

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION



Budget Information			
Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	14-15	301.001B	\$350,000
			\$
			\$
R&D Program Area: EGRO: EA		TOTAL:	\$350,000
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer		Recipient's Project Manager	
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Selection Process Used	
<input checked="" type="checkbox"/> Competitive Solicitation	Solicitation #: GFO-15-309
<input type="checkbox"/> First Come First Served Solicitation	

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

Agreement Manager_____
Date_____
Office Manager_____
Date_____
Deputy Director_____
Date

EXHIBIT A Scope of Work

I. TASK/ACRONYM TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Risk identification Barriers and Performance
3		Risk Quantification Barriers and Performance
4	x	Adaptation Planning Under Uncertainty
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
TAC	Technical Advisory Committee

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the evaluation of the barriers for climate-change adaptation in the electricity sector via qualitative surveys presented to stakeholders as well as quantitative data and to create a stochastic dynamic programming model that will optimize adaptation strategies in conjunction with government officials and mitigation scenarios currently considered. In parallel, a metric will be developed to evaluate the performance of California's power sector in terms of adaptation to climate change over time and in comparison with other countries.

B. Problem/ Solution Statement

Problem: Adaptation to climate change has been widely recognized as a critical endeavor in society. While there is concern and interest in the subject, there is no analysis of the system wide effectiveness of current adaptation activities and the barriers faced by the stakeholders to implement those measures.

Solution: The Recipient will develop a framework to systematically identify barriers to adaptation to climate change. Potential risks resulting from climate change on the power sector will be evaluated via qualitative surveys presented to stakeholders as well as quantitative data. A stochastic dynamic programming model will be created in order to overcome barriers and

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

EXHIBIT A

Scope of Work

optimize adaptation strategies in conjunction with government officials and mitigation scenarios currently considered. In parallel, a metric will be developed to evaluate the performance of California's power sector in terms of adaptation to climate change over time and in comparison with other countries.

C. Goals and Objectives of the Agreement

Agreement Goals

The primary goal of this Agreement is to identify barriers to climate-change adaptation in the electricity sector and provide policy makers with a systematic approach to assess and optimize strategies for adaptation to climate change for California's power system. The Recipient has targeted the following goals for this Agreement:

- Develop a framework to assess climate change risk and adaptation practices in the electricity sector.
- Use climate change impact scenarios to develop risk measures applicable to the electricity sector.
- Identify barriers perceived by stakeholders for the execution of adaptation plans in the electricity sector.
- Investigate current mitigation practices and empirical know-how to develop a knowledge base of implemented policies.
- Develop a dynamic model for long-term adaptation planning capable to define optimal policies to hedge the system against risks in climate change scenarios.
- Analyze and clarify the institutional and infrastructural barriers to climate adaptation in the electricity sector.
- Cross-compare independent adaptation policies among the stakeholders with a system wide strategy to uncover possible mitigation deficits.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability and lower medium-term costs. The purpose of adaptation is to optimize the mix and ensure its resilience against the remaining impacts of climate change after mitigation strategies have been implemented. Barriers to adaptation will lead to the emergence of two types of risks in the power sector: its potential inability to meet a particular objective (e.g. supplying electricity) under a higher probability of extreme events, and/or its potential inability to maintain reasonable costs to reach this objective. The proposed project, aiming at overcoming those barriers, will help the state plan and implement optimal adaptation strategies. The future electricity system must include affordable means to fulfill its essential functions (providing electricity) in an adverse context resulting from uncertain climate change.

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 by contextualizing the state's adaptation needs, given the

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

mitigation scenarios currently under consideration. The project will result in the creation of a versatile tool that identifies and characterizes barriers to adaptation, and provide solutions and alternative pathways to overcome them.

Agreement Objectives

The objectives of this Agreement are to:

- Analyze adaptation needs in the clean energy pathways.
- Identify barriers for the elaboration and execution of adaptation plans in the electricity sector.
- Identify the effect of decision making process about risk on adaptation planning.
- Assess how market designs and regulatory policies influence power system resilience and societal risk allocation in the clean energy pathways.
- Provide detailed models to measure climate change induced risk in future electric power systems adaptation planning.
- Benchmark the effectiveness of current practices in reducing risks in the power sector.

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 IV)**. Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

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

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

EXHIBIT A

Scope of Work

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**

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

EXHIBIT A Scope of Work

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;
 - 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*)

EXHIBIT A Scope of Work

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.

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.

EXHIBIT A Scope of Work

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 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

EXHIBIT A Scope of Work

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

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.

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:

EXHIBIT A

Scope of Work

- 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.
 - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
 - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
- Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
- Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
- Include a brief description of the project results in the Abstract.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

EXHIBIT A Scope of Work

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 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.

EXHIBIT A

Scope of Work

- 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.

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.

EXHIBIT A

Scope of Work

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:

- 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;

EXHIBIT A

Scope of Work

- 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.

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

IV. TECHNICAL TASKS

*Products that require a draft version are indicated by marking “(draft and final)” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.*

TASK 2 RISK IDENTIFICATION BARRIERS AND PERFORMANCE

The goal of this task is to perform a review of the current adaptation practices for California’s power sector and barriers perceived by utilities, of the existing random process models applicable to climate change modeling

TASK 2.1 Interviews of Main Actors of California Power Sector

The Recipient shall:

- Perform open-ended interviews to utilities that will address the following questions:
 - Build a schematic process of actors and institutions/departments playing a role in the design and the implementation of adaptation strategies for the state’s power sector.
 - Inquire about modeling tools currently used by utilities to plan the long-term expansion of the power sector, and to assess its resilience to climate change.
 - Identify potential barriers or caveats to the adoption of new modeling tools by utilities.
 - Draw up a list of adaptation strategies that have already been implemented for the state’s power sector.
 - Inquire about potential barriers for adaptation strategies that have been considered but not implemented.
 - Inquire about strategies that have not been implemented nor considered (prompt with adaptation practices found in the literature).
 - Identify systematic categorization of adaptation strategies as made by interviewees.
- Prepare and provide a *Survey Report* that will include but not be limited to the responses obtained in conducted open-ended interviews (questions listed above)

Products:

- Survey Report

TASK 2.2 Simulate Future Climate Change Variability and Long-Term Electricity Planning

The Recipient shall:

- Collect publicly available climate change scenario datasets developed for the state including but not limited to The California Climate Change Center, Western Regional Climate Center and Cal-Adapt, as well as datasets for electricity sectors outside of California.
- Perform an academic and non-academic literature review of existing models for long-term planning of the power sector and climate change simulation,
- Perform an academic and non-academic literature review of random processes used to simulate the variance of future impacts of climate change.

EXHIBIT A

Scope of Work

- Identify random process models that are most suitable to grasping and quantifying the uncertainty of future impacts from climate change on the power sector, given the type of data currently available for utilities (identified in first bullet point).
- Prepare and provide a report entitled “*Random Processes Models for Quantification of Future Impacts from Climate Change*” that will summarize and interpret results from the Task 2.2.

Products:

- Random Processes Models for Quantification of Future Impacts from Climate Change

TASK 2.3 Analyze Current Practices in Climate Change Randomness Modeling in the Electricity Sector.

The Recipient shall:

- Compare long-term planning modeling tools for the power sector currently used by utilities in California (identified in Task 2.1) with other modeling tools available and random processes that can be applied to climate change modeling (identified in Task 2.2).
- Characterize the structural differences between these models and how they influence the results.
- Compare their performances using a multi-criteria analysis.
- Evaluate the possibility for adoption of more efficient or suitable tools by utilities, based on answers to the survey (Task 2.1).
- Create and provide a *Modeling Options Report* providing an overview of the different types of models that can be used by utilities and policy makers to simulate the future impact of climate change on the power sector, and how they compare to the models currently used (accessibility, scope and comprehensiveness, computing requirements)

Products:

- Modeling Options Report

TASK 2.4 Cognitive Elements of Structured Expert Judgment in Characterizing Climate Change Uncertainty

The Recipient shall:

- Code answers to the surveys following a systematic pattern focusing on linguistics (content analysis).
- Identify cross-domain interactions using the Theory of Magnitude and the Conceptual Metaphor Theory.
- Evaluate how different framing (i.e. changes in wording) influences everyday people’s conceptions of energy use and their perceptions of risk around energy use (e.g., shortage of energy, high costs related to energy, climate disruption from excessive energy use) using surveys that have short scenarios worded in two or more ways (with metaphor, without metaphor or with two different metaphors) and a set of questions designed to get at reasoning about energy use and impact.
- Examine how linguistics about energy are currently worded in the general public and private sectors by doing a corpus analysis of text, for instance, when are metaphors used.

EXHIBIT A

Scope of Work

- Prepare and provide an evaluation report entitled “*Linguistics Impacts to the Perception of Climate Change*” listing the findings from the Task 2.

Products:

- Linguistics Impacts to the Perception of Climate Change

TASK 3 RISK QUANTIFICATION BARRIERS AND PERFORMANCE

The goal of this task is to define adaptation as a mean to minimize uncertain impacts of climate change on the future power sector, and to assess how risk is currently perceived and managed

Task 3.1: Risk Measures for the Electricity Sector

The Recipient shall:

- Develop a review of the various existing metrics to quantify risks (including, but not limited to climate change risk) and/or develop risk measures if needed.
- Identify future potential risks on the power sector resulting from climate change, based on climate scenarios mitigation (including 2030 and 2050 emission reduction goals) currently under consideration by the state of California.
- Develop and provide a report entitled “*Risk Categorization Framework*” that will categorize the various types of risks resulting from climate change within a finite number of impacts on the power sector, based on Task 2.2 (climate change scenarios).

Products:

- Risk Categorization Framework

Task 3.2: Current Risk Assessment and Management Practices Used by Stakeholders

The Recipient shall:

- Identify definition of risk and risk assessment methods used by stakeholders.
- Evaluate how these methods account for adaptation strategies and barriers to adaptation.
- Assess the capacity of these risk assessment methods to evolve from a qualitative risk perception by stakeholders to a quantitative risk evaluation and further definition of adaptation strategies.
- Prepare and provide an evaluation report entitled “*Risk Assessment and Management Practices Used by Stakeholders*” presenting findings from Task 3.2

Products:

- Risk Assessment and Management Practices Used by Stakeholders

Task 3.3: Understand Judgment of Key Decision-Makers in Planning Adaptation under Climate-Change Uncertainty

The Recipient shall:

- Collect information, based on interviews (Task 2.1) and previous team work about the importance of metaphor and vocabulary in risk description.

EXHIBIT A

Scope of Work

- Evaluate how the language used by stakeholders of California's power sector helps make risks more concrete and encourages the implementation of adaptation strategies.
- Evaluate how the language used by stakeholders of California's power sector shapes the understanding of risks by stakeholders and which potential limitations it creates.
- Prepare and provide a *Risk Communication Report* on how language currently shapes the perception of risks for California's power sector and, based on previous work, how it can be improved.
- Participate in a CPR as described in Task 1.3 and prepare a *CPR Report*.

Products:

- Risk Communication Report
- CPR Report

TASK 4 ADAPTATION PLANNING UNDER UNCERTAINTY

The goal of this task is to identify barriers to adaptation through the development of a dynamic program and to communicate results to utilities and officials, and to identify strategies to overcome barriers and design optimal adaptation strategies specific to California's power sector

Task 4.1 Dynamic Programming Planning Model for Adaptation Policies and Barrier Identification

The Recipient shall:

- Identify a dynamic modeling approach adapted to risk measures and random process models, based on previous tasks (in particular Task 2.3 and Task 3.1)
- Develop and provide a long-term *Adaptation Planning Model* for California's power sector with the following characteristics:
 - The objective of the model is to identify optimal adaptation strategies and policies, initially assuming no barriers others than those identified through interviews.
 - The model will be flexible, and will use utility-available demand and cost projections as well as risks from climate change identified in Task 3.1.
 - The model will rely on dynamic programming as it is the best available method to account for the temporal impact of adaptation initiatives and barriers.
 - Markov-Decision Processes has been identified as being an excellent approach to build such model, however this choice will be further analyzed based on the findings from Tasks 2 and 3.
 - The assumptions used in the model will be refined after communication of results (see Task 4.4 below).

Products:

- Adaptation Planning Model

Task 4.2 Performance of California's Power Sector and Identification of Causes of Barriers

The Recipient shall:

- Compare optimal strategies identified by the model with current strategies undertaken for the state's power sector.

EXHIBIT A

Scope of Work

- Develop and provide a *Performance Evaluation Metrics* with the following characteristics:
 - The metrics should characterize the efficiency of adaptation strategies to ensure a resilient power sector.
 - The metrics is calculated based on the consequences of current adaptation strategies on each of the future time steps as identified in Task 4.1.
 - The performance of the state's power sector in terms of adaptation is evaluated against optimal strategies identified with the planning model (Task 4.1) and against other regions' power sector (Task 2.2).
 - The metrics provides a quantitative performance value for each of the climate change impact categories determines in Task 3.1.
- Create a list of current "limitations" faced by California's power sector, defined as optimal adaptation strategies that have not been implemented.
- Identify "weak points" (i.e. stages where barriers occur) within adaptation policy design and implementation process, based on the comparison between optimal and actual adaptation strategies.

Products:

- Performance Evaluation Metrics

Task 4.3 Communication of Results to Stakeholders

The Recipient shall:

- Participate in a TAC meeting with the state's utilities and California Energy Commission to communicate results.
- Meet individually with actors of the stages where barriers have been identified in order to:
 - Obtain detailed information about the structures/operation of these particular stages in order to refine the model (Task 4.4 below).
 - Discuss reasons for non-implementation of adaptation policies identified by model.
 - Discuss perception of barriers identified by the comparison between optimal and actual adaptation practices.
- Identify barriers based limitations and weak stages identified previously as well as information provided by stakeholders.
- Create and provide a detailed *Barriers Overview Report* concerning adaptation to climate change in California's power sector, including the stages in the adaptation process where they are created, and their consequences on the future resilience of the power system as well as their impacts on other adaptation strategies

Products:

- Barriers Overview Report

EXHIBIT A

Scope of Work

Task 4.4 Definition of Strategies to Overcome Barriers and Plan Optimal Adaptation

The Recipient shall:

- Refine adaptation planning model defined in Task 4.1 in order to integrate a more detailed representation of the “weak stages” (where barriers are most likely to occur) based on discussion in Task 4.3.
- Re-iterate the performance evaluation process based on additional information obtained in Task 4.3.
- Prepare and provide a *Performance Report* for California’s power sector in terms of future climate threats and adaptation strategies including:
 - Different barriers to adaptation, with a detailed presentation of their cause (and position in the adaptation process), the adaptation strategies that they limit, and their consequences on the future power sector; and
 - Interconnection between barriers will be highlighted.
- Prepare and provide *Planning Report* for the state of California providing optimal strategies to overcome barriers and implement optimal adaptation strategies, developed by our dynamic modeling tool and constrained by information provided by stakeholders

Products:

- Performance Report (draft and final)
- Planning Report (draft and final)

TASK 5 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

- 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 has 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 6 Technology/Knowledge Transfer Activities

The goal of this task is to develop a plan to make the knowledge gained, experimental results,

EXHIBIT A

Scope of Work

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.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- High Quality Digital Photographs
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: UNIVERSITY OF CALIFORNIA, BERKELEY

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-15-078 from GFO-15-309 with the Regents of the University of California, on behalf of the Berkeley campus, for a \$350,000 grant to provide policy makers with a systematic approach to assess and optimize climate change adaptation strategies for California's electricity system by (1) surveying public understanding on the subject of climate change adaptation, (2) addressing new technological and operational risks from climate change, (3) quantifying risk minimization practices, and (4) evaluating resilience of the electricity sector against extreme events; and

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

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on May 17, 2016.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat