



STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 12/2019)

CALIFORNIA ENERGY COMMISSION

A) New Agreement # EPC-20-045 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Kevin Mori	51	916-776-0794

C) Recipient's Legal Name	Federal ID Number
Empowered Solutions, LLC	46-1975495

D) Title of Project
Artificial Intelligence for Energy Efficiency Optimization in California Dairy Operations

E) Term and Amount

Start Date	End Date	Amount
6/30/2021	3/31/2025	\$ 1,638,868

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:

ENPOWERED SOLUTIONS, LLC. Proposed resolution approving Agreement EPC-20-045 with Empowered Solutions, LLC for a \$1,638,868 grant to demonstrate an energy management system using artificial intelligence to optimize energy efficiency and plant utility control systems in five California dairy industrial facilities, 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)):

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; Cal. Code Regs., tit. 14, § 15306

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

Explain reason why Agreement is exempt under the above section: Cal. Code Regs., tit. 14, sect. 15301 provides that projects which consist of operation, repair, maintenance, leasing, licensing, or minor alteration of existing structure, facilities, mechanical equipment, or topographical features, which involve negligible or no expansion of use beyond that existing at the time of the lead agency's California Environmental Quality Act determination are categorically exempt from the

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provisions of the California Environmental Quality Act. The project will include the installation of various meters, sensors, and controls for energy optimization of the current facilities' processes.

Cal. Code Regs., tit. 14, sect. 15306 provides that projects which consist of basic data collection, research, experimental management, and resource evaluation activities, and which do not result in a serious or major disturbance to an environmental resource are categorically exempt from the provisions of the California Environmental Quality Act. This project will be collecting electricity usage data from different existing processes within the five dairy facilities as inputs for the artificial intelligence system that will be installed for improved energy efficiency optimization.

- 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	\$ 192,505
TBD Electrical & Mechanical Contractor (Santa Ana)	\$ 44,438
TBD Electrical & Mechanical Contractor (Riverside)	\$ 44,438
TBD Electrical & Mechanical Contractor (COI North)	\$ 44,438
TBD Electrical & Mechanical Contractor (COI South)	\$ 44,438
TBD Electrical & Mechanical Contractor (Turlock)	\$ 44,438
Rockwell Automation, Inc.	\$ 0 (match only \$22,500)

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	\$1,638,868

R&D Program Area: EERO: IAW

TOTAL: \$ 1,638,868



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CALIFORNIA ENERGY COMMISSION

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:

K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Shiva Subramanya

Address: 32 Executive Park Ste 140

City, State, Zip: Irvine, CA 92614-4722

Phone: 949-529-5302

E-Mail: shivas@enpllc.com

2. Recipient's Project Manager

Name: Shiva Subramanya

Address: 32 Executive Park Ste 140

City, State, Zip: Irvine, CA 92614-4722

Phone: 949-529-5302

E-Mail: shivas@enpllc.com

L) Selection Process Used

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

☐ First Come First Served Solicitation - Solicitation #:

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

Exhibit A Scope of Work Empowered Solutions

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		DairyAI Implementation Planning
3		DairyAI Design
4		DairyAI Installation
5		Configuration and Programming
6	X	Simulate and Test PLC and AI Code
7		Commissioning and Startup
8		Demonstration
9		Project Measurement and Verification
10		Evaluation of Project Benefits
11		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/ Term	Meaning
AI	Artificial Intelligence
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
DairyAI	Dairy control system that uses artificial intelligence to optimize energy efficiency
PLC	Programmable Logic Controller
Simple Payback	A measure of the length of time required for the cumulative savings from a project to recover the initial investment cost and other accrued costs, without taking into account the time value of money.
TAC	Technical Advisory Committee
VFD	Variable Frequency Drive

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.

Exhibit A Scope of Work Empowered Solutions

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

A. Purpose of Agreement

The purpose of this Agreement is to demonstrate a process control system in five dairies in California. This energy management system is intended to optimize energy efficiency for three dairy processes (pasteurization, cleaning-in-place, and cold storage and freezing) and the supporting plant utilities controls systems (refrigeration and steam) using artificial intelligence, model predictive control, and provide advanced analytics, dashboards, and reports to dramatically reduce the energy intensity of dairies.

B. Problem/ Solution Statement

Problem

Today's standard control systems for improving energy efficiency in plant utility systems, such as steam and refrigeration, are comprised of controllers, meters/sensors, and variable frequency drives (VFDs) that implement various controls strategies based on common energy efficiency measures for these systems. These control systems are reactive, as they respond to the aggregated plant demand requirements of heating and cooling from multiple processes in other areas of the plant. They use proportional integral derivative control of VFDs and valve positioning and start/stop commands based on static setpoints created to meet overall plant requirements, however this results in less-than-optimal energy reductions that are not sustained over the long term due to dynamic plant operations.

Solution

DairyAI utilizes artificial intelligence and model predictive control to utilize the real-time process data to make decisions on how to control and operate the utility systems at any given moment. Dynamic constraints are monitored, predicted, and enforced in a manner never before realized. This is intended to result in lower energy consumption and better monitoring and tracking of key performance indicators for energy intensity on a continuous basis, sustaining energy reductions over the long-term while also permitting insights to be shared across dairy plants.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to:

- Utilize artificial intelligence, predictive model control learning, advanced analytics, and dashboards to reduce energy consumption and increase product throughput in the dairy plants' processes.
- Simple Payback of less than three years

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety. DairyAI will utilize artificial intelligence and

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).

Exhibit A Scope of Work Empowered Solutions

predictive modelling controls to improve energy efficiency by using monitored data and machine learning from previous experiences, and then applying reasoning and rules in the control strategy. These attributes will benefit IOU ratepayers in the following ways:

- Quantifiable energy savings, such as kW, kWh, and therms, through historic reporting and analytics using an open architecture that can be vetted and verified.
- Reduced energy costs from energy savings through continual real-time sequencing of the production line.
- Lowered energy intensity of product, thereby improving the product economics at the manufacturing level, potentially leading to lower dairy product prices.
- Increased product and energy resiliency for the plant through predictive modeling, enabling the plant to be forewarned of unexpected maintenance needs or shutdowns.
- Improved employee safety through DairyAI's immediate, precision alarms and remote access by minimizing the need for service calls to troubleshoot at the equipment location and directing crews to the exact issue if a call-out is warranted.
- Improved manufacturing reliability through DairyAI's ability to be remotely accessed, monitored, and controlled in real-time from anywhere on the planet.

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 energy goals through machine learning and AI breakthroughs embedded in DairyAI. The technology will provide improved production value, resiliency, and energy use and GHG reductions to overcome barriers to achieving California's energy goals.

The technology's systems play a key role in providing dashboards, reports, and alerts to plant personnel to assist them in identifying problem areas and assigning accountability for energy use within a facility. In addition, process control systems optimize process operations and improves product, data quality, and consistency and are used to improve energy efficiency. Energy management systems, coupled with process control systems, will use artificial intelligence and predictive model controls to improve energy efficiency, by using monitored data and learning from previous experiences, and then applying reasoning and rules in the control strategy (at a plant and across multiple plants).

³ California Public Resources Code, Section 25711.5(a) also requires EPIC-funded projects to lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory and energy goals.

Exhibit A

Scope of Work

Empowered Solutions

Agreement Objectives

The objectives of this Agreement are to:

- Apply machine learning from prior monitored data to update reasoning and rules in control strategies for operating refrigeration and steam systems.
- Implement more robust process models that account for significant dairy process interactions to stabilize the variability of the plant utility systems and enable the control loops to be pushed closer to process constraints.
- Apply advanced analytics in dashboards and reports with real-time key performance indicators from the plant floor to allow dairy processors make informed, effective decisions.
- Enable cross-plant intelligence whereby insights gleaned from the AI can be shared immediately with other plants in the system and ultimately with dairies across California.
- Reduce the overall dairy plants' energy intensity, kwh or energy per gallon of product, by 10%.
- Reduce the dairy plant's refrigeration, steam systems, and ancillary energy consumption by 10% - 15%.
- Increase production throughput by 1% - 2% by eliminating waste and production delays caused by heating and cooling issues.
- Demonstrate the energy management system at five California dairies.

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.

Exhibit A Scope of Work Empowered Solutions

- 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).

Exhibit A Scope of Work Empowered Solutions

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.

The CAM shall:

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

Exhibit A Scope of Work Empowered Solutions

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 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.

Exhibit A Scope of Work Empowered Solutions

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

Exhibit A Scope of Work Empowered Solutions

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
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Energy Commission Style Manual, and Final Report Template provided by the CAM with the following considerations:
 - Ensure that the report includes the following items, in the following order:

Exhibit A Scope of Work Empowered Solutions

- 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.

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.

Exhibit A Scope of Work Empowered Solutions

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 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.

Exhibit A

Scope of Work

Empowered Solutions

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).

Products:

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

Exhibit A Scope of Work Empowered Solutions

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

Scope of Work

Empowered Solutions

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

Exhibit A Scope of Work Empowered Solutions

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 Empowered Solutions

IV. 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 – DAIRYAI IMPLEMENTATION PLANNING

The goal of this task is to plan the implementation of DairyAI by defining the heating and cooling requirements for each process and the specific products they handle; understanding the current control logic for each subject process and utility system; defining the control and process variables to be included in DairyAI; and, completing a hazard and operability study.

The Recipient shall:

- Complete and submit a *Hazard and Operability Study* to identify and evaluate problems that may represent risks to operations, personnel, or equipment, and describing how the study will be used in the simulation and testing task.
- Provide an *Implementation Planning Report* that includes, but is not limited to:
 - A summary of Heating and Cooling Requirements:
 - Product names
 - Min/max temperatures
 - Time at temperatures
 - Number of cycles
 - A description of current control logic for each subject process and utility systems (non-proprietary).
 - A description of control and process variables to be monitored and controlled in DairyAI.
- Schedule and attend a Planning Review Meeting, provide a *Planning Review Agenda* in advance of the meeting, and *Planning Review Meeting Minutes* after the meeting.

Products:

- Hazard and Operability Study
- Implementation Planning Report
- Planning Review Agenda
- Planning Review Meeting Minutes

Exhibit A

Scope of Work

Empowered Solutions

TASK 3 – DESIGN

The goal of this task is to design DairyAI facility systems by creating detailed technical specifications, design drawings, product datasheets, commissioning plan, dashboard mockups, reporting structures, and alert algorithms, and predictive models.

The Recipient shall:

- Provide a *Design Report* that includes, but is not limited to:
 - A list of technical specifications and a discussion of the importance of the specifications for:
 - Low-Voltage Electrical Distribution
 - Electrical Protection
 - Primary Control Devices
 - Process Control and Enterprise Management Systems
 - Instrumentation for Process Systems
 - Design drawings and a discussion of:
 - Facility Layouts
 - Network Diagrams
 - Control Panel Layouts
 - Wiring Diagrams
 - Piping & Instrumentation Diagrams
 - Installation Details
 - Product datasheets for:
 - Controllers
 - Instrumentation
 - VFDs
 - A description of the AI predictive control models for each system
 - A discussion on the commissioning plans for each site that includes:
 - Procedures to check, inspect and test operational components of DairyAI
 - Develop Construction Checklists
 - Create System Readiness Plan with Checklists
 - Develop AI Predictive Control Models Results Checklist
 - Prepare Functional Performance Test Forms
 - Prepare Factory Acceptance Test Forms
 - Screenshots of dashboard mockups for the following systems:
 - Refrigeration
 - Steam Generation
 - Pasteurization
 - Cleaning-in-Place
 - Cold Storage and Freezing
 - A discussion of the DairyAI reporting structures that includes, but is not limited to:
 - Type of reports
 - Data and calculations fields
 - Frequency
 - Facility operators and decision makers
 - A discussion of the type of alert algorithms and what they will be reporting to the facility operators and decision makers.
 - A discussion of the predictive and learning models that includes, but is not limited to, the following:
 - Sequence of input data

Exhibit A Scope of Work Empowered Solutions

- Defined and forced constraints
 - Future process output
 - Define statistical techniques for learning
- Schedule and attend Design Review Meeting. Distribute *Design Review Agenda* prior to meeting and produce *Design Review Meeting Minutes* after the meeting.

Products:

- Design Report
- Design Review Agenda
- Design Review Meeting Minutes

TASK 4 – DAIRYAI INSTALLATION

The goal of this task is to physically install the components of DairyAI in each of the five California dairy plants.

The Recipient shall:

- Establish corporate and plant servers with the necessary SQL databases and software required for DairyAI and provide *Database Schema Report* that includes, but is not limited to:
 - A list of steps taken to establish the servers and databases for each site
 - A summary of the barriers encountered, and the steps taken to resolve them
 - A discussion of potential improvements that can be made in the future e.
- Complete and provide *Factory Acceptance Testing Results* of control panels.
- Install ControlLogix PLC and LogixAI in each dairy plant.
- Install CompactLogix control panels at each steam and refrigeration system as required.
- Install VFDs on glycol/chilled water pumps and condenser fans as needed.
- Network existing and new plant utility processors with pasteurization and clean-in-place processors and new ControlLogix PLCs.
- Install new meters and sensors as needed.
- Run conduit and wire as needed between controls and instrumentation.
- Maintain a construction issues Log and provide a summarized *Construction Issues Report* that discusses the main barriers encountered and how they were resolved.
- Redline design drawings to reflect actual installation conditions to create *As-Built Drawings*.

Products:

- Database Schema Report
- Factory Acceptance Testing Results
- Construction Issues Report
- As-Built Drawings

Exhibit A Scope of Work Empowered Solutions

TASK 5 – CONFIGURATION AND PROGRAMMING

The goal of this task is to configure and program the various components of DairyAI in each of the plants, including new instrumentation, PLCs, DairyAI server, and dashboards, reports, and alerts.

The Recipient shall:

- Configure and program all controls-related hardware, metering and instrumentation, and integrate everything into the new DairyAI Platform.
- Create Dashboards, Reports, and Alerts.
- Create and provide *Programming Documentation* for all instrumentation, PLCs, VFDs, Dashboards, Reports, and Alerts.

Products:

- Programming Documentation

TASK 6 – SIMULATE AND TEST PLC AND AI CODE

The goal of this task is to simulate and test the PLC and AI code without using actual hardware; which will save time on commissioning, minimize system critical errors, and uncover potential system deadlocks.

The Recipient shall:

- Create a simulation for the three dairy processes and two plant utility systems.
- Test the strategies to ensure everything operates as designed.
- Test robustness by inputting scenarios from the Hazard and Operability Study.
- Validate AI predictive results utilizing various statistical tests.
- Produce a *Simulation and Testing Results Report* that includes, but is not limited to:
 - A summary of the initial simulation strategy for each plant
 - A list of barriers encountered and how they were resolved
 - A discussion of the results of the tests and the improvements made.
- Prepare a *CPR Report*
- Participate in a CPR meeting in accordance with subtask 1.3 (CPR Meetings).

Products:

- Simulation and Testing Results Report
- CPR Report

TASK 7 – COMMISSIONING AND STARTUP

The goal of this task is to determine and implement the methods and procedures to check, inspect and test every operational component of DairyAI as described in the Task 3 commissioning section of the Design Report.

The Recipient shall:

- Complete system readiness and construction checklists for each site and verify that the system was constructed properly and is ready to startup.
- Perform and document a final installation verification to confirm that equipment and systems are completely installed and ready for functional performance testing.

Exhibit A Scope of Work Empowered Solutions

- Perform Functional Performance Tests.
- Confirm AI Predictive Control Models.
- Complete and prepare the *System Readiness Manual* that includes, but is not limited to:
 - A list of checks required before starting the system.
 - A list of instructions on how to startup the system.
 - A discussion of potential errors and how to correct them.
 - A list of key operational functions and a discussion on how to use them.
- Prepare *Commissioning Report* that includes, but is not limited to:
 - A summary of the checks and verifications performed prior to the startup of the systems at each site.
 - A summary of the procedures for the Function Performance Test and the AI Predictive Control Models confirmation.
 - A list of barriers encountered, and solutions used to resolve them.

Products:

- System Readiness Manual
- Commissioning Report

TASK 8 - DEMONSTRATION

The goal of this task is to demonstrate that the three production processes and two utility plant processes were integrated properly, and all achieve the desired AI predictive control model results at the five California dairy plants. During this task a test method will be developed to ensure AI predictive control model results are acceptable and energy reduction is replicable.

The Recipient shall:

- Establish verification and testing methods to demonstrate:
 - AI predictive control model results
 - energy reduction
- Create and provide a *Verification Plan* that includes but is not limited to the following for each dairy:
 - The tests being conducted
 - Critical metrics being validated
 - Data used for verification
- Prepare and provide a draft *Verification Report* which includes but not limited to the following for each dairy:
 - High-level executive summary discussing:
 - Process and results of the final demonstration
 - Testing of the DairyAI system
 - Technical issues and how resolved
 - Lessons learned for this phase in the project including feedback from each dairy
- Submit the draft *Verification Report* to the CAM for feedback and incorporate changes as requested in the final *Verification Report*.

Products:

- Verification Plan
- Verification Report (draft and final)

Exhibit A Scope of Work Empowered Solutions

TASK 9 - 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. At a minimum this will include the goals/objectives in Section II.C., performance metrics in Subtasks 1.12, pre- and post-project energy use (kilowatt hours, kilowatts, therms), and calculations of energy cost savings and greenhouse gas emissions. When directed by the CAM, 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.
- Enter into agreement with M&V vendor per Task 1.9
- Coordinate site visits with the M&V firm at the demonstration sites identified.
- Develop M&V Plan for pre-install measurement of:
 - Optimized systems (Pasteurization, CIP and Storage) and its ancillary equipment as fully outlined in the narrative.
- Perform pre-install measurements based on the M&V Plan for pre-install
- Develop M&V Plan for post-install measurement of:
 - Optimized systems (Pasteurization, CIP and Storage) and its ancillary equipment as fully outlined in the narrative.
- Perform post-install measurements based on M&V Plan for post-install
- Prepare *M&V Findings Reports* for each demonstration site that includes M&V Plan, pre- and post-install measurements, analysis, results performed in this task as agreed with the CAM, and whether the goals/objectives from Section II.C. and performance metrics in Subtask 1.12 were achieved.

Products:

- M&V Findings Report(s)

TASK 10 - 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.

Exhibit A Scope of Work Empowered Solutions

- 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](http://www.energizeinnovation.fund) (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](http://www.energizeinnovation.fund) (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 11 - 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:

- 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*.

Exhibit A Scope of Work Empowered Solutions

- 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: ENPOWERED SOLUTIONS, LLC

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-20-045 with Enpowered Solutions, LLC for a \$1,638,868 grant to demonstrate an energy management system using artificial intelligence to optimize energy efficiency and plant utility control systems in five California dairy industrial facilities; 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