STATE OF CALIFORNIA
CONTRACT REQUEST FORM (CRF)
CEC-94 (Revised 01/13) CALIFORNIA ENERGY COMMISSION

A) New Agreement ____ - ____ (To be completed by CGL Office)

B) Division	**Agreement Manager:**	**MS-**	**Phone**
ERDD	Marla Mueller	43	916-327-1716

C) Contractor's Legal Name	**Federal ID Number**
The Regents of the University of California, Advanced Power and Energy Program, UC Irvine	95-2226406

D) Title of Project
Gas Fuel Interchangeability Criteria Phase 2: Validations and Refinement

E) Term and Amount	**Start Date**	**End Date**	**Amount**
	2/19/2014	2/29/2016	$ 100,000

F) Business Meeting Information

☐ Operational agreement (see CAM Manual for list) to be approved by Executive Director

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

Proposed Business Meeting Date	1/8/2014	☐ Consent	☒ Discussion
Business Meeting Presenter	Marla Mueller	Time Needed:	5 minutes

Please select one list serve. Select

Agenda Item Subject and Description

UNIVERSITY OF CALIFORNIA, IRVINE. Possible approval of Agreement 500-13-XXX with the University of California at Irvine for a $100,000 contract to verify and test the modeling methodologies developed under Energy Commission Contract 500-08-034, entered into to estimate the impact of fuel composition on the stability and pollutant emissions of combustion systems operated on biogas resources. (PIER Natural Gas funding) Contact: Marla Mueller (5 minutes).

G) California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?
   ☐ Yes (skip to question 2) ☒ No (complete the following (PRC 21065 and 14 CCR 15378)):
   Explain why Agreement is not considered a "Project":
   Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because this is a modeling/paper study.
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: ____
   ☐ Common Sense Exemption. 14 CCR 15061 (b) (3)
   Explain reason why Agreement is exempt under the above section:
   ☐ 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

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

Legal Company Name:	Budget	SB	MB	DVBE
	$	☐	☐	☐
	$	☐	☐	☐
	$	☐	☐	☐
	$	☐	☐	☐
	$	☐	☐	☐
	$	☐	☐	☐
	$	☐	☐	☐
	$	☐	☐	☐
	$	☐	☐	☐

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

J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
NG Subaccount, PIERDD	12-13	501.001G	$100,000
			$
			$
			$
			$
			$
R&D Program Area: EGRO: EA		TOTAL:	$
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

K) **Contractor's Administrator/ Officer**				**Contractor's Project Manager**			
Name:	Natalie Nodianos			Name:	Vince McDonell		
Address:	UCI Office of Research			Address:	221 Engineering Lab Facility		
City, State, Zip:	Irvine, CA 92697-7600			City, State, Zip:	Irvine, CA 92697-3550		
Phone:	949-824-8109 /	Fax:	- -	Phone:	949 824-5950	Fax:	- -
E-Mail:	natalie.nodianos@uci.edu			E-Mail:	mcdonell@apep.uci.edu		

L) Selection Process Used (For amendments, address amendment exemption or NCB, do not identify solicitation type of original agreement.)

☐ Solicitation Select Type Solicitation #: _____ # of Bids: _____ Low Bid? ☐ No ☐ Yes
☐ Non Competitive Bid *(Attach CEC 96)*
☐ Exempt Interagency

M) Contractor Entity Type

☐ Private Company *(including non-profits)*
☒ CA State Agency *(including UC and CSU)*
☐ Government Entity *(i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)*

N) Is Contractor a certified Small Business (SB), Micro Business (MB) or DVBE? ☒ No ☐ Yes
If yes, check appropriate box: ☐ SB ☐ MB ☐ DVBE

O) Civil Service Considerations

☒ Not Applicable (Agreement is with a CA State Entity or a membership/co-sponsorship)
☐ Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER)
☐ The Services Contracted:
- ☐ are not available within civil service
- ☐ cannot be performed satisfactorily by civil service employees
- ☐ are of such a highly specialized or technical nature that the expert knowledge, expertise, and ability are not available through the civil service system.

☐ The Services are of such an:
- ☐ urgent
- ☐ temporary, or
- ☐ occasional nature

that the delay to implement under civil service would frustrate their very purpose.

Justification:

STATE OF CALIFORNIA

CONTRACT REQUEST FORM (CRF)

CEC-94 (Revised 01/13) CALIFORNIA ENERGY COMMISSION

P) Payment Method

☒ A. Reimbursement in arrears based on:
☐ Itemized Monthly ☒ Itemized Quarterly ☐ Flat Rate ☐ One-time
☐ B. Advanced Payment
☐ C. Other, explain:

Q) Retention

1. Is Agreement subject to retention? ☒ No ☐ Yes
   If Yes, Will retention be released prior to Agreement termination? ☒ No ☐ Yes

R) Justification of Rates

The rates identified in this contract are consistent with the standard negotiated rates between the University of California and the Energy Commission.

S) Disabled Veteran Business Enterprise Program (DVBE)

1. ☒ Exempt (Interagency/Other Government Entity)
2. ☐ Meets DVBE Requirements DVBE Amount:$ _____ DVBE %: _____
   ☐ Contractor is Certified DVBE
   ☐ Contractor is Subcontracting with a DVBE: _____
3. ☐ Contractor selected through CMAS or MSA with no DVBE participation.
4. ☐ Requesting DVBE Exemption (attach CEC 95)

T) Miscellaneous Contract Information

1. Will there be Work Authorizations? ☒ No ☐ Yes
2. Is the Contractor providing confidential information? ☒ No ☐ Yes
3. Is the Contractor going to purchase equipment? ☒ No ☐ Yes
4. Check frequency of progress reports
   ☐ Monthly ☒ Quarterly ☐ _____
5. Will a final report be required? ☐ No ☒ Yes
6. Is the contract, with amendments, longer than a year? If yes, why? ☐ No ☒ Yes

   The Department of General Services has agreed to give the Commission blanket authority to execute multi-year contracts to support the Commission's RD&D Programs.

U) The following items should be attached to this CRF (as applicable)

1. Exhibit A, Scope of Work	☐ N/A	☐ Attached
2. Exhibit B, Budget Detail	☐ N/A	☐ Attached
3. CEC 96, NCB Request	☐ N/A	☐ Attached
4. CEC 30, Survey of Prior Work	☐ N/A	☐ Attached
5. CEC 95, DVBE Exemption Request	☐ N/A	☐ Attached
6. CEQA Documentation	☐ N/A	☐ Attached
7. Resumes	☐ N/A	☐ Attached
8. CEC 105, Questionnaire for Identifying Conflicts		☐ Attached

Agreement Manager	Date	Office Manager	Date	Deputy Director	Date

Exhibit A
SCOPE OF WORK

TECHNICAL TASK LIST

.

Task #	CPR	Task Name
1	N/A	Administration
2		Identify Burner Configurations and Fuel Composition Ranges
3		CFD/CRN Analysis
4		Technology Transfer Activities

KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1-4	V.G. McDonell	NA	NA

GLOSSARY

Specific terms and acronyms used throughout this work statement are defined as follows:

Acronym	Definition
CAD	Computer-aided Design
CAM	Commission Agreement Manager
CFD	Computational Fluid Dynamics
HC	Hydrocarbons
CO	Carbon Monoxide
CPR	Critical Project Review
CRN	Chemical Reactor Network
Energy Commission	California Energy Commission
N_2O	Nitrous Oxide
NOx	Oxides of Nitrogen
NNH	Diazenyl Radical
PAC	Project Advisory Committee
PIER	Public Interest Energy Research
UC Irvine	University of California at Irvine
VOC	Volatile Organic Compounds

Problem Statement

The 2011 Bioenergy Action Plan indicates that biomass-derived fuels (i.e., biogas) can help California achieve waste reduction, increased adoption of renewable energy, and climate change goals. Examples of these gases include those produced by waste in

landfills, and anaerobic digestion processes such as those at water treatment plants and dairies. However, the air quality and safety implications of using such gases in combustion devices are not well understood.

Under California Energy Commission Contract 500-08-034, the contractor has demonstrated simulation methodologies that are able to correctly predict trends in emissions as a function of fuel composition for several representative burners, namely a jet-stirred burner, an axisymmetric swirl stabilized burner, and a commercial microturbine generator. In addition, methodologies for predicting combustion stability for the jet-stirred burner and the axisymmetric swirl burner were also demonstrated.

The work on fuel composition impacts on emissions has been particularly insightful as it has illustrated some of the reasons why certain burner configurations may see an increase in emissions, while others show a decrease for the same changes in fuel composition. A key factor is that as burner designs evolve to achieve low oxides of nitrogen (NOx) emissions, the "traditional" NOx emissions, those formed by high reaction temperatures, may no longer be the bulk of the NOx emitted. Rather, the contribution to the NOx from other NOx formation pathways (e.g., Prompt, nitrous oxide (N_2O) intermediate, or diazenyl radical (NNH)) can become comparable with or exceed traditional NOx, which makes interpretation of the observed NOx emissions complex.

In three burner configurations considered under Contract 500-08-034, it was observed that the Jet Stirred Reactor NOx forms mainly through the Prompt mechanism which requires the presence of hydrocarbon (CH). As hydrogen is added, CH reduces and the overall NOx is reduced. For a high swirl burner, NOx changes only modestly as hydrogen is added. In this case, as hydrogen is increased, NOx formed via the NNH mechanism dominates and, as hydrogen increases, the relative contributions of the other mechanisms cancel each other out. For the microturbine generator featuring a jet flame burner, NOx increases with added hydrogen and the NOx is formed via the N_2O mechanism. NOx can increase or decrease depending upon the burner configuration. With the methodology developed under Contract 500-08-034 for studying how fuel composition impacts emissions, the details become available that can be used to explain the apparently contrary results for NOx emissions. It can also be used to explore how modifying the burner configuration might help reduce NOx.

Previous work on characterizing the emissions behavior for various burners operated on natural gas and variations in natural gas composition have resulted in a range of results relative to fuel composition impact (e.g., Energy Commission Contract 500-05-026*)*. With the methodology developed under Contract 500-08-034, it is likely that an explanation for the differences in trends can be identified. This is likely to do with the relative contribution of different NOx formation pathways in these different systems. The conditions under which each pathway contributes can be used, in conjunction with the burner configuration, to further generalize the results regarding how fuel composition impacts emissions.

Based on the examples evaluated under Contract 500-08-034, the Computational Fluid Dynamics (CFD)/ Chemical Reactor Network (CRN) methodology to predict fuel composition effects on emissions appear promising. However, the ability to correctly predict behavior for burners in general has not been fully evaluated. As a result, it is proposed to apply these methodologies to commercial burner configurations and/or fuel compositional ranges to: (1) better demonstrate the validity of the CFD/CRN methodology; and (2) provide more generalized results relative to how extensive use of biogas might impact air quality. Given sufficient application of the methodologies, some trends in terms of the overall impact fuel composition on emissions of NOx, carbon monoxide (CO), and volatile organic compounds (VOCs) can be better estimated, thus providing input to policy makers.

Goals of the Agreement

The goal of this Agreement is to verify and test the CFD/CRN simulation methodology developed under Energy Commission Contract 500-08-034 to estimate the impact of fuel composition on the stability and pollutant emissions of combustion systems operated on biogas resources.

Objectives of the Agreement

The objectives of this Agreement are to:

- Further validate the methodologies developed under Contract 500-08-034 for predicting stability and emissions as a function of fuel composition
- Use the methodologies to determine how biogas fuel composition impacts combustion system stability
- Use the methodologies to determine how biogas fuel composition impacts combustion system emissions

TASK 1.0 ADMINISTRATION

MEETINGS

Task 1.1 Attend Kick-off Meeting

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

The Contractor shall:

- Attend a "kick-off" meeting with the Commission Contract Manager, the Contracts Officer, and a representative of the Accounting Office. The Contractor shall bring their Project Manager, Contracts Administrator, Accounting Officer, and others designated by the Commission Contract Manager to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the Commission Contract Manager will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Terms and conditions of the Agreement
- CPRs (Task 1.2)
- Match fund documentation (Task 1.7)
- Permit documentation (Task 1.8)

The technical portion of the meeting shall include, but not be limited to, the following:

- The Commission Contract Manager's expectations for accomplishing tasks described in the Scope of Work;
- An updated Schedule of Deliverables
- Progress Reports (Task 1.4)
- Technical Deliverables (Task 1.5)
- Final Report (Task 1.6)
- Establish the PAC (Task 1.10)
- PAC Meetings (Task 1.11)

The Commission Contract Manager shall designate the date and location of this meeting.

Contractor Deliverables:

- An Updated Schedule of Deliverables
- An Updated List of Match Funds
- An Updated List of Permits
- Schedule for Recruiting PAC Members

Commission Contract Manager Deliverables:

- Final Report Instructions

Task 1.2 CPR Meetings

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and if it should, are there any modifications that need to be made to the tasks, deliverables, schedule or budget.

CPRs provide the opportunity for frank discussions between the Energy Commission and the Contractor. CPRs generally take place at key, predetermined points in the Agreement, as determined by the Commission Contract Manager and as shown in the Technical Task List above and in the Schedule of Deliverables. However, the Commission Contract Manager may schedule additional CPRs as necessary, and, if necessary, the budget will be reallocated to cover the additional costs borne by the Contractor, but the overall contract amount will not increase.

Participants include the Commission Contract Manager and the Contractor, and may include the Commission Contracts Officer, the PIER Program Team Lead, other Energy Commission staff and Management as well as other individuals selected by the Commission Contract Manager to provide support to the Energy Commission.

The Commission Contract Manager shall:

- Determine the location, date and time of each CPR meeting with the Contractor. These meetings generally take place at the Energy Commission, but they may take place at another location.

- Send the Contractor the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on both match funding and permits.

- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.

- Determine whether to continue the project, and if continuing, whether or not to modify the tasks, schedule, deliverables and budget for the remainder of the Agreement, including not proceeding with one or more tasks.

- Provide the Contractor with a written determination in accordance with the schedule. The written response may include a requirement for the Contractor to revise one or more deliverable(s) that were included in the CPR.

The Contractor shall:

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include

recommendations and conclusions regarding continued work of the projects. This report shall be submitted along with any other deliverables identified in this Scope of Work. Submit these documents to the Commission Contract Manager and any other designated reviewers at least 15 working days in advance of each CPR meeting.

- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

Contractor Deliverables:
- CPR Report(s)
- CPR deliverables identified in the Scope of Work

Commission Contract Manager Deliverables:
- Agenda and a List of Expected Participants
- Schedule for Written Determination
- Written Determination

Task 1.3 Final Meeting
The goal of this task is to closeout this Agreement.

The Contractor shall:

- Meet with the Energy Commission to present the findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

  This meeting will be attended by, at a minimum, the Contractor, the Commission Contracts Officer, and the Commission Contract Manager. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the Commission Contract Manager.

  The technical portion of the meeting shall present findings, conclusions, and recommended next steps (if any) for the Agreement. The Commission Contract Manager will determine the appropriate meeting participants.

  The administrative portion of the meeting shall be a discussion with the Commission Contract Manager and the Contracts Officer about the following Agreement closeout items:

  - What to do with any state-owned equipment (Options)
  - Need to file UCC.1 form re: Energy Commission's interest in patented technology
  - Energy Commission's request for specific "generated" data (not already provided in Agreement deliverables)

- Need to document Contractor's disclosure of "subject inventions" developed under the Agreement
- "Surviving" Agreement provisions, such as repayment provisions and confidential deliverables
- Final invoicing and release of retention

- Prepare a schedule for completing the closeout activities for this Agreement.

Deliverables:
- Written documentation of meeting agreements and all pertinent information
- Schedule for completing closeout activities

REPORTING

See Exhibit D, Reports/Deliverables/Records.

Task 1.4 Quarterly Progress Reports
The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement.

The Contractor shall:

- Prepare progress reports which summarize all Agreement activities conducted by the Contractor for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the Commission Contract Manager within 10 working days after the end of the reporting period. Attachment A-2, Progress Report Format, provides the recommended specifications.

Deliverables:
- Quarterly Progress Reports

Task 1.5 Test Plans, Technical Reports and Interim Deliverables
The goal of this task is to set forth the general requirements for submitting test plans, technical reports and other interim deliverables, unless described differently in the Technical Tasks. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

http://www.energy.ca.gov/contracts/pier/contractors/index.html

The Contractor shall:

- Unless otherwise directed in this Scope of Work, submit a draft of each deliverable listed in the Technical Tasks to the Commission Contract Manager for review and

comment in accordance with the approved Schedule of Deliverables. The Commission Contract Manager will provide written comments back to the Contractor on the draft deliverable within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final deliverable to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final deliverable within 5 working days of receipt. Key elements from this deliverable shall be included in the Final Report for this project.

Task 1.6 Final Report

The goal of this task is to prepare a comprehensive written Final Report that describes the original purpose, approach, results and conclusions of the work done under this Agreement. The Commission Contract Manager will review and approve the Final Report. The Final Report must be completed on or before the termination date of the Agreement. When creating these deliverables, the Contractor shall use and follow, unless otherwise instructed in writing by the Commission Contract Manager, the latest version of the PIER Style Manual published on the Energy Commission's web site:

http://www.energy.ca.gov/contracts/pier/contractors/index.html

The Final Report shall be a public document. If the Contractor has obtained confidential status from the Energy Commission and will be preparing a confidential version of the Final Report as well, the Contractor shall perform the following subtasks for both the public and confidential versions of the Final Report.

Task 1.6.1 Final Report Outline

The Contractor shall:

- Prepare a draft outline of the Final Report.

- Submit the draft outline of Final Report to the Commission Contract Manager for review and approval. The Commission Contract Manager will provide written comments back to the Contractor on the draft outline within 10 working days of receipt. Once agreement has been reached on the draft, the Contractor shall submit the final outline to the Commission Contract Manager. The Commission Contract Manager shall provide written approval of the final outline within 5 working days of receipt.

Deliverables:

- Draft Outline of the Final Report
- Final Outline of the Final Report

Task 1.6.2 Final Report

The Contractor shall:

- Prepare the draft Final Report for this Agreement in accordance with the approved outline.

- Submit the draft Final Report to the Commission Contract Manager for review and comment. The Commission Contract Manager will provide written comments within 10 working days of receipt.

  Once agreement on the draft Final Report has been reached, the Commission Contract Manager shall forward the electronic version of this report for Energy Commission internal approval. Once the approval is given, the Commission Contract Manager shall provide written approval to the Contractor within 5 working days.

- Submit one bound copy of the Final Report with the final invoice.

Deliverables:
- Draft Final Report
- Final Report

MATCH FUNDS, PERMITS, AND ELECTRONIC FILE FORMAT

Task 1.7 Identify and Obtain Matching Funds
The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. While the PIER budget for this task will be zero dollars, the Contractor may utilize match funds for this task. Match funds shall be spent concurrently or in advance of PIER funds during the term of this Agreement. Match funds must be identified in writing, and the associated commitments obtained before the Contractor can incur any costs for which the Contractor will request reimbursement.

The Contractor shall:

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:

  1. 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 such in the letter.

2. 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 each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied.

     - Amount of each in-kind contribution, a description, documented market or book value, and its 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 Contractor shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.

   - A copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured.

- Discuss match funds and the implications to the Agreement if they are significantly reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.

- Provide the appropriate information to the Commission Contract Manager if during the course of the Agreement additional match funds are received.

- Notify the Commission Contract Manager within 10 working days if during the course of the Agreement existing match funds are reduced. Reduction in match funds may trigger an additional CPR.

Deliverables:
- A letter regarding Match Funds or stating that no Match Funds are provided
- Letter(s) for New Match Funds
- A copy of each Match Fund commitment letter
- Letter that Match Funds were Reduced (if applicable)

Task 1.8 Identify and Obtain Required Permits
The goal of this task 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 reimbursable under this Agreement. Permits must be identified in writing before the Contractor can

incur any costs related to the use of the permit(s) for which the Contractor will request reimbursement.

The Contractor shall:

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting:

    1. If there are no permits required at the start of this Agreement, then state such in the letter.

    2. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:

        - A list of the permits that identifies the:
            - Type of permit
            - Name, address and telephone number of the permitting jurisdictions or lead agencies
        - Schedule the Contractor will follow in applying for and obtaining these permits.

- The list of permits and the schedule for obtaining them will be discussed at the kick-off meeting, and a timetable for submitting the updated list, schedule and the copies of the permits will be developed. The implications to the Agreement 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 the progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the appropriate information on each permit and an updated schedule to the Commission Contract Manager.

- As permits are obtained, send a copy of each approved permit to the Commission Contract Manager.

- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Contract Manager within 5 working days. Either of these events may trigger an additional CPR.

Deliverables:

- A letter documenting the Permits or stating that no Permits are required
- Updated list of Permits as they change during the Term of the Agreement
- Updated schedule for acquiring Permits as it changes during the Term of the Agreement
- A copy of each approved Permit

Task 1.9 Electronic File Format
The goal of this task is to unify the formats of electronic data and documents provided to the Energy Commission as contract deliverables. Another goal is to establish the computer platforms, operating systems and software that will be required to review and approve all software deliverables.

The Contractor shall:

- Deliver documents to the Commission Contract Manager in the following formats:
  - Data sets shall be in Microsoft (MS) Access or MS Excel file format.
  - PC-based text documents shall be in MS Word file format.
  - Documents intended for public distribution shall be in PDF file format, with the native file format provided as well.
  - Project management documents shall be in MS Project file format.

- Request exemptions to the electronic file format in writing at least 90 days before the deliverable is submitted.

Deliverables:
- A letter requesting exemption from the Electronic File Format (if applicable)

PAC

Task 1.10 Establish the PAC

The goal of this task is to create an advisory committee for this Agreement.

The PAC should be composed of diverse professionals. The number can vary depending on potential interest and time availability. The exact composition of the PAC may change as the need warrants. PAC members serve at the discretion of the Commission Contract Manager.

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

- Researchers knowledgeable about the project subject matter
- Members of the trades who 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 project subject matter
- U.S. Department of Energy Research Manager
- Public Interest Environmental Groups
- Utility Representatives
- Members of the relevant technical society committees

The purpose of the PAC is to:

- Provide guidance in research direction. The guidance may include scope of research; research methodologies; timing; coordination with other research. The guidance may be based on:

  -technical area expertise
  -knowledge of market applications
  -linkages between the agreement work and other past, present or future research (both public and private sectors) they are aware of in a particular area.

- Review deliverables. Provide specific suggestions and recommendations for needed adjustments, refinements, or enhancement of the deliverables.
- Evaluate tangible benefits to California of this research and provide recommendations, as needed, to enhance tangible benefits.
- Provide recommendations regarding information dissemination, market pathways or commercialization strategies relevant to the research products.

The Contractor shall:

- Prepare a draft list of potential PAC members that includes name, company, physical and electronic address, and phone number and submit it to the Commission Contract Manager at least 2 working days prior to the kick-off meeting. This list will be discussed at the kick-off meeting and a schedule for recruiting members and holding the first PAC meeting will be developed.
- Recruit PAC members and ensure that each individual understands the member obligations described above, as well as the meeting schedule outlined in Task 1.11.
- Prepare the final list of PAC members.
- Submit letters of acceptance or other comparable documentation of commitment for each PAC member.

Deliverables:

- Draft List of PAC Members
- Final List of PAC Members
- Letters of acceptance, or other comparable documentation of commitment for each PAC Member

Task 1.11 Conduct PAC Meetings

The goal of this task is for the PAC to provide strategic guidance to this project by participating in regular meetings or teleconferences.

The Contractor shall:

- Discuss the PAC meeting schedule at the kick-off meeting. The number of face-to-face meetings and teleconferences and the location of PAC meetings shall be determined in consultation with the Commission Contract Manager. This draft

schedule shall be presented to the PAC members during recruiting and finalized at the first PAC meeting.

- Organize and lead PAC meetings in accordance with the schedule. Changes to the schedule must be pre-approved in writing by the Commission Contract Manager.
- Prepare PAC meeting agenda(s) with back-up materials for agenda items.
- Prepare PAC meeting summaries, including recommended resolution of major PAC issues.

Deliverables:

- Draft PAC Meeting Schedule
- Final PAC Meeting Schedule
- PAC Meeting Agenda(s) with Back-up Materials for Agenda Items
- Written PAC meeting summaries, including recommended resolution of major PAC issues

TECHNICAL TASKS

The Contractor shall prepare all deliverables in accordance with the requirements in Task 1.5. Deliverables not requiring a draft version are indicated by marking "(no draft)" after the deliverable name.

Task 2 Identify Burner Configurations and Fuel Composition Ranges

The goal of this task is to identify appropriate commercial burner configurations and fuels to evaluate the effect of fuel composition on burner operations and emissions. Existing information (e.g., burner classification results from Energy Commission Contract 500-05-026) will be used to assist in this process along with input from the advisory team. At least two burners that have been tested on a variety of fuels (e.g., those tested under Energy Commission Contract 500-05-026) will be used to validate the methodology. To apply the CFD/CRN methodology in Task 3, information about the geometry and the air and fuel flows will be required so that a computational fluid dynamics simulation can be carried out. Ideally, emissions data for natural gas will be available for representative burners.

Based on the burner configuration assessment, a set of representative burners will be established for application of the CFD/CRN methodology. A minimum of nine commercial burner configurations will be studied. In addition, the range of fuels to be studied will be established using information previously compiled (e.g., under Energy Commission Contract 500-08-034), focusing on those with the largest potential California market. A minimum of three fuel classes will be studied with at least four specific compositions within each class.

The Contractor shall:

- Survey available commercial burner configurations and identify burner configurations most applicable to the California market. Identify 12 burner configurations for application of the CFD/CRN methodology under Task 3.
- Prepare a list of recommended commercial burner configurations and fuel classes with specific compositions within each class.
- Identify four fuel classes to be studied and four specific compositions per class.
- Present proposed burner configurations and fuel compositions to the PAC and based on PAC and CAM input, prepare a final proposed list of nine commercial burner configurations and three fuel classes with four compositions per class.
- Obtain approval from the CAM for burner configurations and fuels to test.
- Work with manufacturers to obtain the detailed information needed to carry out a CFD analysis.

Deliverables:

- List of recommended commercial burner configurations and fuel classes

Task 3 CFD/CRN Analysis

The goal of this task is to carry out application of the CFD/CRN methodology developed under Energy Commission Contract 500-08-034 to the burner configurations identified in Task 2 for the fuel compositional range identified in Task 2. This task will provide detailed information regarding how composition impacts combustion system stability and pollutant emissions. CFD simulations will be run first on the burners that have been tested on a variety of fuels to validate the methodology.

The Contractor shall:
For the approved burner configurations:

- Obtain burner geometry information necessary to create a computer-aided design (CAD) model of the geometry to be used to create a CFD simulation grid. If available, obtain existing emissions measurements and operating conditions for the approved burner configurations.
- Apply appropriate boundary conditions for the CFD simulations.
- Run CFD simulations.
- Develop a CRN network based on the CFD simulations.
- Compare CRN results with any available data; Modify the CRN as needed.
- Use the CRN to estimate fuel composition effect on stability and emissions.
- Develop a Matrix Table summarizing burner configurations, fuel composition ranges and the associated impact on emissions and stability for each.
- Prepare an Analysis Report for each burner configuration including details regarding geometry, boundary conditions, and results from parametric fuel composition studies.

Deliverables:
- Matrix Table
- Analysis Report

Task 4 Technology Transfer Activities
The goal of this task is to make the knowledge gained, experimental results and lessons learned available to key decision-makers.

The Contractor shall:
- Prepare one Technical Paper for a journal based on results from the research and submit to a relevant journal.
- Prepare Presentation Materials for and present research results at one technical meeting.

Deliverables:
- Technical Paper
- Presentation materials

EXHIBIT A, ATTACHMENT A-2
CONTENT AND FORMAT OF PROGRESS REPORTS – RECOMMENDED

PROGRESS REPORT for
Project Title, Agreement Number
Month, Year
Contractor Project Manager:
Commission Project Manager:

What we planned to accomplish this period
[This is taken directly from the section on "What we expect to accomplish during the next period" from the last progress report.]

What we actually accomplished this period
[Concise description of major activities and accomplishments.]

How we are doing compared to our plan
[Explain the differences, if any, between the planned and the actual accomplishments. Describe what needs to be done, if anything, to get back on track.]

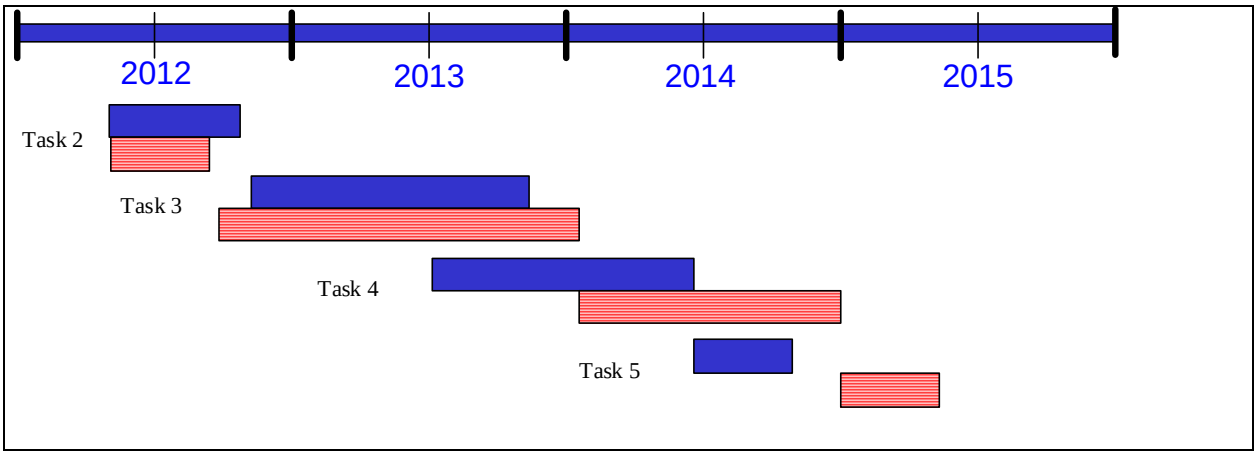
Significant problems or changes
[Describe any significant technical or fiscal problems. Request approval for significant changes in scope of work, revised milestone due dates, changes in key personnel assigned to the project, or reallocation of budget cost categories. If none, include the following statement: "Progress and expenditures will result in project being completed on time and within budget."]

What we expect to accomplish during the next period
[Concise description of major activities and accomplishments expected. This will be transferred to the next progress report]

Status of Milestones and Deliverables:
[This should be the complete list as contained in the revised scope of work. Highlight differences between actual and planned.]

Description	Start Date		Due Date		Status (%)
	Planned	Actual	Planned	Actual	
Identify top 3 assessment candidates	4/15/12	4/15/12	5/1/12	5/1/12	Ontime 100%
Develop test plan	4/20/12	**4/10/12**	7/7/12	**6/10/12**	**Ahead 100%**
Analyze experimental data	5/1/12	**6/1/12**	1/1/13	**2/1/13**	**Delayed 25%**

EXHIBIT A, ATTACHMENT A-2
CONTENT AND FORMAT OF PROGRESS REPORTS – RECOMMENDED



Overall schedule for the _____ project.
[Planned is solid blue, actual is red striped. This work flow diagram needs to correlate with the schedule in Exhibit A. This example has been prepared as a Word Picture, but a comparable Excel diagram or Gantt chart is fine.]

Overview of Fiscal Status: (See invoices for detail.)
[It is useful to track the rate of expenditure of project funds. The most useful way to do this is to compare the actual expenditure rate with the planned expenditure rate. You get the planned rate at the beginning of the project, so it becomes a baseline. If you change course at a critical project review, you should show the original and the modified baseline, and then track against the new one.]

Photographs:
Include photographs where appropriate to document progress. The photos shall be shot with color print film or be very high quality digital photos (at least 300 dpi).

Evidence of Progress:
If there is a long time between interim deliverables, then attach evidence of the progress being made (e.g., test data, product mock-ups, field site descriptions, preliminary analyses) to the progress reports to allow the Commission Contract Manager to review contract progress and gauge the quality of research results.

Notes:
The tracking for tasks and money is generally done at the major task level, but this depends on the project and fiscal controls.

Notice that there is no technical detail in these reports. This should come in specific deliverables so that critical project management information does not get lost. If the contractor is reporting monthly, but submitting invoices quarterly, then use the three monthly reports as an equivalent quarterly report. Do not make them write another report just to get paid.

The progress report on each project should be 1-2 pages long (plus photographs) and take about 1 hour to prepare for each reporting period.

Exhibit A Attachment A-3
Resumes

Vincent G. McDonell
Adjunct Professor of Mechanical and Aerospace Engineering
University of California
Irvine CA 92697-3550
949 824 5950x11121, mcdonell@ucicl.uci.edu

Education and Training

Ph.D. in Mechanical Engineering, University of California, Irvine	1990
M.S. in Mechanical Engineering, University of California, Irvine	1987
B.S. in Engineering, University of California, Irvine	1985

Research and Professional Experience

- Department of Mechanical and Aerospace Engineering, University of California, Irvine
  7/08 *Adjunct Professor*
  8/04-6/08 *Adjunct Associate Professor*
- Advanced Power and Energy Program, University of California, Irvine
  10/99 *Associate Director*
- UCI Combustion Laboratory, University of California, Irvine
  7/95 *Associate Director*
- Pacific Region Clean Energy Application Center
  11/05-9/13 *Co-Director and Southern California Office Lead*
- Wright Patterson Air Force Base, Ohio
  1/88-7/90 *Laboratory Research Fellow*
- Imperial College of Science and Technology, London, UK
  6/87-9/87 *Visiting Researcher*

Research Interests

Gas turbine combustion, Industrial combustion, Alternative gaseous fuels, Alternative Liquid Fuels, Sprays, Experimental Methods and Diagnostics, Fuel Injector Design, Low Emission combustion systems, Applied Modeling, Statistical Based Experimental Design, Combined Heat and Power Systems, Distributed Generation, Oil-in-Water Emulsions, Combustion/Materials Interaction

Technical Society Service

• ILASS-Americas, Member at Large	2004-2008
• ILASS-Americas, Executive Board	2008-present
• Western States Section, Combustion Institute, Member at Large	2000-2003, 2011-present
• Western States Section, Combustion Institute, Information Chair	2004-2010
• ASME IGTI, Combustion and Fuels Technical Committee	2000-present

RESOLUTION NO: 14-0115-8

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, IRVINE

RESOLVED, that the State Energy Resources Conservation and Development Commission (Energy Commission) approves Agreement 500-13-004 with **The Regents of the University of California, Irvine Campus**, for a **$100,000 contract** to verify and test the modeling methodologies developed under Energy Commission Contract 500-08-034, an agreement to estimate the impact of fuel composition on the stability and pollutant emissions of combustion systems operated on biogas resources.

FURTHER BE IT RESOLVED, that this document authorizes the Executive Director to 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 January 15, 2014.

AYE: [List of Commissioners]
NAY: [List of Commissioners]
ABSENT: [List of Commissioners]
ABSTAIN: [List of Commissioners]

Harriet Kallemeyn,
Secretariat