

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

New Agreement PIR-17-005 (To be completed by CGL Office)

ERDD	David Weightman	51	916-327-1631
------	-----------------	----	--------------

The Regents of the University of California on behalf of the Riverside campus	95-6006142
---	------------

Demonstration of Smart Combustion Technology Using Natural Gas Fuel Quality Sensors

6/1/2018	9/30/2021	\$ 1,499,910
----------	-----------	--------------

☐ ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	3/21/2018	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Rajesh Kapoor	Time Needed:	5 minutes

Please select one list serve. NaturalGas (NG Research Program)

Agenda Item Subject and Description

UNIVERSITY OF CALIFORNIA, RIVERSIDE. Proposed resolution approving Agreement PIR-17-005 with The Regents of the University of California, on behalf of the Riverside campus for a \$1,499,910 grant to demonstrate a smart control system that measures natural gas fuel quality and makes adjustments to optimize fuel efficiency in the combustion process.

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":
 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:
☒ 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 section 15301
☐ Common Sense Exemption. 14 CCR 15061 (b) (3)
 Explain reason why Agreement is exempt under the above section:
 California Code of Regulations, Title 14, Section 15301 Existing Facilities exempts from CEQA minor alterations to existing facilities and mechanical equipment that involves negligible or no expansion of use. The activities funded by the agreement will involve testing and demonstration of a Smart Combustion System at an industrial facility. The sensor system will be installed and commissioned on an existing natural gas boiler in order to monitor fuel quality. The only modification to the existing boiler equipment is to install the sensor system, and there will be no expansion of the boiler.

☐ b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
 Check all that apply
☐ Initial Study ☐ Environmental Impact Report
☐ Negative Declaration ☐ Statement of Overriding Considerations
☐ Mitigated Negative Declaration

Legal Company Name:	Budget
CSU Fullerton Auxiliary Services Corporation	\$ 157,159
Retrofit City Networks	\$ 450,300
TBD (M& V monitoring and instrumentation)	\$ 25,000
TBD Engineering (subcontractor to Retrofit City Networks)	\$ 22,000
	\$
	\$
	\$
	\$
	\$

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

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

Legal Company Name:

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
NG Subaccount, PIERDD	16-17	501.001K	\$1,499,910
			\$
			\$
			\$
			\$
			\$
R&D Program Area: EERO: IAW			\$1,499,910
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Name:	Briana Moreno	Name:	Chan Seung Park
Address:	1084 Columbia Ave	Address:	1084 Columbia Ave
City, State, Zip:	Riverside, CA 92507-2134	City, State, Zip:	Riverside, CA 92507-2134
Phone:	951-781-5635 /	Fax:	- -
E-Mail:	bmoreno@engr.ucr.edu	E-Mail:	cspark@cert.ucr.edu

☒ Competitive Solicitation

Solicitation #: GFO-17-501

☐ First Come First Served Solicitation

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

Agreement Manager

Date

Office Manager

Date

Deputy Director

Date

EXHIBIT A Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2	X	Develop and Analyze a Natural Gas Fuel Composition Database
3	X	Develop and Test an Intelligent Adaptive Controller, Sensors and Software
4		Integrate, Demonstrate, and Verify the SCS System for Commercialization, and Develop a Cloud-Based Data Collection and Monitoring System
5		Conduct Independent Measurement and Verification of Demonstration Results
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
SCS	Smart Combustion System
TAC	Technical Advisory Committee
WI	Wobbe Index

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the development and demonstration of a Smart Combustion System (SCS) technology based on the low cost, reliable, fuel Wobbe Index (WI) sensor. SCS technology could significantly increase fuel efficiency (up to 10 percent) and lower net Greenhouse gas (GHG) emissions (up to 30 percent) and also reduce criteria pollutant emissions.

B. Problem/ Solution Statement

Problem

Natural gas fuel quality sold in the marketplace varies in quality. The quality of the fuel can significantly affect combustion process efficiency. Some examples of the metrics that affect fuel

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

EXHIBIT A

Scope of Work

quality include water content, levels of contaminants, vapor pressure and the percentages of carbon dioxide and methane.

Solution

Application of the SCS which uses intelligent sensing and control technology that measures the variation of fuel quality of natural gas, e.g., Wobbe Index, in real time, could improve fuel efficiency and lower GHG emissions via optimization of the combustion process.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to develop and demonstrate a Smart Combustion System (SCS) based on a real-time WI sensor, to increase fuel efficiency and decrease the air emissions associated with the operation of industrial natural gas boilers.

