

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

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

ERDD	Kevin Mori	51	916-327-1475
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Irrigation for the Future	47-1883233
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Facilitating On-farm Participation in Energy Demand Management Programs

4/3/2017	12/31/2020	\$ 1,588,872
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 ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	3/8/2017	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
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Business Meeting Presenter	Kevin Mori	Time Needed:	5 minutes
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Please select one list serve. EPIC (Electric Program Investment Charge)

Agenda Item Subject and Description

IRRIGATION FOR THE FUTURE. Proposed resolution approving agreement GFO-16-305-21 with Irrigation for the Future for a \$1,588,872.00 grant to fund research and development of sophisticated analytical tools for identifying and implementing optimal irrigation management strategies --- specifically including deficit irrigation --- that capitalize on Time-of-Use rates, and Demand Response and Automated Demand Response programs.

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:

Cal. Code Regs., tit. 14, sect. 15306 provides that projects which consist of basic data collection, research, experimental management, and resource evaluation activities, which do not result in a serious or major disturbance to an environmental resource are categorically exempt from the provisions of the California Environmental Quality Act. This project will involve installation of moisture sensors at the participating farms in the San Joaquin Valley, and will be collecting data from the sensors for software analysis.

 b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)

Check all that apply

 Initial Study

 Negative Declaration

 Mitigated Negative Declaration

 Environmental Impact Report

 Statement of Overriding Considerations

Legal Company Name:	Budget
To Be Determined	\$ 116,000
Oregon State University, Dept of Biological and Ecological	\$ 57,000
David Doll	\$ 25,500
Thomas Trout	\$ 6,030
Charles Hillyer	\$ 78,750
	\$
	\$

EXHIBIT A Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1	N/A	General Project Tasks
2		IMO Update and Telemetry Automation
3		Integrate Demand Response Programs into Irrigation Scheduling
4	X	Field Trial for the ADR Analysis and Management System
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities
7		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
ADR	Automated Demand Response
CAM	Commission Agreement Manager
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
DR	Demand Response
DSS	Decision Support System
ET	Evapotranspiration
IEM	Irrigation Efficiency Model
IMO	Irrigation Management Online (an irrigation targeting software)
IMO	Irrigation Management Online
Recipient	Irrigation For The Future, Inc.
TAC	Technical Advisory Committee
TOU	Time of Use
TSP	Technical Service Provider

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

A. Purpose of Agreement

The purpose of this Agreement is to upgrade, deploy and support sophisticated analytical tools for identifying and implementing optimal irrigation management strategies—specifically including deficit irrigation—that capitalize on Time-of-Use (TOU) rates, Demand Response (DR) and Automated Demand Response (ADR).

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

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B. Problem/ Solution Statement

Problem

It will be challenging to reduce energy use by 20% in an already mature and sophisticated irrigation industry. A recent analysis concluded that such a substantial improvement in energy use efficiency will be difficult without a fundamental change in the way irrigation is managed. Rather than focusing exclusively on full irrigation to achieve maximum yields, managers will also need to consider partial irrigation, or regulated deficit irrigation. But deliberate under-irrigation runs contrary to generations of common practice and technical training, and it can be challenging. California irrigation today is largely characterized by use of scientific irrigation scheduling (SIS) to maximize yields with a minimum of water and delivery systems with limited system capacity, operating 24/7 during peak Evapotranspiration (ET) periods, to minimize capital costs. These technologies are designed to assure that crop water demands are satisfied at all times, and that limits the management flexibility needed to utilize deficit irrigation strategies.

Solution

This project increases awareness and interest in Regulated Deficit Irrigation (RDI) by addressing the management challenges it poses. The project will upgrade, deploy and support an existing Decision Support System (DSS) for identifying and implementing optimal irrigation management strategies — specifically including deficit irrigation — that capitalize on incentive programs for energy conservation. The DSS (called IMO) will be used first to demonstrate the theory and potential economic benefits of alternative irrigation strategies. These strategies will encompass both full irrigation and deficit irrigation coupled with participation in energy conservation incentive programs. The DSS will then be used to guide detailed planning and implementation of clients' preferred strategies tailored to the specific circumstances of their individual farms and fields.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to facilitate customer cost optimization by providing sophisticated analytical tools to identify profit maximizing irrigation strategies suitable for the specific circumstances of individual farms and fields that capitalize on energy conservation incentive programs, especially TOU, DR, and ADR.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability and lower costs by allowing growers to manage loads to minimize peak demand or shift processes in response to price signals. Potential energy savings could be up to 1 terawatt hours per year and much of the energy use could be concentrated in off-peak periods. Research indicates that deficit irrigation can reduce California crop water use without reducing crop yields. Research-based figures for potential water savings without yield reduction have ranged from about 4% for a mix of high value crops³ to 12% for almonds⁴. When the economics

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 Potential water savings associated with agricultural water efficiency improvements: a case study of California; Juliet Christian Smith, Heather Cooley and Peter H. Glick. Water Policy 14(2102) 194-213

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of production are considered, water use can often be reduced by still more, on the order of 15% to 20% or more, without reducing net farm income⁵. Based on these figures, and assuming energy conservation would be proportional to water savings, a 10% reduction in energy use is a reasonable order of magnitude estimate of the maximum potential water savings from deficit irrigation. Since total irrigation energy requirements in California are on the order of 10 terrawatt hours per year⁶, a reasonable estimate of the upper limit of attainable energy savings would be about 1.0 terawatt hours.

Technological Advancement and Breakthroughs:⁷ 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 deploying and commercializing a decision support system that will facilitate analysis, planning and implementation of deficit irrigation strategies⁸. Success in deficit irrigation management will depend on more advanced and sophisticated modeling of the whole complex system encompassing irrigation hardware performance; management preferences; operational constraints; the disposition of applied water in heterogeneous fields; and the crop physiological response to available water. The new technology is characterized by its use of advanced modeling tools.

Agreement Objectives

The objectives of this Agreement are to:

- promote DR participation in utility programs by minimizing the management effort required to implement preferred management strategies; this will involve: (i) forward scheduling of water use for the entire season; (ii) tracking field conditions and updating advance schedules as needed when circumstances change; (iii) error detection and model recalibration to improve analytical accuracy;
- facilitate load control automation by providing a forward-scheduling algorithm for quickly and automatically adapting an advance water use schedule to accommodate remotely controlled interruptions in pumping energy without compromising the management strategy;
- facilitate farm management participation using an interactive irrigation calendar that allows the irrigation manager to edit the irrigation calendar to make near term adjustments in timing and set times of planned irrigations without compromising the underlying irrigation strategy; and
- commercialize these tools for ready access and rapid dissemination.

4 Regulated deficit irrigation reduces water use of almonds without effecting yield; Stewart, W.C., A Fulton, W.H. Kruger, B.D Lampinen, K. A. Shackel. California Agriculture 65(2):90-95. April-June, 2011.

5 A Roadmap for Energy and Water Efficiency in Irrigated Agriculture; a general guide for improving irrigation efficiency; 2013; Irrigation for the Future; Marshall English and Robert Evans; contributing authors: Collin English, Steven Evett, Chad Higgins, Charles Hillyer, Brad King, Troy Peters, John Sadler, Thomas Trout; prepared for Northwest Energy Efficiency Alliance, 421 SW 6th Ave # 600, Portland, OR 97204

6 California Agricultural Water Electrical Energy Requirements; ITRC, 2003. Irrigation Training and Research Center (ITRC) California Polytechnic State University.

7 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.

8 The Attachment 4 addendum (Illustrating the Decision Support System) shows of how application of the IMO system results in energy savings.

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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.

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.

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- 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

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- 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.

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- 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.

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- 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 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

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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 Product:

- Style Manual

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)

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

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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

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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

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- 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

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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

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IV. TECHNICAL TASKS

The research has three principle technical tasks: 1) update the decision support software known as Irrigation Management Online (IMO) to a more maintainable form and enable automated integration of field telemetry, 2) develop algorithms for incorporating ADR into the irrigation scheduling process and implement those algorithms into the IMO platform, 3) Conduct a field trial of the adapted IMO system.

TASK 2: IMO UPDATE AND TELEMETRY AUTOMATION

The goal of this task is to update the decision support software and enable automated integration of field telemetry.

The Recipient Shall:

- **Port Irrigation Efficiency Model (IEM) to a Spreadsheet base interface**
The IEM/IMO system was built with a three-tiered architecture with IEM comprising the Business Logic Layer. The presentation layer will be implemented entirely in Microsoft Excel. Repeat analyses of IEM's outputs. Develop a spreadsheet-based interface to facilitate use of the existing data management skillset.
- **Enable automated integration of field telemetry**
Upgrade IMO software to enable automated uploading of flow meter telemetry (time and rate) and pressure at the delivery point for cooperating fields. Upgrade IMO interface.
- **Automated search for optimal management strategies**
Implement several automated search functions in the IEM/IMO system to include:
 - developing crop production functions based on generic ET based models
 - rapid adaptation of irrigation plans in response to abrupt changes in field conditions
 - feasibility testing of recommended irrigation plans based on key performance metrics
 - error flagging of potential water limitation problems based on field data feedback
 - components to search for optimal strategies in the context of ADR
 - an interactive calendar component that facilitates farmer-directed search for short term strategies to implement DR events when irrigation capacity is limited
- **Refine ADR interface components**
Customize the user interface to meet the operational requirements and preferences of the technical service providers (consultants, scheduling services). These changes will be based on feedback and experiences obtained from the field trial in year 2.
- **Prepare *IMO Update and Telemetry Automation Report*.**
The report must discuss the results of all work completed in this task, including the development of Microsoft Excel spreadsheets, development of the spreadsheet interface for data management, the IMO software update for automated integration of field telemetry, IMO interface upgrades, the implementation of automated search for optimal management strategies and the refinement of ADR interface components.

Products:

- IMO Update and Telemetry Automation Report

TASK 3: INTEGRATE DEMAND RESPONSE PROGRAMS INTO IRRIGATION SCHEDULING

The goal of this task is to add functionality to the IMO system so that it supports and promotes adoption of ADR programs.

EXHIBIT A Scope of Work

The Recipient Shall:

- **Recruit 10 cooperating farms**

Beginning in year one, recruit 10 farms that will test and evaluate the proposed system. Recruitment criteria include farms that have significant acreage of either alfalfa or almonds and are concentrated in one sub-region of California. Analyses from the IMO system will illuminate opportunities for ADR that would not otherwise be apparent. Provide a *Recruitment List* to include a list of all cooperating farms and a brief summary of their farming operation for CAM consideration and review.

- **Set up IMO and perform preliminary calibration**

Collect the information needed including a detailed description of the field's soil properties, irrigation system characteristics, past irrigation history, and local weather data during two site visits at each cooperating farm to be used by the IMO system in order to produce detailed analysis of irrigation strategies.

- During the first site visit complete the following:

- interview the grower to ascertain his/her management style and preferences for irrigation strategy
- survey the irrigation system and pumping hardware to collect the input data needed
- set up the farm in IMO using the data collected
- perform a preliminary calibration using the data collected
- generate several alternative irrigation strategies that incorporate a DR program by using the preliminary calibration

- During the second site visit, complete the following:

- demonstrate each of the proposed irrigation strategies using the preliminary calibration
- solicit feedback from the grower on the feasibility of each strategy which will lead to:
 - better assessment of IMO simulation of the growers irrigation operations
 - better assessment of the capacity of participation in different DR programs
 - develop general irrigation strategies to increase energy use efficiency and farm profits taking into account preferential rate schedules and/or participation in TOU, DR, and ADR programs
- identify any hardware needed to participate in the program based on the type of DR program preferred by the grower
- arrange for Installation of the hardware and instrumentation necessary to participate in an ADR program with care taken to avoid interference with ongoing farm operations

- **Develop an algorithm**

A critical component for success is compatibility with a grower's current management preferences. To achieve this compatibility, the Recipient shall:

- test different procedures for advising growers on the potential risks and benefits of participating in DR programs. These procedures will inform the development of an 'algorithm' for generating an analysis that will quickly and easily inform a grower if any particular DR program is compatible with their current water needs.
- develop this algorithm based on the feedback collected during the on-site interviews and the post season analysis described in Task 2.

- **Conduct post season analysis**

At the end of each season, the Recipient will conduct a thorough reanalysis of the irrigation strategy. This will involve another site visit with the grower and an interactive

EXHIBIT A

Scope of Work

simulation session as described in Task 2. During this session, the Recipient shall:

- review each of the DR events and solicit feedback from the grower on the IMO system performance and potential improvements.
- assess any changes in the grower's perception of its ability to participate in the DR program. Particular focus will be made to evaluate the utility of the system from the farms perspectives (profit potential, ease of use) and the potential changes to be expected from the larger population of users in terms of energy conservation and load shifting.
- compare frequency of delayed irrigations relative to DR events from first and second years. An overall reduction in crop stress caused by participation in DR events is expected. The reduced crop stress is derived from more precise timing of irrigation in response to DR or ADR program participation.
- **Conduct Outreach and Education**

To promote knowledge and awareness of precision water management in the context of DR programs, the IMO team will conduct two outreach activities in the cooperating grower's region:

 - A seminar for the general audience where the IMO team will present a review of research and generally accepted strategies for managing both full and partial irrigation for the two crops of interest. Provide the CAM with a *General Audience Seminar Agendas and Materials* prior to the seminar and include list of participants.
 - An Advanced topics seminar with discussions of detailed analyses and comparison of past season practices and profit maximizing strategies to show past performance and potential gains from optimization of irrigation scheduling and utility incentive programs. Provide *Advance Topics Seminar Agendas and Materials* prior to the seminar and include list of participants.

Products:

- Recruitment List
- General Audience Seminar Agendas and Materials (draft and final)
- Advanced Topics Seminar Agendas and Materials (draft and final)

TASK 4: FIELD TRIAL FOR THE ADR ANALYSIS AND MANAGEMENT SYSTEM

The goal of this task is to develop an effective DR management system through manual and automated implementation of IMO system.

The Recipient Shall:

- **Recruit a Technical Service Provider (TSP)**

During year one, the Recipient shall recruit a TSP who will collect in-season measurements and observations at the cooperating farms. The primary measurements will be soil moisture readings via a neutron probe, collected weekly. The TSP will also make general observations of field conditions, including crop stages of growth, irrigation system performance, soil conditions, crop stage of development, pest infestations, etc.
- **Perform manual implementations**

During year 1, the Recipient shall perform a 'manual' implementation of the IMO analysis and in-season reanalysis. The IMO team will manually update the IMO system to provide updated irrigation analysis. For TOU programs, a thorough pre-season analysis will be conducted as described in Task 2. For DR or ADR programs, the implementation

EXHIBIT A Scope of Work

will be more interactive; involving reanalysis on-demand. For ADR events where there is not enough time to generate a pair of schedules, the IMO team will only generate the updated IMO analysis and send it as soon as possible.

- **Conduct a field trial, year 2**

The second year will be a full-scale field trial of the automated system. This trial will employ the automated data integration and updated irrigation schedules will be sent to the grower on demand via the updated IMO interface. The IMO system will inform the growers of the water use and yield reduction consequences of participating in any particular DR event. The system will also track which DR events are compatible with the grower's current strategy and which ADR events resulted in yield reductions that were larger than the accepted tolerance.

- **Conduct a field trial, year 3**

The third year will be a continuation of the trial from year 2. The IMO system will employ any refinements developed during year 2. The year 3 trial will be a demonstration of the completed and refined DR management system.

- Develop *Annual Post-season Analysis Reports* detailing total season water and energy use of the cooperating farms.
- Prepare a *CPR Report* and participate in a CPR meeting, per Subtask 1.3.

Products:

- Annual Post-season Analysis Reports
- CPR 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.

EXHIBIT A

Scope of Work

- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Additional Information for Product Development Projects:
 - Outcome of product development efforts, such copyrights and license agreements.
 - Units sold or projected to be sold in California and outside of California.
 - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
 - Investment dollars/follow-on private funding as a result of Energy Commission funding.
 - Patent numbers and applications, along with dates and brief descriptions.
- Additional Information for Product Demonstrations:
 - Outcome of demonstrations and status of technology.
 - Number of similar installations.
 - Jobs created/retained as a result of the Agreement.
- For Information/Tools and Other Research Studies:
 - Outcome of project.
 - Published documents, including date, title, and periodical name.
 - A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
 - The number of website downloads.
 - An estimate of how the project information has affected energy use and cost, or 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

TASK6: 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.

EXHIBIT A

Scope of Work

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)

TASK 7: PRODUCTION READINESS PLAN

The goal of this task is to determine the steps that will lead to the manufacturing of technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
 - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
 - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
 - The estimated cost of production.

EXHIBIT A

Scope of Work

- The expected investment threshold needed to launch the commercial product.
- An implementation plan to ramp up to full production.
- The outcome of product development efforts, such as copyrights and license agreements.
- Patent numbers and applications, along with dates and brief descriptions.
- Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: IRRIGATION FOR THE FUTURE INC.

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-16-027 from GFO-16-305 with Irrigation for the Future Inc. for a \$1,588,872 grant to test analytical tools that can help growers identify and implement optimal irrigation management strategies. These strategies will allow growers to capitalize on time-of-use rates, and participate in demand response and automated demand response programs. The tools will be tested in farms in the San Joaquin Valley; and

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

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on March 8, 2017.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat