

CONTRACT REQUESTS FORM (CRF)

CEC-94 (Revised 5/11)

CALIFORNIA ENERGY COMMISSION


 New Contract 500-11-026 Amendment to Existing Contract: _____ Amendment Number: _____

Division	Contract Manager:	MS-	Phone	CM Training Date
Energy Research and Development	Marla Mueller	43	916-327-1716	8/19/2002

Contractor's Legal Name	Federal ID Number
The Regents of the University of California on behalf of the Merced campus	27-0093858

Title of Project
Impact of Plasma-assisted Biomass Gasification and Power Generation on Air Quality

Term	Start Date	End Date	Amount
New/Original Contract	6/29/2012	3/30/2015	\$ 258,383

Line up the Amendment information as best as possible within the following table.

Amendment #	End Date (mm/dd/yy)	Amount

Business Meeting Information

Proposed Business Meeting Date	6/13/2012	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Marla Mueller	Time Needed:	5 minutes

Agenda Item Subject and Description [This agenda item should be sent to the Research List Serve (Energy RD&D/PIER program)]

Possible approval of Contract 500-11-026 for \$258,383.00 with the Regents of the University of California on behalf of the Merced campus to determine the type and amount of air pollutants formed during combustion of synthesis gas generated from a plasma-assisted biomass gasification process. The project will also study the economic implications and challenges of using such technology to produce heat and power including the cost benefits of reducing pollutants in non-attainment areas such as California's Central Valley. This project includes \$50,000 cost share from Foret Plasma Labs. (PIER electricity funding.) Contact: Marla Mueller. (5 minutes)

Business Meeting approval is not required for the following types of contracts: *Executive Director's signature is required in all cases.*

- Contracts less than \$10k (*Policy Committee's signature is also required*)
- Amendment for a no-cost time extension. Must be first extension, less than one year and original contract less than \$100k.
- Contracts less than \$25k for Expert Witness in Energy Facility licensing cases and amendments.

Purpose of Contract or Purpose of Amendment, if applicable

This project will determine the type and amount of air pollutants formed during combustion of synthesis gas (syngas) generated from a plasma-assisted biomass gasification process. The project will also study the economic implications and challenges of using such technology to produce heat and power including the cost benefits of reducing pollutants in non-attainment areas such as California's Central Valley.

California Environmental Quality Act (CEQA) Compliance

1. Is Contract considered a "Project" under CEQA?
 Yes: skip to question 2 No: complete the following (PRC 21065 and 14 CCR 15378):
 Explain why contract is not considered a "Project":
 Contract will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because it involves laboratory testing to obtain data and modeling information on the formation and release of air pollutants during the formation of synthesis gas and during combustion of synthesis gas generated from plasma-assisted biomass gasification.
2. If contract is considered a "Project" under CEQA:
 a) Contract **IS** exempt. (Draft NOE required)
 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 contract is exempt under the above section: _____
- b) Contract **IS NOT** exempt. The Contract Manager needs to consult with the Energy Commission attorney assigned to their division and the Siting Office regarding a possible Initial Study.

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CALIFORNIA ENERGY COMMISSION



Budgets Information								
Contract Amount Funded		Breakdown by FY			Funding Sources			
Funding Source	Amount	FY	Amount	Approved?	Funding Source	FY	Budget List No.	Amount
ARFVTF	\$	11-12	\$258,383	Yes	PIER-E	11-12	501.027J	\$258,383
ECAA	\$		\$					\$
State- ERPA	\$		\$					\$
Federal	\$		\$					\$
PIER - E	\$258,383		\$					\$
PIER - NG	\$		\$					\$
Reimbursement	\$		\$					\$
Other	\$		\$					\$
TOTAL:	\$258,383	TOTAL:	\$258,383		TOTAL:			\$258,383
Reimbursement Contract #:					Federal Agreement			

Contractor's Administrator/ Officer		Contractor's Project Manager	
Name:	Wendy Ewald	Name:	Thea Vicari
Address:	5200 N Lake Rd 5200 N. Lake Road	Address:	P O Box 2039
City, State, Zip:	Merced, CA 95343-5001	City, State, Zip:	Merced, CA 95344-0039
Phone/ Fax:	209-228-4023 / 209-228-4047	Phone/ Fax:	209-724-4318 / 209-724-2912
E-Mail:	wewald@ucmerced.edu	E-Mail:	tvicari@ucmerced.edu

Contractor Is
<input type="checkbox"/> Private Company (including non-profits) <input checked="" type="checkbox"/> CA State Agency (including UC and CSU) <input type="checkbox"/> Government Entity (i.e. city, county, federal government, air/water/school district, joint power authorities, university from another state)

Selection Process Used
<input type="checkbox"/> Solicitation <u>Select Type</u> Solicitation #: _____ # of Bids: _____ Low Bid? <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Non Competitive Bid (Attach CEC 96) <input checked="" type="checkbox"/> Exempt Interagency

Civil Service Considerations
<input checked="" type="checkbox"/> Not Applicable (Contract is with a CA State Entity or a membership/co-sponsorship) <input type="checkbox"/> Public Resources Code 25620, et seq., authorizes the Commission to contract for the subject work. (PIER) <input type="checkbox"/> The Services Contracted: <input type="checkbox"/> are not available within civil service <input type="checkbox"/> cannot be performed satisfactorily by civil service employees <input type="checkbox"/> are of such a highly specialized or technical nature that the expert knowledge, expertise, and ability are not available through the civil service system. <input type="checkbox"/> The Services are of such an: <input type="checkbox"/> urgent <input type="checkbox"/> temporary, or <input type="checkbox"/> occasional nature that the delay to implement under civil service would frustrate their very purpose. Justification: Contract is with a UC.

Payment Method
<input checked="" type="checkbox"/> A. Reimbursement in arrears based on: <input type="checkbox"/> Itemized Monthly <input checked="" type="checkbox"/> Itemized Quarterly <input type="checkbox"/> Flat Rate <input type="checkbox"/> One-time <input type="checkbox"/> B. Advanced Payment <input type="checkbox"/> C. Other, explain:

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Retention		
1. Is contract subject to retention?	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
If Yes, Do you plan to release retention prior to contract termination?	<input type="checkbox"/> No	<input type="checkbox"/> Yes

Justification of Rates	
The contract rates are consistent with going rates in industry and academia, as well as with the rates negotiated for Energy Commission/UC interagency agreements.	

Disabled Veteran Business Enterprise Program (DVBE)	
1. <input checked="" type="checkbox"/> Not Applicable	
2. <input type="checkbox"/> Meets DVBE Requirements	DVBE Amount:\$ _____ DVBE %: _____
<input type="checkbox"/> Contractor is Certified DVBE	
<input type="checkbox"/> Contractor is Subcontracting with a DVBE:	_____
3. <input type="checkbox"/> Requesting DVBE Exemption (attach CEC 95)	

Is Contractor a certified Small Business (SB), Micro Business (MB) or DVBE?		<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
If yes, check appropriate box:		<input type="checkbox"/> SB	<input type="checkbox"/> MB <input type="checkbox"/> DVBE

Is Contractor subcontracting any services?		<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes
If yes, give company name and identify if they are a Small Business (SB), Micro Business (MB) and/or DVBE:			
Foret Plasma Labs		<input checked="" type="checkbox"/> No	<input type="checkbox"/> SB <input type="checkbox"/> MB <input type="checkbox"/> DVBE

Miscellaneous Contract Information		
1. Will there be Work Authorizations?	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
2. Is the Contractor providing confidential information?	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
3. Is the contractor going to purchase equipment?	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes
4. Check frequency of progress reports	<input type="checkbox"/> Monthly <input checked="" type="checkbox"/> Quarterly <input type="checkbox"/> _____	
5. Will a final report be required?	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes
6. Is the contract, with amendments, longer than a year? If yes, why?	<input type="checkbox"/> No	<input checked="" type="checkbox"/> 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.		

The following items should be attached to this CRF		
1. Scope of Work, Attach as Exhibit A.	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached
2. Budget Detail, Attach as Exhibit B.	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached
3. CEC 96, NCB Request	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached
4. CEC 30, Survey of Prior Work	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached
5. CEC 95, DVBE Exemption Request	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached
6. Draft CEQA Notice of Exemption (NOE)	<input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Attached
7. Resumes	<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Attached
8. CEC 105, Questionnaire for Identifying Conflicts		<input checked="" type="checkbox"/> Attached

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Contract Manager Date Office Manager Date Deputy Director Date

The following signatures are only required when contract approval is delegated to the Executive Office and not approved at a Business Meeting.
See Business Meeting Information Section.

Presiding Policy Committee Date Associate Policy Committee Date Executive Director Date

Exhibit A SCOPE OF WORK

TECHNICAL TASK LIST

Task #	CPR/	Task Name
1	N/A	Administration
2		Equipment Modification/Installation
3		Air Quality and Pollutant Measurements
4		Economic and Air Pollution Benefits Analysis
5		Technology Transfer Activities

KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	Gerardo Diaz, University of California, Merced (UCM)		
2	Gerardo Diaz, UCM	Foret Plasma Labs	
3	Gerardo Diaz, UCM Wolfgang Rogge, UCM		
4	Yishu Chen, UCM		
5	Gerardo Diaz, UCM Wolfgang Rogge, UCM Yishu Chen, UCM		

GLOSSARY

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

Acronym	Definition
CH ₄	methane
CO	carbon monoxide
CO ₂	carbon dioxide
CPR	Critical Project Review
Energy Commission	California Energy Commission
EPA	United States Environmental Protection Agency
FPL	Foret Plasma Labs
H ₂	hydrogen
MSW	municipal solid waste
NMHC	total non-methane hydrocarbons
NO	nitric oxide
NO ₂	nitrogen dioxide
NO _x	oxides of nitrogen

Acronym	Definition
O ₂	oxygen
PAC	Project Advisory Committee
PAH	polycyclic aromatic hydrocarbon
PIER	Public Interest Energy Research
Syngas	Synthesis gas
THC	total hydrocarbons
UCC.1	Uniform Commercial Code (Financing Statement)
UCM	University of California, Merced

Problem Statement

Biomass is usually considered garbage obtained from a variety of sources including dead trees, yard clippings, orchard prunings, left-over crops, wood, bark, sawdust, and even livestock manure. According to a recent study, approximately thirty five million bone dry tons of biomass are produced in California each year. Of this, only five million tons are used for the generation of electricity. Unfortunately, a large fraction of this biomass is still burned on site in an inefficient manner, generating vast amounts of carbon dioxide (CO₂), carbon monoxide (CO), methane (CH₄), oxides of nitrogen (NO_x), sulfur compounds, and particulate matter. Due to the release of NO_x and volatile hydrocarbons during pile burning, atmospheric ozone formation is enhanced. This combustion continues to be a significant source of ozone and particulate matter pollution impacting health and social issues.

Opposite from biomass combustion, where biomass is combined with stoichiometric oxygen (O₂) to form hot combustion products, gasification involves the combination of biomass with limited amounts of O₂ with other gasifying agents such as steam, air, CO₂, etc., to generate synthesis gas (syngas). Syngas is mainly composed of a mixture of hydrogen (H₂) and CO. Depending on the amount of air added, the molar fraction of nitrogen may become significant. Biomass gasification can be performed with different technologies including up- and down-draft gasification reactors and concentrating-solar biomass gasification processes. Because syngas generation processes are still being optimized, filtering devices and scrubbers are utilized to remove tar and particulate matter and gaseous pollutants from the generated gas. Hence, syngas process optimization and reduction of pollutant formation is a key element of the proposed project.

Biomass gasification with plasma generates high quality syngas with a positive net energy balance in terms of the energy available in the syngas compared to the energy required to produce the plasma. As stated in the 2005 article "Demonstration plasma gasification/vitrification system for effective hazardous waste treatment" in the *Journal of Hazardous Materials*, "Plasma gasification technologies use an electric arc gasifier (plasma torch) to create a high-temperature ionized gas which breaks organic matter primarily into syngas and solid waste (slag) in a controlled vessel (plasma converter—either furnace or reactor)."

Incomplete gasification of organic waste leaves biochar as a residue which can increase soil fertility and transfer a large amount of CO₂ from the atmosphere into stable storage as opposed to other carbon dioxide sequestration techniques currently being pursued. The utilization of syngas to generate heat and electric power in internal combustion engines, lean/combustion turbines, and/or solid oxide fuel cells constitutes a viable way of reducing pollutant emissions with the additional benefit of increased energy conversion efficiency.

This project will acquire urgently needed scientific information related to the type and amount of air pollutants formed during combustion of syngas generated from a plasma-assisted biomass gasification process. The project will also study the economic implications and challenges of using such technology to produce heat and power, including the cost benefits of reducing pollutants in non-attainment areas such as California's Central Valley.

The project will utilize a laboratory-scale plasma gasification unit that has already been successfully tested at the Principal Investigator's laboratory at UC Merced. In addition, a lean combustion plasma turbine from Foret Plasma Labs (FPL) will be added to the existing system in order to determine the exhaust gas composition and to quantify the level of pollutants obtained for a variety of biomass types.

Goals of the Agreement

The first goal of this Agreement is to obtain urgently needed data on the formation and release of air pollutants during the formation of syngas and likewise during combustion of syngas generated from plasma-assisted biomass gasification. Obtaining quantitative pollutant data for syngas generation and syngas combustion allows for investigation of potential strategies in optimizing the biomass-energy conversion process as a function of different types of biomass available.

The second goal involves the study of the economic implications and challenges of using such technology to produce heat and power. This will also include the cost benefits of reducing pollutants in non-attainment areas such as California's Central Valley.

Objectives of the Agreement

The objectives of this Agreement are to:

- Determine combustion products and greenhouse gases, including O₂, CO, CO₂, total hydrocarbons (THC) and total non-methane hydrocarbons (NMHC), nitric oxide (NO), nitrogen dioxide (NO₂), and particulate matter from plasma assisted steam reforming of biomass.
- Correlate combustion products and pollutants to measurements of syngas composition H₂, O₂, CO, CO₂, nitrogen and CH₄.
- Collect particulate matter from the combustion exhaust and analyze for the presence of polycyclic aromatic hydrocarbons (PAHs).
- Demonstrate operation of a plasma turbine for lean combustion of syngas generated from 10 types of biomass feedstock (almond shells, almond hulls,

- Use the combustion parameter and pollutant data obtained to suggest modification to the syngas generation process with the aim of reducing pollutant formation by 10 percent with respect to biomass incineration.
- Study economic and air quality impact of this technology.

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 (CCM), 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)

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

Contractor Deliverables:

- An Updated Schedule of Deliverables
- An Updated Gantt Chart (if included)

- An Updated List of Match Funds
- An Updated List of Permits

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

- 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 Equipment Modification/Installation

The goal of this task is to complete the necessary modifications to the existing plasma unit and to install a lean-combustion plasma turbine to run the proposed tests. The plasma unit consists of a reactor that utilizes carbon rods as the electrode and an auger for the biomass feeding system. It uses steam, generated in a glow discharge reactor, as the gasifying agent and a solution of sodium bicarbonate in water as the electrolyte to produce syngas. A FPL lean-combustion plasma turbine will be added to the plasma unit to produce electric power.

The Contractor shall:

- Finalize the configuration of the plasma unit to include the plasma turbine.
- Obtain the necessary parts needed to modify the existing plasma unit.
- Work with the subcontractor (FPL) to install the lean-combustion plasma turbine at the sustainable plasma gasification lab at UC Merced.
- Develop a verification test protocol to determine that the combined units operate properly and safely.
- Submit draft Verification Test Protocol to CCM and PAC for review and comment and modify plan as needed.
- Obtain CCM approval of the Verification Test Protocol. Verify that the existing plasma unit, modified with the lean-combustion plasma turbine, operates properly to perform the proposed project tests.
- Prepare a task report on the results of the verification testing.
- Include in the progress report a confirmation that the installation was completed.

Deliverables:

- Verification test protocol
- Task report on verification testing (no draft)

Task 3 Air Quality and Pollutant Measurements

The goal of this task is to measure products of combustion and air pollutants from the combustion of syngas obtained from plasma assisted gasification of biomass.

The Contractor shall:

- Identify and prepare a list of the top ten biomass wastes generated in the San Joaquin Valley and three mixes of municipal solid waste (MSW) to be tested.
- Submit the list to the CCM and PAC for review.
- Obtain CCM approval of the list.
- Obtain samples of the top ten biomass wastes and three MSW sources to test.

- Develop a Test and Monitoring Plan to determine system efficiency and emissions of combustion products, greenhouse gases and criteria pollutants, including O₂, CO, CO₂, THC and NMHC, NO, NO₂, and particulate matter from plasma assisted steam reforming of biomass and from the plasma turbine. Include collecting particulate matter from the combustion exhaust and analyzing for PAHs. Include chemical analysis of feedstock and liquid waste stream and analysis of quality of syngas.
- Submit draft Test and Monitoring Plan to CCM and PAC for review and comment and modify plan as needed.
- Identify specific instrumentation needs to measure products of combustion and criteria air pollutants and purchase and install.
- Submit final Test and Monitoring Plan to CCM for approval.
- Test operation of plasma turbine for lean combustion of syngas generated from 10 types of biomass and three MSW feedstocks and implement the final Test and Monitoring Plan.
- Analyze data from measurements and correlate combustion products, greenhouse gases and air pollutants to measurements of syngas composition.
- Use the combustion parameter and pollutant data obtained to suggest modification to the syngas generation process with the aim of reducing pollutant formation by 10 percent with respect to biomass incineration.
- Prepare a Task Report on results of the task including analyzed data, emissions impacts and suggested approaches to reduce emissions.

Deliverables:

- List of biomass wastes and MSW mixes to test
- Test and Monitoring Plan
- Task Report (no draft)

Task 4 Economic and Air Pollution Benefits Analysis

The goal of this task is to complete the economic analysis of the benefits and drawbacks of the use of plasma gasification to process biomass in California.

The Contractor shall:

- Study the costs of operating a plasma-enhanced gasification unit (inputs to the spatial-location models in next steps).
- Compile and geo-reference the central valley biomass data (inputs to the spatial location models in next steps).
- Build optimization-based spatial location models to identify the possible plasma-enhanced gasification facilities in the central valley, considering costs of transportation and other constraints.
- Collect information on the hourly electricity demand at the aggregated level in the Central Valley, which will serve as the baseline scenario.
- Examine the extent to which the load in the baseline scenario could be displaced by the energy produced by the plasma-enhanced gasification units under various assumptions concerning the size of the facilities.

- Quantify the economic costs and benefits of operating the plasma-enhance gasification unit to produce power vs. the baseline scenario.
- Quantify the amount of air pollution emission reduction using the United States Environmental Protection Agency (EPA) BenMap or other approaches (inputs to the BenMap or other approaches).
- Estimate emission and health related benefits using the EPA BenMap or other approaches.
- Prepare an Economic and Air Pollution Benefits Analysis Report to include information obtained in this task.
- Prepare a report on PAC meetings and resolution of PAC issues.

Deliverables:

- Economic and Air Pollution Benefits Analysis Report
- PAC Report

Task 5 Technology Transfer Activities

The goal of this task is to transfer the knowledge gained, experimental results and lessons learned to key policy- and decision-makers.

The Contractor shall:

- Prepare a 1-2 page summary of the project for posting on the Energy Commission website.
- Present project results at a conference.
- Prepare and submit a journal article to an appropriate peer reviewed journal.

Deliverables:

- Project summary
- Copies of conference presentation
- Copy of a journal article ready for submission to an appropriate peer reviewed journal