



GRANT REQUEST FORM (GRF)

A) New Agreement # PIR-19-013 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Bradley Meister	51	916-327-1722

C) Recipient's Legal Name	Federal ID Number
Regents of the University of California, Berkeley Campus	94-6002123

D) Title of Project
Getting Out of Hot Water: Reducing Gas Consumption in Existing Large Commercial Buildings

E) Term and Amount

Start Date	End Date	Amount
6/30/2020	3/29/2024	\$ 1,446,850

F) Business Meeting Information

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

Proposed Business Meeting Date 6/10/2020 Consent Discussion

Business Meeting Presenter Bradley Meister Time Needed: 5 minutes

Please select one list serve. NaturalGas (NG Research Program)

Agenda Item Subject and Description:

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA, BERKELEY CAMPUS.

Proposed resolution approving Agreement PIR-19-013 with The Regents of the University of California, Berkeley campus, for a \$1,446,850 grant to demonstrate and evaluate packages of low-cost software controls and other measures targeting space heating, hot water distribution and boiler operational efficiency in large commercial buildings, and to adopt staff's determination that this action is exempt from CEQA. The measures will be demonstrated in large commercial buildings located in disadvantaged communities.

G) California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?

Yes (skip to question 2)

No (complete the following (PRC 21065 and 14 CCR 15378)):

Explain why Agreement is not considered a "Project":

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

a) Agreement **IS** exempt.

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

Categorical Exemption. List CCR section number:

Cal. Code Regs., tit 14, § 15301; Cal. Code Regs., tit 14, §15306

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



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Explain reason why Agreement is exempt under the above section:

This project fits within Cal. Code Regs., tit. 14, sect. 15301 because it involves minor construction and equipment installation at an existing facility, with no expansion of capacity. This installation is at an existing, developed urban site on land that is not environmentally sensitive. No historic resources or buildings will be affected. Noise and odors will not be generated by these installations in excess of existing permitted amounts. The installation will not increase traffic to the sites. The installation will not require permits for air, water, conditional use, building expansion, hazardous waste, or rezoning.

In addition, this project fits within Cal. Code Regs., tit. 14, sect. 15306 because it involves basic data collection which will not result in a serious or major disturbance to an environmental resource.

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
The Regents of the University of California, Davis Campus	\$ 150,000
Taylor Engineering, LLC	\$ 546,700
TRC Engineers, Inc.	\$ 191,700

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
NG Subaccount, PIERDD	18-19	501.001M	\$1,446,850

R&D Program Area: EERO: Buildings

TOTAL: \$ 1,446,850

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:



GRANT REQUEST FORM (GRF)

K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Margaret Nguyen

Address: Wurster Hall

City, State, Zip: Berkeley, CA

94720-0001

Phone: (510) 664-7489

E-Mail: nguyen_m@berkeley.edu

2. Recipient's Project Manager

Name: Therese Peffer

Address: Wurster Hall

City, State, Zip: Berkeley, CA 94720-0001

Phone: 510-289-4278

E-Mail: tpeffer@berkeley.edu

L) Selection Process Used

Competitive Solicitation Solicitation #: GFO-19-504

First Come First Served Solicitation Solicitation #:

M) The following items should be attached to this GRF

- | | | |
|---|---|--|
| 1. Exhibit A, Scope of Work | <input checked="" type="checkbox"/> | Attached |
| 2. Exhibit B, Budget Detail | <input checked="" type="checkbox"/> | Attached |
| 3. CEC 105, Questionnaire for Identifying Conflicts | <input type="checkbox"/> | Attached |
| 4. Recipient Resolution | <input checked="" type="checkbox"/> N/A | <input type="checkbox"/> Attached |
| 5. CEQA Documentation | <input type="checkbox"/> N/A | <input checked="" type="checkbox"/> Attached |

Agreement Manager

Date

Office Manager

Date

Deputy Director

Date

Exhibit A Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2	x	Primary Field Demonstrations
3		Lab Testing
4	x	Data-Driven Analysis to Scale Across Portfolios
5		Market Transformation
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
BAS	Building Automation System
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
HVAC	Heating, ventilation and air conditioning
TAC	Technical Advisory Committee

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

A. Purpose of Agreement

The purpose of this Agreement is to demonstrate, evaluate, and scale packages of non-proprietary low-cost software control and other measures to substantially reduce natural gas consumption in large commercial buildings.

B. Problem/ Solution Statement

Problem

Natural gas accounts for a third (32%) of all energy consumed by commercial buildings²; in California 90% of natural gas consumed in large commercial office buildings provides space and water heating,³ producing 9.7 MMT CO₂e,^{4 5} representing two-thirds of emissions due to commercial buildings (over 2% of California's total emissions).⁶ Natural gas-fired boilers

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 U.S. Energy Information Administration, 2012 Commercial Buildings Energy Consumption Survey

³ California Commercial End-use Survey, <http://capabilities.itron.com/CeusWeb/Chart.aspx>

⁴ CARB Emission Factor Database, 2019

⁵ Attachment 14 for GFO-19-504

⁶ https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2016/ghg_inventory_trends_00-16.pdf

Exhibit A Scope of Work

constitute the vast majority of space heating systems in large commercial buildings in California, and typically these boilers supply hot water to ‘reheat’ coils at building zones and sometimes also at the air handling units. Many of the zones served by these systems have incorrect minimum airflows, unnecessarily wasting reheat energy as well as fan energy to unnecessarily recirculate indoor air within the building. Furthermore, though they have high nominal efficiencies (>90%), gas-fired boiler systems serving hot water reheat systems are generally inefficient in operation. A recent study showed that 83% of the energy cost to operate such a system was lost due to a combination of high distribution losses and poor boiler efficiency due to a combination of poor controls, oversizing issues, and faults.

To recipient’s knowledge, despite that this is the predominant system installed in existing large buildings, there are no viable proposed solutions to decarbonize this system without entirely replacing it. This is not feasible from a cost perspective (even at boiler and/or air handling unit end-of-life) as it effectively means replacing the entire heating, ventilation and air conditioning (HVAC) system including the zone-level reheat coils serving individual rooms and the associated disruption to occupants. However, in order to meet our climate goals, it is essential that we determine a pathway to cost-effectively reduce the carbon emissions associated with these systems. That includes determining a means of doing so that accounts for the myriad conditions found in the existing building stock.

Solution

The project will demonstrate, evaluate, and scale packages of non-proprietary low-cost software control and other measures to substantially reduce natural gas consumption in large commercial buildings. This will include measures to ensure that higher cost items (i.e. end-of-life boiler replacements) are done as energy- and cost-efficiently as possible. The project will target three main areas of energy waste: unnecessary demand for space heating, hot water distribution losses, and poor boiler operational efficiency. The project will demonstrate and evaluate this solution in at least two buildings in a campus in a disadvantaged community, conducting lab testing to further evaluate measures and incorporate into new design decisions. The lessons learned from field and lab studies in conjunction with data-driven analyses in other campuses, again in disadvantaged communities, will inform the scaling of solutions. Finally, through workshops with stakeholders, the project team will develop, test, and deploy a screening tool that will provide building operators with a means of quickly determining which cost-tiered option of measures fit their budgets, and prepare a design guide that will provide detailed recipes to deliver energy savings. Through presentations, publications, video, and targeting large campuses portfolios, the project will conduct technology transfer activities in order to further deployment.

By using a combination of data analytics, fault detection, and software control algorithms in conjunction with targeted space conditioning devices or equipment in critical zones, the project can realize deep energy efficiency that will reduce natural gas consumption by over 60% with simple paybacks of less than 7 years. Additionally, the publicly available resources generated will include recipes for no- and low-cost solutions that can be implemented in capital constrained organizations such as those that serve disadvantaged and low-income communities. Methods to scale the solution include workshops, a screening tool, a design guide, and video, and working with commercial firms focused on energy efficiency retrofits in existing buildings.

Exhibit A

Scope of Work

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to

- substantially reduce natural gas consumption in large commercial buildings through improved performance of natural-gas fired boiler fed hot water reheat systems,
- provide a path to scale cost-tiered packages of measures across large commercial building portfolios.
- demonstrate that the deep energy efficiency improvements will reduce natural gas consumption by over 60% with simple paybacks of less than 7 years.

Ratepayer Benefits: This Agreement will result in the ratepayer benefit of **lower costs** and **increased safety** by reducing waste and inefficiencies in natural-gas fueled heating of large commercial buildings. The project will develop an integrated set of low-cost measures, including improvements to fault detection, improved controls through simple Building Automation System (BAS) changes or minor controls changes, low cost localized heating/cooling solutions, and will demonstrate, evaluate, and scale these measures to lower natural gas consumption in large commercial buildings. Reduced natural gas consumption will reduce energy bills as well as reduce greenhouse gas emissions and other pollutants such as NO_x and CO. Emissions from natural gas-fired boilers and furnaces includes nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO₂), methane, (CH₄), volatile organic compounds (VOCs), trace amounts of sulfur dioxide (SO₂), and particulate matter (PM). Through natural gas-fueled HVAC systems, campuses of large commercial buildings greatly impact the air quality of the surrounding areas. Reducing these emissions will improve the air quality of these regions, which provides increased safety especially to vulnerable populations.⁷

Technological Advancement and Breakthroughs: This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by demonstrating a set of low-cost innovations to reducing natural gas consumption and providing a path to scale these solutions across California's existing large commercial buildings. This project provides a demonstrated integrated set of non-proprietary low-cost measures, a screening tool and design guide to rapidly assess and select the most cost-effective measure for one's buildings, and a path to rapidly scale across California education, research, and industry campuses.

Agreement Objectives

The objectives of this Agreement are to:

- Demonstrate measures in at least two buildings (each exceeding 100,000 sq. Ft.) in a campus in a disadvantaged community:
 - 1) analyze BAS data to identify malfunctioning components (e.g., stuck dampers, leaking reheat valves) and either fix or replace them,
 - 2) reduce minimum airflow rates to the required ventilation rates,
 - 3) reduce boiler short-cycling (where the boiler turns on and off in short intervals of time, which wastes energy and unnecessarily wears the equipment),
 - 4) reduce hot water supply temperatures, including using electric heaters in a very small number of critical zones (not paid for by PIER funds), where feasible

⁷ Environmental Protection Agency, www3.epa.gov
June 2020

Exhibit A Scope of Work

- 5) implement a novel supply air temperature reset and use cost-effective cooling devices (e.g., space cooling, personal comfort systems, etc.) in critical zones where feasible,
- 6) evaluate the cost effectiveness and feasibility of installing a small boiler system to efficiently serve the low base load of these systems.
- Conduct lab testing to evaluate measures and incorporate into new design decisions,
- Perform data-driven analyses in other campuses in disadvantaged communities to evaluate scaling of solutions and ensure the solutions cover the wide range of conditions found in the existing California building stock
- Through workshops with stakeholders, develop a screening tool, video, and design guide as part of the market transformation, and conference meetings every 6 months with approximately 200 attendees from over 50 companies representing a diverse group of stakeholders in the building industry.
- Document impact and implementation rates by stakeholders based on the workshops and other stakeholder outreach.
- Conduct mandatory tasks such as evaluation of project benefits and technology transfer activities.

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.

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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.

- **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.

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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

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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

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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 quarterly *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

Exhibit A Scope of Work

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.

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)

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- 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:

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- 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 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.

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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:

Exhibit A Scope of Work

- 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

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.

Exhibit A Scope of Work

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.

Products:

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

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: PRIMARY FIELD DEMONSTRATIONS

The goal of this task is to conduct field testing in two buildings at the primary demonstration site. The field testing will demonstrate and evaluate several energy efficiency measures towards reducing natural gas consumption. The work at the primary site will be on 2 buildings at 100,000 square feet each.

The Recipient shall:

- Install metering and develop data aggregation plan for existing BAS to capture trend time-series data.

Exhibit A Scope of Work

- Conduct initial data analysis and fault detection including malfunctioning components (e.g., stuck dampers, passing valves, etc.).
- Develop *Field Test and Measurement & Verification Plan* that describes test objectives, procedures, conditions, facilities, and equipment, including the initial analysis, description of implementation of various measures, and evaluation methods, design and implementation of control retrofits, commissioning plan, list of control measures, and M&V plan.
- Design and implement control retrofits, including commissioning. Control measures include correcting zone ventilation minimum air flows, monitoring for rogue zones, reducing boiler short-cycling and improving heating equipment efficiency, and adjusting supply air and water temperature setpoints.
- Quantify hot water distribution losses and boiler operational efficiency in the two large office buildings under different operating conditions.
- Prepare a *CPR Report #1* and participate in a CPR meeting in accordance with subtask 1.3 (CPR Meetings).
- Conduct detailed field testing and validation of method and loss pathways. Prepare *Field Testing Validation Report* to include the identification of existing control measures and the results of field validation of hot water distribution losses and boiler operational efficiency in each building.
- Perform analysis and evaluation of measurements. Document in a *Deep De-Carbonization Re-Design Demonstration Report* to include identification of the control measures to be implemented, evaluation of natural gas reductions, and the results of commissioning in each building.

Products:

- Field Test and Measurement & Verification Plan
- CPR Report #1
- Field Testing Validation Report
- Deep De-Carbonization Re-Design Demonstration Report

TASK 3: FULL SCALE LABORATORY TESTING

The goal of this task is to test and evaluate the HVAC components and control sequences in a laboratory.

The Recipient shall:

- Create a full-scale laboratory test rig of a variable air volume box and representative branch of hot water piping.
- Perform testing towards project goals such as quantifying loss pathways in a hot water branch piping and reheat coil valve train; the design, selection and control of hot water reheat coils for low water temperature operations; identification of discharge air temperature stratification conditions.
- Document findings in a *Lab Testing Report Memo*
- Prepare a *Deep De-Carbonization and Efficiency Evaluation Lab Testing Report* to include the design, selection and control of hot water reheat coils for low water temperature operations; identification of discharge air temperature stratification conditions resulting in the best comfort and savings.

Product:

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Regents of the University of California,
Berkeley Campus

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- Lab Testing Report Memo
- Deep De-Carbonization and Efficiency Evaluation Lab Testing Report

TASK 4: DATA-DRIVEN ANALYSIS TO SCALE ACROSS PORTFOLIOS

The goals of this task are to select buildings in additional campuses in disadvantaged communities, implement any necessary sensors or meters, and aggregate building data for evaluation. The work done at the 2 large campuses (to include a total of 3 buildings) is in addition to the buildings in Task 2. Further, these 3 buildings should each be 100,000 square feet.

The Recipient shall:

- Prepare a CPR Report #2 and participate in a CPR meeting in accordance with subtask 1.3 (CPR Meetings).
- Acquire building meter and automation system level datasets from a portfolio of buildings on at least two large campuses, both in disadvantaged communities.
- Select at least three additional buildings from the two large campuses and deploy metering or sensing equipment as needed (e.g., flow meters, temperature sensors, IR imagery, etc.).
- Implement trend-level acquisition and storage system for data aggregation and evaluation.
- Conduct in depth data analysis, informed by the results from Task 2 field testing such as fault detection, feasibility of various control and equipment measures, quantification of distribution losses, boiler operational efficiency, and savings potential.
- Prepare a *Data Analysis Report* to include results of work completed in this task.

Products:

- CPR Report #2
- Data Analysis Report

TASK 5: MARKET TRANSFORMATION

The goal of this task is hold workshops with stakeholders and develop tools that drive adoption of measures tested and evaluated in this project.

The Recipient shall:

- Hold at least three workshops with stakeholders, including on-site meetings with building operators of buildings located in and serving disadvantaged communities (other than the primary demonstration site in Task 1).
- Develop a *De-carb 101 Video* that describes the process of screening a building and selecting the most appropriate measures for one's building and budget, first highlighting no- and low- cost measures that building operators can perform in capital constrained organizations.
- Develop *Measures Recommendation Memos* for each of the campuses from Task 4 to include at a minimum, information on baseline conditions, retrofit measures implemented, energy and cost savings and other benefits, and overall project economics (simple payback or rate of return).
- Based on the results of the workshops, develop a *Rapid Retrofit Design and Screening Tool*, an online tool to help operators determine the most cost-effective tier of measures

Exhibit A Scope of Work

for their building and budget. Include how the tool will be maintained and updated, and record the number of users, and benefits.

- Organize conference meetings every 6 months with approximately 200 attendees from over 50 companies representing a diverse group of building industry stakeholders to obtain feedback and to disseminate research results.
- Develop a *Hot Water Heating Design and Retrofit Guide* with the details on how to achieve each of the cost-effective measures evaluated in Task 2.
- Based on evaluation results, produce a *Policy Recommendations Memo* that describes recommendations for changes to incentive programs, codes and standards to drive adoption of measures.

Product:

- Campus Measures Recommendation Memos
- De-Carb 101 Video
- Rapid Retrofit Design and Screening Tool
- Hot Water Heating Design and Retrofit Guide
- Policy Recommendations Memo

TASK 6: EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

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

Exhibit A Scope of Work

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

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

Products:

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

TASK 7: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to develop a plan to make the knowledge gained, experimental results,

Exhibit A Scope of Work

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.

To: Office of Planning and Research
 PO Box 3044
 1400 Tenth Street, Room 113
 Sacramento, CA 95812-3044

From: California Energy Commission
 1516 Ninth Street, MS-48
 Sacramento, CA 95814

Project Applicant: Regents of the University of California, Berkeley Campus

Project Title: Getting Out of Hot Water: Reducing Gas Consumption in Existing Large Commercial Buildings

Project Location – Specific: 455 E Grand Ave

Project Location – City: South San Francisco 94080 **Project Location – County:** San Mateo

Description of Nature, Purpose and Beneficiaries of Project:

The proposed project will demonstrate, evaluate, and scale packages of non-proprietary lowcost software control and other measures to substantially reduce natural gas consumption in large commercial buildings. This will include measures to ensure that higher cost items (i.e.end-of-life boiler replacements) are performed as energy- and cost-efficiently as possible. The project will target three main areas of energy waste in natural gas-fired boiler-fed hot water systems: unnecessary demand for space heating, hot water distribution losses, and poor boiler operational efficiency.

Name of Public Agency Approving Project: California Energy Commission

Name of Person or Agency Carrying Out Project: The Regents of The University of California

Exempt Status: *(check one)*

- Ministerial Exemption (Pub. Resources Code § 21080(b)(1); Cal. Code Regs., tit 14, § 15268);
- Declared Emergency (Pub. Resources Code § 21080(b)(3); Cal. Code Regs., tit 14, § 15269(a));
- Emergency Project (Pub. Resources Code § 21080(b)(4); Cal. Code Regs., tit 14, § 15269(b)(c));
- Categorical Exemption. State type and section number
Cal. Code Regs., tit 14, §15301; Cal. Code Regs., tit 14, §15306
- Statutory Exemptions. State code number.
- Common Sense Exemption. (Cal. Code Regs., tit 14, §15061(b)(3))

Reasons why project is exempt:

This project fits within Cal. Code Regs., tit. 14, sect. 15301 because it involves minor construction and equipment installation at an existing facility, with no expansion of capacity. This installation is at an existing, developed urban site on land that is not environmentally sensitive. No historic resources or buildings will be affected. Noise and odors will not be generated by these installations in excess of existing permitted amounts. The installation will not increase traffic to the sites. The installation will not require permits for air, water, conditional use, building expansion, hazardous waste, or rezoning.

In addition, this project fits within Cal. Code Regs., tit. 14, sect. 15306 because it involves basic data collection which will not result in a serious or major disturbance to an environmental resource.

Authority cited: Sections 21083 and 21110, Public Resources Code. Reference: Sections 21108, 21152, and 21152.1, Public Resources Code.

Lead Agency

Contact Person: Bradley Meister **Area code/Telephone/Ext:** 916-327-1722

If filed by applicant:

1. Attach certified document of exemption finding.
2. Has a Notice of Exemption been filed by the public agency approving the project? Yes No

Signature: _____ **Date:** _____ **Title:** _____

Signed by Responsible Agency

Signed by Lead Agency

Signed by Applicant

Date received for filing at OPR: _____

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: THE REGENTS OF THE UNIVERSITY OF CALIFORNIA,
BERKELEY CAMPUS.

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

RESOLVED, that the CEC approves Agreement PIR-19-013 with the Regents for a \$1,446,850 grant to demonstrate and evaluate packages of low-cost software controls and other measures targeting space heating, hot water distribution and boiler operational efficiency in large commercial buildings. The measures will be demonstrated in large commercial buildings located in disadvantaged communities; 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 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 CEC held on June 10, 2020.

AYE:

NAY:

ABSENT:

ABSTAIN:

Cody Goldthrite
Secretariat