

GRANT REQUEST FORM (GRF)CEC-270 (Revised 10/2015)
COMMISSION

CALIFORNIA ENERGY

New Agreement PIR-18-004 (To be completed by CGL Office)

| | | | |
|------|--------------------|----|--------------|
| ERDD | Abolghasem Edalati | 43 | 916-327-1499 |
|------|--------------------|----|--------------|

| | |
|---------------|------------|
| Taylor Energy | 47-2198242 |
|---------------|------------|

| |
|------------------------------|
| Renewable Syngas Methanation |
|------------------------------|

| | | |
|-----------|-----------|--------------|
| 6/28/2019 | 3/31/2023 | \$ 1,999,695 |
|-----------|-----------|--------------|

☐ ARFVTP agreements under \$75K delegated to Executive Director.Proposed Business Meeting Date 45/15/19 ☐ Consent ☒ Discussion

Business Meeting Presenter Prab Sethi Time Needed: 5 minutes

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

Agenda Item Subject and Description

TAYLOR ENERGY. Proposed resolution approving Agreement PIR-18-004 with Taylor Energy for a \$1,999,695 grant to fund the pilot-scale demonstration of a unique pulse-detonation gasification-reforming process to convert forest biomass into synthesis gas foll

1. Is Agreement considered a "Project" under CEQA?

☒ Yes (skip to question 2)☐ No (complete the following (PRC 21065 and 14 CCR 15378)):

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, § 15301☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section:

Section 15301 Existing Facilities provides an exemption for the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing structures, facilities, mechanical equipment or topographical features involving negligible or no expansion of use beyond that existing. This project will involve operation and minor alternations to an existing biomass gasifier system at the University of California Riverside Center for Environmental Research & Technology. The facility already researches the production of biomass-derived fuel for electric generation, therefore there will be negligible to no expansion of the existing use of the facility for testing of an autothermal-gasification process designed to convert forest-biomass into pipeline-quality renewable natural gas. The research activities do not require any trenching or construction work. The materials being used are chemically inert, not hazardous to human health, and do not have a significant effect on the environment.

☐ b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)

Check all that apply

☐ Initial Study☐ Negative Declaration☐ Mitigated Negative Declaration☐ Environmental Impact Report☐ Statement of Overriding Considerations

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

| Legal Company Name: | Budget |
|--|------------|
| Tech Fab | \$ 315,486 |
| The Regents of the University of California on behalf of the Riverside | \$ 192,555 |
| Engineering Subcontractor (TBD) | \$ 20,000 |
| Tower Industrial | \$ 168024 |
| TBD #1 | \$ 26,000 |
| TBD #2 | \$ 16,000 |
| TBD #3 | \$ 8,310 |
| | \$ |

Legal Company Name:

| Funding Source | Funding Year of Appropriation | Budget List No. | Amount |
|-----------------------------------|-------------------------------|----------------------|-------------|
| NG Subaccount, PIERDD | 17-18 | 501.001L | \$1,999,695 |
| | | | \$ |
| | | | \$ |
| | | | \$ |
| R&D Program Area: | EGRO: Renewables | | \$1,999,695 |
| Explanation for "Other" selection | | | |
| Reimbursement Contract #: | | Federal Agreement #: | |

| | | | |
|-------------------|-----------------------|-------------------|-------------------------|
| Name: | Deila Taylor | Name: | Donald Taylor |
| Address: | 416 Whiting Woods Rd | Address: | 416 Whiting Woods Rd |
| City, State, Zip: | Glendale, CA 91208 | City, State, Zip: | Glendale, CA 91208 |
| Phone: | 714-309-5384 / | Fax: | - - |
| E-Mail: | deilataylor@gmail.com | E-Mail: | taylor@TaylorEnergy.org |

