

**GRANT REQUEST FORM (GRF)**New Agreement PIR-17-015 (To be completed by CGL Office)

ERDD	Katharina Snyder	43	916-327-2201
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DOE-Lawrence Berkeley National Laboratory	94-2951741
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SUper eMitters of Methane detection using Aircraft, Towers, and Intensive Observational Network (SUMMATION)
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5/17/2018	3/31/2022	\$ 6,000,000
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<input type="checkbox"/> ARFVTP agreements under \$75K delegated to Executive Director.			
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Proposed Business Meeting Date	4/11/2018	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
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Business Meeting Presenter	Katharina Snyder	Time Needed:	10 minutes
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Please select one list serve. NaturalGas (NG Research Program)

**Agenda Item Subject and Description**

DOE- LAWRENCE BERKELEY NATIONAL LABORATORY. Proposed resolution approving agreement PIR-17-015 with Lawrence Berkeley National Laboratory for a \$6,000,000 grant to fund a comprehensive field study identifying and mitigating methane emissions in the southern San Joaquin Valley, a region that has been disproportionately impacted by environmental issues arising from the natural gas system, that will result in advanced understanding of methane emissions while validating new technologies and strategies that could be affordably applied in other parts of the State.

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

Explain why Agreement is not considered a "Project":

Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because

2. If Agreement is considered a "Project" under CEQA:
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 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, § 15306 Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section:

This project will involve data collection and the surveying of methane emissions in the San Joaquin Valley of California through aerial imagery collection conducted by research aircraft, on road surveys, remote measuring sensors affixed to existing structures (television or radio towers), and sampling of emissions from approximately 50 homes and 10 commercial buildings. Selected emissions samples will then be analyzed in an existing laboratory. Project activities will not require modification to any existing permits, will not increase traffic to any emission test site in any significant way, and will not involve any construction or modification to any facilities. These activities will not have a significant effect on the environment. This project is therefore categorically exempt under CEQA Guidelines Section 15306 as a basic data collection, research and resource evaluation activity that will not result in a serious disturbance to an environmental resource.

 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

Legal Company Name:	Budget
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Jet Propulsion Laboratory	\$ 2,092,620
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University of California, Riverside	\$ 446,489
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Board of Trustees Leland Stanford Junior University	\$ 486,568
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Central California Asthma Collaborative	\$ 131,079
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## Exhibit A Scope of Work Lawrence Berkeley National Lab

### I. TASK ACRONYM/TERM LISTS

#### A. Task List

Task #	CPR <sup>1</sup>	Task Name
1		General Project Tasks
2	X	Tiered Observing System
3		Data Integration and Synthesis Analysis
4		Stakeholder and Community Engagement
5	X	Monitoring and Mitigation Scaling/Economic Analysis
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

#### B. Acronym/Term List

Acronym/Term	Meaning
AVIRIS-NG	Next Generation Airborne Visible/Infrared Imaging Spectrometer
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CH <sub>4</sub>	Methane
CPR	Critical Project Review
SJV	San Joaquin Valley
SUMMATION	Super eMitters of Methane detection using Aircraft, Towers and Intensive Observational Network
TAC	Technical Advisory Committee

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

#### A. Purpose of Agreement

The purpose of this Agreement is for the Lawrence Berkeley National Laboratory (Recipient) to complete the SUpEr eMitters of Methane detection using Aircraft, Towers, and Intensive Observational Network (SUMMATION) project to conduct a comprehensive field study to identify and mitigate methane emissions in the southern San Joaquin Valley (SJV).

#### B. Problem/ Solution Statement

##### **Problem**

Multiple studies have identified significant underestimation of methane emissions reported by greenhouse gas inventories for the US, California and other domains. This uncertainty presents barriers to accurate CH<sub>4</sub> accounting and cost-effective mitigation. In addition, there is compelling evidence of a long-tail distribution of emission sources--indicating that methane footprints across

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<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 Lawrence Berkeley National Lab**

the natural gas supply chain are dominated by a relatively small number of super-emitters; in many cases 1-10% of potential sources contribute more than half the emissions. The recent California Methane Survey observed the same behavior across all methane point source emission sectors including oil and gas, livestock operations, and waste management. However, while those studies were spatially extensive and offer an indication of stochastic activity, they lack the continuous, high frequency sampling necessary to constrain the distribution of intermittent emission processes as well as diffuse area sources. The same limitations pose barriers to providing relevant and timely information to guide mitigation efforts – with implications for California policy-makers, businesses, communities and natural gas rate-payers.

### **Solution**

The Recipient will demonstrate various collective capabilities in persistent regional-scale methane emissions monitoring, high spatial resolution remote-sensing of point sources, intensive field campaigns, low-cost sensors, large data set integration, synthesis analysis, and partnerships with local stakeholders to conduct a comprehensive field study to identify and mitigate methane emissions in the southern SJV. The project objectives will dramatically advance understanding of methane emissions in one of the largest and most complex regions in California--a region that has been disproportionately impacted by environmental issues arising from the natural gas system--while validating new technologies and strategies that could be affordably applied in other parts of the State.

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

#### **Agreement Goals**

The goal of this Agreement is to develop a framework to identify, quantify, and mitigate methane emissions in the SJV.

**Ratepayer Benefits:** This Agreement will result in the ratepayer benefits of lower costs, and increased safety by improving the monitoring and measurement of CH<sub>4</sub> emissions, particularly high-emission CH<sub>4</sub> hot spots using the best available and cost-effective methods. Facilitating an end-to-end multi-scale and scalable approach for CH<sub>4</sub> monitoring can identify cost-effective investments in gas infrastructure and monitoring programs, which will effectively lower the hours and risk for maintenance crews, and shelter ratepayers from unnecessary monitoring and measurement costs, resource losses, and damages from associated smog forming compounds, hazardous air pollutants.

**Technological Advancement and Breakthroughs:** 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 demonstrating the application of a tiered observing system to detect and characterize methane emissions from the natural gas system in a comprehensive, continuous and affordable fashion. This will offer a transformational ability that can be scaled to identify and mitigate methane super-emitters across California.

# Exhibit A

## Scope of Work

### Lawrence Berkeley National Lab

#### Agreement Objectives

The objectives of this Agreement are to:

- Detect, quantify, and monitor methane emissions across multiple scales. The Recipient will deploy a tiered observing system and modeling framework that spans the western half of Kern County to identify, attribute, quantify and track methane emission fluxes at regional, facility and component scales.
- Integrate observations and Synthesis Analysis. The Recipient will integrate multiple large data sets and conduct a synthesis analysis to provide a comprehensive accounting of the net methane emission budget for this domain, the relative contributions of key sectors, individual super-emitters, and the spatial and temporal distribution of emissions.
- Engage stakeholder and local communities. The Recipient will engage early and often with stakeholders from local communities, investor owned utilities, oil and gas production companies and others to elicit input on the study design and to encourage participation and co-production of knowledge through ground truth measurements and/or crowd-sourced information to help validate the data and analysis.
- Monitor and perform mitigation scaling/economic analysis. The Recipient will apply lessons learned from the design and implementation of this study and Recipient's broader experience with other programs to assess the potential costs of applying these methods to affordably improve monitoring and mitigation of methane emissions in other key parts of the State.
- Evaluate project benefits. The Recipient will capture the project's benefits, at the kick-off meeting, a mid-project update, and a final meeting.
- Develop a Technology transfer plan. The Recipient will develop materials that aid in technology transfer, such as project fact sheets, and a plan to make the knowledge gained and lessons learned available to the public and key decision makers.

### 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.

## **Exhibit A Scope of Work Lawrence Berkeley National Lab**

### **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.
- 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.

## Exhibit A Scope of Work Lawrence Berkeley National Lab

### ○ **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**

#### **Lawrence Berkeley National Lab**

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.

**Exhibit A**  
**Scope of Work**  
**Lawrence Berkeley National Lab**

**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.

**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.

## Exhibit A Scope of Work Lawrence Berkeley National Lab

### 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
- 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.

## Exhibit A Scope of Work Lawrence Berkeley National Lab

### 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

#### 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**)

## **Exhibit A**

### **Scope of Work**

#### **Lawrence Berkeley National Lab**

- 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
- 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

## Exhibit A Scope of Work Lawrence Berkeley National Lab

### 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.
  - 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*)

## Exhibit A Scope of Work Lawrence Berkeley National Lab

### Subtask 1.8 Permits

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

#### The Recipient shall:

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

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

#### Products:

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

### Subtask 1.9 Subcontracts

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

#### 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.

## **Exhibit A Scope of Work Lawrence Berkeley National Lab**

- 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);
- 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.

## **Exhibit A Scope of Work Lawrence Berkeley National Lab**

### **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.

### **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

### Lawrence Berkeley National Lab

#### 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: TIERED OBSERVING SYSTEM**

The goal of this task is to deploy a tiered observing system and modeling framework to identify, attribute, quantify and track methane emission fluxes at regional, facility and component scales in the Southern San Joaquin Valley.

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

- Deploy up to four but not less than two new sites on existing television or radio transmitter towers located in the study domain
- Conduct periodic broad airborne surveys of CH<sub>4</sub> point sources across the study domain with Jet Propulsion Laboratory’s Next Generation Airborne Visible/Infrared Imaging Spectrometer (AVIRIS-NG)
- Conduct facility-scale mass balance flights for selected high priority facilities or sources identified by AVIRIS-NG including coordinated flights with AVIRIS-NG to jointly derive net facility CH<sub>4</sub> emissions
- Conduct six on-road surveys of surface CH<sub>4</sub> (three coordinated with AVIRIS-NG airborne surveys) on accessible roads within the study domain
- Sample CH<sub>4</sub> emissions from approximately 50 homes and 10 commercial buildings that represent the building practices and uses typical of the Bakersfield area
- Select and evaluate emerging low-cost measurement technologies alongside the research-grade measurement systems at different scales and vantage points. This will include coordinated measurements by mobile sensors of controlled releases of pipeline gas contributed by Southern California Gas Company and Pacific Gas and Electric.
- Prepare a *Tiered-Observing System in the SJV Report* which will include, but is not limited to:
  - Progress summary on tower network design, site visits, site selection
  - Progress summary on procurement of Picarro and related equipment
  - Progress summary on contract with tower operators
  - Progress summary on tower installation and commissioning
  - Progress summary on low-cost sensor vendor engagement and selection
  - Progress summary on intensive field campaign #1
  - Progress summary on Intensive field campaign #2; AVIRIS survey#1
  - Progress summary on Intensive field campaign #3
  - Progress summary on intensive field campaign #4; AVIRIS survey#2
  - Progress summary on intensive field campaign #5; controlled release experiment
  - Progress summary on intensive field campaign #6; controlled release experiment; and AVIRIS survey#3
  - Progress summary on measurement data archiving
- Participate in a CPR meeting to discuss the details of anticipated field measurements in accordance with Subtask 1.3.
- Prepare *CPR Report #1*

## Exhibit A Scope of Work Lawrence Berkeley National Lab

### Products:

- Tiered-Observing System in the SJV Report
- CPR Report #1

### **TASK 3: DATA INTEGRATION AND SYNTHESIS ANALYSIS**

The goals of this task are to integrate multiple large data sets and conduct a synthesis analysis to provide a comprehensive accounting of the net methane emission budget for this domain, the relative contributions of key sectors, individual super-emitters, and the spatial and temporal distribution of emissions.

### **The Recipient shall:**

- Collect and compile bottom-up data sets of predicted CH<sub>4</sub> emissions based on activity and emission factors as well as other information that can provide context and support interpretation
- Apply hierarchical Bayesian and geostatistical inverse modeling approaches to provide inverse estimates of CH<sub>4</sub> fluxes at regional/local scale (100 to ~1 km)
- Use AVIRIS-NG data to estimate integrated methane enhancements and point source emission fluxes at facility/component scale (1 km to ~1 m)
- Run plume tracking inversion model to locate hotspots sources, so that mitigation actions can be taken
- Compare direct flux estimates of individual emission sources from mobile surveys and potential low-cost sensors to point source emissions estimates from AVIRIS-NG. These will be added to Vista database with their associated uncertainties
- Leverage and combine existing data management frameworks and tools developed for multiple Department of Energy (DOE) and National Aeronautics and Space Administration/ National Institute of Standards and Technology (NASA/NIST) projects to empower data sharing
- Prepare an *Integration and Data Synthesis Analysis Report* which will include, but is not limited to:
  - Progress summary on assessment of tower network performance and initial inverse modeling
  - Progress summary on bottom-up data set generation
  - Progress summary on controlled-release experiment analysis
  - Progress summary on Tier-1 flux estimates
  - Progress summary on Tier-2 flux estimates
  - Progress summary on Tier-3 flux estimates

### Products:

- Integration and Data Synthesis Analysis Report

## **Exhibit A**

### **Scope of Work**

#### **Lawrence Berkeley National Lab**

#### **TASK 4: STAKEHOLDER AND COMMUNITY ENGAGEMENT**

The goal of this task is to engage early and often with stakeholders from local communities, investor owned utilities, oil and gas production companies and others to elicit input on the study design and to encourage participation and co-production of knowledge through ground truth measurements and/or crowd-sourced information to help validate our data and analysis.

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

- Hold community meetings and empanel a dedicated research project “Community Advisory Board” (CAB) within the study area.
- Develop and distribute informational materials to communicate and discuss study results
- Encourage residents and interested members of low-income and disadvantaged communities to participate in “Community Advisory Board” and in the community meetings to allow for broad discussion concerning the goals and targets of the project
- Prepare a *SJV Community Engagement Effort Report* which will include, but is not limited to:
  - Informational material for local communities and stakeholders such as printed or electronic materials including, but not limited to newsletters, factsheets, articles on the Central California Asthma Collaborative website to accompany quarterly CAB meetings, and annual community meetings/media event(s).

##### **Products:**

- SJV Community Engagement Effort Report

#### **TASK 5: MONITORING AND MITIGATION SCALING/ECONOMIC ANALYSIS**

The goal of this task is to extrapolate outwards results of source specific emissions observations and component identification and evaluated for the purpose of determining regional abatement costs.

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

- Apply lessons learned from the design and implementation of this study and Recipient’s broader experience with other programs to analyze the advantages and drawbacks of different sets of CH<sub>4</sub> detection techniques and systems and develop a methodology for a scalable, cost-effective, and continuous monitoring system applicable to other regions in California
- Develop a spatially-explicit method for evaluating the potential capital installation and operational costs of using emerging low-cost measurement technologies in disparate urban areas in the Southern San Joaquin Valley
- Determine the best strategies to apply the framework to other regions in California including, but not limited to San Francisco Bay, the Los Angeles Basin, the Central Valley and provide stakeholders with a method for understanding spatially heterogeneous costs, which will lower the risk associated with using novel monitoring approaches
- Prepare a *Best Cost Strategies to Scale Methane Monitoring and Emission Quantification Framework Used in the SJV to Other Regions in California Report*, to include but not be limited to a summary of the activities in Task 5.
- Participate in a CPR meeting in accordance with Subtask 1.3
- Prepare *CPR Report #2*

## Exhibit A Scope of Work Lawrence Berkeley National Lab

### Products:

- Best Cost Strategies to Scale Methane Monitoring and Emission Quantification Framework Used in the SJV to Other Regions in California Report
- CPR Report #2

### 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:

## Exhibit A Scope of Work Lawrence Berkeley National Lab

- 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**  
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- 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(s) on the project.
- 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: DOE-LAWRENCE BERKELEY NATIONAL LABORATORY

**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 PIR-17-015 from GFO-17-502 with DOE-Lawrence Berkeley National Laboratory for \$6,000,000, to fund a comprehensive field study identifying and mitigating methane emissions in the southern San Joaquin Valley, a region that has been disproportionately impacted by environmental issues arising from the natural gas system, that will result in advanced understanding of methane emissions while validating new technologies and strategies that could be affordably applied in other parts of the State; 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 April 11, 2018.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

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Cody Goldthrite,  
Secretariat