

GRANTS/CONTINGENT AWARD REQUEST

CEC-270 (Revised 02/10)

CALIFORNIA ENERGY COMMISSION

To: Grants and Loans OfficeDate: 3/20/2013Project Manager: Leah MohnyPhone Number: 916-327-1506Office: Energy Efficiency Research OfficeDivision: Energy Research and DevelopmentMS- 51Project Title: Tools and Materials for Zero Net Energy California Buildings**Type of Request:** (check one)

<input checked="" type="checkbox"/> New Agreement: (include items A-F from below)	Agreement Number: <u>Assigned by G&L Office</u>
Program: <u>PIER NG / Buildings End-Use Energy Efficiency</u>	
PON-12-503-02 (Building Energy Efficiency Research and Technology)	
Solicitation Name and/or Number: <u>Grant Program</u>	
Legal Name of Recipient: <u>The Regents of the University of California</u>	
<u>UCLA Luskin School of Public Affairs</u>	
Recipient's Full Mailing Address: <u>3320 Public Affairs Building - Box 951656</u>	
<u>Los Angeles, CA 90095-1656</u>	
Recipient's Project Officer: <u>Murray Milne</u>	Phone Number: <u>310-454-7328</u>
Agreement Start Date: <u>7/15/2013</u>	Agreement End Date: <u>3/31/2017</u>

<input type="checkbox"/> Amendment : (Check all that apply)	Agreement Number: _____
<input type="checkbox"/> Term Extension – New End Date: _____	
<input type="checkbox"/> Work Statement Revision (include Item A from below)	
<input type="checkbox"/> Budget Revision (include Item B from below)	
<input type="checkbox"/> Change of Scope (include Items A – F as applicable from below)	
<input type="checkbox"/> Other: _____	

ITEMS TO ATTACH WITH REQUEST:

A. Work Statement

B. Budget

C. Recipient Resolution, if applicable. (Resolution may be requested in Special Conditions if not currently available.)

D. Special Conditions, if applicable.

E. CEQA Compliance Form

F. Other Documents as applicable

• Copy of Score Sheets

• Copy of Pre-Award Correspondence

• Copy of All Other Relevant Documents

California Environmental Quality Act (CEQA)

<input checked="" type="checkbox"/> CEC finds, based on recipient's documentation in compliance with CEQA:	
<input checked="" type="checkbox"/> Project exempt: <u>14 CCR Sections 15301 and 15306</u>	NOE filed: _____
<input type="checkbox"/> Environmental Document prepared: _____	NOD filed: _____
<input type="checkbox"/> Other: _____	
<input type="checkbox"/> CEC has made CEQA finding described in CEC-280, attached	

Funding Information:

*Source #1: <u>NG</u>	Amount: <u>\$ 700,000.00</u>	Statute: <u>11-</u>	FY: <u>12-13</u>	Budget List #: <u>501.001F</u>
*Source #2: <u>PIER-E</u>	Amount: <u>\$ 635,074.00</u>	Statute: <u>11-</u>	FY: <u>12-13</u>	Budget List #: <u>501.027J</u>
*Source #3: _____	Amount: <u>\$ _____</u>	Statute: _____	FY: _____	Budget List #: _____

If federally funded, specify federal agreement number: _____

* Source Examples include ERPA, PIER-E, PIER-NG, FED, GRDA, ARFVT, OTHER.

Business Meeting Approval: (refer to Business Meeting Schedule)

Proposed Business Meeting Date: <u>6/12/2013</u>	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Participant: <u>Leah Mohny</u>	Time Needed: <u>5 minutes</u>	

Agenda Notice Statement: (state purpose in layperson terms) Possible approval of a Grant / Contingent Award to...

UNIVERSITY OF CALIFORNIA LOS ANGELES. Possible approval of Agreement PIR-12-032 with the Regents of the University of California, Los Angeles Campus, for a \$1,335,074 grant to conduct research in new phase change materials for wall assemblies and development of associated software tools. The project will contribute to Zero Net Energy commercial buildings. (PIER electricity and natural gas funding) Contact: Leah Mohny. (5 minutes)

Project Manager

Date

Office Manager

Date

Deputy Director

Date

Award Number: PON-12-503-2Date: 04 / 09 / 2013

Note: The Energy Commission Project Managers Manual includes detailed instructions on how to complete this section, with examples of grants that are “Projects” and are not “Projects”. When the Project Manager is completing this section, if questions arise as to the appropriate answers to the questions below, please consult with the Energy Commission attorney assigned to review grants or loans for your division.

1. Is grant/loan considered a “Project” under CEQA? Yes (skip to question #2) No (continue with question #1)

Please complete the following: [Public Resources Code (PRC) 21065 and 14 California Code of Regulations (CCR) 15378]:

Explain why the grant/loan is **not** considered a “Project”? The grant/loan will not cause a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because grant/loan involves:

2. If grant/loan is considered a “Project” under CEQA: (choose either **IS** or **IS NOT**)

Grant/loan **IS** exempt:

Statutory Exemption: (List PRC and/or CCR section numbers) _____

Categorical Exemption: (List CCR section number) 14 CCR Sections 15301 and 15306

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

Explain reason why the grant/loan is exempt under the above section:

The project involves the development of computer models and limited laboratory testing of phase change material in concrete wall assemblies.

Please attach draft Notice of Exemption (NOE). Consult with the Energy Commission attorney assigned to your division for instructions on how to complete the NOE.

- Grant/loan **IS NOT** exempt. The Project Manager needs to consult with the Energy Commission attorney assigned to your division and the Siting Office regarding a possible initial study.

To: Office of Planning and Research
PO Box 3044, 1400 Tenth Street, Room 222
Sacramento, CA 95812-3044

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

Project Title: Tools and Materials for Zero Net Energy California Buildings

Project Location - Specific:

Project Location - City: Project Location - County:

Description of Project:

PCMs are energy storage materials that can store thermal energy in the form of latent heat when subjected to temperatures in excess of their melting point by undergoing a phase transition from solid to liquid state. Reversibly, PCMs can release the thermal energy previously stored when the system temperature drops below their melting point. This research project proposes to exploit such thermal energy storage by embedding PCMs in light-weight cement-based composites, to design building envelopes that are able to self-regulate their thermal state and provide thermal auto-adaptability to an otherwise passive building element. The second phase of the project will involve integrating temperature sensors into the smart envelope, to communicate in real-time with the heating, ventilation and air-conditioning (HVAC) systems to optimize energy-use and space conditioning by monitoring thermal loads across the envelope. The proposed effort will result in a building envelope, which is able to better manage thermal demands by buffering the internal building thermal conditions against diurnal and seasonal variations. The outcomes will enable marked reductions in building energy use, and (time)-shift peak load periods to off-peak hours, thus also enhancing electrical grid stability. Other tasks in this project include developing and updating a popular design tool called Consultant with new sets of design guidelines and comfort criteria for Non-Residential building types. Another task involves creating the Small Building Energy Efficiency Design (SBEED, a new user-friendly one-day design software tool to help owners of small low-rise non-residential buildings build or remodel. This can help owners see which retrofit alternatives for using phase change materials in building envelope systems constitute the best economic choice. SBEED will be available for public distribution at no cost in early 2015.

Name of Public Agency Approving Project: California Energy Commission

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

Exempt Status: (check one)

- Ministerial (Sec. 21080(b)(1); 15268);
Declared Emergency (Sec. 21080(b)(3); 15269(a));
Emergency Project (Sec. 21080(b)(4); 15269(b)(c));
[X] Categorical Exemption. State type and section number 14 CCR Sections 15301 and 15306
Statutory Exemptions. State code number.
Common Sense Exemption. 15061(b)(3)

Reasons why project is exempt:

The project involves the development of computer models and limited laboratory testing of phase change material in concrete wall assemblies

Lead Agency

Contact Person: Leah Mohney Area code/Telephone/Ext: 916-327-1506

If filed by applicant:

- 1. Attach certified document of exemption finding.

2. Has a Notice of Exemption been filed by the public agency approving the project? Yes No

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

Signed by Lead Agency

Signed by Applicant

Date received for filing at OPR: _____

Exhibit A WORK STATEMENT

TECHNICAL TASK LIST

Task #	CPR	Task Name
1	N/A	Administration
2	X	Composite Phase Change Envelope for ZNE
3		Tools to Help Californians Design Zero Net Energy Buildings
4		Data Collection and Analysis
5		Technology Transfer Activities
6		Production Readiness Plan

KEY NAME LIST

Task #	Key Personnel	Key Partner(s)
1	Laurent Pilon, UCLA	
2	Gaurav Sant, UCLA	Entropy Solutions, Inc. U.S. Concrete National Research Laboratory Webcor Builders
3	Murray Milne, UCLA	EnergySoft LLC
4	Robin Liggett, UCLA	

GLOSSARY

Specific terms and acronyms used throughout this scope of work are defined as follows:

Term/ Acronym	Definition
AB 758	Assembly Bill 758 (Skinner, Chapter 470, Statutes of 2009)
ACM	California Title 24 Alternative Calculation Method Manual
ASHRAE	American Society of Heating, Ventilating, and Air Conditioning Engineers
ASTM	American Society for the Testing of Materials
CalGreen	California Green Building Initiative
CBE	California-Based Entity
CEC-PV	California Energy Commission's photovoltaic performance calculator
CO ₂	Carbon dioxide
CPM	Commission Project Manager
CPR	Critical Project Review
EnergyPlus	Building energy performance model
EnergyPro	Building energy performance model
EPW	EnergyPlus building performance model weather file
ERDD	Energy Research and Development Division
EUI	Energy Use Intensity in Btu/hr-sq.ft.
GHG	Greenhouse gas emissions
HEED	Home Energy Efficient Design software tool
HVAC	Heating, ventilating, air conditioning

Exhibit A WORK STATEMENT

Term/ Acronym	Definition
OPAQUE	Building envelope performance tool to be developed by research
PCM	Phase-change material
PG&E	Pacific Gas and Electric
PV	Photovoltaic (solar cells that generate electricity)
SBEED	Small Building Energy Efficient Design software design tool
SCE	Southern California Edison
SCG	Southern California Gas Company
SDG&E	San Diego Gas and Electric
SDHW	Solar Domestic Water Heating
SMUD	Sacramento Municipal Utility District
UCLA	University of California Los Angeles
UX	User Experience
XML	Extensible markup language
ZNE	Zero Net Energy

Problem Statement:

All new homes in California must be Zero Net Energy (ZNE) by 2020, and all new non-residential buildings must also be ZNE by 2030. Many Californians are not aware of these requirements, and most of them have no idea how to achieve them.

The goal of this project is to develop new construction materials and software tools that will help California builders, building owners, and ratepayers create energy efficient new or existing residential and small commercial buildings that lead to ZNE. These needs are not adequately addressed by competitive or regulated entities. The new building envelope material that will be developed has not been described, modeled, or tested for California climates. The suite of new software design tools being developed in conjunction with the new building materials will be offered at no cost and without marketing any particular company's product.

Goals of the Agreement:

The goal of this Agreement is to fund energy efficiency improvements in California's residential and commercial building stock. This project will generate two new types of technological advances: (1) a more effective type of high-mass building material; and (2) new software design tools that help small commercial or residential building owners reach ZNE through new construction or building retrofits. The project will involve development of a new building envelope performance tool called OPAQUE, which integrates the option of using the new high-mass material being developed by this project in California buildings. In addition to supporting the state's energy efficiency policies and initiatives, this project supports improving affordability, reliability, health, safety, the economy, the environment, and consumer choices relevant to energy supply and use in California by reducing energy usage and costs associated with heating and cooling of buildings, creating new construction jobs, and lowering greenhouse gas (GHG) emissions.

Exhibit A WORK STATEMENT

Objectives of the Agreement:

The objectives of the Agreement are to:

- Demonstrate a new type of building material that increases the effectiveness of thermal mass (Task 2); and
- Equip Californians with simple tools to encourage them to invest in ZNE buildings (Task 3).

The model developed in Task 2 will be incorporated into a new tool for Californians that will be developed in Task 3. The completion of tasks 2 and 3 will help Californians lower building energy use and peak demand in both new and existing residential and commercial buildings by making a commercial product available that has superior thermal and energy characteristics compared to current best practice.

TASK 1 ADMINISTRATION

Instructions for Submitting Electronic Files and Developing Software

Electronic File Format

The Recipient will deliver an electronic copy (CD ROM or memory stick or as otherwise specified by the Commission Project Manager (CPM) of the full text of any Agreement products in a compatible version of Microsoft Word (.doc).

The following describes the accepted formats of electronic data and documents provided to the Energy Commission as products and establishes the computer platforms, operating systems, and software versions that will be required to review and approve all software deliverables.

- Data sets will be in Microsoft (MS) Access or MS Excel file format.
- PC-based text documents will be in MS Word file format.
- Documents intended for public distribution will be in PDF file format, with the native file format provided as well.
- Project management documents will be in MS Project file format.

Software Application Development

If this Scope of Work includes any software application development, including but not limited to databases, websites, models, or modeling tools, the Recipient will use the following standard Application Architecture components in compatible versions:

- 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

Exhibit A WORK STATEMENT

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 Energy Commission's Information Technology Services Branch.

Task 1.1 Attend Kick-off Meeting

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

The Recipient shall:

- Attend a "Kick-Off" meeting with the CPM, the Grants Officer, and a representative of the Accounting Office. The Recipient shall bring its Project Manager, Agreement Administrator, Accounting Officer, and others designated by the CPM to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the CPM will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Discussion of the terms and conditions of the Agreement
- Discussion of Critical Project Review (Task 1.2)
- Match fund documentation (Task 1.6) *No work may be performed until this documentation is in place.*
- Permit documentation (Task 1.7)
- Discussion of subcontracts needed to carry out project (Task 1.8)

The technical portion of the meeting shall include, but not be limited to, the following:

- The CPM's expectations for accomplishing tasks described in the Scope of Work
- An updated Schedule of Products
- Discussion of Progress Reports (Task 1.4)
- Discussion of Technical Products (Product Guidelines located in Section 5 of the Terms and Conditions)
- Discussion of the Final Report (Task 1.5)

The CPM shall designate the date and location of this meeting.

- Submit an updated Schedule of Products, List of Match Funds, and List of Permits to the CPM.

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Recipient Products:

- Updated Schedule of Products
- Updated List of Match Funds
- Updated List of Permits

Commission Project Manager Product:

- Kick-Off Meeting Agenda

Task 1.2 Critical Project Review (CPR) Meetings

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and to identify any needed modifications to the tasks, products, schedule, or budget.

CPRs provide the opportunity for frank discussions between the CPM and the Recipient. The CPM may schedule CPRs as necessary, and CPR costs will be borne by the Recipient.

Participants include the CPM and the Recipient, and may include the Commission Grants Officer, the Energy Research and Development Division technical lead, other Energy Commission staff and Management, and any other individuals selected by the CPM to provide support to the Energy Commission.

The Commission Project Manager shall:

- Determine the location, date, and time of each CPR meeting with the Recipient. These 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 Commission Project Manager.
- Send the Recipient the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion of both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, and/or budget for the remainder of the Agreement. If the CPM 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 written determination in accordance with the schedule. The written response may include a requirement for the Recipient to revise one or more products that were included in the CPR.

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The Recipient shall:

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work on the project. This report shall be submitted along with any other products identified in this Scope of Work. The Recipient shall submit these documents to the CPM and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

Commission Project Manager Products:

- Agenda and a list of expected participants
- Schedule for written determination
- Written determination

Recipient Product:

- CPR Report(s)

Task 1.3 Final Meeting

The goal of this task is to close out this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present the project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

This meeting will be attended by, at a minimum, the Recipient, the Commission Grants Office Officer, and the CPM. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the discretion of the CPM.

The technical portion of the meeting shall involve the presentation of an assessment of the degree to which project and task goals and objectives were achieved, in addition to findings, conclusions, recommended next steps (if any) for the Agreement, and recommendations for improvements. The CPM will determine the appropriate meeting participants.

The administrative portion of the meeting shall involve a discussion with the CPM and the Grants Officer about the following Agreement closeout items:

- Disposition of any equipment purchased with Energy Commission funds

Exhibit A WORK STATEMENT

- Energy Commission's request for specific "generated" data (not already provided in Agreement products)
- Need to document Recipient's disclosure of "subject inventions" developed under the Agreement
- "Surviving" Agreement provisions
- Final invoicing and release of retention
- Prepare written documentation of any agreements made between the Recipient and Commission staff during the meeting.
- Prepare a schedule for completing the closeout activities for this Agreement.

Products:

- Written documentation of meeting agreements
- Schedule for completing closeout activities

Task 1.4 Monthly Progress Reports

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement on time and within budget.

The objectives of this task are to summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, and to form the basis for determining whether invoices are consistent with work performed.

The Recipient shall:

- Prepare a Monthly Progress Report that summarizes all Agreement activities conducted by the Recipient for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the CPM within 10 days of the end of the reporting period. The recommended specifications for each progress report are contained in the Terms and Conditions of this Agreement.
- In each Monthly Progress Report and invoice, document and verify:
 - Energy Commission funds received by California-Based Entities (CBEs);
 - Energy Commission funds spent in California; and
 - Match fund expenditures

Also provide a synopsis of project progress.

Product:

- Monthly Progress Reports

Exhibit A WORK STATEMENT

Task 1.5 Final Report

The goal of the Final Report is to assess the project's success in achieving its goals and objectives, advancing science and technology, and providing energy-related and other benefits to California.

The objectives of the Final Report are to clearly and completely describe the project's purpose, approach, activities performed, results, and advancements in science and technology; to present a public assessment of the success of the project as measured by the degree to which goals and objectives were achieved; to make insightful observations based on results obtained; to draw conclusions; and to make recommendations for further projects and improvements.

The Final Report shall be a public document. If the Recipient has obtained confidential status from the Energy Commission and will also prepare a confidential version of the Final Report, the Recipient shall perform the following activities for both the public and confidential versions of the Final Report.

The Recipient shall:

- Prepare an Outline of the Final Report.
- Prepare a Final Report following the approved outline and the latest version of the Final Report guidelines which will be provided by the CPM. The CPM shall provide written comments on the Draft Final Report within 15 working days of receipt. The Final Report must be completed at least 90 days before the end of the Agreement Term.
- Submit one bound copy of the Final Report with the final invoice.

Products:

- Draft Outline of the Final Report
- Final Outline of the Final Report
- Draft Final Report
- Final Report

Task 1.6 Identify and Obtain Match Funds

The goal of this task is to ensure that the match funds planned for this Agreement are obtained and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. Although the Energy Commission budget for this task will be zero dollars, the Recipient may utilize match funds for this task. Match funds shall be spent concurrently or in advance of Energy Commission funds for each task during the term of this Agreement. Match funds must be identified in writing and the associated commitments obtained before the Recipient can incur any costs for which the Recipient will request reimbursement.

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The Recipient shall:

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the CPM at least 2 working days prior to the kick-off meeting. 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 such 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 each cash match fund, its source (including a contact name, address and telephone number), and the task(s) to which the match funds will be applied.
 - Amount of each in-kind contribution, a description, documented market or book value, its 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 shall identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
- Provide a copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured. For match funds provided by a grant a copy of the executed grant shall be submitted in place of a letter of commitment.
- Discuss match funds and the implications to the Agreement if they are reduced or not obtained as committed, at the kick-off meeting. 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 letter including the appropriate information to the CPM if during the course of the Agreement additional match funds are received.
- Provide a letter to the CPM within 10 days if during the course of the Agreement existing match funds are reduced. Reduction in match funds must be approved through a formal amendment to the Agreement and may trigger an additional CPR.

Products:

- A letter regarding match funds or stating that no match funds are provided
- Copy(ies) of each match fund commitment letter(s) (if applicable)
- Letter(s) for new match funds (if applicable)
- Letter that match funds were reduced (if applicable)

Exhibit A WORK STATEMENT

Task 1.7 Identify and Obtain Required Permits

The goal of this task 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. Although the Energy Commission budget for this task will be zero dollars, the Recipient shall budget match funds for any expected expenditures associated with obtaining permits. Permits must be identified in writing and obtained before the Recipient can make any expenditure for which a permit is required.

The Recipient shall:

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the CPM at least 2 working days prior to the kick-off meeting. If there are no permits required at the start of this Agreement, then state such in the letter. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies the:
 - Type of permit
 - Name, address and telephone number of the permitting jurisdictions or lead agencies
 - The schedule the Recipient will follow in applying for and obtaining these permits.
- Discuss the list of permits and the schedule for obtaining them at the kick-off meeting and develop a timetable for submitting the updated list, schedule, and copies of the permits. The implications to the Agreement 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 the Progress Reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, provide an updated list of permits (including the appropriate information on each permit) and an updated schedule to the CPM.
- As permits are obtained, send a copy of each approved permit to the CPM.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CPM within 5 working days. Either of these events may trigger an additional CPR.

Products:

- Letter documenting the permits or stating that no permits are required
- Updated list of permits as they change during the term of the Agreement (if applicable)

Exhibit A WORK STATEMENT

- Updated schedule for acquiring permits as changes occur during the term of the Agreement (if applicable)
- A copy of each approved permit (if applicable)

Task 1.8 Obtain and Execute Subcontracts

The goal of this task is to ensure quality products and to procure subcontracts required to carry out the tasks under this Agreement consistent with the terms and conditions of this Agreement and the Recipient's own procurement policies and procedures. This task will also provide the Energy Commission an opportunity to review the subcontracts to ensure that the tasks are consistent with this Agreement, and that the budgeted expenditures are reasonable and consistent with applicable cost principles.

The Recipient shall:

- Manage and coordinate subcontractor activities.
- Submit a draft of each subcontract required to conduct the work under this Agreement to the Commission Agreement Manager for review.
- Submit a final copy of the executed subcontract.
- If the Recipient decides to add new subcontractors, it shall notify the Commission Agreement Manager.

Products:

- Letter describing the subcontracts needed, or stating that no subcontracts are required
- Draft subcontracts
- Final subcontracts

TECHNICAL TASKS

TASK 2 –COMPOSITE PHASE CHANGE ENVELOPE FOR ZNE BUILDINGS

Task 2.1 - Characterize and Select Materials Adapted to California Buildings and Climates

The goal of this task is to identify phase change materials (PCM) in both bulk and encapsulated forms which can be used in PCM-cement mortar composites compatible with California's 16 climate zones.

The Recipient shall:

- Year 1:
 - Review the nature and magnitude of temperature oscillations in each of the 16 California climates using Climate Consultant, a tool previously developed at the University of California Los Angeles (UCLA).

Exhibit A WORK STATEMENT

- Create and submit a Database of Thermo-physical Properties of PCM Adapted to California Climates by reviewing the manufacturer's properties for: thermal conductivity and specific heat, density, and thermal expansion coefficient as functions of temperature for various commercially available, bulk, and encapsulated PCMs.
 - Identify PCMs that are best adapted to metropolitan areas in northern, southern, and central California.
 - Identify PCMs that are missing the thermophysical data necessary to fully assess their potential of use in building elements.
 - Prepare a PCM Characterization Study report that includes but is not limited to the research, analysis and results completed in Year 1, including recommendations on whether further measurements of thermo-physical properties of PCMs are needed in Year 2.
 - Participate in a CPR meeting and prepare and submit a CPR Report as per Task 1.2. The CPR Report will discuss all Year 1 Tasks in this Work Statement.
- Year 2:
 - If needed, measure thermo-physical properties of PCMs identified as lacking in the PCM Characterization Study (Task 2.1, Year 1).
 - Participate in a CPR meeting and prepare a CPR Report as per Task 1.2. The CPR Report will discuss all Year 2 Tasks in this Work Statement.

Products:

- Database of Thermo-physical Properties of PCM Adapted to California Climates (CD, memory stick, or other media specified by the CPM)
- PCM Characterization Study Report
- Year 1 CPR Report
- Year 2 CPR Report

Task 2.2 - Fabricate PCM-Mortar Walls and Characterize their Thermomechanical Properties

The goals of this task are to: (1) fabricate PCM-mortar composite walls using the PCMs identified in Task 2.1; and (2) measure the thermal behavior of PCM-mortar composites in terms of their effective thermal conductivity, sensible/latent heat capacity, mechanical strength, and stiffness. The experimental data will be used to validate the models developed in Task 2.3.

The Recipient shall:

- Year 1:
 - Fabricate PCM-mortar composite wall elements of different geometries containing different PCMs, for variations in PCM volume fraction, transition temperature and enthalpy.

Exhibit A WORK STATEMENT

- Build and calibrate an experimental setup for thermal measurements, for environmental (air) temperatures between -10°C and 50°C.
- Year 2:
 - Collect experimental data for thermal conductivity, heat capacity, strength, and stiffness in the temperature range relevant to California's climate as identified in Task 2.1.
 - Fabricate optimized PCM mortar composite elements as prescribed by the results of Year 1 work in Task 2.3.
- Prepare a PCM-mortar Composite Report that discusses the research, analysis, and results from Years 1 and 2 activities for this task, including a discussion of the fabrication of PCM composites and their thermo-physical and mechanical properties in the temperature ranges relevant to California's climate zones.

Products:

- PCM-mortar Composite Report

Task 2.3 - Develop Thermomechanical Models of PCM-Mortar Composites to Design, Optimize, and Control Smart Multifunctional Building Envelopes

The goal of this task is to develop models for predicting the effective thermal conductivity, thermal mass, strength, stiffness, and overall heat (energy) transfer response of PCM-mortar composite elements. These models will be validated against experimental data collected in Task 2.2, and will be considered acceptable if they can recover experimental results within $\pm 20\%$.

The Recipient shall:

- Year 1:
 - Develop models for effective thermal conductivity, heat capacity, thermal expansion coefficient, and mechanical strength and stiffness as a function of temperature, PCM size, volume fraction, and PCM and cement mortar properties.
- Year 2:
 - Validate models developed in Year 1 with experimental data collected in Task 2.2, Year 2.
 - Improve the models developed in Year 1 if the disagreement between model predictions and experimental data exceeds 20%, over the temperature range considered.
 - Develop numerical tools based on the composite models developed in Task 2.3, Year 1. The tools will determine the ability of PCMs to improve energy efficiency in building envelope applications by limiting heat transfer.

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- Year 3:
 - Determine the optimum PCM capsule size and volume fraction of PCM required to achieve the desired thermomechanical performance.
 - Develop composite models and simulation tools capable of predicting the thermo-mechanical properties and thermal response of PCM-mortar composites.
- Prepare a Composite Models and Simulation Tools Report that includes but is not limited to: (1) a discussion of the research, analysis, and results from the Year 1, 2, and 3 activities; (2) a discussion of the difference between validation results for the model and the experimental data including whether the difference was within +/-20% of each; and (3) instructions on how to access and use the composite models and simulations tools developed in Task 2.3.

Products:

- Composite Models and Simulation Tools Report

Task 2.4 - Assess the Durability of PCM-Mortar Composites under Simulated Environmental Conditions

The goal of this task is to assess the durability of PCM-mortar composites under realistic California weather conditions as simulated in a laboratory environmental chamber.

The Recipient shall:

- Year 2:
 - Assess the survivability, stability, and cyclic phase change response of PCMs emplaced in cement mortar systems that are exposed to environmental conditions.
- Year 3:
 - Evaluate the durability properties of PCM-mortar composites using standardized American Society for the Testing of Materials (ASTM) protocols in the context of:
 - Water absorption and transport behavior (ASTM C1585),
 - Restrained cracking behavior (ASTM C1581), and
 - Deformation susceptibility in the context of moisture and thermal loading (ASTM C157).
- Prepare a PCM-mortar Composite Durability Test Report that includes but is not limited to a description of the research, analysis, and results from Years 2 and 3 of this task and a description of test results for the durability of PCM-mortar composites under simulated environmental conditions.

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Products:

- PCM-mortar Composite Durability Test Report

Task 2.5 - Develop a Control Scheme for Integrating Heating, Ventilating, and Air Conditioning (HVAC) Systems and Multifunctional Smart Envelopes for Thermal Energy Efficiency

The goal of this task is to develop new control and regulation schemes for residential and commercial building HVAC systems to account for: (1) time lag due to the presence of PCMs in building envelopes; and (2) temperature difference developed across the building envelope, energy transfer issues, and ambient room temperature maintenance (space conditioning).

The Recipient shall:

- Year 2:
 - Identify and/or fabricate temperature sensors to measure temperature differences that manifest across the exposed and interior faces of the building envelope.
 - Develop and assess the performance and the robustness of control strategies and their algorithms to simulated California climates as provided by Climate Consultant. This step will use Simulink, MATLAB®, and thermal models of envelope response to heat loads to simulate/understand correlations between climate and heat transfer across the envelope, in addition to the energy efficiency implications of the heat transfer.
- Year 3:
 - Procure or fabricate temperature sensors, and calibrate and embed them in PCM-mortar composites.
 - Test the durability of thermocouples embedded in PCM-mortar composites from Task 2.4.
 - Demonstrate measures for HVAC control and regulation strategies that respond to changes in ambient environmental conditions, internal room (building) temperatures and temperature differences developed across the phase changing envelope.
- Prepare a MATLAB/Simulink Implementation Report that includes but is not limited to the research, analysis, and results completed in Years 2 and 3 of this task and a description of the implementation of an adaptive feedback control scheme for HVAC with PCM-mortar building envelopes.

Products:

- MATLAB/Simulink Implementation Report

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Task 2.6 - Build Test Cells Constructed of Multifunctional Smart Envelopes with Embedded Adaptive HVAC Control

The goal of this task is to construct, with input from industry partners, laboratory-based test cells using fully optimized PCM-mortar based materials, that are either: (1) homogeneous; or (2) stratified with respect to PCM volume fraction and transition temperature, designed to achieve the best thermal performance. The Recipient will refine and validate the materials/models described above so as to demonstrate energy efficiency improvements.

The Recipient shall:

- Year 3:
 - Build test cells of enclosures made of traditional cement mortars and determine their thermal and energy transfer behavior.
 - Build test cells of enclosures made of PCM-cement mortars and determine their thermal and energy transfer behavior, using optimized material proportions and solutions identified in Task 2.3, Year 3.
 - Integrate the HVAC and temperature sensing systems with the envelope materials to measure, validate, and rank the thermal/energy transfer behavior of the phase changing envelopes when used in combination with a smart, adaptive HVAC system.
 - In collaboration with the industrial partners, install these new envelope materials in a real building, where the performance of the envelope can be monitored under realistic conditions. The test cells will be constructed using field-relevant techniques, integrated with temperature sensors and arranged to interact with an adaptive (i.e., heat flow) based HVAC control system. The test cells will provide means to consider necessary steps towards ZNE buildings, such as energy savings, sought modifications in material properties.
 - Prepare a PCM/Mortar Building Envelopes and Associated HVAC Control Scheme Report that includes but is not limited to the test results and analysis of the test cells, potential energy savings, and a discussion of all work, analysis, and results of Year 3 of this task.

Products:

- PCM/Mortar Building Envelopes and Associated HVAC Control Scheme Report

Task 2.7 - Evaluate Benefits to California Ratepayers and Develop Guidelines for Deployment of Prototypical Multifunctional Composite Envelopes for Residential and Commercial Buildings

The goals of this task are to quantitatively evaluate the benefits of the prototypical multifunctional composite envelopes and to develop guidelines for practical scale deployment and construction.

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The Recipient shall:

- Year 3:
 - Evaluate benefits of the PCM-mortar composite and associated thermal control to ratepayers for representative residential and commercial buildings under specific California climate with respect to peak diurnal and seasonal temperature change, peak energy shift, and peak energy reduction needs.
 - Prepare a Benefits to Ratepayers Using PCM-mortar Building Envelopes Report that will include but not be limited to a discussion of: (1) the benefits and cost effectiveness of using PCM/mortar building envelopes; (2) analysis and evaluations of benefits related to diurnal and seasonal peak temperature changes, peak energy use shifts; and peak energy reduction available from the use of multifunctional composite envelopes; and (3) the evaluation completed in the preceding bullet.
 - Develop Guidelines for Deploying PCM-mortar Composites for building envelopes for residential and commercial buildings. These guidelines will be developed for architects, structural engineers and other building professionals. They will address the selection, design and proportioning of PCM-mortar based envelope materials for use in residential/commercial building envelopes.

Products:

- Benefits to Ratepayers Using PCM-mortar Building Envelopes Report
- Guidelines for Deploying PCM-mortar Composites

TASK 3 - TOOLS TO HELP CALIFORNIANS DESIGN ZNE BUILDINGS

TASK 3.1 - OPAQUE Building Element Simulation

The goal of this task is to create a user-friendly software tool for building design (tentatively called OPAQUE) to help Californians create ZNE buildings by showing them how the opaque parts of the building's envelope (walls, roofs, and floors) can be designed to modify indoor air temperature. Years 1 and 2 will involve the development of an algorithm to predict the performance of composite (built-up) building envelope sections that could include a layer of concrete that contains PCMs. The UCLA Recipient's architecture team will concurrently develop a graphic user interface with a similar look and feel to other existing energy design tools currently available on UCLA's Energy Design Tool website.

The Recipient shall:

- Year 1:
 - Coordinate these tasks with the development of the first order models for effective thermal conductivity, heat capacity, thermal

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- expansion coefficient, strength, and stiffness as a function of temperature, PCM size, volume fraction, and PCM and concrete properties begun in Task 2, Subtask 2.3, Year 1.
- Begin to write design tool specifications including: inputs variables, output results, and graphic user interface (i.e. how to display time lag and decrement).
- Year 2:
 - *(this activity links to Subtask 2.3, Year 2)* Complete development of model PCM-concrete thermochemical properties to predict time lag.
 - Create the first mockup of the OPAQUE User-Friendly Envelope Design Tool interface.
- Year 3:
 - Complete Development of the OPAQUE User-Friendly Envelope Design Tool.
 - At no cost to the public, release and distribute the Year 3 final OPAQUE version (to be posted on UCLA's Energy Design Tools web site and available via hot links from the Energy Commission's website and other sites as appropriate).
 - For three years following the completion of this task, continue to maintain the OPAQUE User Hotline at no cost.
 - Post OPAQUE on UCLA's website with a hot link to other sites as specified by the CPM.
 - Maintain an OPAQUE User E-Mail Hotline on the UCLA website through Year 3, and for three years after the completion of this task.
 - Prepare an OPAQUE Summary Letter Report that includes but is not limited to a description of its features and capabilities, how to access it on UCLA's website, and how to receive user support through the Hotline.
 - Prepare and submit a descriptive OPAQUE Flyer (1-2 pages) that describes its features, capabilities, applications, uses, and accessibility.

Products:

- OPAQUE Summary Letter Report
- OPAQUE Flyer (electronic copy)

TASK 3.2 - Small Building Energy Efficient Design (SBEED) Tool

The goal of this task is to create a user-friendly design tool (tentatively called SBEED) to help Californians create ZNE low-rise non-residential buildings (defined as buildings under three stories) that meet or exceed the new 2013 Title 24 Energy Efficiency Standards for Non-Residential Buildings. The design situation for small commercial building owners is completely different from that of large high-rise buildings that have

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their own complex simulation models and highly specialized professionals to fine-tune building performance. The thousands of low-rise non-residential buildings in the state consume a disproportionate amount of energy, and most of them will require a deep retrofit to bring them up to current energy efficiency standards.

The Recipient shall:

- Year 1:
 - In consultation with the CPM, create a SBEED tool that meets the new 2013 Title 24 Code specifications by automatically creating a Standard Design Small Building for each California climate zone. Add new data input and Construction Assembly screens to allow users to select any Alternative Calculation Method (ACM) construction type or to design and calculate any unique assembly not covered in Title 24.
 - Add a new photovoltaics (PV) system components catalog and accompanying calculations to coordinate with updates in the Energy Commission's photovoltaics calculator (CEC-PV). Also enhance the graphic user interface that allows click and drag placement anywhere on site including on roofs of any shape.
 - Include the following in SBEED: (1) each California electric utility's most widely used 2013 non-residential electricity rate applicable to small and medium buildings; and (2) the 2013 carbon dioxide (CO₂) emission factors, and Smart Meter rate structure simulation if available.
SBEED will use a postal zip code input to automatically select the appropriate commercial building electric rate/ sub-rate and the current CO₂ emission factors for Pacific Gas and Electric (PG&E), Southern California Edison (SCE), San Diego Gas and Electric (SDG&E), Sacramento Municipal Utility District (SMUD).
 - Include in the following in SBEED: (1) building additions and remodeling capabilities to support the Energy Commission's Comprehensive Energy Efficiency Program for Existing Buildings (AB 758 – Skinner, Statutes of 2009); and (2) compatible features for CalGreen, California's mandatory green building code, by adding new data input screens and energy/GHG emission calculation capabilities as needed (which will include the ability to model passive solar gain, night flushing, and building orientation).
 - Release and distribute at no cost the new Year 1 development of SBEED 2013 (posted on UCLA's Energy Design Tools website, and available hyperlinks to other websites, as directed by the CPM).
 - Maintain a SBEED User Hotline.
 - Prepare a Year 1 Summary Letter SBEED Report that includes but is not limited to: (1) a discussion of the SBEED Software Year 1 development process; (2) a description of the features, capabilities, electricity rate structures used, building addition and remodeling

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capabilities, and compatibility features for Cal Green; (3) a discussion of how to access SBEED on UCLA's website and how to receive user support through the hotline.

- Year 2:
 - Expand the Thermal Comfort Calculation Capabilities. SBEED will calculate hourly relative humidity and indoor air velocity based on the United States Department of Energy's EnergyPlus Weather (EPW) data files. This capability is unique among design tools, allowing SBEED to test and demonstrate alternative approaches to achieving energy efficiency and GHG reductions as a result of an expanded definition of comfort ventilation cooling and how minimum air flow requirements will be modified for new indoor comfort criteria in the 2013 Title 24 code for new low-rise non-residential buildings.
 - Upgrade SBEED with each natural gas utility's 2013 gas rates and CO2 Emissions Coefficients. SBEED will use postal zip code input to automatically select appropriate SDG&E, Southern California Gas (SCG), PG&E, or default rates.
 - Add new solar hot water system calculations and enhance click and drag placement of panels any place on the site, including on parking structures and roofs of any shape.
 - Expand SBEED's automatic extensible markup language (XML) file-sharing protocol with EnergyPro to accommodate the new 2013 Title 24 requirements, This will allow the best final scheme developed by SBEED to automatically demonstrate code compliance.
 - Add an hourly "Sun's-Eye-View" graphic simulation (movie) that will show the owners of small non-residential buildings the shading impact of exterior objects like tall buildings, shade structures, and trees on windows, PV panels, and solar domestic hot water (SDHW) collectors for each month of the year.
 - Release and distribute at no cost to the public, the new Year 2 development of SBEED (posted on UCLA's Energy Design Tools web site, and available via hot links from the Energy Commission's website).
 - Maintain a SBEED User Hotline.
 - Prepare a Year 2 Summary Letter SBEED Report that includes but is not limited to: (1) a discussion of the SBEED Software Year 2 development process; (2) a description of the features, capabilities, improvements and updates from Year 1 software, natural gas rate structures used, thermal comfort and solar hot water calculations, code compliance features, and shading impacts; and (3) a discussion of how to access the Year 2 software from UCLA's website and how to receive user support through the hotline.

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- Year 3:
 - Provide algorithms for calculating the hourly performance of very low energy cooling systems and proprietary economizer systems like Night Breeze.
 - Expand SBEED's current model for economizer cooling and night flushing systems to include proprietary systems such as the Night Breeze System, and other air-to-air heat exchangers (heat recovery ventilators).
 - Add to SBEED various evaporative cooling options (e.g., single stage, dual stage) and other very low energy cooling options.
 - Expand SBEED's Existing Building Capabilities for retrofit work that includes the ability to predict the construction of existing small non-residential buildings based on the date they were built (based on the AB758 Scoping Report).
 - Validate SBEED Performance against the American Society of Heating, Air Conditioning, and Refrigeration Engineers (ASHRAE) Standard 140. This standard test procedure applies to building energy computer programs that calculate the thermal performance of a building and its mechanical systems and is used to indicate major flaws or limitations in capabilities.
 - Validate SBEED Performance against EnergyPlus software using the Commercial Reference Buildings Database (this should prove successful given that both are hourly heat balance models). Prepare a SBEED Performance Validation Report that includes but is not limited to the results of validation with ASHRAE Standard 140, EnergyPlus software using Commercial Reference Database.
 - Release and distribute at no cost the Year 3 final SBEED version (posted on UCLA's Energy Design Tools website and hyperlinked to other websites as directed by the CPM).
 - Prepare a Year 3 Summary Letter SBEED Report that includes but is not limited to: (1) a discussion of the SBEED Software Year 3 development process; (2) a description of how the features, capabilities, and improvements/updates compare to Year 2 software; (3) a discussion of algorithms for calculating the performance of low-energy cooling and economizer systems, retrofit capabilities, and validation results; and (4) a discussion of how to access the Year 3 software from UCLA's website and how to receive user support through the hotline.
 - For the three years following the completion of this task, continue to maintain the SBEED User Hotline at no cost.
 - Update SBEED at the ends of Years 1, 2, and 3, and maintain a link to the Energy Commission and other websites.
 - Maintain SBEED User E-mail Hotline through Years 1, 2, and 3, and for three years after the completion of this task.

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- Post on the Energy Tools Website the validation reports of SBEED performance against ASHRAE Standard 140, and against EnergyPlus using the Commercial Reference Buildings Database. Prepare a SBEED flyer (1 or 2 pages) that includes information about its features, capabilities, uses, use guidelines, and access and user support guidelines.

Products:

Year 1:

- Year 1 Summary Letter Report

Year 2:

- Year 2 Summary Letter Report

Year 3:

- Year 3 Summary Letter Report
- SBEED Performance Validation Report
- SBEED flyer (electronic version)

TASK 3.3 - Upgrade Climate Consultant Design Guidelines to 2013 Residential and Non-Residential Code

The goal of this task is to upgrade Climate Consultant for 2013 Title 24 Residential Code and add Non-Residential Design Guidelines. This tool helps Californians understand how to take advantage of the resources of their local climate to reduce building energy consumption.

The Recipient shall:

- Year 1:
 - Generate the Top-20 Design Guidelines based on an analysis of the climate data, using Climate Consultant. The guidelines will inform users on which non-residential building design options are likely to have the highest payoff in energy and GHG savings,
 - Update the residential building guidelines.
 - Upgrade the new comfort criteria in both the Residential and Non-Residential Title 24 Code.
 - Add new types of graphic data representation, sun shading calculations, and new graphic data transfer capabilities.
 - Maintain the Climate Consultant user Hotline.
 - Post the latest version of Climate Consultant on the Energy Design Tools website and link it to other websites based on discussions with the CPM.
 - Prepare a Climate Consultant Summary Letter Report that includes but is not limited to: (1) a discussion of all activities in this task; (2) a description of the features, capabilities, and improvements/updates to the Climate Consultant Software (Version 6); and (3) a

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discussion of how to access the software from UCLA's website and how to receive user support through the Hotline.

- Prepare a Climate Consultant descriptive flyer that includes information about its features, capabilities, uses, and accessibility to the public.

- Year 2:
 - Maintain the Climate Consultant user Hot Line.

- Year 3:
 - Maintain the Climate Consultant user Hot Line.

Products:

- Climate Consultant Summary Letter Report
- Climate Consultant Flyer (electronic version)

TASK 3.4 - Home Energy Efficient Design (HEED) Upgrades to Meet 2013 Title 24

The goals of this task are to update the popular HEED software to meet the new 2013 Residential Title 24 Code and to add several important new capabilities:

The Recipient shall:

- Year 1:
 - Upgrade HEED to meet the new 2013 Title 24 Code in order to automatically create Standard Design Homes for each of the 16 California Climate zones.
 - Update the Photovoltaics System components catalog and accompanying calculations to coordinate with updates in the CEC-PV. Also enhance the graphic user interface that allows click and drag placement of PV panels anywhere on site including on roofs of any shape.
 - Upgrade HEED with: (1) each electric utility's most widely used 2013 electricity rate; (2) the 2013 CO2 Emissions Coefficients; and (3) if available, the Smart Meter rate structure simulation (HEED's zip code input automatically selects the appropriate 2012 PG&E, SCE, SDGE, SMUD rate or sub-rate, and the current CO2 emission coefficients).
 - Update algorithms for calculating the hourly performance of very low energy cooling systems and proprietary economizer systems like Night Breeze for ACM applications.
 - Expand HEED's current model for whole-house economizers and night flushing systems to include proprietary systems such as the Night Breeze System, Air-to-Air Heat Exchangers (Heat Recovery

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- Ventilators), various evaporative cooling options (e.g., single stage, dual stage) and other very low energy cooling options.
 - Generate Top-20 Design Guidelines based on an analysis of the climate data, using the capability in Climate Consultant. The guidelines will inform users on the building design options that will likely have the highest payoff in energy and GHG savings.
 - Increase roof geometry options in HEED to include cathedral ceilings and complex combinations of roofs (including graphics of roof shape, type, slopes, orientations, and materials). Expand HEED's Additions and Remodeling Capabilities to support the Energy Commission's Comprehensive Energy Efficiency Program for Existing Buildings (HEED currently accommodates AB 758).
 - Expand HEED's existing building capabilities including the ability to predict the construction of pre-code homes based on the date they were built (essential for the CPUC's California Solar Initiative program for existing homes, critical as this residential sector has the largest impact on California's GHG reductions).
 - Add features for compatibility with CalGreen, California's mandatory green building code, by adding new data input screens and energy and GHG calculation capabilities as needed (and if necessary expand HEED's ability to model passive solar gain, night flushing, and building orientation, in addition to new capabilities for calculating PV and SDHW systems as discussed in the AB758 Scoping Report).
 - Release and distribute at no cost the new Year 1 development of HEED 2013 (posted on UCLA's Energy Design Tools website, and available via hot links from a number of other sites).
 - Maintain a HEED User Hotline.
 - Prepare a Year 1 Summary Letter HEED Report that includes but is not limited to: (1) all results, data, and analysis completed in Year 1 of this task; (2) a discussion of all new features and capabilities of the expanded HEED program; and (3) a discussion of how to access the software from UCLA's website and how to receive user support through the Hotline.
- Year 2:
 - Maintain the HEED User Hotline.
 - Year 3:
 - Add new graphic and data input Construction Assembly screens to allow users to select any ACM Construction Type (per Appendix) or to design and calculate any unique assembly (per ACM). This new feature of HEED will be built on the OPAQUE program developed in Years 1 and 2.
 - Validate HEED Performance against ASHRAE Standard 140.
Validate HEED Performance against EnergyPlus for all HERS Best

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- Release and distribute at no cost to the public the Year 3 final HEED version (posted on UCLA's Energy Design Tools website, and available via hot links from a number of other websites).
- For the three years following the completion of this task, continue to maintain at no cost the updated version of HEED, the HEED User e-mail hotline, and the Frequently Asked Questions File (both available via the HEED website).
- Prepare a Report of HEED Performance against ASHRAE Standard 140 and EnergyPlus Report including a discussion of the validation results of HEED performance as compared to ASHRAE 140, EnergyPlus for all HERS Best Test Cases.
- Prepare a Year 3 Summary Letter HEED Report that includes but is not limited to: (1) all the results, data and analysis completed in Year 3 of this task; (2) a discussion of new features, capabilities, and improvements over the Year 1 HEED program; and (3) a discussion of how to access the software from UCLA's website and how to receive user support through the hotline.
- Prepare a HEED Descriptive Flyer that includes information about its features, capabilities, uses, and user support guidelines.

Products:

- Year 1 Summary Letter Report
- Year 3 Summary Letter Report
- HEED Descriptive Flyer
- Report of HEED Performance Against ASHRAE Standard 140 and EnergyPlus

TASK 3.5 - Develop Tablet Application for HEED

The goal of this task is to demonstrate that the HEED software can be rewritten for use on tablets or other hand-held mobile devices, to allow its use in the field by contractors and others.

The Recipient shall:

- Year 1:
 - Assess the status of the graphic software issues and the availability of a universal operating system and prepare a HEED Application Assessment Summary Letter Report discussing the assessment and plan for development of the application, devices targeted, and computational components needed to make the application work.

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- Year 2:
 - Begin to re-write HEED software for use on tablets or other hand-held devices.

- Year 3:
 - Complete development of HEED software for use on tablets or other hand-held devices.
 - Prepare a HEED Tablet Application Summary Letter Report that includes but is not limited to a description of its features, capabilities, use, access, and user support guidelines.
 - Prepare a HEED Tablet Application descriptive flyer that includes information about its features, capabilities, uses, and accessibility to the public.

Products:

- HEED Application Assessment Summary Letter Report
- HEED Tablet Application Summary Letter Report
- HEED Tablet Application Descriptive Flyer (electronic copy)

TASK 3.6 - On-Line Tutorials to Help Californians Create ZNE Buildings

The goal of this task is to create and post on UCLA's website a series of 12 tutorials explaining how to use the design tools to create ZNE buildings. These tutorials will meet the needs for technology transfer and are designed for everyone from knowledgeable building owners to builders, architects, and students.

The Recipient shall:

- Year 1:
 - Create and post tutorials 1 through 4.
 - Prepare a Year 1 Tutorial Summary Letter Report with information about tutorials 1-4, including but not limited to: (1) its purpose and objective; and (2) access and use instructions.

- Year 2:
 - Create and post tutorials 5 through 8.
 - Prepare a Year 2 Tutorial Summary Letter Report that includes information about tutorials 5-8, including but not limited to: (1) its purpose and objective; and (2) access and use instructions.

- Year 3:
 - Create and post tutorials 9 through 12.
 - Prepare a Year 3 Tutorial Summary Letter Report that includes information about tutorials 9-12, including but not limited to: (1) its purpose and objective; and (2) access and use instructions.

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- Prepare and design a Tutorials Flyer that describes all of the tutorials (1-12) and explains how to use and access them.

Products:

- Year 1 Tutorials Summary Letter Report (1-4)
- Year 2 Tutorials Summary Letter Report (5-8)
- Year 3 Tutorials Summary Letter Report (9-12)
- Tutorials Flyer (electronic version)

TASK 4 - DATA COLLECTION AND ANALYSIS

The goals of this task are to collect operational data, analyze the data for economic and environmental impacts, and include the data and analysis in the Final Report.

The Recipient shall:

- Develop a data collection test plan based on input from the CPM. The plan will include but not limited to a discussion of the following:
 - Tasks 2 and 3:
 - Energy savings and estimated cost savings
 - GHG reductions
 - Other non-energy benefits
 - Task 3:
 - Number of “hits” on the UCLA website for each of the software programs developed or updated
 - Number of calls to the Hotline for each of the software programs
 - Other verification of implementation rates
- Provide data on potential job creation, market potential, economic development, and increased state revenue as a result of expected future expansion.
- Provide an estimate of the project’s energy savings and other benefits once market potential has been realized.
- Compare project performance to expected performance as described in the proposal and the goals and objectives section of this Work Statement.
- Prepare a Data Analysis Report that includes, but is not limited to the test plan, results, data, and analysis required in this task.

Products:

- Draft Data Analysis Report
- Final Data Analysis Report

TASK 5 - TECHNOLOGY 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.

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The Recipient shall:

- Prepare a Technology Transfer Plan that explains how the knowledge gained in this project will be made available to the public. The level of detail expected is least for research-related projects and highest for demonstration projects. Key elements from this report will be included in the Final Report.
- Conduct technology transfer activities in accordance with the Technology Transfer Plan. These activities will be reported in the Monthly Progress Reports.
- Indicate the intended use(s) for and users of the project results.
- Prepare a report on technology transfer activities that were conducted that will contain, but not be limited to, a discussion of all work analysis and results from this task.

Products:

- Draft Technology Transfer Plan
- Final Technology Transfer Plan
- Draft Technology Transfer Report
- Final Technology Transfer Report

TASK 6 - PRODUCTION READINESS PLAN

The goal of the plan is to determine the steps that will lead to the manufacturing of the technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare and submit both a Draft and a Final Production Readiness Plan. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product and its state of development. As appropriate, the plan will include but not be limited to a discussion of 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"
 - A projected "should cost" for the product when in production
 - The expected investment threshold to launch the commercial product
 - An implementation plan to ramp up to full production

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Products:

- Draft Production Readiness Plan
- Final Production Readiness Plan