air (Zn-air) batteries to demonstrate the technology in simulated grid scenarios.
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[1] Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

B. Problem/ Solution Statement

Problem

As the demand for stationary energy storage grows, battery manufacturers face growing pressure from strained supply chains, and U.S. companies are struggling to compete with foreign companies, particularly when it comes to lithium-ion batteries (LiB). Additionally, the application of LiBs in grid storage scenarios where the battery is subjected to float charge conditions (method of keeping the battery at an optimal charge by supplying a small constant voltage) or stored at full state of charge is not advantageous. These conditions can result in the formation of dendrites which short circuit the cell and may lead to thermal runaway if external controls are not properly implemented. Alternative chemistries which are well suited for float charge conditions are required to diversify the battery supply chain and accelerate the goal of energy independence through domestic manufacturing while delivering the performance of LiBs at lower cost and higher degree of safety.

Solution

The Recipient has developed a 3D microporous zinc sponge electrode to enhance the performance of alkaline NiZn, ZnMn, and Zn-air batteries. The sponge structure provides high surface area to enable greater zinc utilization (higher energy density) and long cycle life with no risk of dendrite formation. Like other aqueous battery chemistries, the Recipient's batteries are tolerant to float or trickle charge conditions and can be employed in applications that are challenging for LiBs. Rechargeable NiZn, ZnMn, and Zn-air batteries can leverage existing U.S. supply chains for consumer and industrial battery products. Integration of the Recipient's battery technologies into stationary energy storage applications will diversify the energy storage supply chain without sacrificing performance.

World leaders in LiB manufacturing are located outside the U.S. As the U.S. and California work towards energy independence, developing domestic energy storage manufacturing has become increasingly important. Unlike LiBs, lead acid batteries (LAB) are manufactured domestically and the Recipient's technology is compatible with LAB manufacturing processes. As growth in demand for LABs slows, domestic manufacturers will have idle manufacturing capacity. The Recipient is partnering with LAB manufacturers to convert their existing manufacturing lines to produce NiZn batteries based on its zinc sponge electrode. After commercializing the NiZn battery technology, the Recipient will focus on the ZnMn battery followed by Zn-air.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Develop a Gen2 zinc sponge electrode which features an embedded current collector.
- Demonstrate alkaline zinc batteries based on the Gen2 electrode as a viable pathway to meeting the CEC's targets of <$0.05/kWh levelized cost of energy storage (LCOS), >10-year calendar life, and >50% roundtrip efficiency.
- Evaluate the performance of the Gen2 technology in multiple grid storage scenarios.
- Develop advanced manufacturing processes for the Gen2 electrode which result in a lower cost, higher performing zinc electrode for alkaline batteries.

- Create opportunities for high quality jobs and provide education to the community on the benefits of zinc batteries to support a more reliable grid.

Ratepayer Benefits:[2] This Agreement will result in ratepayer benefits including greater electricity reliability, lower costs, and increased safety, by accelerating the deployment of aqueous NiZn, ZnMn, and Zn-air batteries for stationary energy storage applications. Aqueous zinc batteries can provide enhanced reliability by acting as a backup power supply in microgrid environments. The battery costs are lowered by leveraging existing lead acid battery manufacturing capacity (lower initial capital requirements) and using earth abundant materials. The batteries are safer than LiBs and do not contain toxic materials present in other aqueous chemistries such as lead and cadmium.

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 delivering zinc-based battery technology using a novel three-dimensional sponge anode that has the energy of lithium-based batteries and the low cost of LABs, while being safer and more sustainable.

Agreement Objectives

The objectives of this Agreement are to:

- Design, test, and validate the Gen2 electrode meeting electrode property key performance indicators (KPI) in a 135 cm^2 form factor. The electrode property KPIs (Electrode Property KPIs) are as follows:
  - The target minimum thickness is <0.8 mm
  - The target percentage of mass in the Gen2 electrode associated with the current collector compared to the total mass is <15%
  - The target thickness non-uniformity, defined as the maximum thickness minus the minimum thickness divided by the average thickness is <10%
- Design, test, and validate NiZn batteries based on the Gen2 electrode meeting the battery KPIs in a 135 cm^2 form factor. The battery KPIs for NiZn cells (Battery KPIs) are as follows:
  - The target specific energy density is >120 Wh/kg
  - The target cycle life is >1000 cycles
  - The target round trip efficiency is >89%
- Demonstrate processes to manufacture the Gen2 electrode and identify the pathway to high-rate production meeting manufacturing KPIs. The manufacturing KPIs (Manufacturing KPIs) are as follows:
  - The target end-to-end processing time is <12 h
  - The target yield is >80%

[2] California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).
[3] California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

  - The target raw material cost is <$58/kWh
- Demonstrate a 48V, 100Ah battery system based on the Gen2 electrode and characterize the performance in a micro-grid testbed
- Demonstrate a Zn-Mn and Zn-air battery based on the Gen2 electrode in a 25 cm^2 form factor as a proof of concept that the Gen2 electrode enables future development of these battery technologies
- Validate the benefits of the technology to enhance grid reliability through the Measurement and Verification Plan.

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 subrecipient and site host agreements, as applicable, required to carry out the tasks under this Agreement; and (2) ensure that the

subrecipient 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 of subrecipient additions in the terms and conditions).

Products:

- Subaward and Site Letter
- Draft Subawards *(if requested by the CAM)*
- Draft Site Host Agreements *(if requested by the CAM)*
- Final Subawards *(if requested by the CAM)*
- Final Site Host Agreements *(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: MEASUREMENT AND VERIFICATION PLAN AND SYSTEMS LEVEL REQUIREMENTS

The goal of this task is to define the stationary energy storage systems level requirements document that will define the parameters for the subsequent tasks.

The Recipient shall:

- Deliver a draft *Measurement and Verification Plan* which includes:
    - Overview of stationary energy storage scenarios to enhance grid reliability including cost and performance metrics
    - Objectives for the *Case Study Report* (see Task 5)
    - Safety, affordability, reliability, environmental sustainability, and equity analysis of incumbent and proposed technologies for grid applications
    - Overview of testing (measurements) required to verify claims of potential benefits
    - Outline and format for the *Measurement and Verification Report* to be completed in Task 5
- Submit the draft *Measurement and Verification Plan* to the CAM for feedback and incorporate changes as requested in the final *Measurement and Verification Plan.*
- Deliver a *Systems Level Requirements Report* which*:*
    - Summarizes the results of a system level requirements review
        - Use input from potential users of the system to create a system performance envelope*.* This top-level document defines the operational parameters of the energy storage system during customer use. The information in this document will flow down to all other design and test documents. The document will be constructed using information provided

by potential customers of the system. This document will be a "living document" and may change based on customer input or testing results.
  - Defines operational parameters
  - Defines environmental factors
  - Defines cost parameters
  - Defines safety and environmental standards required

Products:
- Measurement and Verification Plan (draft and final)
- Systems Level Requirements Report (draft and final)

TASK 3: GEN2 ELECTRODE PROCESS DEVELOPMENT
The goal of this task is to develop the Gen2 Zn sponge electrode in three phases. The first phase will focus on a small format, 25 cm^2 electrode (Task 3.1). Next, the design will be scaled up to a 135 cm^2 format (Task 3.2). Finally, manufacturing processes will be developed which are scalable to high-rate production (Task 3.3). Task 3.1 and 3.2 are aimed at meeting the Electrode Property KPIs of minimum thickness <0.8 mm, percentage mass of the current collector in the assembly <15%, and thickness non-uniformity <10%. Task 3.3 is aimed at meeting the Manufacturing KPIs of <12 h end-to-end processing time, >80% yield, raw material costs <$58/kWh.

Subtask 3.1: SMALL FORMAT ELECTRODE DEVELOPMENT
The goal of this subtask is to optimize the design of the Gen2 electrode in a 25 cm^2 format.

The Recipient shall:
- Optimize the design of the current collector for compatibility with the zinc slurry under high temperature oxidative conditions
- Develop a formulation for the zinc slurry to enable pasting onto the current collector
- Develop processes to paste the zinc slurry onto the current collector
- Develop a process recipe to sinter and oxidize the zinc particles in a batch furnace under nitrogen and air environments for a pasted electrode developed to approach Electrode Property KPIs.
- Deliver a draft *Gen2 Electrode Preliminary Design Report* which includes:
  - Technical analysis of the current collector design, slurry, pasting, and thermal processing
  - Summary of the Gen2 electrode development work
  - Specifications for the Gen2 electrode design in the 25 cm^2 format
  - Proposed specification for the 135 cm^2 format
  - Risk assessment and mitigation strategies
- Submit the draft *Gen2 Electrode Preliminary Design Report* to the CAM for feedback and incorporate changes as requested in the final *Gen2 Electrode Preliminary Design Report*
- Prepare a *CPR Report* and participate in CPR meeting per subtask 1.3

Products:
- Gen2 Electrode Preliminary Design Report (draft and final)
- CPR Report #1 (draft and final)

Subtask 3.2: GEN2 ELECTRODE SCALE UP
The goal of this task is to scale up the dimensions and fabrication processes of the Gen2 electrode.

The Recipient shall:

- Design and optimize the Gen2 current collector design in a 135cm^2 format to meet the Electrode Property KPIs
- Design and optimize the electrode pasting process for the 135 cm^2 form factor to approach the Electrode Property KPIs
- Design and optimize the thermal processing recipe for the 135 cm^2 form factor to approach the Electrode Property KPIs
- Deliver a draft *Gen2 Electrode Detailed Design Report* which includes:
    - Technical analysis of the current collector design, slurry, pasting, and thermal processing
    - Summary of the Gen2 electrode scale up work
    - Final specification for the 135 cm^2 format
    - Proposed process flow and specifications for semi-automated manufacturing of the Gen2 electrode design in the 135 cm^2 form factor
    - Risk assessment and mitigation strategies
- Submit the draft *Gen2 Electrode Detailed Design Report* to the CAM for feedback and incorporate changes as requested in the final *Gen2 Electrode Detailed Design Report*

Products:

- Gen2 Electrode Detailed Design Report (draft and final)

Subtask 3.3: GEN2 ELECTRODE MANUFACTURING DEVELOPMENT
The goal of this task is to develop and demonstrate the manufacturing processes for the Gen2 electrode in a semi-automated fashion and produce electrodes in a sufficient quantity to produce a 48V, 100Ah battery system for demonstration purposes.

The Recipient shall:

- Demonstrate manufacturing processes which are scalable to high-rate production to meet the Manufacturing KPIs
    - The processes themselves do not need to be capable of supporting high-rate production, but a path to high-rate production should be identified as part of the development work.
- Deliver a draft *Gen2 Electrode Critical Design Report* to include:
    - Final process and materials specifications for the current collector design
    - Final process and equipment specifications for the electrode pasting process
    - Final process and equipment specifications for the thermal processing
    - Final quality specifications and tolerances for the Gen2 electrode
    - Production schedule for meeting the deliverables for the demonstration battery build
    - Risk assessment and mitigation strategy
- Submit the draft *Gen2 Electrode Critical Design Report* to the CAM for feedback and incorporate changes as requested in the final *Gen2 Electrode Critical Design Report*
- Manufacture the Gen2 electrodes required for the 48V, 100Ah battery system
- Deliver a draft *Manufacturing Report* to include:

  - Summary of the final manufacturing process, including throughput, yield, and end-to-end processing time statistics
  - Challenges encountered and final resolutions
  - Lessons learned
  - Concept design for high-rate production processes
  - Identify future roadblocks for high-production and mitigation strategies
- Submit the draft *Manufacturing Report* to the CAM for feedback and incorporate changes as requested in the final *Manufacturing Report.*

Products:

- Gen2 Electrode Critical Design Report (draft and final)
- Manufacturing Report (draft and final)

TASK 4: BATTERY CELL DEVELOPMENT AND TESTING

The goals of this task are to design and optimize battery test cells for validating the performance of Gen2 sponge electrodes and assess their ability to meet the Battery KPIs and provide education and mentoring for students in the community. Primary characterization will occur in NiZn batteries, while a small number of ZnMn and Zn-air batteries will be assembled and tested to validate the performance when paired with different positive electrodes. Education and mentoring efforts will focus on the importance of a reliable and sustainable grid.

Subtask 4.1: SMALL FORMAT CELL DEVELOPMENT

The goal of this subtask is to optimize the design of the small format NiZn battery cell as a testing platform for the Gen2 electrodes.

The Recipient shall:

- Perform baseline testing of single layer 25 cm^2 electrodes in the Gen1 configuration and characterize specific energy density, maximum discharge power, cycle life, and round-trip efficiency
- Oversee electrolyte development with a 3rd party vendor to optimize electrolyte additives such as:
  - Static gas testing on zinc electrodes
  - Electrochemical impedance spectroscopy
  - Oxygen evolution reaction testing
  - Electrochemical stability
  - Aged performance stability
- Perform nickel zinc battery testing on down selected electrolyte additives provided by the 3rd party vendor and compare to the baseline performance
- Perform optimization of the nickel electrode, separator, and layering configuration
- Perform cell testing of Gen2 electrode design iterations to validate design improvements
- Deliver a draft *Battery Preliminary Design Report* which includes:
  - Technical analysis of the small format 25cm^2 single layer prismatic cell design
  - Summary of the battery development work
  - Results of electrolyte additive optimization testing
  - Characterization of Battery KPIs for design iterations of the Gen2 sponge in the 25 cm^2 format
  - Technical analysis of the impact of process parameters and material selections and the impact of cell performance

  - Recommendations for the optimal cell design for the 135 cm^2 single layer prismatic cell and 10-layer prismatic cell
  - Proposed design for the 135 cm^2 single-layer prismatic cell and 10-layer prismatic cell
  - Risk assessment and mitigation strategies
- Submit the draft *Battery Preliminary Design Report* to the CAM for feedback and incorporate changes as requested in the final *Battery Preliminary Design Report*

Products:
- Battery Preliminary Design Report (draft and final)

Subtask 4.2:FULL SIZE SINGLE LAYER CELL DEVELOPMENT AND TESTING
The goal of this subtask is to optimize the performance of the Gen2 electrode in a single layer configuration to approach the Battery KPIs.
The Recipient shall:
- Transfer the cell design specifications from the 25 cm^2 form factor to the 135 cm^2 form factor in a single layer design
- Perform optimization of the battery design to approach Battery KPIs at the 135 cm^2 form factor
- Deliver a draft *Battery Detailed Design Report* which includes:
  - Characterization of Battery KPIs for design iterations of the Gen2 sponge in the 135 cm^2 single layer format
  - Technical analysis of the impact of process parameters and material selections to cell performance
  - Component and assembly process specifications
  - Summary of the battery development work
  - Characterization of Battery KPIs
  - Recommendations for the optimal cell design for the 135 cm^2 10-layer prismatic
  - Risk assessment and mitigation strategies
- Submit the draft *Battery Detailed Design Report* to the CAM for feedback and incorporate changes as requested in the final *Battery Detailed Design Report*

Products:
- Battery Detailed Design Report (draft and final)

Subtask 4.3: 100AH NICKEL-ZINC BATTERY CELL DEVELOPMENT
The goal of this subtask is to design and test a 100Ah NiZn battery based on the 135cm^2 Gen2 electrode and optimize to approach the Battery KPIs.

The Recipient shall:
- Design and optimize a 100Ah NiZn battery cell based on the 135 cm^2 Gen2 electrode
- Build 12V modules consisting of the 100Ah battery cells to support module level testing and the 48V system testing in Task 5
- Deliver a draft *Battery Critical Design Report* to include:
  - Technical analysis of the 100Ah battery cell design
  - Component and assembly process specifications
  - Summary of the battery development work

  - Final materials specifications and bill of materials for 100 Ah, 1.65V battery cells which will be used for the battery demonstration
  - Summary of Battery KPIs achieved during testing
  - Design of the 48V battery system
  - Risk assessment and mitigation strategy
- Submit the draft *Battery Critical Design Report* to the CAM for feedback and incorporate changes as requested in the final *Battery Critical Design Report*

Products:
- Battery Critical Design Report (draft and final)

Subtask 4.4: ALTERNATIVE POSITIVE ELECTRODE DEMONSTRATION
The goal of this subtask is to demonstrate the compatibility of the Gen2 electrode in a zinc manganese (ZnMn) and zinc air (Zn-air) rechargeable battery and compile a report regarding the technical feasibility of scaling those technologies.

The Recipient shall:
- Fabricate or source suitable positive electrode materials to facilitate demonstration testing of ZnMn and Zn-air test cells in a 25cm^2 form factor
- Develop a prototype cell design for the ZnMn and Zn-air testing
- Build and test at least 10 cells each for the Zn-air and Zn-Mn achieving greater than 1Ah capacity
- Deliver an *ZnMn and Zn-air Test Report* to include:
  - Overview of fabrication process for manganese dioxide and air electrodes
  - Overview of test cell design for ZnMn and Zn-air cells
  - Battery cycling test results for at least 10 cells per chemistry
  - Overview of technical feasibility and outstanding challenges to scale both technologies

Products:
- ZnMn and Zn-air Test Report (draft and final)

Subtask 4.5: STEM EDUCATION TO UNDERSERVED COMMUNITIES
The goal of this subtask is to engage elementary and middle school students from Richmond and West Oakland communities to learn about battery technologies, grid reliability and the role of energy storage, and key issues including supply chain, manufacturability, and careers in energy storage.

The Recipient will collaborate with a science, technology, engineering, and mathematics (STEM) education community based partner to develop a curriculum and interactive learning experience for students from the local communities including Richmond, CA and West Oakland, CA.

The Recipient shall:
- Develop a curriculum and lesson plan for classroom or site visits targeted for students in grades 3-6 to learn about different types of batteries including how batteries are made, tested, and disposed of.
  - Lessons will be designed for 2-4 hour experiences

  - Lesson plans will be aligned with educational standards
  - Lesson plans will be designed to be interactive for the students
- Participate in STEM education outreach training
- Arrange field trips for students to visit our manufacturing development (West Oakland) and product development (Richmond) facilities or other site deemed appropriate by the CAM in writing
- Complete classroom visits or facilitate student field trips
  - Facilitate transportation of students to the Recipients site location or transportation of the Recipients employees to the students classroom
  - Plan up to three events in Richmond, CA or with students located in Richmond, CA
  - Plan up to three events in West Oakland, CA or with students located in West Oakland, CA
- Develop resources for educators, document student placements, and conduct pre- and post- visit evaluations
- Establish annual scholarships in STEM for high schoolers in disadvantaged communities totaling $7,500 per year for two years.
- Deliver a *STEM Education Outreach Report* summarizing the number and type of classroom or facility events, number of students engaged, curriculum covered and impact of the lessons

Products:
- STEM Education Outreach Report (draft and final)

Subtask 4.6: DEVELOPMENT OF 4TH GRADE CURRICULUM RESOURCE ON ELECTRIC ENERGY GRID RESILIENCE AND BATTERY TECHNOLOGY INNOVATIONS
The goal of this subtask is to develop a brief (4-5 minute) video and accompanying text/visual document resource to be shared online, highlighting how innovations in battery storage play a role in helping communities meet their energy needs and respond to challenges of climate change while contributing to equity in access to solutions for community strength and vitality. The Recipient will work with a community partner to align the educational material with existing curriculum or programs and to make it broadly available to California elementary school educators and their students.

The Recipient shall:
- Develop an initial curriculum resource draft to cover topics on climate change, electrical energy outages, and energy resilience
  - Overview of the topics and content to be covered in the video
  - Draft supplementary text/visual documents to accompany the video
- Produce a field test version of the video and, review it with a community-based partner to align the material with active educational initiatives and programs.
- Produce a final 4-5 minute video and accompanying supplementary materials work with a community partner to distribute it.
- Deliver a *4th Grade Curriculum Development Report* which summarizes the engagement with a community-based partner and expected impact of the project.

Products:
- 4th Grade Curriculum Development Report (draft and final)

TASK 5: BATTERY SYSTEM INTEGRATION INTO MICROGRID TEST BED

The goal of this task is to build a 48V, 100 Ah battery system and perform a battery system integration test with a microgrid test beds. The NiZn battery system will integrate into the microgrid at the Sub-Recipient's facilities or other site deemed appropriate by the CAM in writing and play an active role in the buildings' energy management. The goal of Task 5 is to demonstrate the feasibility of alkaline zinc batteries to achieve system level performance of <$0.05/kWh LCOS, >10-year calendar life, and >50% roundtrip efficiency.

The Recipient shall:

- Build a battery system of at least 48V and at least 100 Ah and deliver it to the Sub-Recipient
- Build three 12V, 100Ah battery modules for module level characterization and deliver it to the Sub-Recipient
- Generate a *Microgrid Test Requirements Report*
    - The test requirements document will outline the requirements on data collection, maintenance, and safety precautions associated with the testing
- Deliver a draft *Measurement and Verification Report* which includes:
    - Results of the verification testing as outlined in the Measurement and Verification Plan Document
    - Analysis of the potential benefits claimed at the beginning of the project and evidence supporting the benefits or additional development that is required to deliver the benefits
    - Follows the outline established in the Measurement and Verification Plan Document
- Submit the draft *Measurement and Verification Report* to the CAM for feedback and incorporate changes as requested in the final *Measurement and Verification Report.*
- Deliver a *Case Study Report*
    - The report will review stationary energy storage scenarios wherein NiZn batteries may be able to address end user pain points
    - For each scenario, the report will highlight the operational limits of the application, the current solutions being employed, the pain points, and the potential advantages that a NiZn battery system could supply
- Perform characterization of individual 12V modules and characterize the performance to compare to the Battery KPIs. The characterization will include:
    - Cycle life
    - Rate capability
    - Float charge stability
    - Testing should last a maximum of 9 months.
- Perform a technical analysis of the microgrid testbed and identify the system level requirements for the NiZn battery system
- Generate a *Microgrid Systems Requirements Report*.
    - The systems requirements document will specify the required voltage and capacity of the battery.
    - The document will describe any additional requirements including but not limited to placement of main terminals, safety requirements, size restrictions.

- Modify or establish a microgrid test bed for the NiZn battery system
    - To integrate the NiZn battery system into the microgrid, modifications to the electrical design of the building and auxiliary equipment to monitor the battery will be required.
- Deliver a *Microgrid Integration Test Plan Report*
    - The test plan will include the specific procedures that will be followed to integrate the NiZn battery system into the microgrid, the load profiles and environmental conditions that the battery system will be subjected to.
    - The test plan will include the duration of the test and the data which will be collected.
    - The test plan will include periodic evaluation of the battery state of health using a controlled cycling environment (e.g. battery cycler)
    - The battery system integration testing is expected to be carried our for a minimum of 3 months and a maximum of 9 months.
- Deliver a *Microgrid Integration Test Report*
    - Results of the characterization of the 12V modules and comparison to Battery KPI targets.
    - The test report will include a summary of all data collected and an evaluation of the state of health of the battery throughout the testing.
    - The test report will identify challenges that were identified or cases where the battery failed to meet the requirements of the application.
    - The test report will identify advantages demonstrated by the NiZn battery prototype
    - The test report will identify areas for improvement in the design of the battery prototype.
- Prepare a CPR Report and participate in CPR meeting per subtask 1.3

Products:

- Microgrid Test Requirements Report (draft and final)
- Measurement and Verification Report (draft and final)
- CPR Report #2 (draft and final)
- Case Study Report (draft and final)
- Microgrid Systems Requirements Report (draft and final)
- Microgrid Integration Test Plan Report (draft and final)
- Microgrid Integration Test Report (draft and final)

TASK 6: 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 7: 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 attached Excel spreadsheet.