

GRANT REQUEST FORM (GRF)New Agreement EPC-14-030 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Prab Sethi	43	916-327-1302

Recipient's Legal Name	Federal ID Number
Lawrence Berkeley National Laboratory	94-2951741

Title of Project
Paths to Sustainable Distributed Generation Through 2050: Matching Local Waste Biomass Resources with Grid,

Term and Amount	Start Date	End Date	Amount
	4/15/2015	3/31/2019	\$ 1,500,000

Business Meeting Information
 ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	3/11/2015	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Prab Sethi	Time Needed:	10 minutes

Please select one list serve. Select

Agenda Item Subject and Description

Lawrence Berkeley National Laboratory. Proposed resolution approving Agreement EPC-14-030 with Lawrence Berkeley National Laboratory for a \$1,500,000 grant to perform analytical research to match locally available waste biomass resources in California with grid, industrial, building power, and waste heat needs. (EPIC funding) Contact: Prab Sethi. (Staff presentation: 10 minutes)

California Environmental Quality Act (CEQA) Compliance

- Is Agreement considered a "Project" under CEQA?
 - Yes (skip to question 2) No (complete the following (PRC 21065 and 14 CCR 15378)):
 - Explain why Agreement is not considered a "Project":
 - Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because
- 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: 14 CCR 15306
 - Common Sense Exemption. 14 CCR 15061 (b) (3)
 - Explain reason why Agreement is exempt under the above section:
 - Class 6 - Basic data collection, research, experimental management, and resource evaluation activities that do not result in major disturbances to an environmental resource.
 - b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
 - Check all that apply

<input type="checkbox"/> Initial Study	<input type="checkbox"/> Environmental Impact Report
<input type="checkbox"/> Negative Declaration	<input type="checkbox"/> Statement of Overriding Considerations
<input type="checkbox"/> Mitigated Negative Declaration	

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

Legal Company Name:	Budget
N/A	\$

Exhibit A Scope of Work

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Waste Biomass Supply Inventory
3		Distributed Generation and Thermal Energy Demand Inventory
4	X	Densification, Logistics, and Power Generation Options Assessment
5	X	Life-cycle Cost and Environmental Assessment, Feasibility, and Regulatory Compliance
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CAP	Criteria Air Pollutant
CBC	California Biomass Collective
CCHP	Combined Cooling, Heat, and Power
CHP	Combined Heat and Power
CPR	Critical Project Review
DG	Distributed Generation
GHG	Greenhouse Gas
RPS	Renewable Portfolio Standard
TAC	Technical Advisory Committee

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

A. Purpose of Agreement

The purpose of this Agreement is to fund analytical research to match locally available waste biomass resources in California with grid, industrial, building power, and waste heat needs. This modeling effort will highlight locations where waste biomass can be used most efficiently and sustainably for distributed generation.

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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B. Problem/ Solution Statement

Problem

Distributed generation (DG) can offer an array of benefits to California, such as reduced transmission losses, improved grid reliability and resiliency, reduced need for transmission and distribution investments, and the potential for cogeneration. California has an ambitious goal: 12 gigawatts of DG by 2020 required by Governor Brown's Clean Energy Jobs Plan. Previous studies indicate that California produces more than 50 million dry tons of waste biomass per year. The state's waste biomass, which is often limited in its usefulness by the expense of collection and long-distance transportation to centralized process/combustion facilities, may therefore be an ideal match for smaller decentralized electricity generation (< 20 megawatts). Using waste biomass will also help the state meet its Renewable Portfolio Standard (RPS).

However, there is a disconnect between studies that develop waste biomass utilization strategies and studies focused on identifying opportunities for DG, and specifically combined heat and power (CHP) or combined cooling, heat, and power (CCHP). No previous research has attempted to match local waste biomass sources in California with the variety of available conversion/power generation technologies and local demand for DG and waste heat applications to identify opportunities for efficient, cost-effective, and environmentally sustainable projects. This is because such an effort is highly interdisciplinary, and presents challenges in cross-discipline coordination that few institutions other than Lawrence Berkeley National Laboratory are able to tackle. Although challenging, the benefits of such an approach could be substantial. Combining waste biomass supply, heating/cooling and power demand, and conversion/generation technologies in one study will reveal specific opportunities and broad strategies for increased waste biomass utilization and improved efficiency likely not identified in previous studies.

