

I. TASK ACRONYM/TERM LISTS

A. Task List

| Task # | CPR ¹ | Task Name |
|--------|------------------|--|
| 1 | | General Project Tasks |
| 2 | X | Development of Visualization Tools |
| 3 | | Development of a Customized Toolkit |
| 4 | | Outreach and Training |
| 5 | | Evaluation of Project Benefits |
| 6 | | Technology/Knowledge Transfer Activities |

B. Acronym/Term List

| Acronym/Term | Meaning |
|-------------------|---|
| API | Application Programming Interface |
| CAM | Commission Agreement Manager |
| CAO | Commission Agreement Officer |
| Cesium | A free and open source JavaScript library for creating 3D globes and 2D maps in a web browser without a plugin. |
| CMIP5 | Coupled Model Intercomparison Project Phase 5 |
| CPR | Critical Project Review |
| D3 | Data-Driven Documents |
| Energy Commission | California Energy Commission |
| GIF | Geospatial Innovation Facility |
| GIS | Geographic Information System |
| Leaflet | A modern open-source Javascript library for mobile-friendly interactive maps. |
| LOCA | Localized Constructed Analogs |
| TAC | Technical Advisory Committee |

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the development of innovative web-based visualizations, custom tool development, and targeted outreach using Cal-Adapt that will provide critical data on the changing climate and its potential impacts on California's energy infrastructure.

B. Problem/ Solution Statement

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.

Problem

California's electricity system is vulnerable to a variety of weather- and climate-related events, ratepayers and other stakeholders involved in electricity system management, operations, and planning must have timely access to relevant, best available, peer-reviewed data in a form that is easy to understand and useful for timely decision-support. The current California electricity infrastructure (power generation facilities and transmission lines) as well as projected and planned energy infrastructure decisions need to contend with a changing climate and extreme weather events that can cause disruption and energy vulnerability. Providing electricity system stakeholders with easy to use visualizations and tools that identify infrastructure locations and populations potentially at risk from a variety of climate-related factors such as sea level rise, inland flooding, storm events, wildfires, and extreme heat events is important for the continuation of reliable, safe and affordable energy in California's future.

Solution

This Agreement will provide critical real data on the changing climate and its impacts on California's energy infrastructure through innovative web-based visualizations, tool development and targeted outreach. The Geospatial Innovation Facility (GIF) has a 10-year proven record in delivering readily understandable visualizations of complex geospatial datasets through innovative web services and applications. With this Agreement GIF builds on that previous work, and develops a suite of visualization, analytical and outreach approaches to answer the specific needs of the California Energy Commission (Energy Commission) to provide electricity system stakeholders with actionable data pertaining to local climate risks.

The work will leverage the Cal-Adapt Application Programming Interface (API) to develop detailed exploratory visualizations using interactive maps, charts and tables for depicting climate-related risks from a range of stressors on the electricity infrastructure. These visualizations and tools will be interactive, visually compelling, and useful to a range of stakeholders. The recipient will build a custom toolkit to support planning and protection of energy infrastructure. The first two tasks are built on the GIF's ability to leverage proven open source web mapping and data visualization technology and experience in dealing with large and complex climate data, powerful GIS modeling and analytics, innovative web visualization tools and feedback from users. The recipient's planned outreach and training will target a range of energy stakeholders, climate practitioners, planners, managers, educators and ratepayers of the state through workshops, webinars, and presentations. These events are built on the GIF's experience in coordinating with diverse stakeholder groups in support of participatory projects.

C. Goals and Objectives of the Agreement

The goals of this project are to create interactive web visualizations and outreach support to communicate climate-related risks to the electricity sector in California in order to foster planning to protect infrastructure, ratepayers, and vulnerable populations. This project is essential because despite the fact that the recipients have numerous and detailed geographical datasets that show the energy infrastructure and project future climates, there are not easily understood tools that explain the impact of a changing climate on power generation facilities, distribution and transmission lines. New visualizations and tools that bring these datasets together and communicate the data in *interactive, visually compelling, and useful ways* are needed. A concerted outreach effort to a range of stakeholders, which includes involving the stakeholders in the design of these visualizations and tools, is critical to ensure that the results of the project

meet the needs of the target audience. Delivery and communication of readily understandable visualizations depicting climate-related risks to a range of stakeholders who are responsible for protecting natural gas infrastructure and planning for future reliability will support efforts to protect ratepayers from major disruptions.

Ratepayer Benefits:² This Agreement will result in benefits to California ratepayers through greater electricity reliability and increased safety by supporting electricity sector planning, management, and adaptation. These benefits are derived from enhanced Cal-Adapt visualization tools that allow integration of up-to-date, peer-reviewed scientific research pertaining to climate-related risk. This project aims to provide critical real data on the changing climate and its impacts on California's energy infrastructure through innovative web-based visualization and targeted outreach. Cal-Adapt.org provides a collection of integrated tools on one website that supports interactive visualization, decision-making, transparency of government data, and local and regional focus. These tools allow users to interactively understand the impact of their decisions in planning processes, to develop shared understandings of complex spatial data, and to support planners and managers as they protect and plan for future electricity infrastructure reliability and stability. Such integrated planning will contribute multiple benefits to California's electricity ratepayers by helping to stabilize the grid, improve service reliability, and reduce financial losses associated with power outages.

Technological Advancement and Breakthroughs:³ California's energy system will contend with a changing climate in the next century. Substantial changes in the climate are projected to occur within a timeframe that overlaps with the time horizons of a variety of electricity system planning decisions, such as siting of power generation facilities and transmission lines. The State has been at the forefront of climate science, funding and promoting numerous advances in climate modeling across a range of domains, generating newer and higher spatial resolution climate projections. These data are valuable resources to better plan electricity and energy infrastructure developments, adaptations, and future siting, however, they are not always made available to policy makers in a format that is easily understood or that facilitates decision making.

Technological advances in computer science and the Internet have increased the ability to produce and share large heterogeneous collections of spatial data. However, these datasets are often complex and not immediately useful for practical purposes by planners, stakeholders, managers and others. The new challenges introduced by increases in these data require the use of novel developments in data curation, integration, and visualization that rely on web services, open standards, and APIs linked to structured spatial databases. Use of these developments makes the interactions between managers, citizens and scientists and multiple diverse data archives easier and more relevant. The proposed project will continue to develop the cutting edge mapping toolkit that California has relied on with Cal-Adapt. The recipient will build custom tools designed for energy sector users, making important peer-reviewed and best

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.

available data available to planners and managers of California's energy infrastructure. The Cal-Adapt energy tools will provide rapid identification of locations at risk and will bring this key information into a usable format that will help to make California's energy reliable, affordable and environmentally sound.

Agreement Objectives

The objectives of this Agreement are to leverage the Cal-Adapt website to visualize climate-related risks to the Electricity System through:

- Developing web-based visualizations depicting climate-related risks from a range of stressors on the electricity infrastructure built on top of the Cal-Adapt API;
- Developing web-based custom tools to support planning to protect energy infrastructure; and
- Developing and delivering four workshops and one or more webinars focusing on outreach and training for the new Cal-Adapt.

II. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

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

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

For products that require a final version only

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

For all products

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

Instructions for Submitting Electronic Files and Developing Software:

o **Electronic File Format**

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

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

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.

- Text documents will be in MS Word file format, version 2007 or later.
 - Documents intended for public distribution will be in PDF file format. The Recipient must also provide the native Microsoft file format.
 - Project management documents will be in Microsoft Project file format, version 2007 or later.
- **Software Application Development**
- Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
 - Microsoft Internet Information Services (IIS), (version 6 and up). Recommend 7.5.
 - Visual Studio.NET (version 2008 and up). Recommend 2010.
 - C# Programming Language with Presentation (UI), Business Object and Data Layers.
 - SQL (Structured Query Language).
 - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
 - Microsoft SQL Reporting Services. Recommend 2008 R2.
 - XML (external interfaces).

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

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

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);

- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

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

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

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

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

CAM Products:

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

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

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

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any state-owned equipment.
 - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
 - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
 - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any Agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

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

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.

- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions, including a financial report on Match Fund and in-state expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

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

Subtask 1.6.1 Final Report Outline

The Recipient shall:

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

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

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

Products:

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

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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.
- 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.

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;
- 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

III. 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: DEVELOPMENT OF VISUALIZATION TOOLS

The goals of this task are to develop web based tools for (1) visualizing vulnerability of electricity generation, transmission, and distribution facilities to storm events and sea level rise and (2) visualization of other climate-mediated changes or extreme weather events, such as extreme heat (nighttime as well as daytime episodes), inland flooding, mudslides, wildfires, and drought, that could affect California’s electricity system.

The Recipient shall:

- Acquire the most up-to-date versions of geospatial data describing the locations of California’s electricity infrastructure (electricity generation, transmission, and distribution facilities) maintained by the Energy Commission and if possible the investor-owned utilities (IOU).
- Develop a visually appealing basemap that shows the location of California’s generation, transmission, and distribution facilities symbolized by facility attributes (e.g. generating capacity, owner) overlaid with other base layers from OpenStreetMap, an open source database of streets, cities, administrative boundaries, points of interests, and other basemap data.
- Identify and acquire peer-reviewed datasets that are available, up to date, and relevant for evaluating impacts on California’s electric grid, such as inland flooding, mudslides, wildfires, drought, and sea level rise. See data description above for more details.
- Add spatial datasets to the Cal-Adapt database and serve the data through the public Cal-Adapt API.
- Prepare an *Electricity Infrastructure Visualizations User Needs Assessment* for the visualization tools based on participatory design workshops conducted with end users.
- Design and develop a web application using open source 2D and 3D mapping and visualization JavaScript libraries (e.g. Leaflet, D3, Cesium) that provides:
 - Exploratory visualizations using interactive maps, charts and tables.
 - Options to compare multiple time periods and scenarios for a climate variable for a range of queries, e.g. particular facility location, for a particular energy type, or time of year.

- Functionality for generating shareable links, embedded views and downloading data.
- Ability to print reports with maps, charts and tables of climate variables locally relevant to a particular facility.
- Explore the technological feasibility of allowing the user to add their own spatial data (e.g. a shapefile of more detailed facility schematics) into the web application within their own browser locally.
- Prepare and provide an *Electricity Infrastructure Visualizations Memo* that describes the new data and visualizations as they become available, to be shared with stakeholders through the Cal-Adapt Newsletter and the Cal-Adapt blog.
- Participate in a Critical Project Review (CPR) as described in Task 1.3 and provide a *CPR Report*.

Products:

- Electricity Infrastructure Visualizations User Needs Assessment
- Electricity Infrastructure Visualizations Memo
- CPR Report

TASK 3 DEVELOPMENT OF A CUSTOMIZED TOOLKIT

The goal of this task is to build customized tools to support planning to protect, manage, and operate the electricity system.

The Recipient shall:

- Identify and acquire models or algorithms for developing custom tools (e.g. relationships between extreme heat thresholds and power line vulnerabilities, projected capacity loss with increasing ambient temperatures; relationships between projected wildfire probabilities and power lines and facilities; relationships between sea level rise scenarios and power station locations, as demonstrated in Sathaye et al., 2012).
- Package the custom tools, visualizations, links to adaptation resources as a toolkit.
- Integrate additional tools through web links to existing efforts such as the U.S. Climate Resilience Toolkit (<https://toolkit.climate.gov/>) and DataBasin (<http://databasin.org/>).
- Prepare and provide an *Electricity Infrastructure Vulnerabilities Toolkit Memo* that describes the tools developed for this project as they become available, to be shared with stakeholders through the Cal-Adapt Newsletter and the Cal-Adapt blog.

Products:

- Electricity Infrastructure Vulnerabilities Toolkit Memo

TASK 4 OUTREACH AND TRAINING

The goals of this task are to: (1) facilitate communicate and coordinate with a range of energy stakeholders, climate practitioners, planners, managers, educators and ratepayers regarding guidance or management options to increase resilience to climate-change risks, (2) facilitate communication and outreach among a range of stakeholders regarding case studies that highlight electricity sector adaptations to climate-related vulnerabilities; and (3) train potential new users of Cal-Adapt involved in electricity-related vulnerability and resilience work.

The Recipient shall:

- Conduct a pre-workshop survey designed to collect information from key stakeholders about their web needs, data requirements, and user experience.
- Facilitate four participatory design workshops conducted with key stakeholders throughout the contract period
 - User Needs Assessment Workshop, planned Spring 2016
 - Prototype Testing, planned Fall 2016
 - Integrating Feedback and Prototype Testing, planned Fall 2017
 - Training on how to use the Cal-Adapt energy sector tools, planned Fall 2018
- Prepare and provide the *Workshop Training Materials* such as PowerPoint presentations and handouts to the Energy Commission.
- Highlight case studies of climate adaptation in the electricity sector that have been provided by partners at the Energy Commission through links to project sites and other relevant adaptation resources within the web application.
- Support communication and outreach efforts involving management options and guidance designed to increase resilience to climate-change related vulnerabilities. This will include links to relevant state or other adaptation resources as well as highlighting this topic by writing blog posts for the Cal-Adapt website.
- Develop and provide a *Webinar Summary Report* which will include an agenda and PowerPoint presentations, and summary of input received from participants during a virtual workshop (Webinar) designed for potential new and practitioners involved in the electricity sector
- Develop and provide *Presentation Visuals* and graphics to support training and outreach efforts targeting electricity sector stakeholders
- Present website development and results at one national conference to promote the new Cal-Adapt electricity sector visualizations and tools

Products:

- Workshop Training Materials
- Cal-Adapt Newsletter
- Webinar Summary Report
- Presentation Visuals

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.
 - 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

TASK 6 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: THE REGENTS OF THE UNIVERSITY OF CALIFORNIA ON
BEHALF OF THE BERKELEY CAMPUS

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-15-008 with The Regents of the University of California on behalf of the Berkeley campus for a \$400,000 grant to support the development of innovative web-based visualizations, custom tool development, and targeted outreach using Cal-Adapt that will provide critical data on the changing climate and its potential impacts on California's energy infrastructure; 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 November 12, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Tiffani Winter,
Secretariat