

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-16-064 (To be completed by CGL Office)

ERDD	David Stoms	43	916-327-2381
------	-------------	----	--------------

US Geological Survey	53-0196958
----------------------	------------

Investigating Avian Attraction to Solar Energy Facilities Through a Lake Effect

6/8/2017	6/30/2020	\$ 499,785
----------	-----------	------------

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

Proposed Business Meeting Date	5/10/2017	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	David Stoms	Time Needed:	5 minutes

Please select one list serve. EPIC (Electric Program Investment Charge)

Agenda Item Subject and Description

US GEOLOGICAL SURVEY. Proposed resolution approving agreement EPC-16-064 with US Geological Survey for a \$499,785 grant to investigate the mechanisms by which birds are attracted to utility-scale solar energy facilities (i.e., "lake effect hypothesis") and thereby identify potential deterrent or mitigation strategies.

1. Is Agreement considered a "Project" under CEQA?
 Yes (skip to question 2) No (complete the following (PRC 21065 and 14 CCR 15378)):
 Explain why Agreement is not considered a "Project":
 Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because
2. If Agreement is considered a "Project" under CEQA:
 a) Agreement **IS** exempt. (Attach draft NOE)
 Statutory Exemption. List PRC and/or CCR section number: _____
 Categorical Exemption. List CCR section number: Cal. Code Regs., tit 14, § 15306
 Common Sense Exemption. 14 CCR 15061 (b) (3)
 Explain reason why Agreement is exempt under the above section:
 The study involves research and data collection related to bird behavior and flight patterns in and around solar energy facilities and nearby natural habitats, with no serious major disturbance to the sites. Research includes: using truck-mounted radar to monitor effects of solar facilities on bird movement; observing bird behavior with different visual cues; surveying bird carcasses at solar facilities. The ultimate goal of the study is to advise how to reduce future bird fatalities. If the solar energy facility has a Special Purpose - Utility permit that allows for the legal handling of bird carcasses, carcasses will be collected and stored in a freezer on-site.
- b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
 Check all that apply
 Initial Study Environmental Impact Report
 Negative Declaration Statement of Overriding Considerations
 Mitigated Negative Declaration

Legal Company Name:	Budget
Western EcoSystems Technology, Inc.	\$ 140,338 (CEC), \$215,352 (Match)
Bard College	\$ 97,642 (CEC), \$133,621 (Match)
Humboldt State University Sponsored Programs Foundation	\$ 0 (CEC), \$42,632 (Match)

Exhibit A Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2	X	Exploring a visual-sensory basis of attraction
3	X	Reorientation of birds in flight toward solar facilities
4	X	Mortality and natural history of birds at solar facilities
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
ISEGS	Ivanpah Solar Electric Generating System
PV	Photovoltaic
SB	Senate Bill
SPUT	Special Purpose - Utility
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 research that investigates the mechanisms by which birds are attracted to utility-scale solar energy facilities (i.e., “lake effect hypothesis”) and thereby identify potential deterrent or mitigation strategies for reducing bird fatalities at those facilities.

B. Problem/ Solution Statement

Problem

Photovoltaic (PV) utility-scale solar energy facilities in California (and elsewhere) are sources of bird mortality. This mortality will increase as the state satisfies renewable energy goals set forth in California law (e.g., SB 350). Waterbirds and songbirds comprise the majority of bird mortality. Currently, it is unknown what behavioral processes and mechanisms lead to bird mortality observed at solar energy facilities. The leading hypothesis suggests that large fields of PV

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.
May 2017

Exhibit A Scope of Work

panels reflect light in a manner similar to large bodies of water. The nature of this reflected light is thought to sufficiently mimic open water to attract birds. Moreover, the presence of these water-like surfaces in arid landscapes may add to their attractiveness to passing birds. Left unaddressed, this problem will lead to increased costs to ratepayers as solar energy projects face greater environmental permitting challenges associated with developing and operating these facilities.

The problem is challenging. Solar energy facilities vary considerably in size, design, operation, and landscape context. Moreover, they impact a wide range of species that likely exhibit a diversity of behavioral motivations in relation to attraction. Solar companies have not attempted to address this problem head-on. Most companies individually do not control a range of sites sufficient to capture the extent of the problem. Also, the problem is sufficiently complex and costly to address that individual companies have been unwilling to commit the resources necessary to identify a solution, especially when costs are not shared among competitors.

Solution

The recipient will explore the behavior of attraction by birds to solar energy facilities, particularly in relation to the “lake effect” hypothesis. Specifically, Recipient will study 1) the ability of birds to detect potentially attractive visual cues associated with solar energy facilities (e.g., polarized light, irradiance); 2) the corresponding change in flight behavior characteristic of movement toward solar energy facilities; and the 3) mortality and natural history of birds that actually occupy solar energy facilities. First, the recipient will examine the sensory basis of attraction. Field and lab experiments will explore the behavioral response of both captive and free-flying birds (waterbirds and songbirds) to polarized light and other visual characteristics associated with PV solar fields. Second, radar and thermal imaging will be used to measure the degree to which birds alter their flight paths to settle at these facilities. Not all birds that reorient toward solar energy facilities will land and succumb to these sites. Therefore, natural history data on behavior and mortality from multiple solar energy facilities will be gathered. These data will inform a statistical model to determine what characteristics of solar energy facilities and species natural history together explain variation in mortality exhibited across sites.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Provide evidence for or against the lake effect hypothesis, or similar, about the mechanisms of attraction of birds to solar energy facilities
- Identify potentially viable approaches for deterring birds from approaching and attempting to occupy solar energy facilities if they are attracted to them
- Inform future siting decisions in ways that reduce the likelihood of birds encountering solar energy facilities

Exhibit A Scope of Work

Ratepayer Benefits:² This Agreement will result in the ratepayer benefit of lower costs by streamlining the permitting process of renewable energy projects in California. Renewable energy projects are often delayed because information on the impacts on wildlife required by state and federal law is insufficient or unavailable. Better information on the effects of these projects will reduce permitting delays. Though wildlife impacts have been examined at many renewable energy projects, there has been no comprehensive analysis of the mortality and behavioral response to solar energy projects. By combining existing mortality and natural history data with new data gathered during the proposed project, solar energy companies, state and federal agencies, and the public will have access to the best information for risk assessment in relation to deterrents and mitigation strategies and future siting decisions. The eventual adoption of such techniques reduces the likelihood that solar energy facilities impact species of concern, particularly state and federal threatened and endangered species, for which the costs of offsetting 'take' can impose a cost to facility operators that may be passed on to ratepayers. Suggested deterrent and mitigation strategies may lead to the application of technologies that reduce bird mortality. The findings of the research may also help to focus pre-construction surveying and post-construction monitoring and mitigation actions to the species at greatest risk from this form of attraction, which would also reduce the soft costs of deployment of solar energy technologies.

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 identifying potentially viable methods for deterring birds from approaching solar energy facilities and informing future siting decisions in ways that reduce the likelihood of birds encountering them. Identification of prospective methods will follow from understanding sensory basis and proximal response of birds to solar energy facilities in relation to the "lake effect" attraction phenomenon.

Agreement Objectives

The objectives of this Agreement are to:

- Measure the visual characteristics (e.g. polarization, irradiance, glare) of PV and other surfaces at solar energy facilities across southern California under varying conditions
- Determine detection and attraction to polarized light in the visible and ultraviolet ranges across a variety of species (three captive waterbird species, several wild waterfowl species, more than half a dozen songbird species)
- Establish whether birds in flight respond behaviorally to solar energy facilities, and if so, how that response varies with altitude and distance from the facility
- Determine what characteristics of solar energy facilities and individual bird species together explain variation in mortality and behavior exhibited across sites

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

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

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

The Recipient shall:

For products that require a draft version

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

For products that require a final version only

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

For all products

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

Exhibit A Scope of Work

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

Exhibit A Scope of Work

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.

Exhibit A Scope of Work

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

Exhibit A Scope of Work

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.

Exhibit A Scope of Work

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize all Agreement activities conducted by the Recipient for the preceding month, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
 - Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions. In addition, each invoice must document and verify:
 - Energy Commission funds received by California-based entities;
 - Energy Commission funds spent in California (*if applicable*); and
 - Match fund expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

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

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM.
- Submit a draft of the outline to the CAM for review and comment.
- Once agreement has been reached on the draft, submit the final outline to the CAM. The CAM will provide written approval of the final outline within 10 days of receipt.

Recipient Products:

- Final Report Outline (draft and final)

CAM Products:

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

Exhibit A Scope of Work

Subtask 1.6.2 Final Report

The Recipient shall:

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

Products:

- Final Report (draft and final)

CAM Product:

- Comments on Draft Final Report Outline

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

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

Exhibit A Scope of Work

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.

Exhibit A Scope of Work

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.

Exhibit A Scope of Work

- 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.

Exhibit A Scope of Work

- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

Products:

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

IV. TECHNICAL TASKS

TASK 2 Exploring a Visual-Sensory Basis of Attraction

The goals of this task are to 1) measure the visual polarization characteristics of PV solar collecting surfaces and other surficial features at solar energy facilities, and 2) determine detection of and attraction to polarized light in the visible and ultraviolet ranges by waterbird and songbird species.

The Recipient shall:

- Collect raw video-polarimetry and produce false-color close-up polarization-reflection imagery of PV infrastructure at various solar energy facilities in California. There will be a total of 4-6 sites, that are spread out over three different geographic regions. The imagery will include: 1) PV panels, 2) PV support structures, 3) buildings, and 3) driving surfaces. This will include visible and ultraviolet imagery, taken three times throughout a day during one fall bird migration season from different angles.
- Develop a *Small Scale Choice Experimental Study Plan* for California and New York studies.
- Conduct series of small-scale choice experiments in the wild and at an existing bird research facility.
 - Conduct field and enclosure-based behavioral experiments with captive waterfowl at Humboldt State University in Arcata, California, at their aviary that is licensed under existing state and federal permits. Purchase captive waterfowl and conduct dual-choice experiments. Repeat these experiments with wild lines of waterfowl under natural conditions in a landscape of habitat for fall migratory and wintering waterfowl near Arcata, California.
 - Conduct visual experiments on songbirds at or near the Bard College campus in New York (permits not required). Identify a network of specific experimental sites. Construct specialized bird feeders and specialized test surfaces. Place multiple-choice experiments in the field, and collect behavioral data.
- Statistically analyze behavioral and video-polarimetry data. Prepare a *Visual-Sensory Basis of Attraction Report* that links visual properties of test surfaces and avian responses and identifies potential mitigation strategies for PV installations inferred from the visual properties of avoided surfaces. Include the false-color imagery.
- Prepare *Critical Project Report #1* that includes

Exhibit A Scope of Work

- Description of progress to date on small scale choice experiments at the California and New York study sites
- Explanation of any logistical or technical issues encountered and their resolution

Products:

- Small Scale Choice Experimental Study Plan (draft and final)
- Visual-Sensory Basis of Attraction Report (draft and final)
- Critical Project Review Report #1

TASK 3 Reorientation of Birds In Flight Toward Solar Facilities

The goals of this task are to 1) quantify the proportion of birds that adjust their flight behaviors, through descent and reorientation, when approaching solar energy facilities, and 2) determine the range at which solar energy facilities influence attraction beyond their own immediate airspace. This will occur at the same solar energy facility sites selected in Task 2.

The Recipient shall:

- Analyze existing radar tracking data collected by the researchers at Ivanpah Solar Electric Generating System (ISEGS) in 2014 to inform study plan and other study design considerations on forthcoming radar data collection.⁴
- Prepare a *Re-Analysis of ISEGS Data Report*.
- Develop a *Bird Reorientation Study Plan*.
- Select matched control sites located near each of the solar energy facilities. The combination of the solar energy facility and its matched control site is referred to as a study site. Investigate the correspondence between the timing of grebe exodus identified by weather radar and mortality and perhaps other grebe observations documented at solar energy facilities (especially those toward the eastern side of the study region, which is more likely to intercept grebe movements out of Great Salt Lake). The eared grebe is selected because it is common among bird fatalities at some solar energy facilities.
- Collect radar data on the movements of birds during two spring and two fall bird migration seasons in relation to focal study sites following a systematic design that explores the manner and range extent of attraction. The radar units are mounted on trucks, which will be driven to the sampling locations.
- Supplement radar data with thermal imaging observations as needed.
- Statistically quantify radar data to determine the nature of attraction (i.e., descent, reorientation), and the magnitude of attraction as it varies with range in comparison to controls.
- Prepare an *Interim Reorientation of Birds in Flight Report*.
- Prepare a *Final Reorientation of Birds in Flight Report*.
- Prepare *Critical Project Report #2* that includes
 - Description of progress to date on reorientation (Task 3) and mortality (Task 4) studies in California
 - Explanation of any logistical or technical issues encountered and their resolution

⁴ Diehl, R.H., Cryan, P.M., and Valdez, E.W., 2015, Data Recordings from the Ivanpah Solar Electric Generating System (ISEGS) Facility Recorded by the USGS during Spring and Fall 2014: U.S. Geological Survey data release, <http://dx.doi.org/10.5066/F7GM85DN>.

Exhibit A

Scope of Work

Products:

- Re-Analysis of ISEGS Data Report (no draft)
- Bird Reorientation Study Plan (draft and final)
- Interim Reorientation of Birds in Flight Report
- Final Reorientation of Birds in Flight Report
- Critical Project Review Report #2

TASK 4 Mortality and Natural History of Birds at Solar Facilities

The goals of this task are to 1) measure bird movement, behavior, and mortality at a variety of solar energy facilities across southern California, and 2) model bird presence at solar energy facilities as it varies according to both species natural history and the type and landscape context of solar energy facilities.

The Recipient shall:

- Develop a *Mortality and Use Study Plan*. This plan will be closely coordinated with the Bird Reorientation Study Plan in Task 3.
- Use a control-impact design to assess the influence of solar energy facilities on bird movement and behavior at the solar energy facilities and matched control sites from Task 3. Also select a waterbody in the region of each solar energy facility.
- Collect standardized data and information on bird utilization and bird mortality using point count data including behavioral data on waterbird approach including flight behavior (fly-over; approach, landing aborted; approach landing), height from solar panels, and distance from edge of solar facility. Data collection will occur at the same study sites and during the same time periods as Task 3.
- Use night vision goggles to conduct behavioral observations similar to those recorded during the day dependent on opportunity to access the solar energy facilities at night.
- Select ten sample units of approximate equal size (e.g., 20 acres) within the solar field at each solar facility and within matched control sites. Surveys of these sample units will be done during each migration season (spring and fall) for two years.
 - Conduct carcass searches every other day for two seven-day periods during each migration season (spring and fall).
 - If the solar energy facility has a Special Purpose - Utility (SPUT) permit that allows for the legal handling of bird carcasses, carcasses will be collected and stored in a freezer on-site. Western EcoSystems Technology, Inc. will amend its California State Scientific Collecting Permit for a facility with a SPUT. The US Fish and Wildlife Service will determine final disposition of the carcasses.
 - If the solar energy facility does not have a SPUT permit, birds will be surveyed visually, but not touched or removed from the site.
 - Conduct daytime bird use and behavior surveys on two days during each week-long sampling period.
 - Conduct fatality surveys, including pedestrian surveys, along transects located perpendicular to rows of panels.
- Statistically compare bird use and behavior metrics between solar energy facilities and matched control sites.
- Prepare an *Interim Mortality and Use Report* documenting results of the first year analysis.

Exhibit A Scope of Work

- Prepare a *Final Mortality and Use Report* documenting results of the analysis and summarizing which species appear to be most affected.

Products:

- Mortality and Use Study Plan (draft and final)
- Interim Mortality and Use Report
- Final Mortality and Use Report

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:

Exhibit A Scope of Work

- 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

Exhibit A Scope of Work

- Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
- A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
 - The number of website downloads or public requests for project results.
 - Additional areas as determined by the CAM.
 - Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
 - When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(s) on the project.
 - When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
 - 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: U.S. GEOLOGICAL SURVEY

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-16-064 with U.S. Geological Survey for a \$499,785 grant to investigate the mechanisms by which birds are attracted to utility-scale solar energy facilities (i.e., "lake effect hypothesis") and thereby identify potential deterrent or mitigation strategies; 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 10, 2017.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat