



STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 12/2019)

CALIFORNIA ENERGY COMMISSION

A) New Agreement # EPC-20-043 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Neeva Benipal		916-776-0811

C) Recipient's Legal Name	Federal ID Number
The Regents of the University of California on behalf of the Davis Campus	94-6036494

D) Title of Project
Optimized Controls for Cooling California Dairy Cows

E) Term and Amount

Start Date	End Date	Amount
6/30/2021	3/31/2025	\$ 1,529,705

F) Business Meeting Information

☐ ARFVTP agreements \$75K and under delegated to Executive Director

Proposed Business Meeting Date 6/9/2021 ☐ Consent ☒ Discussion

Business Meeting Presenter Michael Lozano Time Needed: 5 minutes

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

Agenda Item Subject and Description:**The Regents of the University of California, Davis Campus**

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, ON BEHALF OF THE DAVIS CAMPUS. Proposed resolution approving Agreement EPC-20-043 with The Regents of the University of California, on behalf of the Davis campus for a \$1,529,705 grant to develop, test, and demonstrate a controller to minimize electricity and water consumption for cooling dairy cows to reduce heat stress, and adopting staff's determination that this action is exempt from CEQA. (EPIC funding) Contact: Michael Lozano. Staff presentation: 5 minutes.

G) 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":

2. If Agreement is considered a "Project" under CEQA:

a) ☒ Agreement **IS** exempt.

☐ Statutory Exemption. List PRC and/or CCR section number:

☒ Categorical Exemption. List CCR section number: Cal. Code Regs., tit. 14, §§ 15301, 15306

☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section: This project will develop, test, and demonstrate an innovative control algorithm for a cooling system that will help minimize electricity and water consumption used to cool dairy cows. The control algorithm will be developed

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and tested in an existing laboratory and will not require any modifications to the laboratory. The control algorithm will be demonstrated at five existing California dairies using existing fans and sprayers at the dairies. The project will not require any additional permitting or involve any construction or installation activities.

This project is therefore categorically exempt from environmental review pursuant to CEQA Guidelines section 15301 as minor alterations to existing facilities that involve negligible or no expansion of an existing or former use at the sites. The project is also categorically exempt pursuant to CEQA Guidelines section 15306 as basic data collection, research, and resource evaluation activities. The project does not involve any unusual circumstances, will not result in damage to any scenic resources within a highway officially designated as a state scenic highway, none of the sites are included on any list compiled pursuant to Government Code section 65962.5, and the project will not cause a substantial adverse change in the significance of a historical resource. The project, when considered as a whole, will not result in a cumulative impact that is significant on the environment. Therefore, none of the exceptions to exemptions listed in CEQA Guidelines section 15300.2 apply to this project.

- 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

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

Legal Company Name:	Budget
RMS Energy Consulting, LLC	\$ 243,301
Agrimesh Technologies	\$ 15,000
Hyhuis	\$ 30,000

I) List all key partners: (attach additional sheets as necessary)

Legal Company Name:

J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	20-21	301.001H	\$1,529,705

R&D Program Area: EERO: IAW

TOTAL: \$ 1,529,705

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:

K) Recipient's Contact Information



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1. Recipient's Administrator/Officer

Name: Theresa Pistoichini

Address: 215 Sage St Ste 100

City, State, Zip: Davis, CA 95616-7379

Phone: 530--754-0918

E-Mail: tepistoichini@ucdavis.edu

2. Recipient's Project Manager

Name: Theresa Pistoichini

Address: 215 Sage St Ste 100

City, State, Zip: Davis, CA 95616-7379

Phone: 530--754-0918

E-Mail: tepistoichini@ucdavis.edu

L) Selection Process Used

☒ Competitive Solicitation Solicitation #: GFO-20-309-5

☐ First Come First Served Solicitation Solicitation #:

☐ Non-Competitive Bid Follow-on Funding (SB 115)

M) The following items should be attached to this GRF

1. Exhibit A, Scope of Work

☒ Attached

2. Exhibit B, Budget Detail

☒ Attached

3. CEC 105, Questionnaire for Identifying Conflicts

☒ Attached

4. Recipient Resolution

☒ N/A

☐ Attached

5. CEQA Documentation

☐ N/A

☒ Attached

Agreement Manager

Date

Office Manager

Date

Deputy Director

Date

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I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR¹	Task Name
1		General Project Tasks
2		Heat and Mass Transfer Modeling
3	X	Control Algorithm Development
4		Demonstration of Optimized Controller
5	X	Project Measurement and Verification
6		Commercialization Assessment
7		Evaluation of Project Benefits
8		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
GHG	Greenhouse Gas
TAC	Technical Advisory Committee
UC	University of California

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

A. Purpose of Agreement

The purpose of this Agreement is for Recipient (The Regents of the University of California, on behalf of the Davis campus, or UC Davis) to develop, test, and demonstrate a controller for dairy cooling systems that will maintain cow health while minimizing electricity and water consumption for cooling.

B. Problem/ Solution Statement

Problem

Heat stress in dairy cows is a key issue affecting many aspects of sustainability and welfare in the U.S. dairy industry, causing an estimated \$1.5 billion in milk production losses annually. A common and effective method of reducing heat stress in dairy cows combines spraying water on cows while using fans to increase air circulation. Optimal use of electricity and water for these spray cooling systems is critically important to improve the sustainability – and financial

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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viability – of the dairy industry. Electricity used for fans and well-pumping is costly for dairy operations and results in greenhouse gas (GHG) emissions. The ability to reduce heat stress in animals, while reducing water and electricity consumption, is a key issue for U.S. dairy production.

Solution

Recipient proposes to improve controls for existing spray cooling systems, where the proposed innovation is the integration of an optimization algorithm based on a heat and mass transfer model of a dairy cow into the control system. The potential for market adoption is high because the proposed retrofit impacts only the control system and uses existing fans and sprayers. If a dairy does not already have speed control for its fans, this can be achieved by retrofitting a variable frequency drive to control fan speed. The controller will operate the existing water spray solenoid valve at the desired frequency. The optimization algorithm developed through this project will be deployed using a commercially available control platform.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to reduce electricity and water consumption by developing, testing, and demonstrating a controller for dairy cooling systems.

Agreement Objectives

- Combine existing dairy cow models to predict heat rejection rate of a dairy cow based on the metabolic production, respiration rate, perspiration, and spray cooling provided to the cow
- Optimize controls for existing spray cooling systems to meet the cooling requirements necessary to reduce heat stress in dairy cows
- Develop and implement the control algorithm based on simplified correlations developed from the outputs of the model using a commercially available control platform
- Demonstrate the control system at five commercial dairies in California to provide real-world performance data and quantify the electricity, water savings, and cost reductions to increase dairy-owner confidence in the technology
- Reduce electricity used for existing cooling systems by 10% at a cost resulting in a 3-year simple payback period
- Perform a commercialization assessment to engage stakeholders and identify a pathway to market for the technology
- Share the knowledge gained, project results, and lessons learned with other dairy industries

Ratepayer Benefits:²

This Agreement will result in the ratepayer benefits of greater electricity reliability and lower costs provided by reduction in annual electricity consumed for cooling dairy cows. It is expected

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).

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that the optimized controller with an annual 2% adoption rate would result in 50 Gwh/year saved within 10 years. The reduction in electricity consumed will decrease stress on the electricity grid by reducing the total load and will lower electricity costs for dairy farmers. In addition to the energy benefits provided by this new technology, there are additional non-energy benefits provided including improved cow health, increased milk production, and a reduction in GHG emissions. Cloud-based controls allow dairy operators to track the function of their cooling systems and receive alerts for cooling system malfunctions so that they can be quickly addressed.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by facilitating demonstration of the optimized controller across five different dairies in the state of California. Results of the demonstrations will increase the Recipient's ability to transfer the technology to industry and increase dairy owner confidence in the technology.

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)**. All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations. All technical tasks should include product(s). Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

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

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

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- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

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

For all products

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

Instructions for Submitting Electronic Files and Developing Software:

- **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 California Energy Commission's (CEC) 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.

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

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

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Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the CEC'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 CEC 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;
- Invoicing and auditing procedures;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

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

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Technical products (subtask 1.1);
 - Progress reports (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide *Kick-off Meeting Presentation* to include but not limited to:
 - Project overview (i.e. project description, goals and objectives, technical tasks, expected benefits, etc.)
 - Project schedule that identifies milestones
 - List of potential risk factors and hurdles, and mitigation strategy
 - Provide an *Updated Project Schedule*, *Match Funds Status Letter*, and *Permit Status Letter*, as needed to reflect any changes in the documents.

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The CAM shall:

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

Recipient Products:

- Kick-off Meeting Presentation
- Updated Project Schedule (*if applicable*)
- Match Funds Status Letter (subtask 1.7) (*if applicable*)
- Permit Status Letter (subtask 1.8) (*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 CEC 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 CEC 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 CEC.

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 CEC, 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 and submit 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.
- 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* with 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

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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)

CAM Products:

- CPR Agenda
- 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 CEC 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 procured equipment.
 - The CEC'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 copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

Products:

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

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REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
 - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the “Payment of Funds” section of the terms and conditions, including a financial report on Match Funds and in-state expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. When creating the Final Report Outline and the Final Report, the Recipient must use the CEC 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 *Energy Commission Style Manual* provided by the CAM.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

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

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Energy Commission Style Manual, and Final Report Template provided by the

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CAM with the following considerations:

- Ensure that the report includes the following items, in the following order:
 - Cover page (**required**)
 - Credits page on the reverse side of cover with legal disclaimer (**required**)
 - Acknowledgements page (optional)
 - Preface (**required**)
 - Abstract, keywords, and citation page (**required**)
 - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
 - Executive summary (**required**)
 - Body of the report (**required**)
 - References (if applicable)
 - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
 - Bibliography (if applicable)
 - Appendices (if applicable) (Create a separate volume if very large.)
 - Attachments (if applicable)
- Submit a draft of the Executive Summary to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* received on the Executive Summary. For each comment received, the recipient will identify in the summary the following:
 - Comments the recipient proposes to incorporate.
 - Comments the recipient does propose to incorporate and an explanation for why.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt.
- Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments were not incorporated into the final product.
- Submit the revised *Final Report* electronically with any Written Responses to Comments within 10 days of receipt of CAM's Written Comments on the Draft Final Report, unless the CAM specifies a longer time period or approves a request for additional time.

Products:

- Summary of TAC Comments
- Draft Final Report
- Written Responses to Comments (*if applicable*)
- Final Report

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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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 CEC 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 CEC 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 CEC 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.
 - If different from the solicitation application, provide 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

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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 each 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).

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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.
- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate, to the extent the TAC members feel is appropriate, on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

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

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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.

The TAC shall:

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

EXHIBIT A

Scope of Work

University of California, Davis

- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

Products:

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

Subtask 1.12 Project Performance Metrics

The goal of this subtask is to finalize key performance targets for the project based on feedback from the TAC and report on final results in achieving those targets. The performance targets should be a combination of scientific, engineering, techno-economic, and/or programmatic metrics that provide the most significant indicator of the research or technology's potential success.

The Recipient shall:

- Complete and submit the project performance metrics from the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.
- Present the draft project performance metrics at the first TAC meeting to solicit input and comments from the TAC members.
- Develop and submit a *TAC Performance Metrics Summary* that summarizes comments received from the TAC members on the proposed project performance metrics. The *TAC Performance Metrics Summary* will identify:
 - TAC comments the Recipient proposes to incorporate into the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
 - TAC comments the Recipient does not propose to incorporate with and explanation why.
- Develop and submit a *Project Performance Metrics Results* document describing the extent to which the Recipient met each of the performance metrics in the *Final Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
- Discuss the *Project Performance Metrics Results* at the Final Meeting.

Products:

- TAC Performance Metrics Summary
- Project Performance Metrics Results

EXHIBIT A
Scope of Work
University of California, Davis

IV. TECHNICAL TASKS

TASK 2 HEAT AND MASS TRANSFER MODELING

The goal of this task is to develop a comprehensive predictive model to quantify the accumulated heat stress in the cow, heat rejection rate, and drying time to use as the basis for the optimized controller control algorithm.

The Recipient shall:

- Develop a comprehensive predictive model to quantify the accumulated heat stress in a dairy cow to include, but not be limited to:
 - Respiration heat loss
 - Perspiration heat loss
 - Metabolic heat production
- Combine predictive model to quantify accumulated heat stress and spray-cooling heat and mass transfer model for use in the optimized controller control algorithm
- Validate model using existing data available in literature
- Prepare *Heat and Mass Transfer Modeling Report* to summarize findings of heat and mass transfer model development

Products:

- Heat and Mass Transfer Modeling Report (Draft/Final)

TASK 3 CONTROL ALGORITHM DEVELOPMENT

The goal of this task is to develop simplified correlations from the comprehensive model to determine heat rejection rate and drying time as a function of ambient conditions.

The Recipient shall:

- Develop simplified correlations based on outputs from the comprehensive model over the range of environmental conditions expected in California.
- Develop algorithm that uses simplified correlations for heat rejection rate and drying time, current ambient conditions, and weather forecast to determine control outputs for optimized fan speed and water spray frequency.
- Program control algorithm into commercial control platform and bench test in the laboratory to ensure controls are working as designed.
- Perform annual forecasting to predict electricity and water savings based on control algorithm developed.
- Prepare *Control Algorithm Report* to describe the final control algorithm, bench test results, and forecasted field performance.
- Prepare *CPR Report #1* in accordance with subtask 1.3.
- Participate in a CPR Meeting.

Products:

- Control Algorithm Report (Draft/Final)
- CPR Report #1

EXHIBIT A

Scope of Work

University of California, Davis

TASK 4 DEMONSTRATION OF OPTIMIZED CONTROLLER

The goal of this task is to demonstrate the optimized controller in five dairies in California to provide real-world test data and improve dairy owner confidence in the technology.

- Select dairies for demonstration sites from those identified in the proposal and any other qualified dairies identified subsequent to the proposal. All demonstration sites to be approved by the CAM in writing.
- Execute research use agreements with each demonstration dairy to allow the Recipient and its subcontractors access to each demonstration site.
- Install the optimized controller by deploying commercially available control hardware modified with the Recipient's algorithm. The optimized controller will be deployed so that the system can be switched between the existing controls (e.g. simple thermostat and/or Agrimesh's automated intelligence control system) and the Recipient optimized controls for the purpose of testing and M&V. The optimized controller will be deployed to operate the existing fan and spray cooling system in one barn in each of five dairies in two phases:
 - Phase I – Two dairies
 - Phase II – Three additional dairies
- Prepare *Installation Report* to include a summary of the installation including confirmation of the installation, any challenges associated with the installation, estimated costs, and installation photos. Installation report to be updated after Phase II installations.

Products:

- Installation Report Phase I (Draft/Final)
- Installation Report Phase II (Draft/Final)

TASK 5 PROJECT MEASUREMENT AND VERIFICATION

The goal of this task is to conduct independent third-party measurement and verification (M&V) to measure and quantify project benefits.

The Recipient shall:

- Consult with the CAM to identify and confirm the specific project benefits to be measured and should include the following at a minimum: performance metrics from Subtask 1.12, pre and post-project energy use (kilowatt hours, kilowatts, therms), and calculations of energy cost savings and greenhouse gas emissions. This can include pre and post measurements of water use (million gallons) and other project benefits, and calculations of the resulting cost savings and greenhouse gas emission reductions and project economics (e.g., simple payback).
- Enter into agreement with M&V firm per Task 1.9
- Coordinate site visits with the M&V firm at the demonstration sites.
- Develop *Phase I M&V Test Plan* for **pre-install** measurement of:
 - Electricity use, to be measured by M&V firm
 - Water use, to be measured by M&V firm
 - Cow health metrics, to be measured by the Recipient
- Perform pre-install measurements based on Phase I M&V Test Plan for pre-install
- Develop Phase I M&V Test Plans for post-install measurement of:
 - Electricity use, to be measured by M&V firm

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- Water use, to be measured by M&V firm
 - Cow health metrics, to be measured by the Recipient
- Perform post-install measurements based on *Phase I M&V Test Plans* for post-install
- Develop *Phase II M&V Test Plan* for **pre-install** measurement of:
 - Electricity use, to be measured by M&V firm
 - Water use, to be measured by M&V firm
 - Cow health metrics, to be measured by Recipient
- Perform pre-install measurements based on *Phase II M&V Test Plan* for pre-install
- Develop *Phase II M&V Test Plans* for **post-install** measurement of:
 - Electricity use, to be measured by M&V firm
 - Water use, to be measured by M&V firm
 - Cow health metrics, to be measured by Recipient
- Perform post-install measurements based on *Phase II M&V Test Plans* for post-install
- Prepare *M&V Findings Reports* for each demonstration site that includes M&V Plan, pre and post install measurements, analysis, results, and analysis of whether the goals and objectives in Section II.C. and the performance metrics in Subtask 1.12 were met. The results and analysis will include:
 - Electricity impacts of the tested technology
 - Water impacts of the tested technology
 - Greenhouse gas emission reduction estimates for the technology
 - Economic impacts of the technology, including installation costs and operational cost savings
- Prepare *CPR Report #2* in accordance with subtask 1.3
- Participate in a CPR Meeting

Products:

- Phase I M&V Test Plan (memo)
- Phase II M&V Test Plan (memo)
- M&V Findings Report (Draft/Final)
- CPR Report #2

TASK 6 COMMERCIALIZATION ASSESSMENT

The goal of this task is to engage stakeholders and conduct a commercialization assessment of the optimized controller.

The Recipient shall:

- Assess the controller's commercial readiness in terms of level of development, ease of adoption, and estimated price and cost effectiveness based on the field demonstration results and the M&V data collected in Task 5.
- Gather information from a variety of sources (e.g., manufacturers and vendors, extension schools, stakeholder interviews) to estimate the market potential for the optimized controller (i.e., the approximate number and size of commercial dairies with and without variable speed fans in California that could use this technology based on existing practices and equipment).

EXHIBIT A
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University of California, Davis

- Prepare the *Commercialization Assessment Report* that includes the optimized controller's market readiness, target market, and potential pathways, barriers, and opportunities for market deployment.

Products:

- Commercialization Assessment Report (Draft/Final)

TASK 7 EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

- Complete the *Initial Project Benefits Questionnaire*. The *Initial Project Benefits Questionnaire* shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Complete the *Annual Survey* by December 15th of each year. The Annual Survey includes but is not limited to the following information:
 - Technology commercialization progress
 - New media and publications
 - Company growth
 - Follow-on funding and awards received
- Complete the *Final Project Benefits Questionnaire*. The *Final Project Benefits Questionnaire* shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete and update the project profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.

Products:

- Initial Project Benefits Questionnaire
- Annual Survey(s)
- Final Project Benefits Questionnaire
- Documentation of Project Profile on EnergizeInnovation.fund
- Documentation of Organization Profile on EnergizeInnovation.fund

TASK 8 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to conduct activities that will accelerate the commercial adoption of the technology being supported under this agreement. Eligible activities include, but are not limited to, the following:

EXHIBIT A
Scope of Work
University of California, Davis

- Scale-up analysis including manufacturing analysis, independent design verification, and process improvement efforts.
- Technology verification testing, or application to a test bed program located in California.
- Legal services or licensing to secure necessary intellectual property to further develop the technology
- Market research, business plan development, and cost-performance modeling.
- Entry into an incubator or accelerator program located in California.

The Recipient Shall:

- Develop and submit a *Technology Transfer Plan (Draft/Final)* that identifies the proposed activities the recipient will conduct to accelerate the successful commercial adoption of the technology.
- Present the *Draft Technology Transfer Plan* to the TAC for feedback and comments.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the *Draft Technology Transfer Plan*. This document will identify:
 - TAC comments the recipient proposes to incorporate into the *Final Technology Transfer Plan*.
 - TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit the *Final Technology Transfer Plan* to the CAM for approval.
- Implement activities identified in *Final Technology Transfer Plan*.
- Develop and submit a *Technology Transfer Summary Report (Draft/Final)* that includes high level summaries of the activities, results, and lessons learned of tasks performed relating to implementing the *Final Technology Transfer Plan*. This report should not include any proprietary information.
- When directed by the CAM, develop presentation materials for an CEC- sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the CEC.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.

Products:

- Technology Transfer Plan (Draft/Final)
- Summary of TAC Comments
- Technology Transfer Summary Report (Draft/Final)
- High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, ON
BEHALF OF THE DAVIS CAMPUS

RESOLVED, that the State Energy Resources Conservation and Development Commission (CEC) adopts the staff CEQA findings contained in the Agreement or Amendment Request Form (as applicable); and

RESOLVED, that the CEC approves Agreement EPC-20-043 with The Regents of the University of California, on behalf of the Davis campus for a \$1,529,705 grant to develop, test, and demonstrate a controller to minimize electricity and water consumption for cooling dairy cows to reduce heat stress; and

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

CERTIFICATION

The undersigned Secretariat to the CEC 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 CEC held on June 9, 2021.

AYE:

NAY:

ABSENT:

ABSTAIN:

Patricia Carlos
Secretariat