

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 02/13)

CALIFORNIA ENERGY COMMISSION



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

Budget Information			
Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	14-15	301.001B	\$500,000
			\$
			\$
			\$
			\$
			\$
R&D Program Area: EGRO: EA		TOTAL:	\$500,000
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer		Recipient's Project Manager	
Name:	Betsy Quayle	Name:	Larry Dale
Address:	1 Cyclotron Rd Bldg 90R4000	Address:	1 Cyclotron Rd Bldg 90R4000
City, State, Zip:	Berkeley, CA 94720-8136	City, State, Zip:	Berkeley, CA 94720-8136
Phone:	510-486-7391 /	Fax:	- -
E-Mail:	bequayle@lbl.gov	E-Mail:	lldale@lbl.gov

Selection Process Used	
<input checked="" type="checkbox"/> Competitive Solicitation	Solicitation #: GFO-15-303
<input type="checkbox"/> First Come First Served Solicitation	

The following items should be attached to this GRF	
1. Exhibit A, Scope of Work	<input type="checkbox"/> Attached
2. Exhibit B, Budget Detail	<input type="checkbox"/> Attached
3. CEC 105, Questionnaire for Identifying Conflicts	<input type="checkbox"/> Attached
4. Recipient Resolution	<input type="checkbox"/> N/A <input type="checkbox"/> Attached
5. CEQA Documentation	<input type="checkbox"/> N/A <input type="checkbox"/> Attached

Agreement Manager _____	Date _____	Office Manager _____	Date _____	Deputy Director _____	Date _____
-------------------------	------------	----------------------	------------	-----------------------	------------

**Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory**

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR¹	Task Name
1		General Project Tasks
2		Analyze historical outage data to evaluate links between fire exposure and outages
3		Identify current T&D circuit exposure to wildfire
4		Project future T&D Locations and Loads
5		Identify future T&D circuit exposure to wildfire
6	X	Evaluate IOU transmission circuit risk and identify adaptation strategies
7		Evaluate IOU distribution circuit vulnerability and identify adaptation strategies
8		Evaluation of Project Benefits
9		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
CPUC	California Public Utilities Commission
GIS	Geographic Information System
IOU	Investor Owned Utility
SCE	Southern California Edison
SWITCH	a loose acronym for “solar, wind, conventional, and hydroelectric generation and transmission”
TAC	Technical Advisory Committee
T&D	Transmission and Distribution

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

A. Purpose of Agreement

The purpose of this Agreement is to fund an assessment of climate change and the impacts of increased wildfire risk on California’s transmission and distribution (T&D) system, and the modeling of future electricity grid adaptation strategies to minimize the costs of wildfires on the electricity grid.

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

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

B. Problem/ Solution Statement

Problem

California's electric grid is undergoing rapid transformation, due to changing resource mix (e.g., increasing renewable electricity production, more distributed energy resources) and population growth. At the same time, climate change is bringing hotter temperatures and extreme weather—increasing the number and severity of wildfires. Without adaptive planning, future wildfires have the potential to adversely affect the State's electricity grid and increase costs to California ratepayers. Advanced wildfire risk planning has never been done on a statewide scale. In part this is a data-sharing problem. The information needed for State fire risk planning is often owned by individual utilities while solutions often exist at the State and multi-State level. However, more important is the fact that wildfire risk and potential solutions are both rapidly evolving in ways that are extremely complicated to forecast. Wildfires will be evolving in response to climate and vegetation changes that are hard to predict. The transmission and distribution grid will be evolving in response to other pressures, including population growth and state's changing resource mix in the electric sector.

Solution

This study will utilize the capacity expansion model SWITCH (a loose acronym for “solar, wind, conventional, and hydroelectric generation and transmission”), updated climate projections, and updated fire projections to evaluate transmission system vulnerability under a range of potential climate scenarios. PLEXOS, a widely used model among California electric utilities, will be used selectively as needed to provide higher-resolution validation of SWITCH results. In addition to improved climate and fire projections, the study will incorporate new information from the Community Climate System Model, with the potential to provide more accurate wind projections. The work for the distribution system will be more granular (i.e., independently assessing outage risks for customers in each feeder area, based on fire damage to upstream infrastructure). The work will be informed by the load-growth projections, (e.g., identifying additional subdivisions and distribution circuits that might be built), or identifying areas where distribution system capacity may need to be expanded to serve higher loads within existing neighborhoods. The approach builds on the Recipient's experience working with Investor Owned Utilities (IOUs) on a previously-funded Energy Commission project that looked at impacts of wildfires on California's transmission system (Jayant et al. 2012, Agreement #500-99-013). The current agreement updates that research with the new generation of climate and wildfire scenarios and extends the analysis to the distribution grid. After projecting the effects of climate change and wildfires on the grid, the research team will suggest grid adaptation strategies to limit future risk.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Maintain the reliability and increase the resiliency of the electricity grid in California
- Assess future wildfire risk to the electricity grid in California
- Propose adaptation strategies to minimize wildfire risk
- Work with utilities to insure that recommended strategies are practical and have a good chance of being implemented

Exhibit A Scope of Work Lawrence Berkeley National Laboratory

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits including lower costs, greater electricity reliability, and increased safety. These benefits will be achieved by the study, which aims to come up with a set of recommendations for changes to transmission and distribution circuit design, capacity, and location to minimize the cost and disruption of future wildfire risk.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals—namely to maintain grid reliability and safety while adapting to the challenge of changing climate and wildfire risk. The Recipient will apply a unique methodology to measure wildfire risk, allowing them to match an evolving wildfire probability over time with an evolving electricity grid. The methodology will reveal grid adaptations for minimizing the risk and cost associated with future wildfires.

Agreement Objectives

The objectives of this agreement are to:

- Produce maps of future transmission and distribution circuit exposure to wildfires within IOU service territories between now and 2050.
- Quantify risk of fire damage to the electricity system under alternative future grid configurations.
- Identify and assess the benefits and costs to utilities and ratepayers of various adaptation strategies for maintaining grid reliability and safety, despite changes in climate, generation, and wildfire risk.

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.

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.

Exhibit A Scope of Work Lawrence Berkeley National Laboratory

The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products

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

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**

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

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

- 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***

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

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:

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

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

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

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

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

- Submit the CPR Report along with any other *Task Products* that correspond to the technical task for which the CPR meeting is required (i.e., if a CPR meeting is required for Task 2, submit the Task 2 products along with the CPR Report).
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

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

Recipient Products:

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

CAM Products:

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

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

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

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

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.

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

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

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
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
 - Ensure that the report includes the following items, in the following order:
 - Cover page (**required**)
 - Credits page on the reverse side of cover with legal disclaimer (**required**)
 - Acknowledgements page (optional)
 - Preface (**required**)
 - Abstract, keywords, and citation page (**required**)
 - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
 - Executive summary (**required**)
 - Body of the report (**required**)
 - References (if applicable)
 - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
 - Bibliography (if applicable)
 - Appendices (if applicable) (Create a separate volume if very large.)
 - Attachments (if applicable)
 - Ensure that the document is written in the third person.
 - Ensure that the Executive Summary is understandable to the lay public.
 - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

- 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 with comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:

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

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

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

Exhibit A Scope of Work Lawrence Berkeley National Laboratory

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, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

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

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

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:

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

- 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
Lawrence Berkeley National Laboratory

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
Lawrence Berkeley National Laboratory

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 ANALYZE HISTORICAL OUTAGE DATA TO EVALUATE LINKS BETWEEN FIRE EXPOSURE AND OUTAGES

The goal of this task is to review historical data regarding outages caused by wildfires in order to identify factors that affected the exposure and sensitivity of T&D circuits to past fires.

The Recipient shall:

- Work with Sacramento Municipal Utility District and SCE to obtain data; explore whether data is available from other investor-owned electric utilities and obtain it if it is available.
- Review and evaluate data in cooperation with electric utilities.
- Evaluate the relationship between T&D circuit exposure to wildfire and outages.
- Determine T&D sensitivity to past fires.
- Prepare and provide a *Transmission and Distribution Wildfire Exposure and Outage Report* that characterizes the relationship between T&D circuit exposure to wildfire and outages and T&D sensitivity to past fires.

Products:

- Transmission and Distribution Wildfire Exposure and Outage Report

TASK 3 IDENTIFY CURRENT T&D CIRCUIT EXPOSURE TO WILDFIRE

The goal of this task is to determine the degree to which the existing transmission grid and the existing distribution grid will be exposed to wildfire projections in the near term.

The Recipient shall:

- Assemble current geographic information system (GIS) transmission circuit data (from the Energy Commission), distribution circuit data (as available from in house utility data sets; where not available the Recipient will conduct their own analysis using online mapping tools—e.g., Microsoft Bing maps or Google Earth/Map images) and near term (2015-2020) wildfire projection data (from Leroy Westerling, UC Merced).
- Overlay these data sets using GIS to locate T&D assets exposed to near term wildfire risk.
- Prepare and provide *Current Transmission Fire Exposure Maps* indicating the current exposure of transmission assets to near term wildfire projections.
- Prepare and provide *Current Distribution Circuit Fire Exposure Maps*, assuming available data, indicating the current exposure of distribution assets to near term wildfire projections. Lacking GIS distribution data, a more qualitative fire mapping will be performed, based on available housing and other information (e.g., substation locations).

Products:

- Current Transmission Fire Exposure Maps
- Current Distribution Circuit Fire Exposure Maps

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

TASK 4 PROJECT FUTURE T&D LOCATIONS AND LOADS

The goal of this task is to determine future changes to California's T&D systems arising from climate change impacts, anticipated California energy and climate policies, and anticipated urban growth.

The Recipient shall:

- Develop gridded population-driven electricity demand maps for 2030 and 2050, using existing electricity demand estimates by SWITCH region, current population maps of the state and future population projections by county (Department of Finance, 2013).
- Obtain historical gridded ambient outdoor temperature and electricity demand from the Energy Commission or other suitable source, such as California electric utilities, and develop correlations relating elevated outdoor temperature to change in electricity demand.
- Determine change in electricity demand by overlaying population-driven electricity demand maps with maps of several climate projections from Scripps Institution of Oceanography, applying temperature-demand correlations, and aggregate into SWITCH regions.
- Update the SWITCH model to include the electricity demand projections and climate change-induced electricity-sector supply policies.
- Use the updated SWITCH model to project changes to the California transmission grid, generation and other load, for 2015-2050 under several climate projections.
- Where possible, work with the utilities to forecast changes to the larger distribution grids in the State.
- Develop and provide *Future T&D Locations and Loads Report*, including Future Transmission Line and Load Maps and Future Distribution Circuit and Load Maps.

Products:

- Future T&D Locations and Loads Report

TASK 5 IDENTIFY FUTURE T&D CIRCUIT EXPOSURE TO WILDFIRE

The goal of this task is to identify future transmission and distribution grid exposure to future wildfires.

The Recipient shall:

- Use GIS to match the location of future T&D assets with future wildfire risk projections (from Leroy Westerling, UC Merced), over the 2015-2050 period.
- Prepare and provide *2030 and 2050 Transmission Fire Exposure Maps*.
- Prepare and provide *2030 and 2050 Distribution Circuit Fire Exposure Maps*.

Products:

- 2030 and 2050 Transmission Fire Exposure Maps
- 2030 and 2050 Distribution Circuit Fire Exposure Maps

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

TASK 6 EVALUATE IOU TRANSMISSION CIRCUIT RISK AND IDENTIFY ADAPTATION STRATEGIES

One goal of this task is to create a wildfire risk metric to identify transmission assets that are particularly exposed to wildfires and particularly important for maintaining a reliable, cost effective grid. Another goal of this task is to identify wildfire adaptation strategies for maintaining grid performance under climate change conditions. The final goal of this task is to identify adaptation strategies that utilities should consider based on the results of this analysis.

The Recipient shall:

- Perform a Monte Carlo analysis across multiple SWITCH runs, taking various transmission lines and substations out of service and using SWITCH to assess the effect on electricity service and production costs (e.g., using more expensive local generation because cheaper power can no longer be imported). Make selected PLEXOS runs as needed to identify in more detail future fire-sensitive transmission segments of the grid.
- Measure the risk to the transmission segments, as a joint function of its value to the grid and its exposure to wildfire.
- Identify transmission circuit adaptation strategies for protecting high-risk transmission segments against wildfire exposure and failure and the costs to implement them.
- Prepare and provide a *Transmission Grid Wildfire Risk and Adaptation Report*, including wildfire risk maps, that identifies current and future segments at high-risk and suggests adaptation options for limiting wildfire risk for particularly high-risk transmission assets.
- Participate in CPR as detailed in task 1.3 and prepare a *CPR Report*

Products:

- Transmission Grid Wildfire Risk and Adaptation Report
- CPR Report

TASK 7 EVALUATE IOU DISTRIBUTION CIRCUIT VULNERABILITY AND IDENTIFY ADAPTATION STRATEGIES

The goals of this task are to create a wildfire sensitivity metric to identify distribution assets that are particularly sensitive to wildfires and particularly important for maintaining a reliable, cost effective grid; to map circuit vulnerability as a function of wildfire exposure and sensitivity; to identify wildfire adaptation strategies for maintaining grid performance under climate change conditions; and to identify adaptation strategies that utilities should consider based on the results of this analysis.

The Recipient shall:

- Evaluate the outage risks for customers in each distribution feeder area, based on fire damage to upstream substation paths and evaluating damage downstream
- Define a sensitivity metric, based on factors such as population served and system materials (e.g., wood poles), equipment, and age. They will consider, after accounting for network redundancy (which is part of the adaptive capacity of the system), and the number of customers and key assets (e.g., hospitals, dispatch centers) that could be affected by an outage.
- Using GIS, develop maps of vulnerability of distribution circuits as a function of wildfire exposure and circuit sensitivity.

Exhibit A

Scope of Work

Lawrence Berkeley National Laboratory

- Identify distribution adaptation strategies that will protect sensitive distribution segments against wildfire exposure and failure. Account for the reduction of costs of future wildfires in high-risk urban areas and the cost of implementation of the adaptation strategies.
- Identify additional subdivisions and distribution circuits that might be built, or identify areas where distribution capacity may need to be expanded to serve higher loads within existing neighborhoods.
- Identify additional upgrades to reduce risk, e.g., building extra distribution feeders around high-risk areas.
- Prepare *Distribution Grid Wildfire Vulnerability and Adaptation Report*, including wildfire sensitivity and vulnerability maps, that identifies current and future segments at high-risk under several climate and wildfire projections and suggests adaptation options for limiting wildfire risk in particularly vulnerable distribution assets.

Products:

- Distribution Grid Wildfire Vulnerability and Adaptation Report

TASK 8 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.

Exhibit A Scope of Work Lawrence Berkeley National Laboratory

- 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.
 - 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

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

TASK 9 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.
- 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 or Amendment Request Form (as applicable)]; and

RESOLVED, that the Energy Commission approves Agreement EPC-15-006 from GFO-15-303 with the Department of Energy's Lawrence Berkeley National Laboratory for a \$500,000 grant to identify regions of California's electricity system within IOU service territories that are vulnerable to future wildfires, to quantify probabilities and costs of wildfire damage, and to evaluate utility adaptation options; 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 October 14, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Tiffany Winter,
Secretariat