STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015) CALIFORNIA ENERGY COMMISSION

New Agreement EPC-18-008 (To be completed by CGL Office)

ERDD	Benson Gilbert	51	916-445-5406

MicroBio Engineering, Inc.	27-0524479

Improving Energy Efficiency and Performance of Wastewater Recycling

	3/6/2019	3/30/2022	$ 1,550,227

☐ ARFVTP agreements under $75K delegated to Executive Director.			
Proposed Business Meeting Date	2/20/2019	☐ Consent	☒ Discussion
Business Meeting Presenter	James Friedrich	Time Needed:	5 minutes
Please select one list serve. EPIC (Electric Program Investment Charge)			

Agenda Item Subject and Description

MICROBIO ENGINEERING, INC. Proposed resolution approving Agreement EPC-18-008 with MicroBio Engineering, Inc. for a $1,550,227 grant to further advance the Recycle Nutrients Energy and Water (RNEW®) process to the pilot-demonstration stage, and adopting staff's determination that this action is exempt from the California Environmental Quality Act. The RNEW® technology overcomes the seasonal limitation by the selective use of mechanical aeration to optimize wastewater treatment and nitrification in winter months and incorporates a two-stage process of biomass settling and filtration for harvesting. The RNEW® technology has the potential to reduce electricity consumption at wastewater treatment facilities by 80 percent compared to conventional technologies by enabling year-round algal treatment of wastewater.

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. (Attach draft NOE) ☐ 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, § 15303 ☐ Common Sense Exemption. 14 CCR 15061 (b) (3) Explain reason why Agreement is exempt under the above section:

For Cal. Code Regs. (CCR), Title 14, Section 15301: This project will demonstrate algal wastewater treatment and reuse of nutrients at three existing wastewater treatment facilities. All three facilities currently house wastewater treatment equipment and have hosted previous experiments for algal wastewater treatment. The RNEW® technology to be installed and operated is expected to integrate with the existing piping equipment at all three sites as a beneficial add-on for efficient wastewater treatment.

The technologies to be installed at the San Luis Obispo Water Resource Recovery Facility will include between four to six raceway ponds approximately 3.5 square meters each; one denitrification tank with approximately a 50 to 200 gallon capacity; and a membrane skid station with a footprint of approximately seven feet by five feet. The ponds and tank will be permanently installed at the San Luis Obispo Water Resource Recovery Facility for future research.

At the Delhi County Water District Wastewater Treatment Facility, the following will be installed for operation with the existing 3.5-acre raceway pond: a brush aerator, a paddle wheel motor, a gearbox and a variable frequency drive. The new equipment will be used in operation with the existing 3.5-acre raceway pond to demonstrate nitrification at full scale.

The technology to be installed at the Templeton Community Services District Wastewater Treatment Plant will include a membrane skid station with a footprint of approximately seven feet by five feet. The membrane filter skid will be temporarily installed at the Templeton site, and will be removed after completion of the project.

Replacement of existing motors and pumps, as well as reconfiguration of existing piping, may occur to facilitate the applied research testing. This project will not result in expanded capacity at any of the three wastewater treatment sites. The work will involve basic data collection at the three existing wastewater treatment facilities and a fourth site at Cal Poly San Luis Obispo for computer-based laboratory water quality analysis to determine the system performance. For these reasons, the project will not have a significant effect on the environment and falls under the categorical exemption listed in 14 C.C.R. § 15301.

For Cal. Code Regs. (CCR), Title 14, Section 15303: This project will install limited numbers of new, small structures appurtenant to three existing wastewater treatment facilities.

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The technology to be installed at the Templeton Community Services District Wastewater Treatment Plant will include a membrane skid station with a footprint of approximately seven feet by five feet. The membrane filter skid will be temporarily installed at the Templeton site, and will be removed after completion of the project.

Additional minor modifications may be made to existing facilities, including replacement of existing motors and pumps, as well as reconfiguration of existing piping. For these reasons, the project will not have a significant effect on the environment and falls under the categorical exemption listed in 14 C.C.R. § 15303.

☐ 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

List all subcontractors (major and minor) and equipment vendors: (attach additional sheets as necessary)	
Legal Company Name:	Budget
Cal Poly Corporation	$ 569,227
	$
	$
	$
	$
	$
	$
	$
	$

Legal Company Name:

Funding Source		Funding Year of Appropriation	Budget List No.	Amount
EPIC		17-18	301.001E	$1,550,227
				$
				$
				$
				$
				$
R&D Program Area:	EERO: Buildings			$1,550,227
Explanation for “Other” selection				
Reimbursement Contract #:			Federal Agreement #:	

Name:	John Benemann		Name:	John Benemann	
Address:	3547 S Higuera St Ste H		Address:	3547 S Higuera St Ste H	
City, State, Zip:	San Luis Obispo, CA 93401-7361		City, State, Zip:	San Luis Obispo, CA 93401-7361	
Phone:	805-242-3876 /	Fax: - -	Phone:	805-242-3876 /	Fax: - -
E-Mail:	jbenemann@microbioengineering.com		E-Mail:	jbenemann@microbioengineering.com	

☒ Competitive Solicitation Solicitation #: GFO-17-308
☐ First Come First Served Solicitation

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
MicroBio Engineering Inc.

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2	X	Test Set 1 — Central Valley Configuration and Setup
3		Test Set 1 — Operational Optimization Experiments
4		Test Set 1 — Biological Treatment Performance Data Collection in the Central Valley
5		Test Set 1 — Central Valley Recycled Water Filtration Studies
6	X	Test Set 2 — Pilot System Configuration of Selected Effluent Treatment
7		Test Set 2 — Operational Optimization Experiments of Selected Effluent
8		Test Set 2 — Biological Treatment Performance Data Collection of Selected Effluent
9		Test Set 2 — Recycled Water Filtration Studies of Selected Effluent
10		Evaluation of Project Benefits
11		Technology/Knowledge Transfer Activities

B. Acronym/Term List.

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
DO	Dissolved oxygen is a measure of how much oxygen is dissolved in the water.[2]
kWh/m^3	Kilowatt hour per cubic meter
pH	pH is a measure of how acidic or basic water is.[3]
RNEW®	Recycle Nutrients Energy and Water technology
TAC	Technical Advisory Committee

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

A. Purpose of Agreement

[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.
[2] *Water properties: Dissolved oxygen*. U.S. Geological Survey, U.S. Department of the Interior, page last modified 20 January 2017, https://water.usgs.gov/edu/dissolvedoxygen.html. Accessed 21 December 2018.
[3] *pH -- Water properties*. U.S. Geological Survey, U.S. Department of the Interior, page last modified 08 August 2018, https://water.usgs.gov/edu/ph.html. Accessed 21 December 2018.

Exhibit A
Scope of Work
MicroBio Engineering Inc.

The purpose of this Agreement is to fund development of a wastewater resource recovery technology. This technology has low power intensity, allows for demand scheduling, and, through its low cost, promotes water recycling with its inherit energy efficiency.

For many communities, the power costs of wastewater treatment are the largest of any activity. Other associated costs are also high due to the labor required to operate complex wastewater treatment technologies. With increasing needs for recycled water and better nitrogen control, the power intensity and complexity of wastewater treatment are increasing. The wastewater treatment industry has been working to reduce power costs and shape power demands to control costs and contribute to climate change solutions.

Solution

This project will advance the Recipient's RNEW® technology of recovering nutrients, energy, and water from wastewater sources toward commercialization. Two applications are to be evaluated: greenfield wastewater treatment and upgrading of existing treatment facilities for nutrient removal. Three separate technologies will be individually tested. The integrated technology comprises an energy efficient algal wastewater treatment system followed by membrane filtration to meet California Title 22 water reuse standards. Algal wastewater treatment takes advantage of photosynthesis, which uses solar energy to naturally oxygenate wastewater for organics removal as well as nutrient assimilation and nitrification. Innovative membrane technologies are being investigated to minimize the parasitic energy costs of membrane filtration. Additionally, biomass from the system is harvested and anaerobically digested to generate a net surplus of electricity. A key challenge for implementing this technology in a full scale setting is to overcome seasonal variation in performance, with the proper control of nutrients, in order to enable the system to perform well in winter months.

Three technologies will be tested at three site locations. The first site location will use one raceway pond to demonstrate nitrification at full-scale in support of TEST SET 1 tasks. The second site location will use between four to six raceway ponds, and one denitrification tank, to determine the optimal aeration schedule in support of TEST SET 2 tasks. The third site location will use one membrane filter skid to determine the optimal hydraulic and solids loading rate on the membrane filter skid pilot unit in support of TEST SET 1 and 2 tasks.

B. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Develop a low energy intensity wastewater treatment process to reduce the electrical demand from wastewater treatment facilities in California.
- Develop a low-cost alternative wastewater treatment technology to enable disadvantaged communities to upgrade their existing facilities to meet discharge requirements.
- Ensure that the wastewater treatment technology is robust for all seasons, reliable and can meet discharge limits year-round.

Ratepayer Benefits:[4] This Agreement will result in the ratepayer benefit of reduced wastewater treatment costs, greater reliability of water resources, and reduced air emissions from reduced electrical demand. The proposed technology is an energy efficient and low-cost technology for disadvantaged communities. The system has a net surplus of electricity when biogas is used to generate electricity.

In addition, the system reduces odors typically associated with wastewater treatment and has a low profile, which is more aesthetically pleasing. An estimated 40% market penetration of this technology will lead to 14 MW of electrical savings and a reduction of 41,000 mt CO_2e/yr in the San Joaquin Valley alone.

Technological Advancement and Breakthroughs:[5] The RNEW® process is a novel technology that takes advantage of photosynthesis to oxygenate and treat wastewaters instead of using energy intensive mechanical aeration. The process generates abundant amounts of carbon neutral biogas to be used as a fuel for electrical generation or transportation fuels. Broad implementation of the proposed wastewater treatment system will lead to wastewater treatment facilities being net electrical generators instead of large electrical consumers.

Wastewater treatment facilities with the Recipient's proposed wastewater treatment system have the added advantage of meeting strict future nutrient discharge limitations. Communities would otherwise need to upgrade existing systems to energy intensive conventional technologies, which use mechanical aeration.

Agreement Objectives

The objectives of this Agreement are to:

- Measure year-round wastewater treatment performance of an algae based wastewater treatment system through three distinct systems.
- Measure year-round electrical consumption from an algae based wastewater treatment system.
- Determine the rate and timing of supplemental mechanical aeration required for small and large scale nitrification to meet nutrient discharge limits during low-performing winter months.
- Pilot and measure fouling rates of innovative low-energy membrane filtration systems, which filter the effluent of the algal wastewater treatment process to meet Title 22 water reuse regulations.

[4] 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).

[5] 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
MicroBio Engineering Inc.

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

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

The Recipient shall:

For products that require a draft version, 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.
- 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 Energy Commission's software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

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

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

o **Software Application Development**

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

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

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

The administrative portion of the meeting will include discussion of the following:
- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The technical portion of the meeting will include discussion of the following:
- The CAM's expectations for accomplishing tasks described in the Scope of Work;
- An updated Project Schedule;
- Technical products (subtask 1.1);
- Progress reports and invoices (subtask 1.5);
- Final Report (subtask 1.6);
- Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
- Any other relevant topics.

- Provide an *Updated Project Schedule, List of Match Funds,* and *List of Permits*, as needed to reflect any changes in the documents.

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

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

CAM Product:
- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not

increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

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

CAM Products:

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

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

of the CAM.

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

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
  - Disposition of any state-owned equipment.
  - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
  - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
  - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
  - "Surviving" Agreement provisions such as repayment provisions and confidential products.
  - Final invoicing and release of retention.

- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

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

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
  - Summarize 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 Fund and in-state expenditures.

Exhibit A
Scope of Work
MicroBio Engineering Inc.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

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

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Style Manual* provided by the CAM. *(See Task 1.1 for requirements for draft and final products.)*

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- 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, 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:
    - 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)

- Ensure that the document is written in the third person.
- Ensure that the Executive Summary is understandable to the lay public.
  - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
  - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
  - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
- Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
- Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
- Include a brief description of the project results in the Abstract.

- 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
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report 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.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:

- Final Report (draft and final)
- Written Responses to Comments on the Draft 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 Energy Commission funds. Match funds must be identified in writing, and the Recipient must obtain any associated commitments before incurring any costs for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Match Funds Status Letter* that documents the match funds committed to this Agreement. If no match funds were part of the proposal that led to the Energy

Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

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

- A list of the match funds that identifies:
  - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
  - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
  - 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.

The Recipient shall:

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

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

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

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of the executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

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

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest,

availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

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

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

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

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

Exhibit A
Scope of Work
MicroBio Engineering Inc.

Subtask 1.11 TAC Meetings

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

The Recipient shall:

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

Products:

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

Exhibit A
Scope of Work
MicroBio Engineering Inc.

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: TEST SET 1 — CENTRAL VALLEY CONFIGURATION AND SETUP

The goal of this task is to upgrade and reconfigure the Central Valley facility to achieve lower nitrogen discharges and improve electrical efficiency of nitrogen removal. The upgrades will also ensure mechanically reliable operation over the course of the project.

The Recipient shall:

- Upgrade the mixing and aeration system. Upgrade sensors, data loggers, wiring, and sensors for measuring factors such as pH, DO, and temperature in the raceway.
- Prepare *Site Modification Report*, which should be at least 4 pages in length. The report is to include, but is not limited to, details of the upgrades and modifications made, in addition to factors considered in equipment, sensor, and controller selection.
- Prepare a *CPR Report* in accordance with subtask 1.3 (CPR Meetings) that discusses the progress of the Agreement toward achieving its goals and objectives, including recommendations and conclusions regarding continued work on the project.
- Participate in CPR meeting #1.

Products:

- Site Modification Report
- CPR Report #1

TASK 3: TEST SET 1 — OPERATIONAL OPTIMIZATION EXPERIMENTS

The goals of this task are to determine the initial aeration schedule for both treatment and demand schedule purposes in addition to the corresponding appropriate algae concentrations to perform nitrogen removal.

The Recipient shall:

- Conduct experiments to determine the initial aeration timing to use in data collection.
- Determine the suspended solids concentrations that are required and perform chemical measurements while utilizing guidelines developed from analysis of previous data from the Department of Energy funded project (DE-SC0013920).
- Prepare *Test Set 1 – Operational Optimization Experiments Report*, which should be at least 4 pages. This report must include, but is not limited to, details of the experiment design, and methodology of analyzing wastewater to determine suspended solid concentrations and aeration schedules.

Products:

- Test Set 1 – Operational Optimization Experiments Report

Exhibit A
Scope of Work
MicroBio Engineering Inc.

TASK 4: TEST SET 1 — BIOLOGICAL TREATMENT PERFORMANCE DATA COLLECTION IN THE CENTRAL VALLEY.

The goals of this task are to generate a data set over an established timeframe, optimize the aeration schedule and suspended solids concentration to maximize the use of photosynthetic oxygen, demonstrate demand scheduling capability, and characterize bioflocculation performance. The experiment will be designed to remove nutrients to a determined level.

The Recipient shall:

- Operate the wastewater system to build up solids in the raceways to promote nitrification.
- Evaluate the effects of the main variables: such as temperature, solar radiation, suspended solids concentration, algae-to-bacteria ratio in suspended solids, and diel dissolved oxygen pattern as controlled by photosynthesis and aeration schedule.
- Monitor dissolved oxygen and temperature continuously during operation of the system.
- Measure routinely the following constituents in the influent and effluent to the raceway: ammonium, nitrate, total nitrogen, total and volatile suspended solids, carbonaceous soluble oxygen demand, and alkalinity.
- Take micrographs and identify algae present to genus level.
- Develop and test an operational model for nitrogen removal that can be used by operators.
- Prepare a *Test Set 1 – Operational Model for Nitrogen Removal User's Manual* that can be used by operators.
- Prepare a *Central Valley Treatment Report* that should be at least 4 pages and is to include, but is not limited to, a detailed description of experimentation activities, resulting data, power savings and demand scheduling results, a techno-economic assessment, and a greenhouse gas life cycle assessment.

Products:

- Test Set 1 – Operational Model for Nitrogen Removal User's Manual
- Central Valley Treatment Report

TASK 5: TEST SET 1 — CENTRAL VALLEY RECYCLED WATER FILTRATION STUDIES

The goals of this task are to evaluate membrane filtration technology to determine power use, total costs, and various other requirements to produce water of suitable disinfection and unrestricted reuse per California's Title 22 water recycling regulations.

The Recipient shall:

- Install a filtration pilot skid, which shall include, but is not limited to a filter specially designed for algae applications.
- Operate the technology continuously for an established timespan to determine the following:
    - The optimal flux for kWh/m^3 recycled water produced.
    - The backwashing intensity that optimizes power use in terms of kWh/m^3 of recycled water.
    - For membrane filters, determine reversible and irreversible fouling rate.
    - Clean-in-place regimes and frequency.

- Repeat the operation and measurement of the technology as needed.
- Prepare the *Test Set 1 – Water Filtration Report*, which should be at least 4 pages and includes, but is not limited to, a detailed description of experimentation activities, resulting data, power savings and demand scheduling results, a techno-economic assessment, and a greenhouse gas life cycle assessment.

Products:

- Test Set 1 – Water Filtration Report

TASK 6: TEST SET 2 — PILOT SYSTEM CONFIGURATION OF SELECTED EFFLUENT TREATMENT

The goal of this task is to re-configure the pilot facility to receive primary effluent or another type of effluent deemed to be the most relevant and with the best market demand based on interviews with the TAC and their network.

The Recipient shall:

- Replace and expand pilot facility components to meet experimental needs.
- Reconfigure piping to deliver the new test fluid to the system.
- Prepare the *Effluent Selection and Facility Reconfiguration Report*, which should be at least 3 pages long and is to include, but is not limited to, details regarding the choice of effluent and methods of reconfiguring the facility for new operation.
- Prepare a *CPR Report* in accordance with subtask 1.3 (CPR Meetings) that discusses the progress of the Agreement toward achieving its goals and objectives, including recommendations and conclusions regarding continued work on the project.
- Participate in CPR meeting #2.

Products:

- Effluent Selection and Facility Reconfiguration Report
- CPR Report #2

TASK 7: TEST SET 2 — OPERATIONAL OPTIMIZATION EXPERIMENTS OF SELECTED EFFLUENT

The goals of this task are to determine the optimal aeration schedule for both treatment and demand schedule purposes and the corresponding appropriate algae concentrations to perform nutrient removal for the new influent source (primary clarifier effluent).

The Recipient shall:

- Conduct experiments using multiple pilot raceways to determine the initial aeration timing to use in data collection.
- Determine the required suspended solid concentrations by performing chemical measurements while utilizing guidelines developed from analysis of previous data from the Department of Energy funded project (DE-SC0013920).
- Prepare the *Test Set 2 – Operational Optimization Experiments Report*, which should be at least 3 pages. This report must include, but is not limited to, details of the experiment design, and methodology of analyzing wastewater to determine suspended solid concentrations.

Products:

- Test Set 2 – Operational Optimization Experiments Report

TASK 8: TEST SET 2 — BIOLOGICAL TREATMENT PERFORMANCE DATA COLLECTION OF SELECTED EFFLUENT

The goals of this task are to generate a data set over an established timeframe, optimize the aeration schedule and suspended solids concentration to maximize the use of photosynthetic oxygen, demonstrate demand scheduling capability, and characterize bioflocculation performance. The experiment will be designed to remove nutrients from primary effluent to the standards met by previous successful scenarios. The experiment will also account for nitrogen removal.

The Recipient shall:

- Operate raceways with algae harvesting efficiency tests.
- Two operational conditions will be simultaneously run to evaluate the effects of the main variables: such as temperature, solar radiation, suspended solid concentration, algae-to-bacteria ratio in suspended solids, and diel dissolved oxygen pattern as controlled by photosynthesis and aeration schedule.
- Monitor dissolved oxygen, temperature, and pH continuously.
- Measure routinely the following constituents in the influent and effluent of each raceway, settling tank, and denitrification tank: ammonium, nitrate, nitrite, total nitrogen, phosphorus, total and volatile suspended solids, carbonaceous soluble oxygen demand, and alkalinity.
- Take micrographs and identify algae present to genus level.
- Develop and test the operational model for nitrogen removal that can be used by operators.
- Prepare a *Test Set 2 – Operational Model for Nitrogen Removal User's Manual* that can be used by operators for primary effluent treatment.
- Operate denitrification tanks to determine needed residence time and carbon source dose (e.g., glycerin or oxygen demand from influent water bypass).
- Prepare a *Selected Effluent Treatment Report* that should be at least 4 pages and is to include, but is not limited to, a detailed description of experimentation activities, resulting data, power savings and demand scheduling results, a techno-economic assessment, and a greenhouse gas life cycle assessment.

Products:

- Test Set 2 – Operational Model for Nitrogen Removal User's Manual
- Selected Effluent Treatment Report

TASK 9: TEST SET 2 — RECYCLED WATER FILTRATION STUDIES OF SELECTED EFFLUENT

The goals of this task are to evaluate filtration technology to determine power use, total costs, and various other requirements to produce water suitable disinfection and unrestricted reuse per California's Title 22 water recycling regulations.

The Recipient shall:

- Install a membrane pilot skid, which shall include, but is not limited to a filter suitable for high solids waters.
- Install a membrane pilot skid filter specially designed for algae applications.
- Operate the filter continuously for an established timespan to determine the following:
    - The optimal flux for kWh/m^3 recycled water produced.
    - The backwashing intensity that optimizes power use in terms of kWh/m^3 recycled water
    - The membrane fouling rate over month-long runs
    - Clean-in-place regimes and frequency
- Repeat the operation and measurement of the technology as needed.
- Prepare the *Test Set 2 – Water Filtration Report*, which should be at least 4 pages and includes, but is not limited to, a detailed description of experimentation activities, resulting data, power savings and demand scheduling results, a techno-economic assessment, and a greenhouse gas life cycle assessment.

Products:

- Test Set 2 – Water Filtration Report

TASK 10: EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:

    - <u>For Product Development Projects and Project Demonstrations:</u>
        - Published documents, including date, title, and periodical name.
        - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
        - Greenhouse gas and criteria emissions reductions.
        - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
        - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.

- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Additional Information for Product Development Projects:
  - Outcome of product development efforts, such copyrights and license agreements.
  - Units sold or projected to be sold in California and outside of California.
  - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
  - Investment dollars/follow-on private funding as a result of Energy Commission funding.
  - Patent numbers and applications, along with dates and brief descriptions.
- Additional Information for Product Demonstrations:
  - Outcome of demonstrations and status of technology.
  - Number of similar installations.
  - Jobs created/retained as a result of the Agreement.

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

- Respond to CAM questions regarding responses to the questionnaires.

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

Products:

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

TASK 11: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

Exhibit A
Scope of Work
MicroBio Engineering Inc.

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

The Recipient shall:

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
  - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
  - A description of the intended use(s) for and users of the project results.
  - Published documents, including date, title, and periodical name.
  - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
  - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
  - The number of website downloads or public requests for project results.
  - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)
- Presentation Materials (draft and final)
- High Quality Digital Photographs
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

Exhibit A
Scope of Work
MicroBio Engineering Inc.

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RESOLUTION NO: 2019-0220-8b

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: MICROBIO ENGINEERING, INC.

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

RESOLVED, that the Energy Commission approves Agreement EPC-18-008 with MicroBio Engineering, Inc. for a $1,550,227 grant to further advance the Recycle Nutrients Energy and Water (RNEW®) process to the pilot-demonstration stage, and adopting staff's determination that this action is exempt from the California Environmental Quality Act. The RNEW® technology overcomes the seasonal limitation by the selective use of mechanical aeration to optimize wastewater treatment and nitrification in winter months and incorporates a two-stage process of biomass settling and filtration for harvesting. The RNEW® technology has the potential to reduce electricity consumption at wastewater treatment facilities by 80 percent compared to conventional technologies by enabling year-round algal treatment of wastewater; and

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

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on February 20, 2019.

AYE: [List of Commissioners]
NAY: [List of Commissioners]
ABSENT: [List of Commissioners]
ABSTAIN: [List of Commissioners]

Cody Goldthrite,

Secretariat