☒ Competitive Solicitation Solicitation #: GFO-18-501
☐ 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 type="checkbox"/> N/A <input checked="" 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 # | CPR¹ | Task Name |
|---------------|------------------------|--|
| 1 | | General Project Tasks |
| 2 | | Contract Execution |
| 3 | | Selection of Catalysts |
| 4 | | Selection of Steam-Nozzle and Burners |
| 5 | X | Evaluation of Gas Shift Reactor |
| 6 | | Slip-Stream Cryogenic Deep-Cleaning System and Methanation |
| 7 | X | Pilot-Scale Testing 500 Hours |
| 8 | | Process Evaluations |
| 9 | | Evaluation of Public Benefits |
| 10 | | Technology/Knowledge Transfer |
| 11 | | Commerical Readiness Plan and Final Report |

B. Acronym/Term List

| Acronym/Term | Meaning |
|---------------------|------------------------------|
| CAM | Commission Agreement Manager |
| CAO | Commission Agreement Officer |
| CPR | Critical Project Review |
| H ₂ | Hydrogen |
| LCO ₂ | Liquid Carbon Dioxide |
| LN ₂ | Liquid Nitrogen |
| NG | Natural Gas |
| M&V | Measurement and Verification |
| Syngas | Synthesis Gas |
| TAC | Technical Advisory Committee |

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

A. Purpose of Agreement

The purpose of this Agreement is to fund pilot-scale testing of an autothermal-gasification process designed to convert forest-biomass into pipeline-quality renewable natural gas.

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.

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Scope of Work

B. Problem/Solution Statement

Problem

Currently, 90-percent of the natural gas consumed in California is imported via pipeline from out-of-state. A large portion of readily available forest biomass could be economically converted into energy in the form of ultra-clean pipeline-quality renewable natural gas (RNG) via thermo-chemical gasification.

The process of syngas methanation is well known and is efficient, but the cost of renewable gas is higher than fossil fuel derived NG. In order to generate renewable pipeline-quality natural gas from California's abundant forest residues technology breakthroughs are needed that enable techno-economic advancements.

Solution

The research team intends to test and prove integrated systems that achieve real capital-cost savings and increase system profitability by making high-value pipeline-quality NG. This will be accomplished using pilot-scale technology designed to reduce system capital cost and improve gasification-reforming through process intensification methods that use pulse-detonation power that enables cost-effective formation of methane and coproducts.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Demonstrate a gasification-reforming technology using forest biomass to produce biofuels that are converted into renewable gases.
- Demonstrate a slip-stream with renewable gas quality that meets NG standards in applicable California IOU territory
- Evaluate four gas shift methods applied to bio-fuels.
- Develop, test, and validate a cryogenic deep-cleaning process that enables methane production.
- Develop, test, and validate a methane production process that can be scaled for commercial deployment.

Ratepayer Benefits: This Agreement will result in ratepayer benefits that include direct cost savings, economic development in rural areas, lower environmental impacts statewide, and increased energy security for all ratepayers. Economic benefits are principally intended to be lower gas utility bills for ratepayers, achieved by lowering the cost of renewable gas, which makes up a portion of California's energy mix. Environmental benefits include reduced fire risk and decreased impacts by using renewable feedstocks instead of fossil fuels; reduced health risks due to minimizing forest fires by using forest-biomass, particularly including the removal of millions of tons of dead-trees and forest-slash, to accomplish sustainable forest management practices. Security benefits include reduced reliance on pipeline-imported fossil-fuel derived gas by using local resources and local labor to produce sustainable energy infrastructure.

Technological Advancement and Breakthroughs: This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by using a first-stage jet spouted bed intended for feed comminution, drying, and devolatilization; followed by a second-stage thermal-reformer where

EXHIBIT A

Scope of Work

pyrolysis vapors are up-graded. Both stages use pulse-detonation power system to pulverize solids and increase gas/solids mixing. A gas-shift reactor will be use to increase the H₂ content.

This Agreement funds a commercialization strategy that will use state-of-the-art methane production technology. Recipient will focus on developing technology that produces synthesis gas with a 3:1 - H₂:CO ratio or otherwise optimized for methane production.

Agreement Objectives

The objectives of this Agreement are to:

- Convert pelletized forest residues into renewable NG.
- Evaluate methane production catalysts and select an optimum catalyst.
- Produce renewable gases that are suitable for production of pipeline-quality NG and test the system operation for 500 hours.
- Produce a 2.5-scfm slip-stream demonstrating pipeline-quality gas composition suitable for injection into Subcontractor's NG grid.
- Produce renewable gas with heat content between 990 – 1150 British Thermal Units per Standard Cubic Feet (BTU/scf) with low sulfur content.

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.

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For all products

- Submit all data and documents required as products in accordance with the following:

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**

- Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the Energy Commission's software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
- Text documents will be in MS Word file format, version 2007 or later.
- Documents intended for public distribution will be in PDF file format.
- The Recipient must also provide the native Microsoft file format.
- Project management documents will be in Microsoft Project file format, version 2007 or later.

- **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.

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MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

- Attend a “Kick-off” meeting with the CAM, the Commission Agreement Officer (CAO), and any other Energy Commission staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

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

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

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

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Subtask 1.3 Critical Project Review (CPR) Meetings

The goal of this subtask is to determine if the project should continue to receive Energy Commission funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the Energy Commission and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient and may include the CAO and any other individuals selected by the CAM to provide support to the Energy Commission.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

- Prepare a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- 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

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- List of Expected CPR Participants
- Schedule for Providing a Progress Determination
- Progress Determination

Subtask 1.4 Final Meeting

The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any state-owned equipment.
 - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
 - 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.

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The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions, including a financial report on Match Fund and in-state expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review the Final Report, which will be due at least **two months** before the Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use the Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM. (See Task 1.1 for requirements for draft and final products.)

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual
- Comments on Draft Final Report Outline
- Approval of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
 - Ensure that the report includes the following items, in the following order:
 - Cover page (**required**)
 - Credits page on the reverse side of cover with legal disclaimer (**required**)
 - Acknowledgements page (optional)
 - Preface (**required**)
 - Abstract, keywords, and citation page (**required**)

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Scope of Work

- Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
- Executive summary (**required**)
- Body of the report (**required**)
- References (if applicable)
- Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
- Bibliography (if applicable)
- Appendices (if applicable) (Create a separate volume if very large.)
- Attachments (if applicable)
- Ensure that the document is written in the third person.
- Ensure that the Executive Summary is understandable to the lay public.
 - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
 - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
 - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
- Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
- Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
- Include a brief description of the project results in the Abstract.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:

- Final Report (draft and final)
- Written Responses to Comments on the Draft Final Report

CAM Product:

- Written Comments on the Draft Final Report

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.

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While the costs to obtain and document match funds are not reimbursable under this Agreement, the Recipient may spend match funds for this task. The Recipient may only spend match funds during the Agreement term, either concurrently or prior to the use of Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:

- A list of the match funds that identifies:
 - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
 - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
 - If different from the solicitation application, provide a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

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

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.

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The Recipient shall:

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

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

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

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- 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*)

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TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
 - Technical area expertise;
 - Knowledge of market applications; or
 - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

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

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

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

EXHIBIT A

Scope of Work

- 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

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: CONTRACT EXECUTION

The goal of this task is to secure that all contracts and subcontracts are executed, and a detailed measurement and verification (M&V) plan is developed.

Subtask 2.1 Execution of a Contract with the Demonstration Site

The goal of this subtask is to confirm the contract with the demonstration site.

The Recipient shall:

- Confirm agreement with the selected deployment site(s) regarding the project timeline, space reserved for the project, equipment installation, permit and insurance requirements, indemnity, and the Recipient's use of support staff.
- Prepare and provide a *Site Readiness Verification Document(s)* (e.g. Copy of Contract, Lease Agreement, and/or Memorandum of Understanding).

EXHIBIT A

Scope of Work

Products:

- Site Readiness Verification Document(s).

Subtask 2.2 Execute a Measurement and Verification (M&V) Plan

The goal of this subtask is to develop a detailed M&V plan.

The Recipient shall:

- Develop a *M&V Plan* to include but not be limited to:
 - A description of the monitoring equipment and instrumentation that will be used.
 - A description of the key input parameters and output metrics that will be measured.
 - A description of the analysis methods.
 - A description of any independent, third party M&V services.
 - Plan shall incorporate fuel source as byproduct of sustainable forest management activities, as defined by the California Public Utilities Commission SB 1122 BioMAT program.²

Products:

M&V Plan (draft and final)

TASK 3: SELECTION OF CATALYSTS

The goal of this task is to identify, design and procure the catalysts used for methane production.

The Recipient shall:

- Design a syngas methanation catalyst based on prior knowledge and literature data including the active metal and support options, active metal loading, synthesis procedures and recommended operating parameters.
- Collaborate with the catalyst supplier to synthesize, test and optimize the catalyst to produce a *Methanation Catalyst Design Report* that includes but is not limited to:
 - A description and comparison of the catalysts.
 - A discussion of the synthesis procedures and recommended operating parameters.

Products:

- Methanation Catalyst Design Report (draft and final)

TASK 4: SELECTION OF STEAM-NOZZLE AND BURNERS

The goal of this task is to design and fabricate an oxy-fuel type pulse-burner.

The Recipient shall:

- Specify and fabricate the nozzle for the pulse burner.
- Optimize small oxy/fuel pulse-detonation burner driving draft-tube circulation.

² See CPUC D14-12-081 - Decision Implementing Senate Bill 1122, Section 2.2.3 Bioenergy Using Byproducts of Sustainable Forest Management and Appendix B SB 1122 Forest Biomass – Forest Biomass Sustainability Byproduct Eligibility Form: Instructions and Worksheet. <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M143/K960/143960061.pdf>.

EXHIBIT A

Scope of Work

- Prepare *Micro-oxy/fuel Pulse-detonation Burner Fabrication Report* that includes but is not limited to:
 - A discussion on the fabrication of the oxy-fuel pulse-detonation burner.
 - A discussion on the optimization of the burner in conjunction with the draft tube.

Products:

- Micro-oxy/fuel Pulse-detonation Burner Fabrication Report (draft and final)

TASK 5: EVALUATION OF GAS SHIFT REACTOR

The goal of this task is to evaluate a gas-shift reactor and select optimum operating conditions.

The Recipient shall:

- Design-build gasifier and reformer pulse-detonation burners for oxygen/propane operation.
- Evaluate gas shift methods.
- Evaluate performance of a gas-shift reactor.
- Make system modifications as needed to integrate gasifier with operation of gas-shift reactor to produce synthesis-gases.
- Prepare *Gasifier Performance Report* that includes but is not limited to:
 - Discussion of the process to design-build gasifier and reformer pulse-detonation burners for oxygen/propane operation.
 - Evaluation of the gas-shift reactor.
 - Discussion of modifications as needed.
- Prepare a *CPR Report #1* in accordance with subtask 1.3 (CPR Meetings).
- Participate in CPR meeting #1.

Products:

- Gasifier Performance Report (draft and final)
- CPR Report #1

TASK 6: SLIP-STREAM CRYOGENIC DEEP-CLEANING AND METHANATION

The goal of this task is to develop and evaluate a cryogenic syngas purification system and to develop and evaluate a methane production system.

SUBTASK 6.1 Slip-Stream Cryogenic Deep-Cleaning System

The goal of this task is to develop a cryogenic syngas purification system.

The Recipient shall:

- Develop a cryogenic syngas purification system.
- Design a liquid carbon dioxide (LCO₂) scrubbing system.
- Modify as needed to achieve syngas purification.
- Operate to produce ultra-clean syngas to make 2.5-scfm RG.
- Prepare *Cryogenic Syngas Purification System Report* that includes but is not limited to:
 - Design of LCO₂ scrubbing system.
 - Syngas composition and quality.

EXHIBIT A

Scope of Work

Products:

- Cryogenic Syngas Purification System Report (draft and final)

SUBTASK 6.2 Slip-Stream Methanation System

The goal of this task is to develop a methane production system.

The Recipient shall:

- Design a methane production system for the syngas up-grading process.
- Construct reactors, piping, subsystems, and controls.
- Operate to deliver >2.5-scfm pipeline quality renewable gas.
- Prepare *Methane Production System Report* that includes but is not limited:
 - Design of methane production system, including reactors, piping, subsystems and controls.
 - Renewable gas composition and quality.

Products:

- Methane Production System Report (draft and final)

TASK 7: PILOT SCALE TESTING 500 HOURS

The goal of this task is to complete 500 hours of operational testing

The Recipient shall:

- *Conduct testing of 500 hours, operating to produce >25-scfm renewable biofuels.* Operate to produce >25-scfm renewable biofuels, with >1.5 mmBTU/ hours heat output.
- Use a slip-stream to produce >2.5 scfm pipeline renewable gas.
- Collect data for 500 hours.
- Prepare *Pilot-Scale Testing Report* that includes but is not limited to:
 - Test plan for operating 500 hours
 - Test results of renewable biofuel quality
 - Slip stream results of pipeline renewable gas quality
- Prepare a *CPR Report #2* in accordance with subtask 1.3 (CPR Meetings).
- Participate in CPR meeting #2.

Products:

- Pilot-Scale Testing Report (*draft and final*)
- CPR Report #2

TASK 8: PROCESS EVALUATIONS

The goal of this task is to evaluate the process and produce a *Mass and Energy Balance*, *Sustainability Report*, and economic analysis for scale-up projections.

The Recipient shall:

- Perform material and energy balances, life cycle, and economic analysis that result in minimal carbon intensity of products.
 - Prepare *Life Cycle Analysis Report* including: 1) total and fossil energy used per unit of energy produced and per mile driven; 2) green-house gas emissions; and 3) criteria and toxic pollutant emissions.

EXHIBIT A

Scope of Work

- Evaluate material and energy balances using a process simulation model, such as Aspen Plus, and prepare *Mass and Energy Balance Report* that includes but is not limited to:
 - A material balance report showing quantitative information by applying the laws of physics to process flow of material.
 - Account for conservation of mass and energy.
- Prepare an *Economic Analysis Report* that includes but is not limited to:
 - Scale-up projections
- Conduct LCA of the components and the integrated process using the CA-GREET model under the International Organization for Standardization (ISO) framework of definitions as an attributional LCA.
- Prepare *Process Evaluation Report* to include Life Cycle Analysis Report, Mass and Energy Balance Report and Economic Analysis Report

Products:

- Process Evaluation Report (draft and final)

TASK 9: EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including: targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
 - For Product Development Projects and Project Demonstrations:
 - Published documents, including date, title, and periodical name.
 - Estimated or actual energy and cost savings and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
 - Greenhouse gas and criteria emissions reductions.
 - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
 - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
 - A discussion of project product downloads from websites, and publications in technical journals.
 - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
 - Additional Information for Product Development Projects:
 - Outcome of product development efforts, such copyrights and license agreements.
 - Units sold or projected to be sold in California and outside of California.

EXHIBIT A

Scope of Work

- 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 10: TECHNOLOGY/KNOWLEDGE TRANSFER

The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

The Recipient shall:

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:

EXHIBIT A

Scope of Work

- 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)

TASK 11: PRODUCTION READINESS PLAN

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
 - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
 - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
 - The estimated cost of production.
 - The expected investment threshold needed to launch the commercial product.
 - An implementation plan to ramp up to full production.

EXHIBIT A

Scope of Work

- The outcome of product development efforts, such as copyrights and license agreements.
- Patent numbers and applications, along with dates and brief descriptions.
- Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: TAYLOR ENERGY

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-18-004 from GFO-18-501 with Taylor Energy for a \$1,999,695 grant to fund the pilot-scale demonstration of a unique pulse-detonation gasification-reforming process to convert forest biomass into high quality renewable gas; 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 May 15, 2019.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat