

**GRANT REQUEST FORM (GRF)**

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

New Agreement EPC-16-003 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Felix Villanueva	51	916-327-2206

Recipient's Legal Name	Federal ID Number
Regents of the University of California, Davis	94-6036494

Title of Project
Pilot-Scale Evaluation of an Integrated Building Control Retrofit Package

Term and Amount	Start Date	End Date	Amount
	7/18/2016	12/31/2020	\$ 1,999,089

**Business Meeting Information**
 ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	7/13/2016	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Felix Villanueva	Time Needed:	5 minutes

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

**Agenda Item Subject and Description**

REGENTS OF THE UNIVERSITY OF CALIFORNIA, DAVIS. Proposed resolution approving agreement EPC-16-003 with the Regents of the University of California, Davis for a \$1,999,089.00 grant to develop and test an integrated building control strategy that includes lighting; daylight harvesting; dynamic fenestration management; and HVAC controls to increase energy efficiency, reduce peak demand, and improve occupant comfort.

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

1. Is Agreement considered a "Project" under CEQA?  
 Yes (skip to question 2)  No (complete the following (PRC 21065 and 14 CCR 15378)):  
 Explain why Agreement is not considered a "Project":  
 Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because
2. If Agreement is considered a "Project" under CEQA:  
 a) Agreement **IS** exempt. (Attach draft NOE)  
 Statutory Exemption. List PRC and/or CCR section number: \_\_\_\_\_  
 Categorical Exemption. List CCR section number: Cal. Code Regs., tit 14, § 15301  
 Common Sense Exemption. 14 CCR 15061 (b) (3)  
 Explain reason why Agreement is exempt under the above section:  
 California Code of Regulations, title 14, section 15301 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of use beyond that existing at the time of the lead agency's determination, are categorically exempt from the provisions of the California Environmental Quality Act. The physical aspects of this project consist of laboratory testing and field testing using minor modifications to an existing building, entirely within the existing building shell. The project will initially be tested in an existing laboratory, using existing equipment in the laboratory. The project will then be tested in an existing campus facilities' management office that is approximately 25,000 sq. ft. Minor electrical and exterior work will be done on approximately 3400 square feet of the existing 25,000 square foot building. Mechanized skylights will be added to a false ceiling and electrically-operable shading devices will be added to interior windows in which electric lighting simulates daylight progression. These modifications will not result in any expansion of capacity. For these reasons, the proposed work will not have any significant effect on the environment and falls under section 15301.
- b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)  
 Check all that apply
- |   |   |
|---|---|
| <input type="checkbox"/> Initial Study                  | <input type="checkbox"/> Environmental Impact Report            |
| <input type="checkbox"/> Negative Declaration           | <input type="checkbox"/> Statement of Overriding Considerations |
| <input type="checkbox"/> Mitigated Negative Declaration |   |

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





# EXHIBIT A Scope of Work

## I. TASK ACRONYM/TERM LISTS

### A. Task List

Task #	CPR <sup>1</sup>	Task Name
1		General Project Tasks
2	X	Control System Refinement
3	X	System-Level Integration, Assessment & Refinement
4		Field Deployment and Evaluation
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities
7		Production Readiness Plan

### B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
HVAC	Heating, Ventilating, and Air Conditioning
Recipient	The Regents of the University of California, Davis
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 fund the development and evaluation of technology that integrates control of heating, ventilating, air conditioning (HVAC), lighting, and fenestration into a single platform to increase the building-wide energy efficiency, reduce peak demand and improve occupant comfort (an “Integrated Building Control Retrofit Package”).

### B. Problem/ Solution Statement

#### **Problem**

Fully optimized, automated, building control requires integration of electric lighting, daylight harvesting, dynamic fenestration management and HVAC systems to increase building-wide energy efficiency, reduce peak demand, and improve occupant comfort. No existing building control system can provide intelligent, integrated control of electric lighting, dynamic fenestration, and HVAC devices.

#### **Solution**

The Recipient will refine and demonstrate an integrated building control strategy to control a network of building systems. Systems include lighting, HVAC and adaptive fenestration. The strategy will be based on consideration of the state of each individual smart device, and on

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

## EXHIBIT A Scope of Work

sharing environmental and operational data among devices to increase the reliability of sensing environmental conditions and end-user performance acceptance. End-user satisfaction will be evaluated using paper and/or online survey tools or personal interview techniques focused on the occupant's perception of the ease of control enabled by IBCS, its energy benefits, the resulting comfort level of the work environment, and other factors. Research will be conducted in collaboration with manufacturers to accelerate lab-to-market technology transfer through pre-commercial systems that will quickly and effectively transition to commercial products and systems.

### C. Goals and Objectives of the Agreement

#### Agreement Goals

The goal of this project is to refine and evaluate a pre-commercial Integrated Building Control Retrofit Package that maximizes the energy efficiency of existing commercial buildings by combining independent electric lighting, fenestration and HVAC control systems into a single, intelligent system accessed through one easy-to-use control portal, and to involve potential equipment suppliers in its development so as to facilitate commercial introduction.

Ratepayer Benefits:<sup>2</sup> This Agreement will result in the ratepayer benefit of greater electricity reliability and reduced costs for ratepayers by enabling comprehensive, optimized, integrated control of all the building devices that contribute to electricity loads in commercial spaces. The proposed research will result in reduced HVAC loads and electric lighting loads because both systems will be controlled in tandem, which will capture the energy savings attributed to their known operational dependencies. Estimated electricity savings will translate directly to cost savings of nearly \$9M annually if used widely throughout California's commercial buildings.

Technological Advancement and Breakthroughs:<sup>3</sup> This Agreement will lead to technological advancement and breakthroughs that will overcome barriers to the achievement of the State of California's statutory energy goals by significantly lowering the amount of electricity consumed by HVAC and electric lighting systems in commercial spaces. Several R&D efforts during the past decade were aimed at improving electric lighting or fenestration control methods to increase system reliability and reduce lighting energy use; however, few accounted for the interdependence of lighting, fenestration and HVAC systems and the consideration of HVAC status in an integrated approach to optimize whole building energy-efficiency. The concept of integrated environmental and operational consideration is unique and untried with respect to full building systems, including devices from the electric lighting, windows, skylights and HVAC systems. Traditional integration methods are typically based on centralized controllers, which receive and process all signals, from all sensors, and then activate actuators that adjust lighting, shading and HVAC systems individually. There are several limitations and challenges to this approach, such as extensive and expensive commissioning, scalability, reliability and timely response. The proposed approach uses multiple distributed controllers instead of a single, centralized one, to greatly improve performance, reliability and cost-effectiveness.

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<sup>2</sup> California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, [http://docs.cpuc.ca.gov/PublishedDocs/WORD\\_PDF/FINAL\\_DECISION/167664.PDF](http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF)).

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

# EXHIBIT A

## Scope of Work

### Agreement Objectives

The objectives of this Agreement are to:

- Refine control algorithms for luminaires, windows, skylights, ventilation strategies and HVAC devices.
- Address natural ventilation and cooling control strategies using dynamic window and skylight openings that are controlled based on indoor/outdoor thermal conditions, HVAC area occupancy status, and building schedules.
- Develop and deploy an integrated building control retrofit package and validate the approach in the Recipient's unique daylight harvesting laboratory, which allows for mockup and simulation of commercial building conditions.
- Deploy and evaluate the pre-commercial retrofit package in a pilot-scale installation to determine its technical and economic potential under real-world conditions.
- Develop targeted design and technology recommendations to improve system deployment, lower installation costs, and increase occupant acceptance, which will lead to increased adoption and actual, sustainable energy savings.
- Involve potential equipment suppliers at all stages of development in a Technical Advisory Committee so as to facilitate commercial adoption of the technology developed.
- Develop final specifications for the retrofit package along with technology transfer materials.
- Develop recommendations addressing occupant behavior, indoor air quality, and other issues that prevent widespread adoption and actual sustainable energy savings.

# EXHIBIT A

## Scope of Work

### 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.

## **EXHIBIT A**

### **Scope of Work**

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.

#### **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

## **EXHIBIT A**

### **Scope of Work**

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.

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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

## **EXHIBIT A**

### **Scope of Work**

#### **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.

## EXHIBIT A Scope of Work

### 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.

### 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)

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### **Scope of Work**

- 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

## EXHIBIT A Scope of Work

### MATCH FUNDS, PERMITS, AND SUBCONTRACTS

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

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

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

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

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

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

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

#### **Products:**

- Match Funds Status Letter

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- 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.

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.

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- 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;

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- 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.

#### **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

### IV. TECHNICAL TASKS

#### **TASK 2 CONTROL SYSTEM REFINEMENT**

##### **Subtask 2.1 Communication System Refinement**

The goal of this subtask is to establish communication and validate data sharing capabilities among the different device types necessary to achieve an Integrated Building Control Retrofit Package. This will be accomplished through the identification and/or development and testing of local, component-level communications components.

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

- Identify commercially available communication hardware and software and develop suitable components that will allow communication among ultra-smart luminaires, windows, skylights and HVAC devices.
- Prepare a *Memo on Retrofit Package Communication Platform* documenting important characteristics of candidate controls and rationale for selections made.
- Install communication capability in each device (luminaire, window, skylight, HVAC control devices).
- Establish communications to create a network of connected devices.
- Test communication platform and connectivity of devices.
- Assess system performance and identify any limiting factors associated with the communication hardware, such as a limit on the number of physical devices that can communicate on a single system; device addressing requirements; and communication error processing constraints.
- Document communication and connectivity in a *Memo on Integrated Building Control Retrofit Package Communication Platform – Draft* and provide a copy to CAM.
- Circulate the memo among TAC members for comment.
- Convene TAC conference call (or meeting) to discuss and record comments.
- Incorporate TAC input, and deliver a revised *Memo on Integrated Building Control Retrofit Package Control Platform – Final*

##### **Products:**

- Memo on Retrofit Package Communication Platform
- Memo on Integrated Building Control Retrofit Package Communication Platform (Draft and Final including TAC input)

##### **Subtask 2. 2 Refine Automated Control Algorithms**

The goal of this subtask is to refine the novel control algorithms that utilize shared device state and environmental data from equipped luminaires, windows, skylights and HVAC control devices to improve overall building system reliability and operation.

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

- Identify environmental and device state parameters that are key in determining operational modes of the Integrated Building Control Retrofit Package components.
- Map variables to individual device sensor(s) and data source(s).

## **EXHIBIT A**

### **Scope of Work**

- Develop logic and flow chart diagrams to represent the overall function and decision sequences of the system based on the collection of identified parameters, variables and data sources.
- Document this subtask's activities and resulting control logic in a *Control Algorithm Summary Report*.

#### **Products:**

- Control Algorithm Summary Report (Draft and Final)

#### **Subtask 2.3 Deploy and Assess Algorithms**

The goal of this subtask is to implement, validate and refine the control algorithms developed under subtask 2.2 by using them as a proof-of-concept, prototype Integrated Building Control Retrofit Package consisting of multiple luminaires; windows; skylights; and HVAC control devices.

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

- Install, connect and commission pre-commercial devices in the recipient's daylight harvesting laboratory.
- Implement and execute the control algorithms developed in Subtask 2.2, using a remote CPU as the logic and overall monitoring center of the proof-of-concept, prototype system.
- Assess various combinations of luminaires, windows, and skylights to understand control sequencing and effective scaling of the proposed approach.
- Test each combination of devices under multiple daylight and occupancy conditions to assess performance of the control program.
- Refine control sequences to optimize overall system response time, reliability, comfort and energy savings.
- Document this subtask's activities in a *Prototype System Operation and Performance Report*.
- Participate in a CPR meeting and prepare *CPR Report #1* in accordance with subtask 1.3 (CPR Meetings)

#### **Products:**

- Prototype System Operation and Performance Report (Draft and Final)
- CPR Report # 1

### **TASK 3 SYSTEM INTEGRATION, ASSESSMENT & REFINEMENT**

#### **Subtask 3.1 Industry Partnerships to Integrate Pre-commercial Systems**

The goal of this subtask is to partner with lighting, fenestration and HVAC system manufacturers interested in incorporating proof-of-concept technology into existing and new product lines, in development of a pre-commercial Integrated Building Control Retrofit Package.

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

- Work with selected manufacturers to build sensors, communications, controllers, skylights, windows, adjustable window and skylight treatments and luminaires.

## **EXHIBIT A**

### **Scope of Work**

- Evaluate the mechanical design of luminaires, windows, skylights and HVAC systems for inclusion of motion and photo sensors, controllers, actuators, and microprocessors necessary to equip the devices for ultra-smart operation.
- Modify commercial partner products to achieve integrated, pre-commercial Integrated Building Control Retrofit components and integrated systems.
- Document subtask activities in a report on *Pre-Commercial Integrated Building Control Retrofit Package*

#### **Products:**

- Pre-Commercial Integrated Building Control Retrofit Package (Draft and Final)

#### **Subtask 3.2 Laboratory Testing of Pre-commercial Systems**

The goal of this subtask is to test the pre-commercial systems to assess performance and reliability under controlled laboratory conditions.

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

- Install, connect and commission pre-commercial devices and systems in the recipient's daylight harvesting laboratory.
- Test various physical combinations of pre-commercial systems to assess their effectiveness in realizing the performance levels comparable to the laboratory devices and systems described under Task 2. (Task 2).
- Test each combination of devices under the same daylight and occupancy conditions utilized under Task 2.
- Document this subtask's activities in a *Pre-Commercial Prototype System Operation and Performance Report*.

#### **Products:**

- Pre-Commercial System Operation and Performance Report (Draft and Final)

#### **Subtask 3.3 System Refinement for Commercialization**

The goal of this subtask is to refine the pre-commercial building control devices and systems including any additional refinements to the control algorithms and prepare them for commercialization by manufacturers.

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

- Update control algorithms, as needed, to eliminate bugs and improve overall system performance, based on outcomes of testing conducted under subtask 3.2.
- Identify and specify production-grade hardware, which will be governed by the final specification for the Integrated Building Control Retrofit Package, hardware cost and availability.
- Provide commercialization support to manufacturers through specific technical modifications to sensors, communication hardware or other device packaging/form factor requirements, tooling, and technical deployment elements necessary to bring Integrated Building Control Retrofit Package strategies and technologies to market.
- Document this subtask's activities and describe modifications to the system hardware and software resulting from Task 3 activities in a *Memo on Updated System Hardware and Control Strategy* and provide a copy to the CAM.

## **EXHIBIT A**

### **Scope of Work**

- Prepare a *Memo on Final System Specification* (Revision of Task 2.1 memo on IBCS communication platform appended with new results from Task 2 and Task 3 activities.).
- Participate in a CPR meeting and prepare a *CPR Report #2* in accordance with subtask 1.3 (CPR Meetings).

#### **Products:**

- Memo on Updated System Hardware and Control Strategy
- Memo on Final System Specification
- CPR Report #2

### **TASK 4 FIELD DEPLOYMENT AND PERFORMANCE EVALUATION**

#### **Subtask 4.1 Building Design and Construction Pathway Identification**

The goal of this subtask is to identify typical building design, construction processes, and required trade needs to integrate the retrofit package with standard building design and construction pathways.

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

- Identify key market players to obtain information regarding standard practices for building design, construction processes, and required trade needs to integrate the retrofit package into current practices.
- Integrate the retrofit package with standard building design and construction pathways.
- Collect industry standard practices for building design, construction processes, and required trade needs to integrate the retrofit package into current practices from key market players.
- Analyze standard practices to identify changes required to successfully integrate the retrofit package with standard building design and construction pathways.
- Document subtask activities in a report on *Building Design and Construction Pathways Report*.

#### **Products:**

- Building Design and Construction Pathways Report (Draft and Final)

#### **Subtask 4.2 Test Site Analysis**

The goal of this subtask is to evaluate and analyze the test site to understand the historical energy use, operating patterns, and associated operating costs related to the building systems to be addressed in the retrofit.

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

- Collect building data for the test site, such as purpose of the building; age; use; square footage; and annual operating hours.
- Conduct in-depth site analysis to determine building energy using systems currently installed; historical energy use of systems; and operating patterns, hours, and associated operating costs related to the building systems to be retrofitted.
- Identify two sub-areas (one for baseline and one for retrofit) of the same size, orientation and purpose within the test site
- Document subtask activities in a *Report on Site Identification and Facility Analysis*.

## **EXHIBIT A**

### **Scope of Work**

#### **Products:**

- Report on Site Identification and Facility Analysis (Draft and Final)

#### **Subtask 4.3 Measurement and Verification Plan**

The goal of this subtask is to develop a measurement and verification plan to assess the performance of the Integrated Building Control Retrofit Package after it is fully installed at the test site.

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

- Identify key performance criteria of building systems to monitor and from which to collect data in order to characterize the baseline system performance and Integrated Building Control Retrofit Package performance. At a minimum, the key performance criteria associated with the Integrated Building Control Retrofit Package must facilitate the evaluation of technical performance; end user acceptance; energy savings; peak demand reduction; and economic potential of the system, compared to the baseline system.
- Conduct electrical audit of test site to identify necessary equipment required to document key performance criteria.
- Develop *Measurement and Verification Plan* for the test site that includes end user acceptance; energy savings; peak demand reduction; and economic potential of the system, compared to the baseline system.
- Identify measurement and verification equipment needed to monitor and collect data on the key performance criteria.

#### **Products:**

- Measurement and Verification Plan (Draft and Final)

#### **Subtask 4.4 Test Site Specification, Procurement, Installation and Commissioning**

The goal of this subtask is to develop the site specific design and engineering specifications required for the Integrated Building Control Retrofit Package. Based on the specification, system components will be procured and modified as needed to ready the system for installation. Commissioning of the system will take place for full integration on site.

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

- Work with the test site facility team to gather site plans required to design the system. If documentation is not available, recipient shall conduct site visits to gather required information.
- Develop *Pre-Commercial System Specification – Draft* and provide a copy to the CAM.
- Procure the specified system and coordinate and execute any necessary modifications to the pre-commercial system.
- Install and commission the pre-commercial Building Control Retrofit Package system and document any lessons learned, comments from the TAC members and others, and updates from field deployment in the *Pre-Commercial System Specification – Final*.

#### **Products:**

- Pre-Commercial System Specification (Draft and Final)

## EXHIBIT A Scope of Work

### Subtask 4.5 Data Collection and Analysis

The goal of this task is to collect data per the *Measurement and Verification Plan – Final* developed in Subtask 4.3. Using the collected data, the performance of the installed Integrated Building Control Retrofit Package will be evaluated and documented to assess the technical performance, end-user acceptance, energy savings, peak demand reduction, and economic potential of the system as compared to the baseline system.

#### The Recipient shall:

- Procure the equipment defined in the *Measurement and Verification Plan – Final*
- Install the equipment defined in the *Measurement and Verification Plan – Final*
- Collect data at necessary intervals to compile 12 months of consecutive data for each key performance criteria defined in the *Measurement and Verification Plan – Final*
- Analyze collected data to evaluate technical performance, end-user acceptance, energy savings, peak demand reduction, and economic potential of the system as compared to the baseline system defined in Subtask 4.2.
- Develop *Pre-Commercial System Performance Report* that discusses the subtask activities, the results of the monitoring and verification on the key performance criteria and whether the agreement goals and objectives described in Section II.C. were met.

#### Products:

- Pre-Commercial System Performance Report (Draft and Final)

### TASK 5 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.

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### **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

## EXHIBIT A Scope of Work

### **TASK 6 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES**

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

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

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

### **TASK 7 PRODUCTION READINESS PLAN**

The goal of this task is to determine the steps that will lead to the manufacturing of technologies

## **EXHIBIT A Scope of Work**

developed in this project or to the commercialization of the project's results.

### **The Recipient shall:**

- Prepare a *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
  - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
  - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
  - The estimated cost of production.
  - The expected investment threshold needed to launch the commercial product.
  - An implementation plan to ramp up to full production.
  - The outcome of product development efforts, such as copyrights and license agreements.
  - Patent numbers and applications, along with dates and brief descriptions.
  - Other areas as determined by the CAM.

### **Products:**

- Production Readiness Plan (draft and final)

## **V. PROJECT SCHEDULE**

Please see the attached Exhibit A Attachment A-1.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: UNIVERSITY OF CALIFORNIA, DAVIS

**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-16-003 from GFO-15-308 with the Regents of the University of California, on behalf of the Davis campus for a \$1,999,089 grant to develop and test an integrated building control strategy that includes lighting, daylight harvesting, dynamic fenestration management, and HVAC controls to increase energy efficiency, reduce peak demand, and improve occupant comfort; 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 July 13, 2016.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

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Cody Goldthrite,  
Secretariat