

**GRANT REQUEST FORM (GRF)**

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-16-014 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Rajesh Kapoor	51	916-327-1388

Recipient's Legal Name	Federal ID Number
Lawrence Livermore National Security, LLC	20-5624386

Title of Project
Reducing the Cost of Desalination and Increasing Water Reuse

Term and Amount	Start Date	End Date	Amount
	9/1/2016	12/31/2020	\$ 999,040

**Business Meeting Information**
 ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	8/10/2016	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
--------------------------------	-----------	----------------------------------	--

Business Meeting Presenter	Rajesh Kapoor	Time Needed:	5 minutes
----------------------------	---------------	--------------	-----------

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

**Agenda Item Subject and Description**

LAWRENCE LIVERMORE NATIONAL SECURITY, LLC. Proposed resolution approving Agreement EPC-16-014 with Lawrence Livermore National Security, LLC for a \$999,040 grant to develop, test, and demonstrate a novel technology that can significantly reduce desalination costs and energy used to treat wastewater. (EPIC Funding) Contact: Rajesh Kapoor. (Staff presentation: 5 minutes)

**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)):

2. If Agreement is considered a "Project" under CEQA:

a) Agreement **IS** exempt. (Attach draft NOE)

Statutory Exemption. List PRC and/or CCR section number: \_\_\_\_\_

Categorical Exemption. List CCR section number: Cal. Code Regs., tit 14, §§ 15301, 15303

Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section:

Cal. Code Regs., tit. 14, sec. 15301 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of use beyond that existing at the time of the lead agency's determination, are categorically exempt from the provisions of the California Environmental Quality Act. Cal. Code Regs., tit. 14, sec. 15303 provides that projects which consist of construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure, are categorically exempt from the provisions of CEQA. This project consists of the development of three flow-through electrode capacitive desalination (FTE-CD) cells which will be incorporated into two FTE-CD pilot devices. The cells will measure approximately 4 cm x 6 cm. The pilot devices will be stand-alone boxes that contain the cells as well as small valves, sensors, a power supply and a control chip. The pilot devices will be integrated into two existing water treatment facilities by connecting the devices to existing power sources and water feeds inside the facilities. No external alterations to the facilities will be needed to incorporate the pilot devices and performance of the devices will operate under existing permits. This project will not expand the existing use of the facilities. Therefore, the project falls within sections 15301 and 15303 and will not have a significant effect 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

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

**GRANT REQUEST FORM (GRF)**

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION



Legal Company Name:	Budget
Stanford University	\$ 170,000
	\$

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

Legal Company Name:

**Budget Information**

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	15-16	301.001C	\$999,040
			\$
R&D Program Area: EERO: IAW		TOTAL:	\$999,040
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

**Recipient's Administrator/ Officer**

Name: Scott Tyler  
Address: 7000 East Ave # L-180

City, State, Zip: Livermore, CA 94550-9698

Phone: 925-424-3299 / Fax: - -

E-Mail: tyler9@llnl.gov

**Recipient's Project Manager**

Name: Michael Stadermann  
Address: 7000 East Ave # L-462

City, State, Zip: Livermore, CA 94550-9698

Phone: 925-423-9128 / Fax: - -

E-Mail: stadermann2@llnl.gov

**Selection Process Used**

Competitive Solicitation

Solicitation #: GFO-15-317

First Come First Served Solicitation

**The following items should be attached to this GRF**

1. Exhibit A, Scope of Work	<input checked="" type="checkbox"/>	Attached
2. Exhibit B, Budget Detail	<input checked="" type="checkbox"/>	Attached
3. CEC 105, Questionnaire for Identifying Conflicts	<input checked="" type="checkbox"/>	Attached
4. Recipient Resolution	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached
5. CEQA Documentation	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached

\_\_\_\_\_  
Agreement Manager

\_\_\_\_\_  
Date

\_\_\_\_\_  
Office Manager

\_\_\_\_\_  
Date

\_\_\_\_\_  
Deputy Director

\_\_\_\_\_  
Date

## EXHIBIT A Scope of Work

### I. TASK ACRONYM/TERM LISTS

#### A. Task List

Task #	CPR <sup>1</sup>	Task Name
1		General Project Tasks
2		Test Cell Production
3	X	Laboratory Desalination Tests
4		Desalination Modeling
5		Pilot Device Production
6		Pilot Test
7		Evaluation of Project Benefits
8		Technology/Knowledge Transfer Activities
9		Production Readiness Plan

#### B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
FTE-CD	Flow Through Electrode Capacitive Desalination
ppm	Parts Per Million
RO	Reverse Osmosis
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 to fund the development and demonstration of a novel desalination method known as flow-through electrode capacitive desalination (FTE-CD). For this project, three test cells and two FTE-CD pilot devices will be built and used to validate the projected performance of FTE-CD with industrial and municipal waste water sources in the lab and at demonstration sites.

---

<sup>1</sup> 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

### B. Problem/ Solution Statement

#### Problem

The salt content of waste water must be reduced to enable recycling and to avoid ecological damage. The primary desalination technology used today is reverse osmosis (RO), which incurs high energy costs that are essentially independent of the salt concentration in the feed water. Therefore, RO is only cost-effective when it is used in large water treatment plants to desalinate sea water and other water with high salt content. There is a significant need for technology that can lower the cost of desalination of water with lower salt content, such as industrial and municipal waste water, and which can be implemented at smaller scale, such as a single factory or small community.

#### Solution

FTE-CD has an energy cost that is based on a scale of the amount of salt content in the feed water. This technology can significantly reduce the cost of desalinating water with low-to-moderate (<5,000 ppm) salt content. The efficiency of FTE-CD is independent of plant size, so this technology can be cost-effectively implemented at the scale of a single factory, small community, or even individual home. In addition to enabling the reuse or ecologically responsible discharge of municipal and industrial waste water, FTE-CD can also be utilized to economically desalinate the brackish aquifer that underlies a large area of California's Central Valley, thus providing an additional fresh water resource to some of California's most disadvantaged communities.

FTE-CD is currently at an early stage, and its efficiency and long-term performance has to be validated with industrial and municipal water samples. Lawrence Livermore National Security, LLC (Recipient) will perform this validation in this project.

### C. Goals and Objectives of the Agreement

#### Agreement Goals

The goal of this Agreement is to validate projected cost-savings of FTE-CD desalination technology.

Ratepayer Benefits:<sup>2</sup> This Agreement will result in the ratepayer benefits of lower cost and greater water supply reliability by reducing the cost of existing water treatment processes and increasing the proliferation of small scale desalination to increase water reuse. By reducing the cost of desalination by 30% or more, the cost of water reuse may become attractive compared to the cost of purchasing water and disposing of waste water. An increase in reuse means that less potable water overall is used, which increases drought resilience.

---

<sup>2</sup> 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](http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF)).

## EXHIBIT A Scope of Work

Technological Advancement and Breakthroughs:<sup>3</sup> 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 reducing the overall energy requirements of supplying water. When water is reused locally, less water must be conveyed to the location from the nearest reservoir, so a reduced treatment cost not only impacts the treatment process, but also water transport requirements.

### Agreement Objectives

The objectives of this Agreement are to:

- Determine the energy cost for desalinating industrial water with FTE-CD
- Determine fouling behavior of FTE-CD electrodes used to treat industrial water
- Develop a process model for FTE-CD that accounts for salt mixtures and addresses fouling mechanisms
- Deploy and test FTE-CD pilot devices under industrial conditions
- Determine whether energy cost reductions of 30% compared to current processes were achieved.

### 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)**. 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.

---

<sup>3</sup> California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

## **EXHIBIT A**

### **Scope of Work**

- 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 Energy Commission's 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 or CD-ROM.

The following describes the accepted formats for electronic data and documents provided to the Energy Commission 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.
- Documents intended for public distribution will be in PDF file format.
- The Recipient must also provide the native Microsoft file format.
- 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).

## EXHIBIT A Scope of Work

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy Commission'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 Energy Commission 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;
- 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 and invoices (subtask 1.5);
  - Final Report (subtask 1.6);
  - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
  - Any other relevant topics.
- Provide an *Updated Project Schedule*, *List of Match Funds*, and *List of Permits*, 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:

- Updated Project Schedule *(if applicable)*
- Updated List of Match Funds *(if applicable)*

## EXHIBIT A Scope of Work

- Updated List of Permits (*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 Energy Commission 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 Energy Commission 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 Energy Commission.

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 Energy Commission, 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 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.
- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- 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* and 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.

## **EXHIBIT A**

### **Scope of Work**

#### **Recipient Products:**

- CPR Report(s)
- Task Products (draft and/or final as specified in the task)

#### **CAM Products:**

- CPR Agenda
- List of Expected CPR Participants
- Schedule for Providing a Progress Determination
- 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 Energy Commission 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 state-owned equipment.
  - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
  - The Energy Commission'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 *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

#### **Products:**

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

## EXHIBIT A Scope of Work

- All Draft and Final Written 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 Fund 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. The CAM will review the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the 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 *Style Manual* provided by the CAM. (See Task 1.1 for requirements for draft and final products.)

#### Recipient Products:

- Final Report Outline (draft and final)

#### CAM Product:

- Style Manual
- Comments on Draft Final Report Outline
- Approval of Final Report Outline

## EXHIBIT A Scope of Work

### Subtask 1.6.2 Final Report

#### The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, 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)
  - Ensure that the document is written in the third person.
  - Ensure that the Executive Summary is understandable to the lay public.
    - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
    - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
    - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
  - Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
  - Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
  - Include a brief description of the project results in the Abstract.
- 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
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product

## **EXHIBIT A**

### **Scope of Work**

- Submit the revised Final Report 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.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

#### **Products:**

- Final Report (draft and final)
- Written Responses to Comments on the Draft 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 Energy Commission 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 Energy Commission 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 Energy Commission 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.
  - A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.

## EXHIBIT A Scope of Work

- 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)*

## **EXHIBIT A**

### **Scope of Work**

#### **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.

#### **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 the 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.

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

- Researchers knowledgeable about the project subject matter;

## **EXHIBIT A**

### **Scope of Work**

- 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.

## EXHIBIT A Scope of Work

### Products:

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

### IV. TECHNICAL TASKS

*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. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.*

#### **TASK 2: TEST CELL PRODUCTION**

The goal of this task is to produce at least three FTE-CD desalination cells for the laboratory tests of industrial water and surrogate solutions (for Task 3). The initial cells produced will have an area of 4 cm X 6 cm and consist of five electrode pairs. As testing progresses, the cells may be modified and improved to enhance performance.

#### **The Recipient shall:**

- Produce at least three FTE-CD desalination test cells for Task 3 of this project. The number of tests cells to be produced may be decreased with CAM written approval. The process to build the test cells will be to:
  - Synthesize electrode material.
  - Process the electrode material into electrode pair frames.
  - Assemble the frames into test cells.
  - Measure the electrical properties of the cells and verify operation.
  - Provide a cell for each type of water sample and replace cells when necessary.
  - Provide a *Test Plan for Laboratory Tests of FTE-CD Cells*, which will include, but not be limited to, test objectives, procedures, materials to be used in the test, and data to be gathered during the test.
  - Provide a *Summary of Test Cell Properties* that includes but is not limited to:
    - Electrical properties of all cells to be used in Task 3.
    - Permeability data of all cells to be used in Task 3.

### Products:

- Test Plan for Laboratory Tests of FTE-CD Cells
- Summary of Test Cell Properties

#### **TASK 3: LABORATORY DESALINATION TESTS**

The goal of this task is to perform the laboratory desalination tests using the cells produced in Task 2 to determine performance with successively more complex feed solutions and troubleshoot any cell failure mechanisms.

#### **The Recipient shall:**

## EXHIBIT A Scope of Work

- Measure the cell performance using a sodium chloride solution with equivalent total dissolved solids to that in the industrial samples. The process will:
  - Prepare the solutions.
  - Perform desalination operation.
  - Calculate performance from conductivity data and energy input and output.
  - Measure device performance over a period of six months, unless a shorter period is approved by the CAM in writing.
  - Iterate with the model development in Task 4 where necessary to improve performance.
  
- Measure the cell performance using a solution with equivalent ion concentrations to that in the industrial samples to:
  - Prepare the solutions.
  - Perform desalination operation.
  - Calculate performance from conductivity data and energy input and output.
  - Measure device performance over a period of six months, unless a shorter period is approved by the CAM in writing.
  - Compare performance between sodium chloride solution and ionic mixes.
  - Determine fouling mechanism if fouling is occurring.
  - Develop a mitigation procedure to remove fouling.
  - Iterate with the model development in Task 4 where necessary to improve performance.
  
- Measure the cell performance using industrial samples to:
  - Prepare the solutions.
  - Perform desalination operation.
  - Calculate performance from conductivity data and energy input and output.
  - Compare performance between sodium chloride solution and ionic mixes.
  - Measure concentration change of trace ions with atomic absorption spectroscopy or inductively coupled plasma mass spectrometry (ICP-MS).
  - Determine fouling mechanism if fouling is occurring.
  - Develop a mitigation procedure to remove fouling.
  - Measure device performance over a period of six months, unless a shorter period is approved by the CAM in writing.
  - Iterate with the model development in Task 4 where necessary to improve performance.
  
- Prepare a *Task 3 Performance Report* that includes but is not limited to the following:
  - A summary of performance with sodium chloride solutions.
  - A summary of performance with ion mix solutions.
  - A summary of the fouling behavior caused by salts only.
  - A summary of the performance with industrial samples.
  - A summary of the fouling behavior caused by industrial samples.
  - A summary of mitigation procedures and results.
  
- Prepare a *CPR Report* and participate in a CPR meeting as described in Subtask 1.3..

### Products:

## **EXHIBIT A**

### **Scope of Work**

- Task 3 Performance Report (Draft and Final)
- CPR Report

#### **TASK 4: DESALINATION MODELING**

The goals of this task are to expand the FTE-CD process model to work with ionic mixes, to compare model predictions to the data gathered in Task 3, and to integrate fouling and aging mechanisms into the model where appropriate.

##### **The Recipient shall:**

- Expand the process model to include multiple ionic species and:
  - Integrate the functionality to track multiple species with different properties.
  - Integrate solubility of salts and precipitation.
  - Model the performance of the FTE-CD process for each solution type.
  - Compare model to data and note differences.
  - Investigate differences between prediction and data with small-scale experiments as necessary.
  - Add additional processes to the model if necessary.
  - Provide a *Summary Report of the Model Equations, Predictions, and Comparisons to Data*, which includes, but is not limited to:
    - All model assumptions and the underlying measurements.
    - All model equations.
    - Performance predictions and experimental comparison.
    - Documentation of the evolution of the model during the project.
- Optimize the operational parameters for each industrial solution to:
  - Perform optimization modeling for each feed water type to determine ideal operation conditions.
  - Provide a *Summary Report of the Proposed Operating Conditions for Each Pilot*, which includes but is not limited to:
    - Water flow rate and timing.
    - Charging current and timing.
    - Predicted performance for the proposed operating conditions.

##### **Products:**

- Summary Report of the Model Equations, Predictions, and Comparisons to Data (Draft and Final)
- Summary Report of the Proposed Operating Conditions for Each Pilot (Draft and Final)

#### **TASK 5: PILOT DEVICE PRODUCTION**

The goals of this task are to assemble and test two complete FTE-CD pilot devices with a throughput of 10 L/hour that are self-sufficient and can be deployed at the pilot sites.

##### **The Recipient shall:**

- Assemble two pilot devices that will:
  - Produce the electrode material (1 L per device).
  - Assemble and test FTE-CD cells.

## **EXHIBIT A**

### **Scope of Work**

- Integrate FTE-CD cells with valves, charge transfer circuit, conductivity sensors, control circuit, and power supply in a single enclosure.
- Test the two pilot devices to:
  - Validate device operation dry.
  - Validate device operation with sodium chloride solution.
  - Validate device operation with industrial sample.
  - Assemble and test FTE-CD cells.
  - Provide a *Test Plan for Pilot Site Tests of FTE-CD Devices*, which will include but not be limited to test objectives, procedures, and data to be gathered during the test.
  - Provide a *Summary Report of the Device Performance* which includes but is not limited to:
    - Electrical data for all cells.
    - Energy use and throughput with sodium chloride solution.
    - Energy use and throughput with industrial sample.

#### **Products:**

- Test Plan Report for Pilot Site Tests of FTE-CD Devices (Draft and Final)
- Summary Report of the Device Performance (Draft and Final)

#### **TASK 6: PILOT TEST**

The goals of this task are to deploy the pilot devices at demonstration sites and monitor device performance. The task also includes troubleshooting of the devices if they fail or if the performance degrades substantially.

#### **The Recipient shall:**

- Deploy the pilot devices to:
  - Transport the devices to the pilot locations.
  - Work with the demonstration site Managers to connect the devices to power and water.
  - Initiate the test and verify that the device is working within expected parameters.
- Monitor pilot device performance and:
  - Review the energy use and desalination performance of the device on a weekly basis, for a period of four months, unless a shorter period is approved by the CAM in writing; site partners will verify that the device is operating on a daily basis
  - Troubleshoot the device if necessary
  - Provide a *Summary Report of the Pilot Results* at the end of the test, which includes but is not limited to:
    - Performance of the device on site over time.
    - Operational issues that were encountered and their solutions.
    - A summary of features that could be added or changed to improve performance.

## **EXHIBIT A**

### **Scope of Work**

- Discussion of whether the goals and objectives in Section II. C. were met and whether cost reductions of 30% compared to current processes were achieved.

#### **Products:**

- Summary Report of the Pilot Results (Draft and Final)

#### **TASK 7: EVALUATION OF PROJECT BENEFITS**

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

#### **The Recipient shall:**

Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.

- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
  - For Product Development Projects and Project Demonstrations:
    - Published documents, including date, title, and periodical name.
    - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
    - Greenhouse gas and criteria emissions reductions.
    - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
    - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
    - A discussion of project product downloads from websites, and publications in technical journals.
    - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
    - Additional Information for Product Development Projects:
      - Outcome of product development efforts, such copyrights and license agreements.
      - Units sold or projected to be sold in California and outside of California.
      - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
      - Investment dollars/follow-on private funding as a result of Energy Commission funding.
      - Patent numbers and applications, along with dates and brief descriptions.

## **EXHIBIT A**

### **Scope of Work**

- Additional Information for Product Demonstrations:
  - Outcome of demonstrations and status of technology.
  - Number of similar installations.
  - Jobs created/retained as a result of the Agreement.
- For Information/Tools and Other Research Studies:
  - Outcome of project.
  - Published documents, including date, title, and periodical name.
  - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
  - The number of website downloads.
  - An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
  - An estimate of energy and non-energy benefits.
  - Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
  - A discussion of project product downloads from websites, and publications in technical journals.
  - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

#### **Products:**

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

#### **TASK 7: TECHNOLOGY/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 start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use 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.

## **EXHIBIT A**

### **Scope of Work**

- 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. State if 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 on the results of the project.
- When directed by the CAM, participate in annual EPIC symposium sponsored by the California Energy Commission.
- Provide at least six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites.
- Provide signed photo waiver release by the California Energy Commission.
- 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)

#### **TASK 9: PRODUCTION READINESS PLAN**

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

#### **The Recipient shall:**

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
  - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
  - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
  - The estimated cost of production.
  - The expected investment threshold needed to launch the commercial product.
  - An implementation plan to ramp up to full production.

## **EXHIBIT A**

### **Scope of Work**

- The outcome of product development efforts, such as copyrights and license agreements.
- Patent numbers and applications, along with dates and brief descriptions.
- Other areas as determined by the CAM.

#### **Products:**

- Production Readiness Plan (draft and final)

#### **V. PROJECT SCHEDULE**

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: LAWRENCE LIVERMORE NATIONAL SECURITY, LLC

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

**RESOLVED**, that the Energy Commission approves Agreement EPC-16-014 from GFO-15-317 with Lawrence Livermore National Security, LLC for a \$999,040 grant to develop, test, and demonstrate a novel technology that can significantly reduce desalination costs and energy used to treat wastewater; and

**FURTHER BE IT RESOLVED**, that the Executive Director or his/her designee shall execute the same on behalf of the Energy Commission.

**CERTIFICATION**

The undersigned Secretariat to the Commission 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 California Energy Commission held on August 10, 2016.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

---

Cody Goldthrite,  
Secretariat