

GRANT REQUEST FORM (GRF)



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

ERDD	Amir Ehyai	916-327-3094
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Zero Net Energy Alliance, Inc.	47-5562137
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Automated Cloud-Based Continuously Optimizing Building Energy Management System

4/1/2017	12/31/2020	\$ 2,500,000
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ARFVTP agreements under \$75K delegated to Executive Director.

Proposed Business Meeting Date	3/8/2017	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Amir Ehyai	Time Needed:	5 minutes

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

Agenda Item Subject and Description
 ZERO NET ENERGY ALLIANCE, INC. Proposed resolution approving Agreement EPC-16-034 with Zero Net Energy Alliance, Inc. for a \$2,500,000 grant to demonstrate, deploy at commercial scale, and initiate rapid market adoption of the Automated Cloud-Based Continuously Optimizing Building Energy Management System. The technology will continuously optimize building energy management systems through an artificial intelligence-enabled analytics engine. The technology will be demonstrated at two college campuses in the Los Angeles Basin and has the potential of reducing energy use by 20 percent in the affected buildings.

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: 14 CCR § 15301
 Common Sense Exemption. 14 CCR 15061 (b) (3)
 Explain reason why Agreement is exempt under the above section:
 14 CCR § 15301 Existing Facilities provides a categorical exemption for the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment or topographical features, involving negligible or no expansion of use beyond that existing. This project consists of the operation and minor alteration of existing facilities -- existing buildings at a college campus -- to demonstrate a cloud-based energy management system. Additionally, the project will involve negligible or no expansion of use beyond that currently existing.

b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)
 Check all that apply
 Initial Study Environmental Impact Report
 Negative Declaration Statement of Overriding Considerations
 Mitigated Negative Declaration

Legal Company Name:	Budget
MelRok, LLC	\$ 1,276,000
Lawrence Berkeley National Laboratory	\$ 450,000
Energy and Environmental Economics, Inc.	\$ 99,000
TBD #1	\$ 75,000
TBD #2	\$ 75,000
TBD #3	\$ 25,000
Pomona College	\$ 0

EXHIBIT A Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Audit and Profile Selected Buildings
3		Connect Energy Systems to Cloud Based Analytic Engines
4	X	Continuously Optimize Energy Usage In Real Time
5		Develop and Support Aliso Canyon Energy Partners' Network
6		Evaluation of Project Benefits
7		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
ACCO-BEMS	Automated Cloud-based Continuously Optimizing – Building Energy Management System
ACEP Network	Aliso Canyon Energy Partner's Network
ADR	Automated Demand Response
BEDES	Building Energy Data Exchange Specification
BEMS	Building Energy Management System
California ISO	California Independent System Operator
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
EMS	Energy Management System
HVAC	Heating Ventilation and Air Conditioning
IOT	Internet of Things
M&V	Measurement and Verification
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 deployment and demonstration of a pre-commercial technology that continuously and automatically assesses and adjusts the critical energy systems in a building to eliminate inefficient energy usage. The agreement will help overcome barriers to scaled market adoption for this technology and provide substantial economic and environmental benefits to rate payers.

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

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B. Problem/ Solution Statement

Problem

Building managers in California are faced with several challenges to reducing energy use and costs, including:

- Building energy management systems (BEMS) are not networked to other databases such as scheduling calendars, California ISO grid requirements, energy rate schedules, and weather, nor are conventional BEMS automated to reprogram themselves based on relevant data.
- BEMS are becoming more complex with a growing knowledge gap between systems and operators. Even the most basic reprogramming to improve performance of BEMS requires costly, and often unaffordable, use of experts.
- Even when installed, BEMS are typically undermanaged.

Energy related systems within buildings ‘drift’ from the moment they are commissioned and these drifts add up to sizable system energy efficiency losses that often exceed 20 percent. Losses may be the result of scheduling inefficiencies, set-point inefficiency, unnoticed degraded performance, undetected defective equipment, or counter-productive operations, for example, simultaneous heating and cooling or economizer open on hot day.

The problem is compounded by a disconnect between the construction and commissioning phase of a building, and its maintenance and operation phase. Often there is a knowledge transfer gap where the commissioning report resides with an entity (design and construction) that is different than the one tasked with managing the building. This is particularly common in university and college campuses. The disconnect is also a natural occurrence in commercial buildings where the builder is not typically the owner or operator of the building.

The challenges identified above have not and cannot be addressed by existing building management systems because the latter rely on outdated technology that is building-centric, has limited and deficient storage and analytics capacity, is disconnected from the outside world, and has no self-assessment capabilities.

Solution

The Recipient will address these persistent challenges in building efficiency by demonstrating and deploying the Automated Cloud-based Continuously Optimizing-Building Energy Management System (ACCO-BEMS). This novel pre-commercial technology continuously and automatically monitors the performance of a building’s energy systems, dictates the necessary operational adjustments and identifies necessary maintenance events. The use of the cloud leverages the elastic storage and analytics capacity of cloud computing, coupled with unfettered access to the web-accessible databases on building benchmarking, weather conditions, grid conditions, market conditions, utility rate information, advanced energy analytics, and energy modeling engines.

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The project will utilize 10 buildings at Pomona College in Claremont, California, which is part of Claremont Colleges Consortium and is located in the Aliso Canyon mitigation area, and one building at Santa Ana College in the Rancho Santiago Community College District, located in Santa Ana (Orange County.) The buildings are of various activity types, including administrative, educational, performing arts, retail centers, and data centers. The project will augment existing building sensors with a network of Ethernet accessible sensors and virtual occupancy sensors developed by Lawrence Berkeley National Laboratory, to enable access to all critical energy information. Existing actuators will be upgraded to Ethernet-based actuators to allow for direct control of these systems. The solution includes the installation of an energy gateway in each building, to connect the building's energy meters, energy management system (EMS), critical energy systems, energy sensors and actuators to the cloud-based continuously optimizing engine. Results of the project will demonstrate a sustained 20 percent or more energy usage reduction in the selected buildings, and a market scalable technology for the continuous optimization of energy usage in buildings throughout the Aliso Canyon area.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Substantially and sustainably reduce energy use in diverse buildings and large campuses by continuously assessing real-time building performance vs. historic benchmarks and building energy modeling algorithms—and by automatically adjusting energy use of critical systems through ACCO-BEMS technology.
- Demonstrate seamless cloud-based integration of ACCO-BEMS with existing building energy management controls and devices—by connecting islanded and proprietary systems to an Energy Internet of Things (IoT) gateway for real-time data access and continuous control.
- Reduce operational and maintenance costs of buildings by automating EMS and fault detection, providing access to real-time data on occupancy and environmental conditions, automated system adjustments, and energy use.
- Accelerate deployment of ACCO-BEMS and related efficiency measures in the Aliso Canyon impact area via the Aliso Canyon Energy Partners' Network (ACEP Network) to achieve deep and sustained energy reductions—with an initial focus on: 1) major higher education campuses; 2) major retail chains; and 3) multi-building corporate headquarters.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability and lower costs by:

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

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- Reducing electric demand in the Aliso Canyon mitigation area, thus improving the reliability of the electric grid. The project is estimated to lead to almost 1.5 GWh of annual energy savings in Pomona College, and the potential for energy savings with the other six co-located Claremont University Consortium colleges approaches 10 GWh of electric energy annually. The project will facilitate ACCO-BEMS technology adoption across the Claremont Colleges and other education and corporate facilities in the Los Angeles Basin.
- Increasing demand response program results in Aliso Canyon and San Onofre Nuclear Generating Station areas and improving the reliability of the grid. In addition to sustained energy savings, ACCO-BEMS will enable real-time automated demand response (ADR) capability in buildings where it is deployed. Pomona College peaks at more than 4 MW load, with the rest of the Claremont colleges peaking at 10 MW. Deploying this technology across these colleges enables more than 1MW of ADR potential, and will demonstrate potential for scaled ADR adoption across other education and corporate campuses in the area.

Technological Advancement and Breakthroughs:³ This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by optimizing energy usage in buildings and leading to an estimated reduction of more than 20 percent in electric and natural gas energy used by buildings.

The ACCO-BEMS technology is aligned with key recommendations for technology advances specified in the California Energy Commission's Achieving Energy Savings in California Buildings (11-IEP-1F) Report⁴. Specifically, energy performance monitoring and fault detection diagnostics software is incorporated in the 2013 Title 24 update, and is a key technology that must be further enhanced and deployed to overcome current barriers to the State of California's goals of achieving zero net energy commercial building standards by 2030. The major technological advances and breakthroughs demonstrated in this project will include:

- **Demonstrating real-time connectivity to multi-protocol critical energy systems.** The project will make use of an Energy IoT Gateway that concurrently communicates with virtually all discrete energy devices using their native protocols and interfaces.

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

⁴ Brook M., B. Chrisman, P. David, T. Ealey, D. Eden, K. Moore, K. Rider, P. Strait, G. D. Taylor, and J. Wu. July 2011. Draft Staff Report: Achieving Energy Savings in California Buildings (11-IEP-1F). California Energy Commission, Efficiency & Renewables Division. Publication #: CEC-400-2011-007-SD.

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- **Real time integration of enhanced sensing technologies and processes.** The project will demonstrate new processes for accurately assessing environmental conditions inside a building, including the use of a complete suite of low cost sensors. The new Virtual Sensor Technology developed at Lawrence Berkeley National Laboratory will be used to inexpensively yet accurately track key building occupancy metrics, essential for accurate energy benchmarking and modeling. The novel virtual sensing technique provides an inexpensive method, compared to physical sensing, to obtain data for dynamic building operation⁵. This technique tracks end-use devices connected to IT networks, and retrieves data from network equipment and infrastructure servers. Each device connected to the network—and its change of state over time—is used as an indicator of human occupancy.
- **Establishing secure big data pipelines between building energy systems and the cloud.** ACCO-BEMS enables secure, high-bandwidth cloud transmission and high-volume storage of all BEMS data at intervals of one minute to enable ongoing optimization.
- **Utilizing a streamlined real-time cloud-based energy optimization engine.** ACCO-BEMS technology will demonstrate pioneering use of a real-time cloud-based energy optimization engine that seamlessly integrates real-time, high-resolution data flow from thousands of energy and environmental sensors and legacy BEMS to enable: a) real-time assessment of energy performance; b) real-time fault detection; and c) continuous and automated adjustment of building operational parameters.
- **Enabling full control of continuously variable and other efficient devices:** Two-way communication between the energy analytics cloud engine and the comprehensive array of legacy energy system devices and controllers enabled via the Touch Gateway will allow the full potential of continuously variable devices that in many cases have underperformed vs. their potential. These include variable speed drives as well as other proven control technologies such as static pressure reset and demand controlled ventilation. Algorithms built into these technologies have been shown to reduce energy consumption but are not supported by many BEMS, which use binary or discrete set points. By contrast, ACCO-BEMS algorithms match incoming data with optimum set points across the full spectrum of variable speed devices.
- **Securely transmitting control messages to site devices.** The project will demonstrate the use of multi-path transmission of encrypted control messages to achieve new levels of security required for the stability of the grid. Multi-path transmission relies on the use of two independent paths to transmit a message to a field device. ACCO-BEMS demonstration and deployment of this capability is particularly urgent given recent “hijacking” of large clusters of IoT enabled devices to launch damaging denial of service attacks against key internet hubs.

⁵ Nordman, B., Occupancy Detection with Implicit Sensing for Energy Savings and More, *Proceedings of the 2016 Summer Study on Energy Efficiency in Buildings*. Asilomar, California, August 2016.

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Agreement Objectives

The objectives of this Agreement are to:

- Reduce energy use by 20 percent or more in 11 mixed use buildings—including 10 buildings at the Pomona College campus and at the Digital Media Center in the Rancho Santiago Community College District.
- Demonstrate automated control and optimization of chillers, air handlers, variable air volume terminal units, variable frequency drives, economizer vanes, environmental and occupancy sensors, light and plug load controllers, and thermostats.
- Reduce costs of energy audits and re-commissioning by eliminating manual BEMS reprogramming and automatically reporting faulty sensors and devices.
- Estimate energy savings and ADR potential of ACCO-BEMS by analyzing 12 months of smart meter data in up to 150 buildings in the Los Angeles Basin.

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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.

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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.

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MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

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

- Terms and conditions of the Agreement;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

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

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
 - An updated Project Schedule;
 - Technical products (subtask 1.1);
 - Progress reports and invoices (subtask 1.5);
 - Final Report (subtask 1.6);
 - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
 - Any other relevant topics.
- Provide an *Updated Project Schedule, List of Match Funds, and List of Permits*, as needed to reflect any changes in the documents.

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

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Subtask 1.3 Critical Project Review (CPR) Meetings

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

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the Energy Commission, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

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

The CAM shall:

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

Recipient Products:

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

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CAM Products:

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

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

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

- The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
- The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
 - Disposition of any state-owned equipment.
 - Need to file a Uniform Commercial Code Financing Statement (Form UCC-1) regarding the Energy Commission's interest in patented technology.
 - The Energy Commission's request for specific "generated" data (not already provided in Agreement products).
 - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
 - "Surviving" Agreement provisions such as repayment provisions and confidential products.
 - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide *All Draft and Final Written Products* on a CD-ROM or USB memory stick, organized by the tasks in the Agreement.

Products:

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

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REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

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

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Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare a *Final Report* for this Agreement in accordance with the approved Final Report Outline, Style Manual, and Final Report Template provided by the CAM with the following considerations:
 - Ensure that the report includes the following items, in the following order:
 - Cover page (**required**)
 - Credits page on the reverse side of cover with legal disclaimer (**required**)
 - Acknowledgements page (optional)
 - Preface (**required**)
 - Abstract, keywords, and citation page (**required**)
 - Table of Contents (**required**, followed by List of Figures and List of Tables, if needed)
 - Executive summary (**required**)
 - Body of the report (**required**)
 - References (if applicable)
 - Glossary/Acronyms (If more than 10 acronyms or abbreviations are used, it is required.)
 - Bibliography (if applicable)
 - Appendices (if applicable) (Create a separate volume if very large.)
 - Attachments (if applicable)
 - Ensure that the document is written in the third person.
 - Ensure that the Executive Summary is understandable to the lay public.
 - Briefly summarize the completed work. Succinctly describe the project results and whether or not the project goals were accomplished.
 - Identify which specific ratepayers can benefit from the project results and how they can achieve the benefits.
 - If it's necessary to use a technical term in the Executive Summary, provide a brief definition or explanation when the technical term is first used.
 - Follow the Style Guide format requirements for headings, figures/tables, citations, and acronyms/abbreviations.
 - Ensure that the document omits subjective comments and opinions. However, recommendations in the conclusion of the report are allowed.
 - Include a brief description of the project results in the Abstract.
- Submit a draft of the report to the CAM for review and comment. The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt
- Consider incorporating all CAM comments into the Final Report. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product
- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

EXHIBIT A Scope of Work

Products:

- Final Report (draft and final)
- Written Responses to Comments on the Draft Final Report

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

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

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

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

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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.

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.

EXHIBIT A

Scope of Work

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

Products:

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

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

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

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

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

EXHIBIT A Scope of Work

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

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.*

EXHIBIT A

Scope of Work

TASK 2: AUDIT AND PROFILE SELECTED BUILDINGS

The goal of this task is document the energy performance of project buildings prior to the installation of the continuous BEMS optimization technology.

Subtask 2.1 Prepare Measurement and Verification Plan

The goals of this subtask are to: (1) define the performance metrics that will be used to evaluate the success of the optimization effort and quantify the energy savings, and (2) create a measurement and verification (M&V) plan that describes the energy performance evaluation process and methodology to be used in the project. The methodology for normalizing energy usage with temperature and other factors will be determined. Performance metrics will include whole-building metrics and system-specific metrics. Performance metrics will be categorized into energy efficiency metrics and operational efficiency metrics.

The Recipient shall:

- Define the performance metrics used to evaluate energy savings
- Define methodology for normalizing energy use
- Prepare *Measurement & Verification Plan* that includes:
 - Energy efficiency performance metrics
 - Operational efficiency performance metrics
 - Methodology for normalizing energy use
 - Description of how energy savings will be measured

Product:

- Measurement and Verification Plan (draft and final)

Subtask 2.2 Pre-Optimization Energy Survey and Analysis of Selected Buildings

The goals of this subtask are to: (1) finalize selection of buildings for optimization; (2) audit the buildings prior the optimization; (3) analyze and profile the historic performance of the building prior to start of project (Tasks 3 and 4); (4) analyze and profile the performance of the building and all the BEMS components (heating ventilation and air conditioning (HVAC) and lighting) in the 12-months per-optimization period; and (5) create normalized baselines and multi-variable models of the building's energy use based on the performance in the 12-month pre-optimization period. The preliminary list of buildings included in this project, along with size and energy use details are given in Table 1. The buildings are divided into two sets. In Set 1, ACCO-BEMS will replace the existing BEMS and automatically manage and optimize all building energy systems. In Set 2, ACCO-BEMS will co-exist with the existing BEMS and adjust the BEMS to optimize energy use in buildings.

EXHIBIT A Scope of Work

Set	Pomona Buildings	Square Footage	Annual Electric (kWh)	Electricity (kWh/sq-ft)
1	Smith Campus Center	74,127	1,927,214	26.0
1	Thatcher Music Hall	30,850	1,586,817	51.4
1	J.C. Cowart IT Building	12,206	944,526	77.4
1	Seeley G Mudd	21,806	575,093	26.4
1	Alexander Hall	32,776	468,652	14.3
2	Hahn Hall	21,186	1,129,768	53.3
2	Mason Hall	33,190	296,033	8.9
2	Pearsons Hall	18,230	199,383	10.9
2	Carnegie Hall	18,064	184,276	10.2
2	Crookshank Hall	17,403	134,751	7.7
	<i>Sub Total Pomona College</i>	<i>279,838</i>	<i>7,446,514</i>	<i>28.7</i>
2	Digital Media Center - Santa Ana College	28,000	572,855	20.5
Total All Buildings		307,838	8,019,369	26.1

Table 1. Preliminary Buildings List

The Recipient shall:

- Finalize *Table 1 Buildings List*.
- Perform an energy survey of the selected buildings consistent with the following tasks:
 - Inventory of HVAC equipment, capacities and rated efficiency
 - Inventory of HVAC and environmental sensors and their location
 - Description of HVAC control methods
 - Inventory of interior and exterior lighting systems and related controls
 - Inventory of any plug loads with significant energy draw relative to building consumption
 - Confirm the power distribution in the building
- Analyze available historic energy data to profile electric and natural gas energy use of buildings, to include:
 - Heat map of annual 15-minute demand
 - Monthly demand profile distribution per building
 - Benchmark the energy use of buildings compared to other buildings of same activity
- Produce an *Initial Audit Report* to include:
 - Results of the energy surveys for each building
 - Details of the historic energy analysis for each building from data available prior to project start
- Analyze energy usage of buildings and their BEMS components in 12-month pre-optimization period to include:
 - Heat map of annual 15-minute demand and critical HVAC components
 - Monthly demand profile distribution per building
 - Identification of periods of excessive demand consumption
 - Identification of periods with potential faults and anomalies in the monitored BEMS components
 - Development of multi-variable energy model for building and individual HVAC components based on measured data in pre-optimization 12-month period

EXHIBIT A Scope of Work

- Produce a *Pre-Optimization Analysis Report* to include:
 - Results of the detailed analysis of the energy use of each building and its HVAC components during the 12-month pre-optimization period
 - Normalized energy usage models for each building and its HVAC components to be used for performance assessment in the M&V reports

Product:

- Table 1 Buildings List
- Initial Audit Report
- Pre-Optimization Analysis Report (draft and final)

TASK 3: CONNECT ENERGY SYSTEMS TO CLOUD BASED ANALYTIC ENGINES

The goal of this task is to augment project building energy systems with sensors and actuators to establish real time telemetry to all energy systems in the building. This task will result in a real-time data and control messaging pipeline to and from all energy systems, sensors, and actuators in the buildings. The data and control messaging pipeline will be used to continuously assess and adjust the energy usage in the buildings.

Subtask 3.1 Cloud Synchronization and Storage of Energy Management System Data

The goals of this subtask are to: (1) stream EMS data to the cloud for storage analysis; and (2) enable the EMS to log information from all energy sensors and at a higher resolution.

The Recipient shall:

- Backup EMS database to the cloud
- Reconfigure EMS to log all needed points
- Install a software application that automatically synchronizes the EMS database to the cloud on an hourly basis
- Prepare a *Synchronization Software Report* that describes:
 - Requirements of synchronization software application
 - Installation instructions for synchronization software
 - Troubleshooting guide for synchronization software

Product:

- Synchronization Software Report

Subtask 3.2 Map the Energy Management System Data

The goal of this subtask is to map the EMS points to a standard naming convention. The Recipient will adopt the Building Energy Data Exchange Specification (BEDES)⁶, a standard naming convention developed by the US Department of Energy, or an alternate standard if requested by demonstration site building owner representative.

⁶ The Building Energy Data Exchange Specification (BEDES) facilitates the exchange of standardized data systems and is developed at LBNL with support from the US Department of Energy.

EXHIBIT A

Scope of Work

The Recipient Shall:

- Map EMS points to standard naming convention (BEDES)
- Create an *EMS Point Map Report* that contains
 - List of all points that are being logged to the cloud
 - Name of all points as identified in the local EMS
 - Name of all points as they are identified in the cloud database
 - Local ID (e.g. BACnet⁷ register) of logged points
 - Assigned ID of logged points
 - Corresponding standard (BEDES) designation of all points logged in the cloud
 - A table showing the mapping of all the above

Product:

- EMS Point Map Report

Subtask 3.3 Install Additional Energy Sensors and Actuators as Needed

The goals of this subtask are to: (1) install additional IP-based⁸ sensors as needed, and (2) install as needed additional actuators, such as variable frequency drives on fans and pumps, or direct load control systems.

The Recipient Shall:

- Make a list of all existing EMS and environmental sensors
- Make a list of new EMS and environmental sensors that need to be added
- Confirm access to critical sensor data and upgrade sensor communication as needed
- Install additional temperature, humidity, flow and CO2 sensors as needed
- Install additional controllers and variable frequency drives as needed.
- Generate a *Sensor and Controller Upgrade Report* that includes:
 - List of all newly installed sensors, including their location and cost
 - List of all sensors that needed a communication upgrade, including their location and cost of upgrade
 - List of all actuators and controllers that were added

Product:

- Sensor and Controller Upgrade Report

Subtask 3.4 Deploy IT-based Occupancy Counting Technology

The goal of this subtask is to deploy a Wi-Fi based technology to estimate occupancy in buildings. The technology will help normalize energy usage in buildings as a function of occupant count.

The Recipient Shall:

- Assess Wi-Fi system technology and hardware deployment to describe how the existing system can provide occupancy estimates
- Conduct limited data analysis and testing to determine how device Wi-Fi presence maps to actual building occupancy

⁷ BACnet is a data communication protocol for building automation and control networks developed under the auspices of the American Society of Heating, Refrigeration and Air-Conditioning Engineers.

⁸ Internet Protocol (IP).

EXHIBIT A

Scope of Work

- Consider if any additional IT data sources available in the selected buildings could usefully inform occupancy estimation
- Conduct limited manual counting (or automated if feasible) of actual building entrance/exits to verify and calibrate the Wi-Fi data
- Develop a method to automatically collect these data for input into the ACCO-BEMS
- Create an *Implicit Sensing Occupancy Data Report* that includes:
 - List of all Wi-Fi access points in and around the selected buildings, including location, and maps that show the same information
 - Sample data by individual access point and whole building
 - Comparison of Wi-Fi data to other estimates of building occupancy and any additional IT system data available in the selected buildings
 - Consideration of confounding factors such as building radio dead areas and inclusion of outdoor spaces in access point (AP) coverage

Product:

- Implicit Sensing Occupancy Data Report

Subtask 3.5 Connect Energy Systems to Cloud Engines

The goals of this subtask are to: (1) install an Energy IoT Gateway in each building; (2) connect the gateway to all sensors and actuators that will be connected to the cloud; and (3) commission all gateways and real time telemetry to and from the sensors and actuators.

The Recipient Shall:

- Install Touch IoT Connectivity Gateway
- Connect to energy meters
- Connect to energy systems
- Connect to energy sensors
- Generate a *Telemetry Report* that includes:
 - List of all sensors and actuators that have been connected
 - Description of telemetry data collected from each sensor
 - Description of any control capabilities enabled via telemetry for each actuator

Product:

- Telemetry Report

TASK 4: CONTINUOUSLY OPTIMIZE ENERGY USAGE IN REAL TIME

The goal of this task is to deploy and commission all cloud-based modules needed to continuously optimize the energy management of the building, and report on the performance of the system. The task will include the repair of all sensors and controllers diagnosed by ACCO-BEMS as being defective.

Subtask 4.1 Commission Heating, Ventilation, and Air Conditioning and Lighting Systems in Selected Buildings

The goal of this subtask is to commission the buildings' sensors, HVAC and lighting controllers prior to start of continuous optimization. Subsequently, ACCO-BEMS will automatically detect the state of the actuators and sensors and identify faulty equipment and sensors. The results of the manual commissioning performed in Subtask 4.1 and the automated ACCO-BEMS commissioning will be compared in Subtasks 4.3 and 4.4.

EXHIBIT A

Scope of Work

The Recipient Shall:

- Commission HVAC and lighting systems prior to entering continuous optimization mode. Commissioning tasks to include:
 - Verification of proper operation of existing HVAC, environmental and occupancy sensors
 - Verification of proper operation of critical HVAC components including supply and return fans, exhaust fans, chilled water pumps, hot water pumps, and air dampers
 - Verification of proper operation of terminal units' dampers and sensors
 - Verify proper operation of lighting controllers
- Generate a *Building Commissioning Status Report* to include:
 - Status of operations of existing HVAC, environmental and occupancy sensors
 - Status of operations of supply and return fans, exhaust fans, chilled water pumps, hot water pumps, and air dampers
 - Status of operations of terminal unit dampers and sensors
 - Status of operations of lighting controllers and sensors

Product:

- Building Commissioning Status Report

Subtask 4.2 Setup Continuous Performance Assessment Module

The goals of this subtask are to: (1) setup and commission the continuous performance assessment modules for critical energy systems; (2) setup and commission the continuous performance assessment modules for the EMS; and (3) set up and commission the continuous performance assessment modules for the operational efficiency.

The Recipient shall deploy and assess the following pre-commercial energy analytics modules:

- Chiller Performance Analysis Module
- Air Handlers Performance Analysis Module
- Variable Air Volume Performance Analysis Module
- Boiler Performance Module
- EMS Performance Module
- Operational Performance Module
- Document the functional description of the different performance assessment modules in a *Performance Module Description Report*.

Product:

- Performance Module Description Report

Subtask 4.3 Setup Sensor Anomaly Detection Modules

The goal of this subtask is to setup and commission the sensor anomaly detection software modules. Sensor accuracy is critical for the functionality of BEMS and of the automated continuous optimization software. Environmental, flow and process sensors measure metrics needed for the determination of heating, cooling and air flow set points. When these sensors fall out of accuracy, or become defective, it can lead to equipment being left on for excessive amounts of time. Critical sensors that are prone to failure will be augmented with redundant units of the same sensor type.

EXHIBIT A

Scope of Work

The Recipient Shall:

- Setup and commission the Flow Sensor Anomaly Detection Module
- Setup and commission the CO₂ Sensor Anomaly Detection Module
- Setup and commission the Temperature Sensor Anomaly Detection Module
- Setup and commission the Occupancy Sensor Anomaly Detection Module
- Setup and commission the Light Sensor Anomaly Detection Module
- Setup and commission the Valve Position Sensor Anomaly Detection Module
- Compare list of faulty controllers and components detected by ACCO-BEMS to the one created in Subtask 4.1
- Document the commissioning results of the Sensor Anomaly Modules in a *Sensor Anomaly Module Commissioning Report*. The report will include:
 - List of faulty sensors detected by the commissioning efforts of Subtask 4.1
 - List of faulty sensors automatically detected by ACCO-BEMS
 - Discussion of any comparison between the results of ACCO-BEMS and manual commissioning's fault detection of faulty sensors
 - Summary of recommended repairs

Product:

- Sensor Anomaly Module Commissioning Report

Subtask 4.4 Setup System Anomaly Detection Modules

The goal of this subtask is to setup and commission the energy systems anomaly detection software modules. The most common energy systems include chillers, cooling towers, pumps, air handlers, exhaust fans, packaged roof top units, and terminal units. These units typically have set-points controlled by a BEMS, or for some smaller units, a stand-alone controller such as a thermostat. The control logic is in most cases dictated by the controller. The controller gets input from sensors at or in the vicinity of the energy systems. Anomalies in such system may result from faulty control logic or in some cases from defective equipment such as relay switches, actuators, or defective sensors.

The Recipient Shall:

- Setup and commission the Chiller Anomaly Detection Module
- Setup and commission the Cooling Tower Anomaly Detection Module
- Setup and commission the Pumps Anomaly Detection Module
- Setup and commission the Air Handlers Anomaly Detection Module
- Setup and commission the Exhaust Fan Anomaly Detection Module
- Setup and commission the Packaged Roof Top Unit Anomaly Detection Module
- Setup and commission the Terminal Units Anomaly Detection Module
- Compare list of faulty controllers and components detected by ACCO-BEMS to the one created in Subtask 4.1
- Generate the *System Anomaly Module Commissioning Report*. The Report will include:
 - List of faulty controllers and components detected by commissioning efforts of Subtask 4.1
 - List of faulty controllers and components detected by ACCO-BEMS
 - Discussion of any comparison between the results of ACCO-BEMS and manual commissioning's fault detection of HVAC and lighting controllers
 - Summary of recommended repairs

EXHIBIT A Scope of Work

Product:

- System Anomaly Module Commissioning Report

Subtask 4.5 Repair Faulty Sensors and Equipment

The goals of this subtask are to: (1) make the necessary sensor repairs recommended in Subtask 4.3, and (2) make the necessary repairs to faulty equipment as recommended in Subtask 4.4.

The Recipient Shall:

- Repair faulty sensors as recommended in Subtask 4.3
- Repair faulty equipment as recommended in Subtask 4.4
- Generate the *Equipment Repair Summary Report* to include:
 - List of faulty controllers and sensors detected by commissioning efforts of Subtask 4.1
 - Summary of repairs to sensors and controllers including costs and timeline of repairs, and location of repaired equipment

Product:

- Equipment Repair Summary Report

Subtask 4.6 Launch ACCO-BEMS Platform in BEMS Continuous Assessment Mode

The goals of this subtask are to: (1) commission ACCO-BEMS to run BEMS continuous performance assessment mode for a period of at least 90 days per building, (2) analyze and document the findings of ACCO-BEMS. In this task, the platform will monitor and assess the performance of the BEMS but will not automatically control any of the energy systems or automatically change set-points on the BEMS. This phase will help guide the commissioning of the continuous performance assessment platform and prepare it for the next task that includes automated adjusting of the controls. This phase is only necessary in this final 'pre-commercial' deployment of the ACCO-BEMS technology and will not be needed in future commercial deployments.

The Recipient Shall:

- Launch the ACCO-BEMS platform to operate in BEMS continuous assessment mode for Set 1 and Set 2 buildings.
- Document the progress and findings of the 90 day ACCO-BEMS initial deployment period in an *ACCO-BEMS Activation Report*. The Report will include:
 - Sequence and dates of activating ACCO-BEMS in each building
 - Summary of findings noted for each building including a report of ACCO-BEMS uptime
- Prepare *CPR Report* in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Product:

- ACCO-BEMS Activation Report
- CPR Report

EXHIBIT A

Scope of Work

Subtask 4.7 Operate Buildings in Cloud-Powered Continuous Optimization Mode

The goals of this subtask are to: (1) operate the Set 1 buildings in the automated cloud-based continuously optimizing mode using ACCO-BEMS, and (2) operate the Set 2 buildings while keeping the existing BEMS in place and using ACCO-BEMS to adjust BEMS set points and optimize energy use. This task will last a period of 12 months during which the buildings will be monitored and their performance assessed and compared to the documented pre-optimization performance.

The Recipient Shall:

- Disable the existing BEMS controllers from Set 1 buildings
- Operate the Set 1 buildings using ACCO-BEMS to manage and optimize all energy systems
- Operate the Set 2 buildings using ACCO-BEMS to adjust BEMS set points and optimize energy use
- Monitor the performance of the Set 1 and Set 2 buildings on a weekly and monthly basis. Monitoring will include reviewing the performance of the buildings for each week and month to confirm proper operations of ACCO-BEMS
- Hold monthly meetings with Pomona College and Santa Ana College staff to solicit feedback on occupant comfort and building operations
- Generate the *ACCO-BEMS Operation Report*. The Report will include:
 - Sequence and dates of ACCO-BEMS activation in Set 1 and Set 2 buildings
 - Monthly whole building energy use profiles during 12-month performance period
 - Monthly energy use profiles of HVAC equipment including chillers, air handlers and packaged units.
 - Log of all sensor and equipment faults detected by ACCO-BEMS during the 12-month performance period
 - Comments by Pomona and Santa Ana College staff regarding occupant comfort and building operations

Product:

- ACCO-BEMS Operation Report

Subtask 4.8 Post-Optimization M&V Analysis of Buildings

The goals of this subtask are to: (1) analyze and profile the performance of the building and all the BEMS components (HVAC and lighting) in the 12 months performance period; (2) Compare energy performance of the buildings post ACCO-BEMS implementation with the energy performance pre ACCO-BEMS implementation; (3) create normalized baselines and multi-variable models of the building's energy use based on the performance in the 12 month post-optimization performance period; and (4) generate the ACCO-BEMS M&V report.

The Recipient shall:

- Analyze energy use of buildings during 12-month performance period
- Analyze energy efficiency and operational efficiency of the buildings' energy systems
- Produce a *Measurement & Verification Report* for each building, to include:
 - List of performance metrics used
 - Evaluation of performance metrics for each building
 - Comparison of performance metric pre- and post-continuous optimization
 - Calculation of energy savings realized using continuous optimization
 - Calculation of cost savings realized using continuous optimization
 - Discussion of whether the Goals and Objectives (Sections II.C.) were met

EXHIBIT A

Scope of Work

- Notes and further recommendations

Product:

- Measurement & Verification Report (draft and final)

TASK 5: DEVELOP AND SUPPORT ALISO CANYON ENERGY PARTNERS' NETWORK

The goal of this task is to create the Aliso Canyon Energy Partners' (ACEP) Network to achieve deep and sustained energy reductions in target facilities across the Los Angeles Basin -- with an initial focus on: 1) major higher education campuses; 2) major retail chains; and 3) multi-building corporate headquarters.

Subtask 5.1 Develop Aliso Canyon Energy Partners' Network

The goals of this subtask are to: (1) form a network of professional, business owners, and energy managers that collectively manage 150 buildings in the Los Angeles Basin; (2) promote the progress and result of the project to accelerate adoption of ACCO-BEMS across the Los Angeles Basin area.

The Recipient Shall:

- Reach out to business owners, energy managers and energy service providers in the Los Angeles Basin area and solicit their interest in joining the ACEP Network
- Incentivize the candidate members by offering a no-cost analysis of their building's 12-month detailed energy performance
- Promote the progress and results of ACCO-BEMS to members of the ACEP Network, with a goal of a minimum of 150 facilities engaged
- Generate the *ACEP Network Members Report*. The Report will include:
 - List of names, contact information, and affiliation of ACEP Network members
 - Size, location, activity type, total energy spent, and energy use intensity of the Los Angeles Basin buildings associated with each ACEP Network members
 - Consent letter from ACEP Network members for use of their building's energy data in the publication of anonymized energy profiles for each building category

Product:

- ACEP Network Members Report

Subtask 5.2 Identify Target Los Angeles Basin Buildings for Deployment of Automated Cloud-based Continuously Optimized – Building Energy Management System

The goal of this subtask is to: (1) analyze 12 months of building 15-minute energy use data from facilities located in the Los Angeles Basin; (2) survey on what systems are used to heat, cool and manage the energy in the buildings; and (3) identify buildings that are candidates for the ACCO-BEMS implementation.

The Recipient Shall:

- Publish online a simple questionnaire requesting basic information on a facility's BEMS, type of cooling system and heating systems
- Assist interested stake holders in completing the necessary forms to transfer 12-months' worth of 15-minute demand data to Recipient for analysis
- Analyze the 12-month energy performance of buildings for which a questionnaire has been completed

EXHIBIT A Scope of Work

- Make the analysis results available in PDF or HTML format to the associated stake holder
- Publish the aggregate anonymized results in an *Energy Profile Report of Los Angeles Basin Buildings*. The Report will include:
 - Number and specification of all buildings that participated in the report
 - Anonymous energy profiles for buildings in each category

Product:

- Energy Profile Report of Los Angeles Basin Buildings

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.
 - 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.

EXHIBIT A Scope of Work

- 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, 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

EXHIBIT A

Scope of Work

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.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: ZERO NET ENERGY ALLIANCE, INC.

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

RESOLVED, that the Energy Commission approves Agreement EPC-16-034 from GFO-16-304 with Zero Net Energy Alliance, Inc. for a \$2,500,000 grant to demonstrate, deploy at commercial scale, and initiate rapid market adoption of the Automated Cloud-Based Continuously Optimizing Building Energy Management System. The technology will continuously optimize building energy management systems through an artificial intelligence-enabled analytics engine. The technology will be demonstrated at two college campuses in the Los Angeles Basin and has the potential of reducing energy use by 20 percent in the effected buildings; 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 March 8, 2017.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat