



STATE OF CALIFORNIA

**GRANT REQUEST FORM (GRF)**

CEC-270 (Revised 12/2019)

CALIFORNIA ENERGY COMMISSION

**A) New Agreement # PIR-19-001 (to be completed by CGL office)**

<b>B) Division</b>	<b>Agreement Manager:</b>	<b>MS-</b>	<b>Phone</b>
ERDD	Reta Ortiz	43	916-327-1494

<b>C) Recipient's Legal Name</b>	<b>Federal ID Number</b>
Paulsson, Inc.	26-1151245

<b>D) Title of Project</b>
All-Optical Multi-Sensor Well Monitoring System to Secure Gas Storage Operations

**E) Term and Amount**

<b>Start Date</b>	<b>End Date</b>	<b>Amount</b>
6/30/2020	6/30/2023	\$ 1,500,000

**F) Business Meeting Information**

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

Proposed Business Meeting Date 4/8/2020 Consent Discussion

Business Meeting Presenter Reta Ortiz Time Needed: 5 minutes

Please select one list serve.

**Agenda Item Subject and Description:**

- a. PAULSSON, INC. Proposed resolution approving Agreement PIR-19-001 with Paulsson, Inc. for a \$1,500,000 grant to develop and demonstrate a downhole multi-sensor array based on fiber optic sensing technologies to monitor a natural gas storage reservoir, and adopting staff's determination that this action is exempt from CEQA. This multi-sensor array will include all-optical pressure, acoustic, strain and temperature sensors to provide real-time monitoring.

**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, § 15306

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

Explain reason why Agreement is exempt under the above section:

California. Code Regs., tit 14, section 15301 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of

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existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of existing or former use, are categorically exempt from the provisions of the California Environmental Quality Act. This project will consist of laboratory testing and field testing of fiber optic sensors to monitor natural gas storage reservoirs. The laboratory testing will be conducted in an existing laboratory, using existing equipment in the laboratory. The field testing will be conducted at an existing borehole at an existing PG&E's natural gas storage facility, where the fiber optic sensors will be placed inside a 2 3/8" tube within the 5,300-foot-deep borehole. In addition, a 160 square-foot, partially air-conditioned instrument storage container will be placed next to the wellhead. These modifications will not result in expanding the capacity or use of the facility.

This project is also exempt under California Code Regs., tit 14, section 15306 which provides that projects which consist of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource are categorically exempt from the provisions of the California Environmental Quality Act. This project will collect data within the natural gas storage well in real-time, for approximately 6 months. The fiber optic sensors include pressure, acoustic, distributed strain, and distributed pressure sensors. They will detect pre-failure micro-seismic noise, excessive strain, and any small leaks. The instruments will be accessed remotely to obtain the data recorded. These activities will not result in a serious or major disturbance to an environmental resource.

For these reasons, the proposed work will not have any significant effect on the environment and falls under sections 15301 and 15306.

- 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)

<b>Legal Company Name:</b>	<b>Budget</b>
DOE- Lawrence Berkeley National Laboratory	\$ 80,000
CBE_TBD Rigger	\$ 50,000
TBD - Contractor	\$ 80,000
	\$
	\$
	\$



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

<b>Legal Company Name:</b>
Pacific Gas and Electric Company

**J) Budget Information**

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
NG Subaccount, PIERDD	18-19	501.001M	\$1,500,000
			\$
			\$

R&amp;D Program Area: ESRO: ETSI

TOTAL: \$ 1,500,000

Explanation for "Other" selection

Reimbursement Contract #:      Federal Agreement #:

**K) Recipient's Contact Information****1. Recipient's Administrator/Officer**

Name: Bjorn Paulsson

Address: 16543 Arminta St

City, State, Zip: Van Nuys, CA  
91406-1745

Phone: 562-694-9598

E-Mail:

bjorn.paulsson@paulsson.com

**2. Recipient's Project Manager**

Name: Bjorn Paulsson

Address: 16543 Arminta St

City, State, Zip: Van Nuys, CA  
91406-1745

Phone: 562-694-9598

E-Mail:

bjorn.paulsson@paulsson.com

**L) Selection Process Used**

Competitive Solicitation Solicitation #: GFO-19-502

First Come First Served Solicitation Solicitation #:

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

- |   |            |
|---|------------|
| 1. Exhibit A, Scope of Work                         | X Attached |
| 2. Exhibit B, Budget Detail                         | X Attached |
| 3. CEC 105, Questionnaire for Identifying Conflicts | X Attached |



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- |                         |   |     |
|-------------------------|---|-----|
| 4. Recipient Resolution | X | N/A |
| 5. CEQA Documentation   | X | N/A |

Attached  
Attached

_____	_____
<b>Agreement Manager</b>	<b>Date</b>

_____	_____
<b>Office Manager</b>	<b>Date</b>

_____	_____
<b>Deputy Director</b>	<b>Date</b>

## 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		Design, Select and Lab test of Borehole Optical Sensors
3	X	Manufacture & Lab Test of Borehole Optical Sensor System
4	X	Borehole Survey Using Optical Sensor System
5		Processing and Interpretation of Borehole Data From Optical Field Sensor System
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

#### B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
TAC	Technical Advisory Committee
Acoustic Sensors	Sensors that record sound without directional information.
Distributed Acoustic Sensor	This sensor technology uses standard fiber and is measuring the Rayleigh back scatter and how the Rayleigh back scatter is changing as function of the ambient acoustic field the fiber is exposed to.
Distributed Strain Sensor	This sensor technology uses Brillouin Scattering as a sensing technique. This sensor technology can obtain a strain measurement every 3 ft.
Distributed Temperature Sensor	This sensor technology uses Raman scattering as a means to measure changes in the temperature along the fiber. This sensor technology can obtain a temperature measurement every 3 ft.
Enhanced Distributed Acoustic Sensors	This sensor uses Rayleigh Scattering as a sensing technique and fiber mandrels to amplify the scattering.
Micro Seismic	Small magnitude seismic data generated by natural processes or by production or stimulation processes

<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**

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

### **A. Purpose of Agreement**

The purpose of this Agreement is to fund the development of efficient and cost-effective gas storage reservoir monitoring technologies using borehole deployed optical sensor arrays.

### **B. Problem/ Solution Statement**

#### **Problem**

As a storage field ages, the associated downhole and surface equipment ages as well, becoming fragile and ultimately wearing out. The equipment aging process, in combination with a lack of surveying and monitoring of the downhole and surface equipment, leads to failures that are often slow to be detected and repaired. If the gas storage fields were monitored by appropriate and robust sensors, the pre-failure symptoms would be recorded and problems could be mediated prior to failure. The oil and gas industry is well-versed in repairing and replacing old wells. On the other hand, the oil and gas industry needs information on the status of gas storage fields and wells to take proactive actions to keep storage fields safe.

#### **Solution**

This project will develop a large aperture array of subsurface optical sensors that will detect anomalous flow, strain, temperature, or fatigue-induced micro seismic signals by continuous monitoring using an optical sensor system. The fiber optic sensors include pressure sensors, enhanced distributed acoustic sensors, distributed strain sensors, and distributed temperature sensors. These sensors will detect pre-failure micro seismic noise, excessive strain and small leaks allowing the operator to intervene before catastrophic failures occur.

### **C. Goals and Objectives of the Agreement**

#### **Agreement Goals**

The goals of this Agreement are to:

- Develop survey and monitoring technologies to make subsurface gas storage safer.
- Develop a real-time monitoring system that will reduce small and large releases of gas.
- Develop a real-time analysis system that allows real-time analysis of gas operations.

**Ratepayer Benefits:** The data from the borehole survey and monitoring system from this project will make gas storage operations safer and more reliable. This will result in ratepayer benefits of greater electricity reliability, lower costs, and increased safety by the installation of sensors that provide the status of the gas field and the gas field equipment in real time.

**Technological Advancement and Breakthroughs:** This project will introduce and work with California utilities to implement a safe gas storage reservoir monitoring program. This project will develop a new line of fit-for-purpose optical sensors and a comprehensive sensor system. This project will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by providing a more secure energy supply for electricity generation and a safer supply of natural gas. It will also reduce the release of methane gas into the atmosphere thereby helping to meet California's goals on lowering greenhouse gas emissions.

## **EXHIBIT A**

### **Scope of Work**

#### **Agreement Objectives**

The objectives of this Agreement are to:

- Obtain real-time information of the integrity of gas storage fields during operations.
- Identify weak and damaged equipment by detecting, processing and analyzing anomalous signals.
- Record data that will allow remediation of compromised equipment prior to failure.
- Provide an easy to access database that allows real-time analysis of gas storage field operations.

## EXHIBIT A

### Scope of Work

#### 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.
- 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.



## **EXHIBIT A**

### **Scope of Work**

- 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).

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.

## **EXHIBIT A**

### **Scope of Work**

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)*
- 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).

## **EXHIBIT A**

### **Scope of Work**

- 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.

#### **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.

## EXHIBIT A

### Scope of Work

- 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
- 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 **five 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.

## **EXHIBIT A**

### **Scope of Work**

#### **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
- 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, 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.

## EXHIBIT A

### Scope of Work

- 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
- 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.

## EXHIBIT A

### Scope of Work

- 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*)

## **EXHIBIT A**

### **Scope of Work**

- 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.

#### **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;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);



## **EXHIBIT A**

### **Scope of Work**

- 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.

## **EXHIBIT A**

### **Scope of Work**

- 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.

#### **Products:**

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

## EXHIBIT A

### Scope of Work

#### 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 or 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: DESIGN, SELECT & LAB TEST OF BOREHOLE OPTICAL SENSORS**

The goals of this task are to: (1) select and design prototype sensors for the monitoring system and (2) build and laboratory-test prototype sensors and sensor components for the borehole optical sensor system.

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

- In consultation with the TAC, select prototype sensors and sensor components and materials that are appropriate for subsurface gas storage wells.
- Laboratory-test sensors and sensor components for the sensor system.
- Prepare a *Laboratory Prototype Sensor Report* for subsurface sensors that includes but is not limited to the following:
  - A description of prototype sensor types, sizes, materials, and performance attributes; and
  - A discussion of sensor installation designs and procedures including mounting of the sensors to the deployment system; and
  - A discussion of data transmission hardware and technologies between sensors and gas storage well diagnostic processing hardware.

##### **Product:**

- Laboratory Prototype Sensor Report

#### **TASK 3: MANUFACTURE & LAB TEST OF BOREHOLE OPTICAL SENSOR SYSTEM**

The goals of this task are to: (1) manufacture optical monitoring sensors for field system; and (2) test the field sensors in the laboratory.

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

- Manufacture field sensors with appropriate sizes and materials for subsurface monitoring.
- Prepare a *Test Plan* to include but not be limited to test design and procedures for laboratory acceptance testing of field sensors.
- Prepare a *Subsurface Field Sensor Report* that includes but is not limited to the following:
  - A description of field sensor sizes, materials and performance attributes; and
  - A discussion of field sensor installation procedures; and
  - A discussion of data transmission attributes and real-time field processing of large data volumes including processing hardware; and
  - A discussion of results of laboratory tests of field sensors.
- Participate in CPR Meeting and prepare a *CPR Report #1* as described in subtask 1.3.

##### **Product:**

- Test Plan
- Subsurface Field Sensor Report
- CPR Report #1

## **EXHIBIT A**

### **Scope of Work**

#### **TASK 4: BOREHOLE SURVEY USING OPTICAL SENSOR SYSTEM**

The goals of this task are to: (1) install the field optical sensor system in a borehole to the depth of gas storage sands at a PG&E natural gas storage facility; and (2) perform a borehole monitoring survey for at least six months using the installed monitoring system.

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

- Prepare a *Field Deployment and Measurement Plan* that will include but not be limited to sensor and site preparation and installation process.
- Deploy field all-optical sensor system to the gas storage field.
- Install the field borehole optical sensor system into the well in the gas storage field.
- Record data for a minimum of six months.
- Remove the system from the survey well and demobilize the system back to the Recipient base.
- Prepare a *Field Survey Installation Report* that includes but is not limited to the following:
  - A description of installation of the optical sensor string into the well in the gas storage field; and
  - A discussion of data acquisition which will be done using the optical well sensor system;
- Participate in CPR Meeting and prepare a *CPR Report #2* as described in subtask 1.3.

##### **Product:**

- Field Deployment and Measurement Plan
- Field Survey Installation Report (draft and final)
- CPR Report #2

#### **TASK 5: PROCESSING AND INTERPRETATION OF BOREHOLE DATA FROM OPTICAL FIELD SENSOR SYSTEM**

The goals of this task are to: (1) process the data while recorded in the field; (2) develop improved processing algorithms for real-time and post-survey processing of field data recorded; (3) re-process the data after the field acquisition period; and (4) interpret the borehole sensor data recorded in the gas storage well.

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

- Field process the optical sensor data.
- Make a complete inventory of all data recorded and confirm data quality.
- Make a backup of the entire field data set.
- Re-process field acquisition data.
- Collect Operator feedback on project and system.
- Prepare a *Field Survey Monitoring Report* that includes but is not limited to the following:
  - A discussion of data processing of using the optical well sensor system;
  - A discussion of real-time remote data access from the office to the field data acquisition system, including real-world data transmission speeds and real-time field processing of large data volumes, and including a description of processing hardware; and
  - A discussion of operator feedback on the project and the system.

## EXHIBIT A

### Scope of Work

#### Product:

- Field Survey Monitoring Report (draft and final)

#### TASK 6 EVALUATION OF PROJECT BENEFITS

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

#### The Recipient shall:

- Complete 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.
    - 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:

## **EXHIBIT A**

### **Scope of Work**

- 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.
  - 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.

## **EXHIBIT A**

### **Scope of Work**

- 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 (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- 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.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: PAULSSON, 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 PIR-19-001 with Paulsson, Inc. for a \$1,500,000 grant to develop and demonstrate a downhole multi-sensor array based on fiber optic sensing technologies to monitor a natural gas storage reservoir. This multi-sensor array will include all-optical pressure, acoustic, strain and temperature sensors to provide real-time monitoring; 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 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 CEC held on April 8, 2020.

AYE:

NAY:

ABSENT:

ABSTAIN:

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Cody Goldthrite  
Secretariat