Ratepayer Benefits: This Agreement will result in the ratepayer benefit of lower costs by increasing the fuel efficiency of natural gas boilers used in California industry.

- Statewide deployment of SCS is estimated by the research team to increase fuel efficiency by 10 percent per year for affected equipment.
- Annual cost saving from natural gas use reduction in a typical food industry (single steam boiler with @850,000 Btu/hr.) is estimated to be \$13,195

Technological Advancement and Breakthroughs: This Agreement could lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by developing the "smart combustion technology" which requires advancing multiple emerging technologies including intuitive fuel quality sensor technology, Artificial Intelligence, and "network of physical devices, and other items embedded with electronics, software, sensors, actuators, and network connectivity" collectively known as the Internet of Things. This project to develop SCS could help overcome barriers to achieving the State's energy goals by reducing overall natural gas consumption and meeting emissions reduction goals.

Agreement Objectives

The objectives of this project are to develop and demonstrate a "Smart Combustion System" (SCS) that uses intelligent sensing and control technology to measure the fuel quality/composition of natural gas feedstock in real time, and then make adjustments that optimize fuel efficiency and lower GHG and other pollutant air emissions in the combustion process.

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:

EXHIBIT A

Scope of Work

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
 - Text documents will be in MS Word file format, version 2007 or later.
 - Documents intended for public distribution will be in PDF file format.
 - The Recipient must also provide the native Microsoft file format.
 - Project management documents will be in Microsoft Project file format, version 2007 or later.
- **Software Application Development**
- Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
 - Microsoft Internet Information Services (IIS), (version 6 and up)
 - Recommend 7.5.
 - Visual Studio.NET (version 2008 and up). Recommend 2010.
 - C# Programming Language with Presentation (UI), Business Object
 - and Data Layers.
 - SQL (Structured Query Language).
 - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008
 - R2.
 - Microsoft SQL Reporting Services. Recommend 2008 R2.
 - XML (external interfaces).

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);

EXHIBIT A

Scope of Work

- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Technical products (subtask 1.1);
 - Progress reports and invoices (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide an Updated Project Schedule, List of Match Funds, and List of Permits, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a Kick-off Meeting Agenda.

Recipient Products:

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

EXHIBIT A

Scope of Work

- 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.

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.

EXHIBIT A

Scope of Work

- 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.

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.

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
- 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**)
 - 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,

EXHIBIT A

Scope of Work

telephone number, and the address where the property is located.

- If different from the solicitation application, provide a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

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

Subtask 1.8 Permits

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

The Recipient shall:

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

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

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

Products:

- Permit Status Letter
- Updated List of Permits (*if applicable*)

EXHIBIT A

Scope of Work

- 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.
- 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.

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/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 DEVELOP AND ANALYZE A NATURAL GAS FUEL COMPOSITION DATABASE

The goal of this task is to develop a natural gas database based on variations in fuel properties, build a predictive model that shows the relationship between Measurable Physical Properties and WI for records in the database, and design a software algorithm based on the model.

The Recipient shall:

- Construct the Natural Gas Fuel Database of various fuel compositions that consists of but is not limited to, the data of possible blended compositions with thermal conductivity and the WI. Existing compositional information of US consumer natural gas will be collected.
- Produce a *Natural Gas Database Report* that explains the construction, contents, access and use of the database and examples of compositional information on natural gas.
- Estimate the Measurable Physical Properties of each blended fuel mixture in the database at varying pressures and temperatures with a software tool that can use compositional information to estimate transport properties of the gas mixture.
- Estimate the Value of Interest (e.g., WI) for each case using a simulation model from the known compositional information.
- Analyze the relationships between Measurable Physical Properties (MPP) and WI and build a predictive model that estimates WI for given Measurable Physical Properties of Natural Gas fuel compositions.
- Design the algorithm based on the predictive model.
- Prepare the *Task 2 Report of the Analysis Results* for the proposed model. This report includes but is not limited to natural gas fuel variations data, estimates of Values of Interest, data of possible blended composition with thermal conductivity, relationship of physical properties and the Wobbe index, a description of the predictive model, findings regarding optimum ways to collect MPP data, and a description of the software algorithm
- Prepare a *CPR Report* and participate in a CPR meeting as described in subtask 1.3.

Products:

- Natural Gas Fuel Database Report
- Task 2 Report of the Analysis Results
- CPR Report

TASK 3 DEVELOP AND TEST AN INTELLIGENT ADAPTIVE CONTROLLER, SENSORS AND SOFTWARE

The goal of this task is to construct the sensors and test them in a relevant laboratory working environment, develop an intelligent and adaptive controller, and develop the necessary software and hardware interfaces to integrate the controller with external devices. The SCS system will be installed and commissioned on an existing natural gas boiler at the industrial site in order to monitor fuel quality.

EXHIBIT A

Scope of Work

The Recipient shall:

- Construct thick film type thermal conductivity sensors and test them under typical gas pressures and temperature combinations experienced by industrial boilers, i.e., up to 300 psi, and between -10°C to 70°C.
- Incorporate the predictive algorithm that estimates WI and embed it into a prototype microcontroller with sensors connected.
- Test and verify the performance of the predictive algorithm.
- Design and develop the software architecture with software interface with external devices.
- Implement the adaptive learning algorithm and embed it into the controller.
- Test the capability of learning and adaptation to the changed inputs through the feedback from external devices.
- Prepare a *Task 3 Report* that includes but is not limited to description of the construction and testing of the sensors, the incorporation of the algorithm and its testing with the microcontroller and connected sensors, a description of the software design and development and the results of testing the learning and adaptive ability of the system to changed inputs via the feedback from external devices.
- Prepare a *CPR Report* and Participate in a CPR meeting as described in subtask 1.3. R

Products:

- Task 3 Report
- CPR Report

TASK 4 INTEGRATE, DEMONSTRATE, AND VERIFY THE SCS SYSTEM FOR COMMERCIALIZATION, AND DEVELOP A CLOUD-BASED DATA COLLECTION AND MONITORING SYSTEM

The goal of this task is to integrate and demonstrate the SCS system and verify its readiness for commercialization, and to develop a prototype cloud-based system that will collect real-time data for analysis, and monitoring that will interface with the SCS system.

The Recipient shall:

- Develop hardware interfaces to integrate the controller with external devices such as existing combustion devices or systems.
- Develop the monitoring application. The mapping for the fuel trimming will be developed using commercially available combustion analysis tools.
- Test the integration of the controller with external devices.
- Test the capability of exchanging data between the controller and computers/servers.
- Develop a prototype cloud-based system for real-time data collection, analysis, and monitoring that will communicate with the controller.
- Test the prototype in a laboratory.
- Install and demonstrate the SCS system at an industrial site with approval from the CAM. The SCM will be installed and commissioned on an existing natural gas boiler at the industrial site to monitor fuel quality.
- Collect feedback from the TAC and other industry partners to define market and product requirements.
- Prepare the *Task 4 SCS Demonstration Report*. This report will describe the results of the laboratory testing, describe how the system was installed and commissioned at the industrial site, and also describe the results of the test including how the SCS improved

EXHIBIT A

Scope of Work

natural gas combustion efficiency at the demonstration site, and the increase in energy efficiency and reductions in GHG and other emissions.

Products:

- Task 4 SCS Demonstration Report

TASK 5 CONDUCT INDEPENDENT MEASUREMENT AND VERIFICATION OF DEMONSTRATION RESULTS

The Recipient shall:

- Hire an independent contractor that will conduct Measurement and Verification of the SCS system performance and prepare a project *Measurement and Verification Report*
 - *Measurement and Verification Report* will include but is not limited to a description of the location(s) and method(s) of collecting pre-installation data for the demonstration, post installation data for the demonstration and an analysis of the findings covering energy savings, GHG emission reductions and cost savings and overall project emissions. The report will also comment on whether the project was able to increase fuel efficiency by 10 percent, lower GHG emissions by 30 percent and the amount of criteria air pollutant emissions reductions.
 - *The Measurement and Verification Report* will be based upon 100 hours of pre-installation and 500 hours of post-installation measurements.

Products:

- Measurement and Verification Report

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

EXHIBIT A

Scope of Work

- 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:
 - 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.

EXHIBIT A

Scope of Work

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.
- 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: UNIVERSITY OF CALIFORNIA, RIVERSIDE

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-17-005 from GFO-17-501 with The Regents of the University of California, on behalf of the Riverside campus for a \$1,499,910 grant to demonstrate a smart control system that measures natural gas fuel quality and makes adjustments to optimize fuel efficiency in the combustion process; 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 March 21, 2018.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat