

**GRANT REQUEST FORM (GRF)**



New Agreement EPC-14-081 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Leah Mohney	51	916-327-1506

Recipient's Legal Name	Federal ID Number
PowWow Energy, Inc.	46-1390134

Title of Project
Irrigation Optimization and Well Pump Monitoring to Reduce Energy and Water Consumption

Term and Amount	Start Date	End Date	Amount
	6/15/2015	12/29/2017	\$ 2,292,829

**Business Meeting Information**

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

Proposed Business Meeting Date	6/10/2015	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Leah Mohney	Time Needed:	15 minutes

Please select one list serve. Select

**Agenda Item Subject and Description**

POWWOW ENERGY, INC. Proposed resolution approving Agreement EPC-14-081 with PowWow Energy, Inc. for a \$2,292,829 grant to demonstrate a software tool that uses existing smart meter data from power utilities to measure groundwater extraction and integrates other data sources to assist growers to optimize irrigation. By using this tool farms can reduce energy and water consumption while maintaining or improving crop yields. Contact: Leah Mohney (5 minutes/EPIC funding)

**California Environmental Quality Act (CEQA) Compliance**

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: 14 CCR 15306  
 Common Sense Exemption. 14 CCR 15061 (b) (3)  
 Explain reason why Agreement is exempt under the above section:  
 Class 6 - Basic data collection, research, experimental management, and resource evaluation activities that do not result in major disturbances to an environmental resource.

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

**List all subcontractors (major and minor) and equipment vendors: (attach additional sheets as necessary)**

Legal Company Name:	Budget
The Regents of the University of California on behalf of the Santa Barbara campus	\$ 14,500
The Regents of the University of California on behalf of the Davis campus	\$ 60,500
Visgence Inc.	\$ 50,000 (match)
Aduro Accounting & Consulting, LLC	\$ 37,500 (match)
	\$
	\$
	\$
	\$
	\$

**GRANT REQUEST FORM (GRF)**

CEC-270 (Revised 02/13)

CALIFORNIA ENERGY COMMISSION



<b>List all key partners:</b> (attach additional sheets as necessary)
Legal Company Name:

Budget Information			
Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	13-14	301.001A	\$2,292,829
			\$
			\$
			\$
			\$
			\$
R&D Program Area: EERO: IAW		TOTAL:	\$2,292,829
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer				Recipient's Project Manager			
Name:	Stan Knutson			Name:	Olivier Jerphagnon		
Address:	440 N WOLFE RD			Address:	440 N WOLFE RD		
City, State, Zip:	SUNNYVALE, CA 94085-3869			City, State, Zip:	SUNNYVALE, CA 94085-3869		
Phone:	415)658-7125 /	Fax:	- -	Phone:	415)658-7125 /	Fax:	- -
E-Mail:	stan@powwowenergy.com			E-Mail:	Olivier@powwowenergy.com		

Selection Process Used	
<input checked="" type="checkbox"/> Competitive Solicitation	Solicitation #: PON-14-304
<input type="checkbox"/> First Come First Served Solicitation	

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

Agreement Manager _____	Date _____	Office Manager _____	Date _____	Deputy Director _____	Date _____
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## EXHIBIT A Scope of Work

### A. Task List

Task #	CPR <sup>1</sup>	Task Name
1		General Project Tasks
2	X	Development of Water Measurement Software Feature
3		Integration of Irrigation Models for Several Crops
4		Integration of Local and Cloud-Based Data
5	X	Software-As-A-Service to Optimize Irrigation
6		Deployment at Farm Sites
7		Measurement and Verification
8		Evaluation of Project Benefits
9		Technology/Knowledge Transfer Activities
10		Production Readiness Plan

### B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CIMIS	California Irrigation Management Information System
CPR	Critical Project Review
ET	Evaporation Transpiration
LCA	Life Cycle Assessment
NRCS	Natural Resources Conservation Service
RDI	Regulated Deficit Irrigation
SaaS	Software As A Service
SCADA	Supervisory Control And Data Acquisition
SMM	Soil Moisture Measurement
TAC	Technical Advisory Committee
UI	User interface
UC-CE	University of California, Cooperative Extension
UCD	University of California, Davis
USDA	US Department of Agriculture

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

### A. Purpose of Agreement

The purpose of this Agreement is to demonstrate energy efficient farming practices and a scalable well pump monitoring solution on more than 1,000 acres of farmland. Unlike existing solutions that require hardware installations, this platform leverages existing smart meter data

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

## **EXHIBIT A**

### **Scope of Work**

from power utilities to measure groundwater extraction and integrates other data sources into a user-friendly software tool to assist growers to optimize irrigation. By using this platform farms will be able to reduce energy and water consumption while maintaining or improving crop yields.

#### **B. Problem/ Solution Statement**

##### **Problem**

Water pumping is putting more and more stress on the power grid as water tables are falling at an alarming rate. Agriculture is a sizeable part of energy consumed in the State of California, and therefore a significant contributor of greenhouse gas emissions. In times of drought, the impact of ground water extraction to compensate for the lack of surface water is far greater. Meanwhile, water shortage is a source of severe hardship among growers who are struggling to maintain food production with reduced water allocation. As a result, groundwater reserves must be monitored to maintain the resiliency of agricultural operations as droughts are projected to be longer and more frequent due to climate change.

Reduced irrigation techniques have been known for years but have not been significantly adopted because of the risks associated with them. Four critical barriers have been identified that explain why most growers do not know exactly how much water they use, and why they are not widely adopting irrigation solutions that could save water and energy and improve crop yields. (1) Growers tend to trust their perception (eyes and fingers are their “sensors”) and fact-based irrigation is not widely adopted because it is time consuming. (2) It is not in the interest of a grower to save water if it jeopardizes crop yields when a mistake is made on the field (3) Growers consider water records as sensitive, and are concerned that they will lose control of their farming operations. (4) Keeping frequent water records currently requires the installation of water flow meters and significant manual labor from irrigators who are not incentivized to measure water.

As a result of the lack of data and large-scale deployments, farmers are hesitant to embrace a new generation of optimized irrigation practices. In addition, utilities do not currently provide incentives to save energy by measuring groundwater extraction or by optimizing irrigation. This is in contrast to the incentives that utilities provide today for hardware solutions, such as drip lines or variable-frequency-drives, to reduce the energy intensity of irrigation.

##### **Solution**

The Recipient will develop a simple and scalable means of measuring groundwater extraction and water application by leveraging existing smart meters deployed by power utilities. The water data will be integrated with other available data in the cloud (e.g., aerial imagery) and at the farm sites (e.g., local hardware sensors) to provide information to growers in the field or at the office, allowing them to safely save water while improving yields.

This solution will be deployed at five commercial farming sites, providing a large-scale demonstration of the technology that will build on the successful completion of several previous pilot projects. The proposed work will accelerate the availability of a generally available software-as-a-service products that address the problem and the barriers of adoption described above by: (1) providing a user-friendly platform that integrates all the data and communicates with the farmer and irrigator (2) optimizing crop yields while simultaneously optimizing water application; (3) maintaining privacy of water records; and (4) providing a simple and scalable means to measure water volumes from pumps without installing hardware devices on site.

## EXHIBIT A Scope of Work

### C. Goals and Objectives of the Agreement

#### Agreement Goals

The goals of this Agreement are to:

- Demonstrate energy savings at commercial farms by optimizing irrigation without adversely impacting crop yield. Irrigation optimization will be based on a number of techniques to cover a wide range of growers, who may be innovative or conservative
- Apply partial irrigation or Regulated Deficit Irrigation (RDI) practices in non-sensitive stage of crop cycles. Water stress will be carefully monitored by aerial imagery and verified with local measurements (pressure bomb or soil moisture) to avoid crop losses
- Demonstrate the ability to measure groundwater extraction and automate water records from smart meter data provided by power utilities

Ratepayer Benefits:<sup>2</sup> This Agreement could result in the ratepayer benefits of greater electricity reliability and lower costs by reducing the amount of water and energy used for irrigation. The reduction in water pumping costs will result directly in lower energy costs to agricultural ratepayers, and the reduction of canal water usage will result in further energy savings at the State level. The Agreement could also reduce the peak electric capacity during the summer, thus reducing the risk of power outages in rural areas.

Technological Advancement and Breakthroughs:<sup>3</sup> This Agreement could lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by accelerating the deployment of energy and water efficiency solutions in the agriculture sector, and by reducing greenhouse gas emissions.

#### Agreement Objectives

The objectives of this Agreement are to:

- Measure groundwater extraction using smart meter data with an accuracy within +/- 5% across various pump operating conditions and irrigation schedules
- Integrate various irrigation models in a software module that can assist farm advisors and growers to save water and optimize crop yields over existing farming practices
- Integrate on-farm data and cloud-based data while protecting the privacy of the growers
- Develop a software-as-a-service (SaaS) that provides daily updates on the condition of the field and sends text alerts when too much water is applied
- Reduce the water use and energy foot-print of irrigation at the deployment sites by at least 20%.
- Verify the measurements and conduct Life Cycle Assessment (LCA) analysis to validate the energy savings

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<sup>2</sup> 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](http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF)).

<sup>3</sup> 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

### II. TASK 1 GENERAL PROJECT TASKS

#### PRODUCTS

##### Subtask 1.1 Products

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

##### The Recipient shall:

###### For products that require a draft version

- 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

## **EXHIBIT A**

### **Scope of Work**

- (Version 2007 or later), or any other format approved by the CAM.
- Text documents will be in MS Word file format, version 2007 or later.
  - Documents intended for public distribution will be in PDF file format. The Recipient must also provide the native Microsoft file format.
  - Project management documents will be in Microsoft Project file format, version 2007 or later.
- ***Software Application Development***

Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

    - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
    - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
    - Visual Studio.NET (version 2008 and up). Recommend 2010.
    - C# Programming Language with Presentation (UI), Business Object and Data Layers.
    - SQL (Structured Query Language).
    - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
    - Microsoft SQL Reporting Services. Recommend 2008 R2.
    - XML (external interfaces).

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

## **MEETINGS**

### **Subtask 1.2 Kick-off Meeting**

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

#### **The Recipient shall:**

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

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

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

## **EXHIBIT A**

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- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

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

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

#### **The CAM shall:**

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

#### **Recipient Products:**

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

#### **CAM Product:**

- Kick-off Meeting Agenda

#### **Subtask 1.3 Critical Project Review (CPR) Meetings**

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

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

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### **Scope of Work**

#### **The Recipient shall:**

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

#### **The CAM shall:**

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

#### **Recipient Products:**

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

#### **CAM Products:**

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

#### **Subtask 1.4 Final Meeting**

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

#### **The Recipient shall:**

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

## **EXHIBIT A**

### **Scope of Work**

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

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

#### **Products:**

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

### **REPORTS AND INVOICES**

#### **Subtask 1.5 Progress Reports and Invoices**

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

#### **The Recipient shall:**

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
  - Summarize 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:

## **EXHIBIT A**

### **Scope of Work**

- 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 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)

## EXHIBIT A Scope of Work

### MATCH FUNDS, PERMITS, AND SUBCONTRACTS

#### **Subtask 1.7 Match Funds**

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

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

#### **The Recipient shall:**

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

If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:

- A list of the match funds that identifies:
  - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
  - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
- A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

#### **Products:**

- Match Funds Status Letter
- Supplemental Match Funds Notification Letter *(if applicable)*
- Match Funds Reduction Notification Letter *(if applicable)*

## EXHIBIT A Scope of Work

### Subtask 1.8 Permits

The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

#### The Recipient shall:

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

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

#### Products:

- Permit Status Letter
- Updated List of Permits (*if applicable*)
- Updated Schedule for Acquiring Permits (*if applicable*)
- Copy of each Approved Permit (*if applicable*)

### Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

#### The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.

## **EXHIBIT A**

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- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

#### **Products:**

- Subcontracts (*draft if required by the CAM*)

### **TECHNICAL ADVISORY COMMITTEE**

#### **Subtask 1.10 Technical Advisory Committee (TAC)**

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
  - Technical area expertise;
  - Knowledge of market applications; or
  - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

## **EXHIBIT A**

### **Scope of Work**

#### **The Recipient shall:**

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

#### **Products:**

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

#### **Subtask 1.11 TAC Meetings**

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

#### **The Recipient shall:**

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

#### **Products:**

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

## EXHIBIT A Scope of Work

### III. TECHNICAL TASKS

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

#### **TASK 2. DEVELOPMENT OF WATER MEASUREMENT SOFTWARE FEATURE**

The goal of this task is to develop a simple and scalable means to measure ground water extraction and water application on farm land.

##### **The Recipient shall:**

- Prepare and provide the *Supervisory Control And Data Acquisition (SCADA) Data Acquisition Requirements* for the water pumps to include a discussion of:
  - The SCADA data will be collected over three different periods and the following at a minimum:
    - Smart meter data via Green Button program
    - Pressure, flow-rate, power and groundwater level via SCADA
    - Operating conditions against pump curve
    - Water calculations from energy smart meter versus flow-meter readings for validation purposes
    - Water measurement algorithm against various operating conditions
    - Analysis of the accuracy of water measurement using smart meter data versus water measurement from SCADA data
    - The recorded accuracy across varying operating conditions
    - The reported average accuracy and standard deviation
- Prepare and provide *Water Measurement Test Plan* to evaluate water measurement from smart meters to include but not be limited to a discussion of:
  - Test water measurement algorithm over one irrigation cycle
  - Analysis of the accuracy of water measurement from smart meter data against water measurement from SCADA data
  - How to tune algorithm to improve accuracy
- Tune algorithm to cover range of operating conditions
- Analyze accuracy of water measurement with improved algorithm with the same data set
  - Record accuracy across varying operating conditions
  - Report average accuracy and standard deviation
- Implement Water Measurement Test Plan
- Integrate and maintain water measurement feature with existing Pump Monitor SaaS product to:
  - Include the water measurement module to calculate water usage (acre-feet) from energy usage (kilowatt-hours) for the last software release of Pump Monitor in 2015
  - Prepare and provide *Memo on June Software Release* that summarizes release activities and fixes
  - Prepare and provide *Memo on September Software Release* that summarizes release activities and fixes
- Create and provide *Mock-up of Water and Energy Report for Growers* to include but not be limited to, examples of water and energy reports that growers will receive
- Develop software to provide end of season report to include but not be limited to:

## **EXHIBIT A**

### **Scope of Work**

- Water and energy savings
- Integration of water usage in gallons or acre-feet which will be reported in the quarterly sustainability reports generated currently by Pump Monitor.
- Review water and energy report with growers during the 2016 season at the deployment sites
- Summarize results of water and energy savings, and grower feedback and comments in *Water Measurement Service Report* to include but not be limited to:
  - Summary and results of the performance of the water measurement feature, test plan implementation over one irrigation cycle and tuning of the algorithm to improve accuracy across varying conditions
  - Summarize comments from TAC members
  - Summarize water and energy savings potential
- CPR meeting and *CPR Report* per task 1.3

#### **Products:**

- SCADA Data Acquisition Requirements
- Water Measurement Test Plan
- Memo on June Software Release
- Memo on September Software Release
- Mock-up of Water and Energy Report for Growers
- Water Measurement Service Report
- CPR Report

#### **TASK 3. INTEGRATION OF IRRIGATION MODELS FOR SEVERAL CROPS**

The goals of this task are to: (1) integrate California Irrigation Management Information System (CIMIS) data, and the University of California, Cooperative Extension (UC-CE) tables for crop coefficients into a software tool for growers; (2) integrate irrigation schedules based on a portfolio of Evaporation Transpiration (ET), Soil Moisture Measurement (SMM) and RDI irrigation techniques for various crops; and (3) develop software module that provides improved irrigation plans (based on ET, SMM or RDI) for one season.

#### **The Recipient shall:**

- Document soil model
  - Summarize the water holding capacity of different soil types in *Soil Model Document* to include but not be limited to:
    - Data model for different soil types such as physical attributes of the soil structure for different depths at different geographic locations
- Document and update ET and SMM models for almond, pistachio, tomato and alfalfa crops and provide *Rational Irrigation Schedules* to include but not be limited to a discussion of the following:
  - The irrigation models for each crop
  - Irrigation frequency and duration using ET data and SMM data
  - Update of the ET and SMM models including calculation automation
- Document RDI model for almond pistachio, tomato and alfalfa and provide *Partial Irrigation Schedule* to include but not be limited to a discussion of:
  - The calculation of irrigation frequency and duration using RDI data for each crop
  - Update of the RDI model for each crop

## **EXHIBIT A**

### **Scope of Work**

- Develop Irrigation plan according to ET, SMM, and RDI models
- Prepare *Irrigation Model Test Plan and Software Module Report* to include but not be limited to a discussion of:
  - Comparison of automated computations by the software module against manual computations by an irrigator or farm advisor
  - Automated computation of water applications for rational irrigation and partial irrigation to include but not be limited to:
    - Design data model to implement the various irrigation schedules in software
    - ET, SMM and RDI data models implemented in database
    - User interface developed to enter various parameters including but not be limited to
      - location, size and shape of field size
      - type of crop
  - Feedback on accuracy of software version of irrigation data model
  - Updated ET, SMM and RDI models for almond, pistachio, tomato and alfalfa
  - Comparison of automated results with manual results for each crop according to test plan
  - The manual irrigation models in MS Excel spreadsheet including storage of the automated results in the SQL database and how and where model can be downloaded
  - Test results using irrigation model software

#### **Products:**

- Soil Model Document
- Rational Irrigation Schedules
- Partial Irrigation Schedules
- Irrigation Model Test Plan and Software Module Report

#### **TASK 4. INTEGRATION OF LOCAL AND CLOUD-BASED DATA**

The goal of this task is to (1) integrate various data sets on the cloud; and (2) integrate local data available at the farm. The test sites are the following, or other site(s) with approval of the CAM:

Site 1- Sierra View Farms in Hanford, California

Site 2- Nichols Farms in Tulare, California

Site 3- Russell Ranch in Davis, California

Site 4- J.H. Meek & Sons, in Davis, California

Site 5- Button & Turkovich in Winters, California

#### **The Recipient shall:**

- Develop data model to integrate CIMIS data in Recipient's cloud data base
- Prepare *Test Plan For CIMIS Data* to include but not be limited to:
  - Integration of CIMIS data in Recipient's cloud data base
  - Integration of crop coefficient tables in data base
- Prepare *Test Plan For Thermal Images* including but not be limited to:
  - Data model to integrate thermal images
  - Integration of thermal images
- Prepare *Aerial Imagery Integration Report* to include but not be limited to:

## EXHIBIT A Scope of Work

- Aerial images (visible, infra-red and thermal) obtained from vendors
- Prepare *Test Plan For Local Data* to include but not be limited to:
  - Integration of local sensor #1 at sites 1 and 2
    - Pressure bomb measurements at a few locations on the field that are manually recorded into ArcGIS
    - Develop adapter to import data from local virtual server to Recipient's cloud data base using secure bidirectional communication
    - Test using ArcGIS (UC Santa Barbara)
  - Integration of local sensor #2 data at deployment sites 3, 4 and 5
    - Identify the type of soil sensors at each deployment site
    - Develop software integrating soil sensor data using UCSB test equipment via the cloud service provided by the vendor of the soil sensors
- Prepare *Local Data Integration Report* to include but not be limited to discussing:
  - Data model to integrate local data into Recipient's cloud data base
  - Bidirectional communication to bring local data into Recipient's cloud data base
  - Mechanism to securely store data records including water records at the farm
  - Storage of output of water measurement calculation from Pump Monitor in private storage at the farm
- Prepare *Test Plan For Water Records* including but not be limited to discussing:
  - Software to provide option to save encrypted water records on the cloud (PowWow's data base)
  - Tested water measurement capability for one field
  - Site 1, site 2 and site 3 canal access points
  - Test at one of the sites depending on 2016 water allocations
- Integrate results of test report to improve cloud-based software on Recipient's server  
Compile *Russell Ranch Irrigation Events* to include but not be limited to discussing:
  - All the irrigation events from Russell Ranch (or other site approved by CAM) for 2015 and 2016 compiled monthly into one MS Excel Spreadsheet
  - Document all irrigation events at Russell Ranch
  - The irrigation events will be recorded in 2015 for software development
  - The irrigation events will be recorded in 2016 for validation
- Prepare *Onsite Water Record Report for Site 3* to include but not be limited to discussing:
  - User interface to access water records at the farm
  - Integration of option to save water records in cloud or in local storage
  - Results of test report to finalize local software running at the farm
- Prepare *Overall Data Integration Report* to include but not be limited to discussing:
  - First security upgrade at all sites
  - First software maintenance at all sites
  - Second security upgrade at all sites
  - Second software maintenance at all sites
  - Third security upgrade at all sites
  - Third software maintenance at all sites
  - Performance of each integration component
  - Privacy protection of the overall data integration
- Prepare and provide *Leaf Temperature Measurement Report* including but not be limited to:
  - How manual pressure bomb measurements could be replaced with automated leaf temperature measurements at deployment sites

## **EXHIBIT A**

### **Scope of Work**

- Correlation between pressure bomb measurements and leaf temperature measurements
- How to integrate automatic leaf temperature measurements
- Determine if leaf temperature measurements correlate with water stress alerts from aerial imagery

#### **Products:**

- Test Plan For CIMIS Data
- Test Plan For Thermal Images
- Aerial Imagery Integration Report
- Test Plan For Local Data
- Local Data Integration Report
- Test Plan For Water Records
- Russell Ranch Irrigation Events
- Onsite Water Record Report
- Overall Data Integration Report
- Leaf Temperature Measurement Report

#### **TASK 5. SOFTWARE-AS-A-SERVICE TO OPTIMIZE IRRIGATION**

The goal of this task is to develop a SaaS that (1) leverages local and cloud-based data measuring water applications and condition of field and (2) provides information in near real-time to optimize irrigation following rational or partial irrigation schedule.

#### **The Recipient shall:**

- Prepare *Software Architecture Document* that describes how to integrate and process the various data sets including but not be limited to:
  - Description of software developed to compute water application (inches) from smart meter data
  - Description of software developed to track cumulative water measurements
  - Description of user interface (UI) developed for Recipient's cloud service
  - Creation of UI mock-ups and comments from review of UI mock-ups with growers and crop advisors
  - Results of implementation of UI for cloud-based dashboard
- Prepare *Soil Map Update Document* that describes how to update historical soil maps from USDA-NRCS using aerial imagery and water measurement module including but not be limited to descriptions of:
  - The development of software to compute updated soil maps
  - The integration of soil map from United States Department of Agriculture-Natural Resources Conservation Service's (USDA-NRCS) web soil service, aerial imagery module and water measurement module
  - The updated soil map
- Prepare *Water Stress Computation Document* that includes but not be limited to:
  - Description of how to monitor water stress from thermal images and water measurement
  - Description of software developed that monitors water stress from cloud-based data
  - Description of software developed that generates alert from water stress data

## EXHIBIT A

### Scope of Work

- Prepare *Alerts Test Plan* that includes but is not be limited to discussion of:
  - Alerts compared to ground truth data
  - Local data from farming staff or on-site sensors
  - Results from visual inspection by ranch manager or irrigator
- Summarize test results and prepare *Water Stress Text Alert Report* that includes but is not be limited to:
  - Test results from water stress text alerts against ground truth at fixed locations at sites 2 (almond and pistachio fields) and 3 (tomato field), or other sites approved by CAM
- Improve algorithm to monitor water stress from thermal images
- Prepare *Water Application Test Plan* to include but not be limited to:
  - Comparison of the computed water application with ground-truth data
  - Comparison of water application from irrigation SaaS with ground truth
  - Local data captured by farming staff or by on-site sensors
  - Results of visual inspection by ranch manager or irrigator
  - Summary of the performance of the water application rate calculations to optimize irrigation
- Prepare a *Text Service Document* that includes but is not be limited to:
  - Text message options for growers
  - Implementation options on dashboard for managing text service (daily or weekly, etc.)
  - Types of alerts that will be generated
    - Range of expected scenarios from under-irrigation to over-irrigation
    - Optimization of alerts to save water and energy using goal orientation techniques that align interest of grower (e.g., crop yield) with the goal of the project (e.g., energy savings)
  - Identification of software developed to send text alerts sent from Recipient's cloud server
- Prepare *Irrigation SaaS Report* to include but not be limited to:
  - Summary of the functionality and the performance of irrigation SaaS
  - Description of software developed to select which schedule the grower wants for the season
  - Description of software developed to compute next water application based on rational irrigation (ET and SMM models) and daily updated data
  - Description of software developed to compute next water application based on partial irrigation (RDI) and daily updated data
  - Water application rates in inches which will be translated into irrigation events of specific duration Integration of first round of feedback from growers to improve user interface
  - Report on improved algorithms to monitor water stress based on ground truth data from soil moisture measurements collected at all deployment sites
  - Ground truth data which will come from pressure bomb measurements at sites 1 and 2 (or other site approved by CAM)
  - Sites 1 and 2 (or other site approved by CAM) may also provide leaf temperature measurements as well during the 2016 season
  - Integration of second round feedback from grower to improve user interface
  - Improved content of text alerts to optimize impact on growers
  - Use of goal orientation techniques to align the interest of the farms to optimize yield and save water and energy

## EXHIBIT A

### Scope of Work

- CPR meeting and *CPR Report* per task 1.3

#### Products:

- Software Architecture Document
- Soil Map Update Document
- Water Stress Computation Document
- Alerts Test Plan
- Water Stress Alert Report
- Water Application Test Plan
- Text Service Document
- Irrigation SaaS Report
- CPR Report

#### TASK 6. DEPLOYMENT AT FARM SITES

The goal of this task is to deploy the SaaS software to (1) reduce water applications over one season; (2) maintain or improve crop yields; and (3) provide an automated record of groundwater extraction. The reduction in water application and groundwater extraction, as well as yield improvement, will result in net energy savings.

#### The Recipient shall:

- Register all sites on Recipient's cloud service
- Organize yield measurement workshop with a variety of growers to include but not be limited to:
  - Hosting the workshop
  - Organize and invite attendees
  - Create all workshop materials
  - Create survey for workshop attendees
  - Collect answers to the survey provided at the end of the workshop
  - Prepare and provide *Yield Measurement Workshop Report* to include but not be limited to:
    - Summary of the results of survey and workshop
    - Copies of all materials from workshop
    - List of attendees
- Prepare *Baseline Irrigation Report* to include but not be limited to a
  - summary of consultations with growers at all sites to review current irrigation practices
- Prepare *Software Deployment Memo* to include but not be limited to a
  - detailed description of installation of software at all sites
- Prepare *Soil Map Report* to include but not be limited to
  - updated soil maps for all sites
- Develop and provide *Energy Savings Test Plan* to include but not be limited to:
  - Documentation of the method used to measure energy savings at each deployment site
    - Using the same methodology across the sites as best as possible while taking into account the specificities of each site (irrigation method and crop type)
    - Consolidating energy data into the same format to facilitate third-party verification and to facilitate the LCA analysis

## EXHIBIT A

### Scope of Work

- Rehearsal of the review process of optimized irrigation plan for 2016 at the experimental field of site 3 (tomato or other site/crop approved by CAM) to include but not be limited to:
  - Using irrigation model software to generate optimized plan for 8-acre block
  - Review process of optimized irrigation plan for 8-acre block
  - Feedback to improve process
- Create and provide *Optimized Irrigation Plan For All Sites* to include but not be limited to a discussion of the following:
  - Irrigation plans to minimize water usage and optimize yield
  - How the plan will achieve the objective to reduce energy consumption by at least 20%
  - Optimized irrigation plan for 2016
  - Irrigation methodology for all sites
  - Comments received on the *Optimized Irrigation Plan For All Sites*
- Create and provide *Weather Station and Soil Sensor Map* to include but not be limited to:
  - Installation of weather stations at sites 1 and 2 for ground truth
  - The weather stations will record temperature, relative humidity, and wind speed and direction
  - GPS locations of the weather stations
  - Installation of soil sensors at sites 3, 4, and 5 for ground truth
  - Location of the soil sensors against the updated soil maps
  - The soil moisture at three different depths
  - GPS locations of the soil sensors
- Create and provide *Irrigation Alerts Test Plan* to include but not be limited to:
  - Comparison of irrigation alerts the growers receive against ground-truth conditions
  - Discussion of Common software-as-a-service platform that allows the use of the same test plan despite the specificities of each site (irrigation method and crop type)
- Create and provide *Russell Ranch Demonstration Field Report* to include but not be limited to discussing:
  - Establishment of demonstration plots
  - Two side-by-side plots to compare partial irrigation (based on RDI) and rational irrigation schedules (based on ET)
  - Results from installation of soil sensors
  - Site accessibility for growers and UC-CE farm advisors to accelerate the adoption of partial irrigation practices in times of drought
  - Summary of the design and functionality of the plots in draft
- Organize workshop at site 3 to introduce the demonstration plots as an interactive tool to learn about optimized irrigation to save energy and water while maintaining or improving yield to include but not be limited to:
  - Organize and invite attendees to event
  - Create all workshop materials
  - Create and disseminate survey for attendees of workshop
  - Interaction with demonstration plots and review of project findings from the other deployment sites
  - Review the results of the 2016 season

## **EXHIBIT A**

### **Scope of Work**

- The results of the workshop and survey will be included in the *Russell Ranch Demonstration Field Report*
- Prepare *Optimized Irrigation Service Report* to include but not be limited to:
  - Record of the alerts the first week of the season at all sites
  - Monitored data processed by cloud service
  - The change in behavior of the growers as a result of the alerts
- Organize a minimum of 2 Field Days on irrigation management and energy efficiency, one in Northern California and one in Southern California to include but not be limited to:
  - Organize and invite attendees to events
    - The field Day for Northern California will be held at Russell Ranch (site 3, or other site approved by CAM)
    - Organize field day on project findings at deployment sites in Southern California
      - The field day will be hosted by Nichols Farms (site 2) or the AgTech Center Southern California Edison (SCE) near Tulare, California or other site approved by CAM
  - Create all Field Days materials
  - Create survey for attendees of Field Days
  - Prepare *Field Days Report* to include but not be limited to:
    - Copy of survey
    - Copies of all Field Days materials
    - List of attendees
    - Summary of results of the Field Days and surveys from each Field Day event

#### **Products:**

- Yield Measurement Workshop Report
- Baseline Irrigation Report
- Software Deployment Memo
- Soil Map Report
- Energy Savings Test Plan
- Optimized Irrigation Plan For all sites
- Weather Station and Soil Sensor Map
- Irrigation Alerts Test Plan
- Russell Ranch Demonstration Field Report
- Optimized Irrigation Service Report
- Field Days Report

#### **TASK 7. MEASUREMENT AND VERIFICATION**

The goal of this task is (1) validate the water measurements at each farm site; and (2) measure and verify the energy and water savings achieved due to reduced irrigation at the farms. The energy consumption of the 2016 season (optimized irrigation) and the 2015 season (baseline irrigation) will be compared, and the energy footprint of the source of water will be taken into account.

## EXHIBIT A Scope of Work

### The Recipient shall:

- Define goal of Life Cycle Analysis (LCA) according to ISO 14044 (2006)<sup>4</sup>, to include but not be limited to:
  - The intended application
  - The reasons for carrying out the study
  - The intended audience
- Define and prepare in *LCA Model for Irrigation* the scope of LCA according to ISO 14044 (2006) and provide to CAM. This includes but is not be limited to:
  - Functional unit and reference flows
  - System boundaries
  - Allocation procedures
  - Impact indicators
  - Impact assessment methods
  - Data requirements
  - Data quality requirements
  - Development of a life cycle inventory model and process flow diagram for irrigation
    - Identification of all unit processes to be included
    - High-level and detailed process flow diagrams
    - Collection and processing of foreground data
    - Water consumption data
    - Well pump electricity consumption data
    - Data transfer, processing, and storage data
    - Crop yield data
    - Cost of electricity
    - Any other relevant foreground data
  - Collection and processing of background life cycle inventory data for
    - Electricity production
    - Canal water pumping
    - Data transfer, processing, and storage
    - Any other relevant background data
- Prepare *Water Measurement Report* to include but not be limited to:
  - Water flow measurement over a period of one week at all test sites, water flow in gallons per minute
  - Water usage over a period of time in acre-feet
  - Accuracy of the new water measurement capability using smart meter data
- Develop and provide *LCA Model For Water Measurement* to include but not be limited to:
  - Reduced life cycle inventory that focuses on water records
    - Water records from water meter devices installed at farms compared to water records generated from smart meters used for electricity billing
  - Assessment of a shorter life cycle impact on water records
  - Comparison of the energy intensity of keeping the water records using water meters against smart meters
- Prepare *Water and Energy Data Collection Plan* to include but not be limited to:

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<sup>4</sup> ISO (2006) ISO 14044: Environmental management – Life cycle assessment – Requirements and guidelines, ISO/FDIS 14044:2006(E), ISO, Genève, Switzerland

## EXHIBIT A Scope of Work

- Requirements for energy data collection
- Energy data collected via Green Button program in collaboration with local utility
- Water data collection requirements
- Prepare *Yield Measurement Requirements* to include but not be limited to:
  - The requirements for how yield will be measured, such as:
    - Almond and pistachio, or other nuts will be collected and weighed from three 200 square feet quadrants per measured orchard
    - Processing tomatoes yields will be measured with a machine harvester provided by the farmer and a scale with a measurement cart. Yields will be measured using three 200-ft strips per measured field.
- Prepare *Data Collection Results For 2015* to include but not be limited to:
  - Energy data for baseline year (2015) collected at all deployment sites
  - Water data for baseline year (2015) collected at all deployment sites
  - Yield data for baseline year (2015) collected at all almond and Pistachio crop deployment sites
  - Consolidate all data in *Data Collection Results For 2015*
    - Yield for almond and pistachio
- Prepare *Measurement, Verification and Data Results For 2016* to include but not be limited to
  - Energy data for year (2016) collected at all deployment sites
  - Water data for year (2016) collected at all deployment sites
  - Yield data for year (2016) collected at all deployment sites
    - Yield for almond and pistachio
    - Yield for tomato and alfalfa
- Consolidate and provide all data in *Measurement, Verification and Data Collection Results For 2016* to include but not be limited to:
  - Verification of energy savings at all deployment sites
  - Life cycle impact assessment on optimized irrigation (2016) compared to baseline irrigation (2015)
  - Life Cycle Analysis Report to include but not be limited to:
    - Net energy savings from measuring water records using existing smart meter data from power utilities, (which avoids installing flow meters at well pumps)
    - Identification of life cycle impact indicators (incl. life cycle costs)
    - Identification of characterization models and factors
    - Calculated impact indicator results
    - Uncertainty and sensitivity analyses conducted
    - Energy and water intensity of 2015 season
      - Include MS Excel spreadsheets summarizing energy, water and yield data at each site
    - Net energy and water savings from optimizing irrigation
    - Energy and water intensity of 2016 season
      - Include MS Excel spreadsheets summarizing energy, water and yield data at each site

### Products:

- LCA Model For Irrigation
- Water Measurement Report
- LCA Model For Water Measurement

## **EXHIBIT A**

### **Scope of Work**

- Water and Energy Data Collection Plan
- Yield Measurement Requirements
- Data Collection Results For 2015
- Measurement, Verification and Data Collection Results For 2016

#### **TASK 8. EVALUATION OF PROJECT BENEFITS**

The goal of this task is to report the benefits resulting from this project.

##### **The Recipient shall:**

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:
  - For Product Development Projects and Project Demonstrations:
    - Published documents, including date, title, and periodical name.
    - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
    - Greenhouse gas and criteria emissions reductions.
    - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
    - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
    - 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:

## **EXHIBIT A**

### **Scope of Work**

- Outcome of project.
- Published documents, including date, title, and periodical name.
- A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
- The number of website downloads.
- An estimate of how the project information has affected energy use and cost, or has resulted in other non-energy benefits.
- An estimate of energy and non-energy benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

#### **Products:**

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

### **TASK 9. TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES**

The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

#### **The Recipient shall:**

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
  - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
  - A description of the intended use(s) for and users of the project results.
  - Published documents, including date, title, and periodical name.
  - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
  - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.

## **EXHIBIT A**

### **Scope of Work**

- 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
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- Technology/Knowledge Transfer Plan
- Technology/Knowledge Transfer Report (draft and final)

### **TASK 10. 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.
  - 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

### **IV. PROJECT SCHEDULE**

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: POWWOW ENERGY, INC.

**RESOLVED**, that the State Energy Resources Conservation and Development Commission (Energy Commission) adopts the staff CEQA findings contained in the Agreement Request Form; and

**RESOLVED**, that the Energy Commission approves Agreement EPC-14-081 from PON-14-304 with **PowWow Energy, Inc.** for a **\$2,292,829** grant to deploy innovative data analytics software that will allow growers to automate water measurements and record keeping to help achieve water and energy savings through irrigation optimization without adversely impacting crop yields; 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 June 10, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

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Harriet Kallemeyn,  
Secretariat