STATE OF CALIFORNIA

# GRANT REQUEST FORM (GRF)

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

**A) New Agreement** # EPC-20-028 (to be completed by CGL office)

| B) Division | Agreement Manager: | MS- | Phone |
|---|---|---|---|
| ERDD | Eleanor Oliver | 51 | 916-776-0800 |

| C) Recipient's Legal Name | Federal ID Number |
|---|---|
| NexTech Batteries, Inc. | 81-5182759 |

| D) Title of Project |
|---|
| Bringing Lithium Sulfur Technology to Market |

**E) Term and Amount**

| Start Date | End Date | Amount |
|---|---|---|
| 5/1/2021 | 3/31/2025 | $ 2,996,782 |

**F) Business Meeting Information**

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

Proposed Business Meeting Date 4/14/2021 ☐ Consent ☒ Discussion

Business Meeting Presenter Michael Ferreira Time Needed: 5 minutes

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

**Agenda Item Subject and Description:**

NEXTECH BATTERIES, INC. Proposed resolution approving Agreement EPC-20-028 with NexTech Batteries, Inc. for a $2,996,782 grant to design and demonstrate a utility-scale battery energy storage system that utilizes a unique lithium-sulfur chemistry cell, and adopting staff's determination that this action is exempt from CEQA. This battery packages a non-cobalt design with improved energy progressive components and a battery management system to create a safe storage system with double the energy density and optimal cycle life of incumbent lithium-ion technology. The project will advance the production design of lithium-sulfur based cells, develop a highcapacity battery module prototype and demonstrate grid-integration of the Lithium-Sulfur Battery Energy Storage System with the University of California, San Diego's microgrid (EPIC funding) Contact: Michael Ferreira.

**G) California Environmental Quality Act (CEQA) Compliance**

1. Is Agreement considered a "Project" under CEQA?
   ☒ Yes (skip to question 2)
   ☐ No (complete the following (PRC 21065 and 14 CCR 15378)):

   Explain why Agreement is not considered a "Project":

2. If Agreement is considered a "Project" under CEQA:
   a) ☒ Agreement **IS** exempt.
      ☐ Statutory Exemption. List PRC and/or CCR section number:
      ☒ Categorical Exemption. List CCR section number: Cal. Code Regs., tit. 14, § 15301 ; Cal. Code Regs., tit. 14, § 15303
      ☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section: This project will (1) design and test lithium-sulfur battery cells and modules and (2) install an approximately 150 kW interconnected field-prototype battery module system at an existing microgrid at University of California, San Diego (UCSD). The majority of the project work, which includes modeling, design, engineering and testing of the battery cells and modules, will be conducted in an existing laboratory at UCSD. The project will not involve any construction activities. Minor modifications to existing facilities to connect the battery module system to the existing electrical transformer. The system will operate for a minimum of 12 months at a medium voltage (12kV) distribution level. This project is therefore categorically exempt from environmental review pursuant to CEQA Guidelines section 15301 as minor alterations to existing facilities that involve negligible or no expansion of an existing or former use at the sites.

The project is also categorically exempt pursuant to CEQA Guidelines section 15303 as the installation of small new equipment in small structures. The project does not involve any unusual circumstances, will not result in damage to any scenic resources within a highway officially designated as a state scenic highway, none of the installation sites are 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 exemptions listed in CEQA Guidelines section 15300.2 apply to this project and the project, when considered as a whole, will not result in a cumulative impact that is significant on the environment.

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

Check all that apply

- ☐ Initial Study
- ☐ Negative Declaration
- ☐ Mitigated Negative Declaration
- ☐ Environmental Impact Report
- ☐ Statement of Overriding Considerations

**H) List all subcontractors (major and minor) and equipment vendors:** (attach additional sheets as necessary)

| **Legal Company Name:** | **Budget** |
|---|---|
| Auto Motive Power, Inc | $ 400,000 |
| The Regents of the University of California, on behalf of the San Diego campus | $ 1,146,782 |
| TBD Engineering | $ 350,000 |

**I) List all key partners: (attach additional sheets as necessary)**

| **Legal Company Name:** |
|---|
| Nextech Batteries, Inc. |
| The Regents of the University of California, on behalf of the San Diego campus |

STATE OF CALIFORNIA

# GRANT REQUEST FORM (GRF)

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

| **Legal Company Name:** |
|---|
| Nextech Batteries, Inc. |
| Auto Motive Power, Inc |

## J) Budget Information

| Funding Source | Funding Year of Appropriation | Budget List Number | Amount |
|---|---|---|---|
| EPIC | 19-20 | 301.001G | $2,996,782 |

R&D Program Area: EDMFO: EDMF TOTAL: $ 2,996,782

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:

## K) Recipient's Contact Information

### 1. Recipient's Administrator/Officer

Name: Warren Rapp

Address: 5138 Metric Way

City, State, Zip: Carson City, NV 89706-2453

Phone: 775-750-6852

E-Mail: Warren@nextechBatteries.com

### 2. Recipient's Project Manager

Name: Warren Rapp

Address: 5138 Metric Way

City, State, Zip: Carson City, NV 89706-2453

Phone: 775-750-6852

E-Mail: Warren@nextechBatteries.com

## L) Selection Process Used

☒ Competitive Solicitation Solicitation #: GFO-20-301

☐ First Come First Served Solicitation Solicitation #:

## M) The following items should be attached to this GRF

| | | | |
|---|---|---|---|
| 1. | Exhibit A, Scope of Work | | ☒ Attached |
| 2. | Exhibit B, Budget Detail | | ☒ Attached |
| 3. | CEC 105, Questionnaire for Identifying Conflicts | | ☒ Attached |
| 4. | Recipient Resolution | ☒ N/A | ☐ Attached |
| 5. | CEQA Documentation | ☐ N/A | ☒ Attached |

**Agreement Manager** **Date**

**Office Manager** **Date**

**Deputy Director** **Date**

# Exhibit A
# Scope of Work
# NexTech Batteries Inc.

## I. TASK ACRONYM/TERM LISTS

### A. Task List

| Task # | CPR[1] | Task Name |
|---|---|---|
| 1 | | General Project Tasks |
| 2 | | Characterize and Model Cell Designs |
| 3 | | Temperature and Compression of Battery Modules |
| 4 | | Testing and Empirical Modeling for Battery Management System |
| 5 | X | Engineering and Laboratory Testing of Prototype Modules |
| 6 | | Install, Commission, and Operate BESS Prototype |
| 7 | | Evaluation of Project Benefits |
| 8 | | Technology/Knowledge Transfer Activities |

### B. Acronym/Term List

| Acronym/Term | Meaning |
|---|---|
| Ah | Ampere-hour, Amps-hour |
| BESS | Battery Energy Storage System |
| BMS | Battery Management System |
| CAM | Commission Agreement Manager |
| CAO | Commission Agreement Officer |
| CEC | California Energy Commission |
| CPR | Critical Project Review |
| Li-S | Lithium-sulfur |
| SOC | State of Charge |
| SOH | State of Health |
| TAC | Technical Advisory Committee |

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

### A. Purpose of Agreement

The purpose of this Agreement is for Recipient (NexTech Batteries, Inc.) to design and demonstrate at utility-scale a grid-integrated battery energy storage system (BESS) that utilizes a unique lithium-sulfur (Li-S) chemistry cell. This battery packages a non-cobalt design with improved energy progressive components, and a battery management system to create a safe storage system with double the energy density of standard lithium-ion batteries and optimal cycle life. The project will advance the design and scale the build of lithium-sulfur-based cells, develop a high-capacity battery module prototype, and demonstrate grid-integration of the Lithium-Sulfur Battery Energy Storage System with the University of California, San Diego's microgrid.

[1] Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

# Exhibit A
# Scope of Work
# NexTech Batteries Inc.

## B. Problem/ Solution Statement

**Problem**

Current state-of-the-art battery technology, including lithium-ion batteries, have four major problems:

1. Batteries are made of flammable organic electrolyte and oxygen-rich cathode materials subject to thermal runway.
2. Batteries are made from expensive materials (cobalt, nickel, and manganese).
3. With repeated charging/discharging or operated under harsh environment conditions (high or low temperature), batteries can form a short circuit which causes battery failure or explosion.
4. Batteries are hazardous to the environment due to the toxic materials used in their fabrication: copper, aluminum, cobalt, and nickel used in the batteries have high impacts on the environment.

**Solution**

Consumers need a battery technology that is safe, cost-effective, reliable, and resilient. The Li-S cell technology will overcome all of the key lithium-ion battery limitations. The Recipient, in collaboration with subcontractors, will develop a Li-S cell-based technology that produces an attractive battery storage system superior to lithium-ion technology in terms of cost, safety, and resiliency.

This solution also will:

- Increase the amount of electricity generated and sold to retail customers per year from eligible renewable energy resources.
- Meet the California Renewables Portfolio Standard Program goals for emissions of greenhouse gases; and
- Meet the emissions limits of the Global Warming Solutions Act of 2016.

## C. Goals and Objectives of the Agreement

**Agreement Goals**

The goals of this Agreement are to:

- Design, fabricate and demonstrate a functional prototype Li-S battery module in a laboratory environment.
- Design, develop and fabricate a compatible Battery Management System (BMS) to demonstrate and verify the performance data.
- Scale up the Li-S battery module system into a grid-integrated BESS. Install, commission, monitor, and collect performance data.
- Demonstrate improved specific energy density, daily cycle capability, longevity, safety, and cost-effectiveness of the Li-S cell technology for a diverse set of IOU customer applications.

Ratepayer Benefits:[2] This Agreement will provide the following ratepayer benefits*:*

[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

- Increase safety
    - The product produced by the Recipient will be safer because all materials used in the development and design of the Li-S batteries are sustainable, environmentally friendly, non-flammable and immune from thermal runway, and recyclable in contrast with current promising lithium-ion batteries.
- Lower cost
    - The main material used to make the battery is composed of sulfur, which is inexpensive and abundant in nature. The battery also does not contain expensive transition metals, such as cobalt and nickel, which are heavily used in lithium-ion batteries.

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 advancing the development of the Recipient's ultra-high-energy, safe, and low-cost energy storage technology made from safe, globally abundant materials. This beyond-lithium-ion energy storage utilizes a solid-state electrolyte with highly conductive Li-S membranes that will eliminate key causes for battery degradation. With the demonstration of the uniquely packaged Li-S BESS, this will be a first-of-a-kind field deployment for 150kW and larger prototypes.

**Agreement Objectives**
The objectives of this Agreement are to:

- Engineer and design a Li-S BESS that meets the state and federal energy storage requirements, ordinances, regulations, and standards. Each BESS will have an intelligent BMS system that enhances user benefits and cycle life.
- Develop and build a Li-S BESS capable of delivering at least eight (8) hours of energy storage duration with improved resiliency and efficiency.
- Design and build a Li-S cell with above 400Wh/kg specific energy that can enable 150kW BESS for an 8-hour duration.
- Demonstrate production of Li-S BESS that can be validated at UCSD for relevant performance metrics.

## 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

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).

act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations**.** All technical tasks should include product(s). Products that require a draft version are indicated by marking **"(draft and final)"** after the product name in the "Products" section of the task/subtask. If "(draft and final)" does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, **"days"** means working days.

**The Recipient shall:**

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products

- Submit all data and documents required as products in accordance with the following:

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**
  - Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the California Energy Commission's (CEC) software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick.

  The following describes the accepted formats for electronic data and documents provided to the CEC as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:
  - Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
  - Text documents will be in MS Word file format, version 2007 or later.
  - Project management documents will be in Microsoft Project file format, version 2007 or later.

- **Software Application Development**

Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up). Recommend 2010.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
- Microsoft SQL Reporting Services. Recommend 2008 R2.
- XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the CEC's Information Technology Services Branch to determine whether the exceptions are allowable.

## *MEETINGS*

**Subtask 1.2 Kick-off Meeting**

The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

**The Recipient shall:**

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other CEC staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

  The administrative portion of the meeting will include discussion of the following:
  - Terms and conditions of the Agreement;
  - Invoicing and auditing procedures;
  - Administrative products (subtask 1.1);
  - CPR meetings (subtask 1.3);
  - Match fund documentation (subtask 1.7);
  - Permit documentation (subtask 1.8);
  - Subcontracts (subtask 1.9); and
  - Any other relevant topics.

  The technical portion of the meeting will include discussion of the following:
  - The CAM's expectations for accomplishing tasks described in the Scope of Work;
  - An updated Project Schedule;
  - Technical products (subtask 1.1);

- Progress reports (subtask 1.5);
- Final Report (subtask 1.6);
- Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
- Any other relevant topics.

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

- Provide an *Updated Project Schedule, Match Funds Status Letter,* and *Permit Status Letter*, as needed to reflect any changes in the documents.

**The CAM shall:**
- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

**Recipient Products:**
- Kick-off Meeting Presentation
- Updated Project Schedule *(if applicable)*
- Match Funds Status Letter (subtask 1.7) *(if applicable)*
- Permit Status Letter (subtask 1.8) *(if applicable)*

**CAM Product:**
- Kick-off Meeting Agenda

**Subtask 1.3 Critical Project Review (CPR) Meetings**
The goal of this subtask is to determine if the project should continue to receive CEC funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the CEC and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient and may include the CAO and any other individuals selected by the CAM to provide support to the CEC.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the CEC, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

**The Recipient shall:**

- Prepare and submit a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

**The CAM shall:**

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* with a list of expected CPR participants in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a schedule for providing a Progress Determination on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

**Recipient Products:**

- CPR Report(s)

**CAM Products:**

- CPR Agenda
- Progress Determination

**Subtask 1.4 Final Meeting**

The goal of this subtask is to complete the closeout of this Agreement.

**The Recipient shall:**

- Meet with CEC staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

  The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.
  - The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
  - The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
    - Disposition of any procured equipment.
    - The CEC's request for specific "generated" data (not already provided in Agreement products).
    - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.

  - "Surviving" Agreement provisions such as repayment provisions and confidential products.
  - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

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

## *REPORTS AND INVOICES*

**Subtask 1.5 Progress Reports and Invoices**
The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

**The Recipient shall:**
- Submit a monthly *Progress Report* to the CAM. Each progress report must:
  - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions, including a financial report on Match Funds and in-state expenditures.

**Products:**
- Progress Reports
- Invoices

**Subtask 1.6 Final Report**
The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. When creating the Final Report Outline and the Final Report, the Recipient must use the CEC Style Manual provided by the CAM.

**Subtask 1.6.1 Final Report Outline**

**The Recipient shall:**
- Prepare a *Final Report Outline* in accordance with the *Energy Commission Style Manual* provided by the CAM.

**Recipient Products:**

- Final Report Outline (draft and final)

**CAM Product:**

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

**Subtask 1.6.2 Final Report**

**The Recipient shall:**

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Energy Commission Style Manual, and Final Report Template provided by the CAM with the following considerations:
  - Ensure that the report includes the following items, in the following order:
    - Cover page (**required**)
    - Credits page on the reverse side of cover with legal disclaimer (**required**)
    - Acknowledgements page (optional)
    - Preface (**required**)
    - Abstract, keywords, and citation page (**required**)
    - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
    - Executive summary (**required**)
    - Body of the report (**required**)
    - References (if applicable)
    - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
    - Bibliography (if applicable)
    - Appendices (if applicable) (Create a separate volume if very large.)
    - Attachments (if applicable)
- Submit a draft of the Executive Summary to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* received on the Executive Summary. For each comment received, the recipient will identify in the summary the following:
  - Comments the recipient proposes to incorporate.
  - Comments the recipient does propose to incorporate and an explanation for why.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt.
- Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments were not incorporated into the final product.
- Submit the revised *Final Report* electronically with any Written Responses to Comments within 10 days of receipt of CAM's Written Comments on the Draft Final Report, unless the CAM specifies a longer time period or approves a request for additional time.

**Products**:

- Summary of TAC Comments

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

**CAM Product:**
- Written Comments on the Draft Final Report

## *MATCH FUNDS, PERMITS, AND SUBCONTRACTS*

**Subtask 1.7 Match Funds**
The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of CEC funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

**The Recipient shall:**
- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the CEC awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

  If match funds were a part of the proposal that led to the CEC awarding this Agreement, then provide in the letter:
  - A list of the match funds that identifies:
    - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
    - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
    - If different from the solicitation application, provide a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.

- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

**Products:**
- Match Funds Status Letter
- Supplemental Match Funds Notification Letter *(if applicable)*
- Match Funds Reduction Notification Letter *(if applicable)*

**Subtask 1.8 Permits**
The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

**The Recipient shall:**
- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
    - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
    - The schedule the Recipient will follow in applying for and obtaining the permits.

  The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

**Products:**
- Permit Status Letter
- Updated List of Permits *(if applicable)*
- Updated Schedule for Acquiring Permits *(if applicable)*
- Copy of Each Approved Permit *(if applicable)*

**Subtask 1.9 Subcontracts**
The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

# Exhibit A
# Scope of Work
# NexTech Batteries Inc.

**The Recipient shall:**

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of each executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

**Products:**

- Subcontracts *(draft if required by the CAM)*

## *TECHNICAL ADVISORY COMMITTEE*

**Subtask 1.10 Technical Advisory Committee (TAC)**

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
  - Technical area expertise;
  - Knowledge of market applications; or
  - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.
- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate, to the extent the TAC members feel is appropriate, on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

**The Recipient shall:**

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

**Products:**

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

**Subtask 1.11 TAC Meetings**

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

**The Recipient shall:**

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.

- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

**The TAC shall:**

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.
- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

**Products:**

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

**Subtask 1.12 Project Performance Metrics**

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

**The Recipient shall:**

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

**Products:**

# Exhibit A
# Scope of Work
# NexTech Batteries Inc.

- TAC Performance Metrics Summary
- Project Performance Metrics Results

# Exhibit A
# Scope of Work
# NexTech Batteries Inc.

## IV. TECHNICAL TASKS

### TASK 2: CHARACTERIZE AND MODEL CELL DESIGNS

The goal of this task is to design, scale-up, and validate the proven Li-S cell chemistry, structure, and components up to the level of 50 ampere-hours (Ah). Cell engineering will use a multi-physics cell model to characterize state-of-health (SOH) and state-of-charge (SOC) estimations for the BMS development. This task will engineer and characterize at least two different capacity-sized battery cells, including but not limited to the 6 Ah cells and 50 Ah cells.

**The Recipient shall:**

- Complete the development of multiphysics models to inform the cell design of different capacity-sized cells for initial large-format cell fabrication and module integration.
- Evaluate the resulting properties and test data.
- Prepare *Cell Design & Specification Informational Materials*, in a visually educational creative form, that will present and compare the resulting properties, designs, and data of all tested cells.
    - Examples of this form are a 3-slide PowerPoint or digital interactive site.
- Prepare a *Cell Design & Specification Assessment* that will include, but is not limited to:
    - The resulting properties, designs, and data of all tested cells from Cell Design & Specification Informational Materials
    - Discussion of cell engineering design space boundaries, including, but not limited to:
        - improvements, barriers, lessons learned
    - Recommendations on cell design
- Any of the above number of cells, designs, data, etc. may be adjusted with prior CAM written approval.

**Products:**

- Cell Design & Specification Informational Materials
- Cell Design & Specification Assessment

### TASK 3: TEMPERATURE AND COMPRESSION OF BATTERY MODULES

The goal of this task is to develop a test plan for demonstrating the performance of the prototyped 50 Ah single-cell battery modules. The test plan aims to characterize the battery by performing electrochemical temperature and compression measurements in a controlled environment. This task will collect and create a comprehensive resource of existing codes and standards for battery safety and performance that may be relevant to battery chemistry and design.

**The Recipient shall:**

- Perform an in-depth test study focused on compression testing of 50 Ah single-cell modules.
- Collect and evaluate test data for design improvement.
- Perform an in-depth test study focused on temperature testing of 50 Ah single-cell modules.
- Collect and evaluate test data for design improvement.
- Develop compression fixtures and strategies for battery module and pack implementation.

- Prepare *Single-Cell Module Temperature and Compression Informational Materials*, in a visually educational creative form, that will present and compare the resulting properties, designs, and data of all tested modules.
    - Examples of this are a 3-slide PowerPoint or digital interactive site.
- Prepare a *Single-Cell Module Temperature and Compression Assessment* that will include, but not be limited to:
    - The resulting properties, designs, and data of all tested modules from Single-Cell Module Temperature and Compression Informational Materials
    - Discussion of module and pack implementation, including, but not limited to:
        - improvements, barriers, lessons learned
    - Recommendations of single-cell module design
- Any of the above number of modules, designs, data, etc. may be adjusted with prior CAM written approval.

**Products:**

- Single-Cell Module Temperature and Compression Informational Materials
- Single-Cell Module Temperature and Compression Assessment

**TASK 4: TESTING AND EMPIRICAL MODELING FOR BATTERY MANAGEMENT SYSTEM**

The goal of this task is to perform a characterization of the Li-S cells to drive the equivalent circuit model for State of Charge (SOC) and State of Health (SOH) estimation through a series of iterative static and dynamic tests. This task will perform a characterization of the Li-S cell to drive the development of a resistance model and thermal model using ANSYS 3D FEM approach.

**The Recipient shall:**

- Complete a Hybrid Pulse Power Characterization test and Calorimetry test.
- Evaluate the test data for cell resistance, health capacity, and heat capacity estimations to develop a comprehensive cell modeling strategy that can also be extended in larger-formatted cells.
- Prepare an *Empirical Modeling Report* that will include, but is not limited to:
    - Discussion of the 3D ANSYS resistance model predictions including model estimations, possible improvements, and validation of cells.
    - Discussion of the 3D ANSYS thermal model predictions including model estimations, possible improvements, and validation of cells.
    - Relate model predictions to test data for evaluation of SOC and SOC accuracy estimation to develop model estimations and validation of SOC and SOH model predictions in cells.
    - A comprehensive cell modeling strategy to be extended to larger cells.
- Any of the above number of testing, models, data, etc. may be adjusted with prior CAM written approval.

**Products:**

- Empirical Modeling Report

# Exhibit A
# Scope of Work
# NexTech Batteries Inc.

**TASK 5: ENGINEERING AND LABORATORY TESTING OF PROTOTYPE MODULES**
The goal of this task is to construct a prototype of the BESS based from the prototype battery modules. The prototype modules will be tested and validated before integrating in the BESS for full system testing and validation. This task will perform a Failure Mechanism and Effects Analysis (FMEA) to address any possible safety issues related to the weatherized module design.

**Subtask 5.1: Design and Fabricate 50V/50Ah Nominal Prototype Modules**
The goal of the subtask is to design and fabricate the battery module that delivers nominal 50V/50AH. This will be done by configuring the module by connecting several batteries in series and/or parallel combinations to deliver the desired voltage and current for the application. This subtask will create an engineer design of the battery module mechanical enclosures and single pole electrical connections.

**The Recipient shall:**

- Develop a prototype module mechanical enclosures assembly design that includes the mechanical enclosures resulting properties.
- Develop a prototype module mechanical electrical assembly design that includes single pole configurations, cell bonding methods, and electrical connections schematics.
- Prepare *Prototype Module Design Documentation* that includes, but is not limited to:
    - Discussion of mechanical enclosures assembly design develop and design improvement recommendations.
    - Discussion of electrical assembly design develop and design improvement recommendations.
    - A module specification sheet
    - Discussion of the full prototype module design
- Any of the above number of testing, models, data, etc. may be adjusted with prior CAM written approval.

**Products:**

- Prototype Module Design Documentation

**Subtask 5.2: Prototype Module Laboratory Testing**
The goal of this subtask is to set-up modules for testing under different protocols, perform battery testing and data acquisition, and analyze the performance of the batteries. Module systems will be tested using duty cycles based on applications and test procedures developed in previous tasks. This subtask will set up the process for testing modules for various temperatures and for ultimate cycle life evaluation under the Recipient's protocol.

**The Recipient shall:**

- Complete modules laboratory testing under Recipient's protocol and under varying temperatures.
- Collect module specification test data
- Develop a prototype module mechanical enclosures assembly design.
- Prepare *Battery Performance Report* including, but not limited to: module test data, refined testing protocols, and protocol improvement recommendations.
- Any of the above number of testing, models, data, etc. may be adjusted with prior CAM written approval.

**Products:**

- Battery Performance Report

**Subtask 5.3: Design and Fabricate BESS Prototype**

The goal of this subtask is for the team to design, engineer, and fabricate a scale up version of the validated prototype module. Energy storage systems will be tested in both controlled laboratory conditions and connected to the subcontractor's microgrid. This subtask will create an engineer design of the mechanical structure and the electrical single pole circuitry for the BESS.

**The Recipient shall:**

- Develop and create a BESS mechanical structure design.
- Develop and create a BESS electrical circuit design.
- Develop and create a BESS design for grid-tied integration.
- Prepare *BESS Design Documentation* that will include, but is not limited to:
    - Discussion of the developed BESS mechanical structure design, BESS mechanical properties, design test, conditions or protocols, mechanical specifications, and structure design improvement recommendations.
    - Discussion of the developed BESS electrical circuit design, BESS electrical single pole configuration, design data, conditions or protocols, electrical specifications, and structure design improvement recommendations.
    - Discussion of the developed BESS design, BESS resulting properties, design data, conditions or protocols, and design improvement recommendations.
- Any of the above number of designs, models, data, etc. may be adjusted with prior CAM written approval.
- Prepare a *CPR Report* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

**Products:**

- BESS Design Documentation
- CPR Report #1

**Task 6: INSTALL, COMMISSION, AND OPERATE BESS PROTOTYPE**

The goal of this task is to install, commission, and monitor the performance of BESS system for at least 3 to 12 months at a medium voltage distribution level. Monitoring includes data acquisition and analyzing the performance of the batteries. Energy storage systems will be tested in both controlled laboratory conditions and connected to the off-site microgrid.

**The Recipient shall:**

- Perform system-level duty-cycle tests that evaluates round trip efficiency, provide an estimation of system lifetime and maintenance for:
    - Demand charge management
    - Energy time shifting
    - Flexible ramping and
    - Frequency regulation
- Prepare a *System Performance Evaluation Report* that includes, but is not limited to:
    - Perform function testing
    - Analyze system performance

- Any of the above number of metrics, tests, data, etc. may be adjusted with prior CAM written approval.

**Products:**
- System Performance Evaluation Report

**Task 7: EVALUATION OF PROJECT BENEFITS**
The goal of this task is to report the benefits resulting from this project.

**The Recipient shall:**
- Complete *the Initial Project Benefits Questionnaire*. The *Initial Project Benefits Questionnaire* shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Complete the *Annual Survey* by December 15th of each year. The Annual Survey includes but is not limited to the following information:
  - Technology commercialization progress
  - New media and publications
  - Company growth
  - Follow-on funding and awards received
- Complete the *Final Project Benefits Questionnaire*. The *Final Project Benefits Questionnaire* shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete and update the project profile on the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the Energize Innovation website (www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.

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

**Task 8: TECHNOLOGY AND KNOWLEDGE TRANSFER ACTIVITIES**
The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

**The Recipient shall:**
- Prepare an *Initial Fact Sheet* at the start of the project that describes the project's goals,

objectives, technical approach and expected products, using the format provided by the CAM.

- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results, using the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
  - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
  - A description of the intended use(s) for and users of the project results.
  - Published documents, including date, title, and periodical name.
  - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
  - A discussion of policy development, describing how the project has been or will be cited in government policy publications or used to inform regulatory bodies.
  - The number of website downloads or public requests for project results.
  - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- Provide at least six (6) *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of before and after technology installation(s) at the project sites, or related project photographs.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

**Products:**

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- High Quality Digital Photographs
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

## V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

**RESOLUTION NO: 21-04-14-19d**

**STATE OF CALIFORNIA**

**STATE ENERGY RESOURCES**
**CONSERVATION AND DEVELOPMENT COMMISSION**

RESOLUTION - RE: NEXTECH BATTERIES, 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-20-028 with NexTech Batteries, Inc. for a $2,996,782 grant to design and demonstrate a utility-scale battery energy storage system that utilizes a unique lithium-sulfur chemistry cell. This battery packages a non-cobalt design with improved energy progressive components and a battery management system to create a safe storage system with double the energy density and optimal cycle life of incumbent lithium-ion technology. The project will advance the production design of lithium-sulfur based cells, develop a highcapacity battery module prototype and demonstrate grid-integration of the Lithium-Sulfur Battery Energy Storage System with the University of California, San Diego's microgrid; and

**FURTHER BE IT RESOLVED,** that the Executive Director or his/her 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 April 14, 2021.

AYE:
NAY:
ABSENT:
ABSTAIN:

_____
Patricia Carlos
Secretariat