Solution

The proposed project is an interdisciplinary effort that brings together experts in biomass resource management and logistics, conversion/power generation technologies, building and industrial energy use, and air quality to develop a roadmap for sustainable, maximally efficient, and cost-effective utilization of waste biomass for DG in California. This project's overall goals are to develop scenarios through 2050 that identify the most promising opportunities for waste biomass-fired DG, identify key technical and regulatory hurdles to waste biomass DG, and suggest solutions for achieving cost parity with fossil fuels.

This unique combination of resources assessment and needs assessment will highlight "low-hanging fruit" DG projects and approaches that would not otherwise be obvious. This project will also provide an entirely new analytical framework by which biomass DG projects and broad strategies can be evaluated. Incorporating the geospatial variation in grid benefits of DG, waste biomass resources, and local demand for heat, cooling, and power will result in a more holistic set of metrics by which potential projects can be evaluated. The assessment of life-cycle costs, water impacts, human health impacts, and regulatory hurdles will ensure that our scenarios account for all dimensions of economic and environmental sustainability.

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C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Identify areas within California where the quantity and type of locally available biomass makes utilization for power generation attractive.
- Quantify the geographic variation in the relative costs and benefits of DG across California.
- Determine the environmental and economic trade-offs associated with constructing waste biomass DG facilities in various localities throughout California.
- Provide a roadmap for waste biomass utilization in DG through 2050, characterizing potential locations, conversion/generation technologies, and feedstock types based on their economic feasibility and sustainability.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety by providing valuable insight for policy makers, utilities, and private companies to help them identify and locate California's greatest opportunities for cost-competitive and sustainable utilization of waste biomass for DG. The incorporation of waste heat for cooling in particular may have substantial long-term benefits for the grid in areas where waste biomass (crop residues and food processing waste in the Central Valley, for example) aligns with large summer peak demand for air conditioning. The project team also plans to account for expected long- and short-term variations in waste biomass availability, as well as the potential for fuel switching, to ensure sufficient power supply and consistent costs. By matching waste biomass resources with conversion/generation technologies and utility, industrial, commercial, and residential needs, we can help policy makers, utilities, and private companies set their priorities for future research, development, and deployment funding. The ultimate result will be a more resilient grid, reduced investments in transmission infrastructure, and reduced fossil carbon emissions.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and breakthroughs that overcome barriers to the achievement of California's statutory energy goals by identifying the most promising opportunities for efficient utilization of waste biomass to meet grid, industrial, commercial, and residential power, heating, and cooling needs. The unique combination of resources assessment and needs assessment will highlight "low-hanging fruit" DG projects that would not otherwise be obvious. This project will also provide an entirely new analytical framework by which biomass DG projects can be evaluated. Incorporating the geospatial variation in grid benefits of DG, waste biomass resources, and local demand for heat, cooling, and power will result in a more holistic set of metrics by which

² California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).

³ California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

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potential projects can be evaluated. The assessment of life-cycle costs, water impacts, human health impacts, and regulatory hurdles will ensure that our scenarios account for all dimensions of economic and environmental sustainability.

The framework will enable additional waste biomass to be utilized for DG beyond what would otherwise be used, those projects will ultimately be more efficient, and the negative environmental externalities can be minimized. By facilitating this increase in California's total DG capacity, the project will help California meet its RPS and Governor Brown's Clean Energy Jobs Plan.

Agreement Objectives

The objectives of this Agreement are to:

- Develop a detailed, geospatially disaggregated inventory of available waste biomass, each potential feedstock's basic components (moisture content, sugar, starch, lignin, cellulose, hemicellulose, and other trace elements or contaminants), and properties as relevant to its use for power generation.
- Extend biomass availability projections through 2050, including the potential impacts of climate, water availability, urbanization, and population on available waste biomass.
- Develop a detailed, geospatially disaggregated inventory of power demand, heat demand for industrial, commercial, and residential applications, and power demand for cooling.
- Identify key distribution system parameters and other factors that affect the attractiveness of DG and, where possible, use these parameters to prioritize lower-cost areas in California.
- Match each major feedstock type with one or more technologies for densification, pre-processing, and power generation based on their relative efficiencies, costs, and emissions.
- Establish candidate sites based on DG feasibility/attractiveness, and potential for cogeneration, and use those candidate sites to complete a transportation optimization analysis with biomass transportation and storage constraints.
- Conduct an assessment of the life-cycle costs, water impacts, greenhouse gas (GHG) emissions, and human health impacts from air emissions for this project's waste biomass DG build-out scenarios.
- Identify key regulatory and technical hurdles likely to arise in this project's waste biomass DG scenarios.
- Deliver a useful model for evaluating the environmental and economic costs and benefits of waste biomass DG projects and strategies, along with documentation in technical reports.

II. 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

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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

- 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.
- Submit the final product to the CAM once agreement has been reached on the draft. The CAM will provide written approval of the final product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- If the CAM determines that the final product does not sufficiently incorporate his/her comments, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

For products that require a final version only

- Submit the product to the CAM for approval.
- If the CAM determines that the product requires revision, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

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**

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Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up). Recommend 2010.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
- Microsoft SQL Reporting Services. Recommend 2008 R2.
- XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the Energy Commission's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

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

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

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;

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

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

- Prepare a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- 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.

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The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

- CPR Report(s)
- Task Products (draft and/or final as specified in the task)

CAM Products:

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

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).

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- Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
-
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
 - Prepare a *Schedule for Completing Agreement Closeout Activities*.
 - Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary (*if applicable*)
- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a quarterly *Progress Report* to the CAM. Each progress report must:
 - Summarize all Agreement activities conducted by the Recipient for the preceding month, including 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.
 - Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions. In addition, each invoice must document and verify:
 - Energy Commission funds received by California-based entities;
 - Energy Commission funds spent in California (*if applicable*); and
 - Match fund 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 and approve the Final Report, which will be due at least **two months** before the

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Agreement end date. When creating the Final Report Outline and the Final Report, the Recipient must use a 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.
- Submit a draft of the outline to the CAM for review and comment.
- Once agreement has been reached on the draft, submit the final outline to the CAM. The CAM will provide written approval of the final outline within 10 days of receipt.

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 and the Style Manual provided by the CAM.
- Submit a draft of the report to the CAM for review and comment. Once agreement on the draft report has been reached, the CAM will forward the electronic version for Energy Commission internal approval. Once the CAM receives approval, he/she will provide written approval to the Recipient.
- Submit one bound copy of the Final Report to the CAM.

Recipient Products:

- Final Report (draft and final)

CAM Product:

- Comments on Draft Final Report Outline

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

The goal of this subtask is to ensure that the Recipient obtains any match funds planned for this Agreement and applies them to the Agreement during the Agreement term.

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

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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.
- A copy of 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. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

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

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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*)

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:

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- 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
- 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.

Exhibit A

Scope of Work

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

Products:

- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

Exhibit A Scope of Work

III. TECHNICAL TASKS

TASK 2 Waste Biomass Supply Inventory

The goal of this task is to develop robust near-term (2020) and long-term (2050) scenario projections for waste biomass supply in California.

The Recipient shall:

- Critically review all prior assessments and projections of California waste biomass potential, with particular emphasis on:
 - Agricultural residue biomass, including by-products from orchards, vineyards, crop fields, and animal manures.
 - Food processing residues, which are the various by-products from primary and secondary processing of agricultural products.
 - Municipal wastes, including the biomass fraction of municipal solid waste (MSW), paper products, food wastes, yard wastes, and biosolids from waste water treatment operations.
 - The following specific reports:
 - California Energy Commission (Energy Commission) report produced by the University of California (UC) Davis' California Biomass Collective (CBC) (Amón, Jenner et al. 2011)
 - *U.S. Billion-Ton Update*, published by the U.S. Department of Agriculture (USDA) and U.S. Geological Survey (USGS)
 - Energy Commission report from the CBC (Kaffka, Jenner et al. 2012)
- Acquire additional biomass resource data where necessary, or develop methods for disaggregating raw data that are not at sufficient resolution for analysis.
- Categorize waste biomass data based on key properties such as moisture content; fractional breakdown of components including sugars, starches, cellulose, hemicellulose, lignin, incombustible minerals, and other elements/compounds; and level of non-organic contamination.
- Identify and quantify key drivers of biomass waste supply, and harmonize differences between previous studies. Drivers may include economic, technical, environmental, demographic, and sociological factors. Gaps in existing knowledge will be identified.
- Create a set of scenarios for future biomass supply potential in California, including detailed scenarios for 2020 and 2050 based on anticipated future changes in key drivers identified in the previous sub-task.
- Develop a series of spatially explicit scenario projections of California biomass waste streams through 2050, incorporating quantities, costs, and the unique chemical and physical characteristics of each biomass waste stream.
- Prepare a *Waste Biomass Supply Inventory Report*. This report shall include the categorized waste resource data, key drivers, gaps and scenario projections.

Products:

- Waste Biomass Supply Inventory Report (draft and final)

Exhibit A Scope of Work

TASK 3 Distributed Generation and Thermal Energy Demand Inventory

The goal of this task is to identify the scope and scale for sale of waste heat and waste heat-generated cooling to customers in the domestic, commercial, and industrial process markets. The analysis will pinpoint locations where biomass-fueled DG may have the greatest potential to achieve cost parity with fossil-fueled DG, through sale of heat and waste-heat derived cooling.

The Recipient shall:

- Estimate census tract or higher-resolution heating and cooling demand in the short and long-term (2020 and 2050) for California.
- Identify factors such as housing density, grid characteristics, and heating/cooling/power demand that impact the attractiveness of DG. This will include large commercial buildings market sub-sector, industrial process heat consumers, proposed new development zones, and multi-family residential buildings.
- Identify and map priority areas where demand-side characteristics may support cost-effective implementation of biomass-fueled cogeneration with district heating and/or cooling. Differentiate areas using a gradation between low- and high-priority. The process for evaluation includes:
 - For sites/communities with detailed heating, cooling, and power demand data, complete site-specific model to approximate contributors to overall cost and efficiency such as steam pipe lengths and sizes
 - For sites/communities with less detailed heating, cooling, and power demand data, model the potential costs based on a gridded approximation of the site/community and uniform pipe sizes
 - For sites/communities with sparse heating, cooling, and power demand data, conduct high-level modeling to determine whether specific regions are sufficiently attractive for cogeneration to warrant collection or estimation of more detailed data. Locations deemed to be too sparsely populated or otherwise not suited for cogeneration will not undergo further study.
- Calculate scenario-based energy savings from new district energy projects, differentiated by energy services (heating, cooling, high-grade [process] heat) and energy sources/fuels (e.g., electricity, natural gas)
- Estimate possible demand savings arising from distributed generation.
- Prepare a *Distributed Generation and Thermal Energy Demand Inventory Report*, including a detailed inventory of current and projected distributed generation and thermal energy needs, including a map of priority areas for implementation of district energy in California.

Products:

- Distributed Generation and Thermal Energy Demand Inventory Report (draft and final)

Exhibit A Scope of Work

TASK 4 Densification, Logistics, and Power Generation Options Assessment

The goal of this task is to identify the most appropriate densification, transportation, storage, and power generation strategies/technologies for each major type of waste biomass available in California.

The Recipient shall:

- Determine the waste biomass types available in sufficient quantities to warrant utilization for power generation based on the results from Task 2.
- Identify and evaluate relevant commercialized and pre-commercial biomass densification technologies on the basis of cost, energy-intensity, and net reduction in volume and moisture content.
- Evaluate the economic, energy, and environmental trade-offs of different conversion pathways from biomass feedstocks to heat and power. This will include:
 - Direct combustion technologies, including fixed and fluidized bed systems.
 - Biochemical and thermochemical conversion pathways to gaseous or liquid fuels useful in power generation.
 - Power generation, CHP, and CCHP technologies for gaseous and liquid fuels, including internal combustion engines, gas turbines, fuel cells, and combined-cycle systems, as well as corresponding emissions controls.
 - Any potential competing uses for waste biomass likely to prevent utilization of a given feedstock for distributed generation.
- Create biomass transportation and storage logistics scenarios to determine optimal distributed power generation facility locations and sizes based on the geospatial distribution of waste biomass resources, transportation and storage requirements for biomass inputs, and regional variations in the feasibility and benefits of DG.
- Prepare a *Densification, Logistics, and Power Generation Options Assessment Report* that incorporates the most promising technologies for densification and conversion of waste biomass to heat and power, including direct combustion, gasification, anaerobic digestion, and liquid fuel pathways.
- Build a web-based *Geospatial Tool for Optimizing Waste Biomass Utilization in Distributed Generation* that will allow California's waste biomass suppliers and potential energy producers to identify promising opportunities to link up with one another with the goal of utilizing waste biomass in distributed generation.
- Prepare a CPR Report and participate in a CPR meeting as described in Task 1.3

Products:

- Densification, Logistics, and Power Generation Options Assessment Report (draft and final)
- Web-based Geospatial Tool (draft and final)
- CPR Report

Exhibit A Scope of Work

TASK 5 Life-cycle Cost and Environmental Assessment, Feasibility, and Regulatory Compliance

The goal of this task is to quantify the life-cycle costs, GHG emissions, water use, and criteria air pollutants (CAPs) and/or their precursor emissions for each DG scenario developed in earlier tasks. The team will also identify key feasibility and regulatory issues.

The Recipient shall:

- Calculate direct and life-cycle economic costs of the DG scenarios developed in previous tasks, differentiated based on feedstock source, logistics, conversion/generation technology, and emissions controls.
- Quantify CAP emissions, resulting air quality impacts, and human health damages for DG scenarios developed in previous tasks, differentiated based on feedstock source, logistics, conversion/generation technology, and emissions controls.
 - Compile power generation emission factors (mass per energy produced) for regulated CAP and/or precursors with and without emissions controls considered in Task 4.
 - Determine emissions for other life-cycle stages, as well as the avoided emissions resulting from CHP/CCHP-related energy savings.
 - Simulate air quality impacts from the air emissions from the scenarios. Choice of the air quality models (three-dimensional, box model, or dispersion model) will be based on the type and quantity of the pollutants to maximize signal-to-noise ratio and achieve computational efficiency.
 - Apply intake fraction and health damage values to resulting changes in pollutant concentrations to determine the net impact on human health. Identify the impact on local air district attainment status.
- Calculate life-cycle GHG emissions, water consumption, and water withdrawals for the DG scenarios developed in previous tasks, accounting for differences in feedstock, logistics, conversion/generation technologies, and cooling systems. Account for alternative fates of biomass waste, such as landfilling.
- Identify key issues affecting the practical feasibility of promising DG strategies highlighted in previous tasks, and highlight regulatory issues.
- Complete a *Life-cycle Cost and Environmental Assessment, Feasibility, and Regulatory Compliance Report*, including a detailed analysis of areas where waste biomass DG is feasible/attractive in California, and its potential to increase or decrease costs and local environmental burdens
- Prepare a CPR Report and participate in a CPR meeting as described in Task 1.3

Products:

- Life-cycle Cost and Environmental Assessment, Feasibility, and Regulatory Compliance Report (draft and final)
- CPR Report

Exhibit A Scope of Work

TASK 6 Evaluation of Project Benefits

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

The Recipient shall:

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

Exhibit A Scope of Work

- The number of website downloads.
- An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
- An estimate of energy and non-energy benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

Products:

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

TASK 7 Technology/Knowledge Transfer Activities

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

The Recipient shall:

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
 - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
 - A description of the intended use(s) for and users of the project results.
 - 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 on the results of the project.

Exhibit A Scope of Work

- 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)
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: LAWRENCE BERKELEY NATIONAL LABORATORY

RESOLVED, that the State Energy Resources Conservation and Development Commission (Energy Commission) adopts the staff CEQA findings contained in the Agreement Request Form; and

RESOLVED, that the Energy Commission approves Agreement EPC-14-030 with **Department of Energy's Lawrence Berkeley National Laboratory** for a **\$1,500,000** grant to perform analytical research to match locally available waste biomass resources in California with grid, industrial, building power, and waste heat needs; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the Energy Commission.

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on March 11, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Harriet Kallemeyn,
Secretariat