STATE OF CALIFORNIA

GRANT REQUEST FORM (GRF)

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

New Agreement EPC-18-004 (To be completed by CGL Office)

ERDD	Joshua Croft	51	916-445-5328

Ubiquitous Energy, Inc.	45-3624852

Accelerating Commercialization of Advanced Energy Efficient Windows

	2/8/2019	12/12/2022	$ 2,998,055

☐ ARFVTP agreements under $75K delegated to Executive Director.

Proposed Business Meeting Date	1/9/2019	☐ Consent	☒ Discussion
Business Meeting Presenter	Rachel Salazar	Time Needed:	5 minutes

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

Agenda Item Subject and Description

UBIQUITOUS ENERGY, INC. Proposed resolution approving Agreement EPC-18-004 with Ubiquitous Energy, Inc. for a $2,998,055 grant to scale its ClearView Power technology to meet the size requirements and specifications needed for window production. ClearView Power is a transparent solar coating that, when applied to glass, selectively absorbs and converts non-visible light to electricity while also blocking the infrared light that causes heat gains in buildings. As part of this project, Ubiquitous Energy will demonstrate that the solar coating application can be integrated into a standard glass manufacturing process.

1. Is Agreement considered a "Project" under CEQA?
   ☒ Yes (skip to question 2) ☐ No (complete the following (PRC 21065 and 14 CCR 15378)):
   Explain why Agreement is not considered a "Project":

2. If Agreement is considered a "Project" under CEQA:
   ☒ a) Agreement **IS** exempt. (Attach draft NOE)
   - ☐ Statutory Exemption. List PRC and/or CCR section number:
   - ☒ Categorical Exemption. List CCR section number: Cal. Code Regs., tit 14, § 15301
   - ☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

   Explain reason why Agreement is exempt under the above section:
   Section 15301 Existing Facilities provides an exemption for the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing structures, facilities, mechanical equipment or topographical features involving negligible or no expansion of use beyond that existing. This project will conduct research, development, and manufacturing within already existing facilities. There will be negligible or no expansion of existing use.

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

Legal Company Name:	Budget		
DOE-Lawrence Berkeley National Laboratory	$ 225,600	($225,600)	match
	$		

Legal Company Name:

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Budget Information			
Funding Source	**Funding Year of Appropriation**	**Budget List No.**	**Amount**
EPIC	17-18	301.001E	$2,998,055
			$
R&D Program Area: EERO: Buildings			$2,998,055
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Name:	Veeral Hardev		Name:	Veeral Hardev	
Address:	3696 Haven Avenue, Suite B		Address:	3696 Haven Avenue, Suite B	
City, State, Zip:	Redwood City, CA 94063-4604		City, State, Zip:	Redwood City, CA 94063-4604	
Phone:	(650) 257-3847	Fax: - -	Phone:	(650) 257-3847	Fax: - -
E-Mail:	veeral@ubiquitous.energy		E-Mail:	veeral@ubiquitous.energy	

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

1. Exhibit A, Scope of Work		☒ Attached
2. Exhibit B, Budget Detail		☒ Attached
3. CEC 105, Questionnaire for Identifying Conflicts		☒ Attached
4. Recipient Resolution	☒ N/A	☐ Attached
5. CEQA Documentation	☐ N/A	☒ Attached

Agreement Manager	Date	Office Manager	Date	Deputy Director	Date

EXHIBIT A
Scope of Work

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		Create Manufacturing Infrastructure
3		Finalize and Select R&D Prototypes for Testing
4		R&D Prototype Testing
5		Conduct Prototype Manufacturing – 1st Pilot Generation
6		Pilot Prototype Testing – 1st Generation
7	X	Evaluation and Assessment of Pilot Prototypes Testing and Commercial Feasibility – 1st Generation
8		Conduct Prototype Manufacturing – 2nd Pilot Generation
9		Pilot Prototype Testing – 2nd Generation
10		Evaluation and Assessment of Pilot Prototypes Testing and Commercial Feasibility – 2nd Generation
11		Evaluation of Project Benefits
12		Technology/Knowledge Transfer Activities
13		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
ASTM	American Society for Testing Materials
CVP	ClearView Power™
HT	High Temperature
HVAC	Heating, Ventilation, and Air Conditioning
IEC	International Electrotechnical Commission
low-E	low-emissivity
PV	Photovoltaic
R&D	Research and Development
SOP	Standard Operating Procedures
TAC	Technical Advisory Committee

[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.

EXHIBIT A
Scope of Work

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the development of marketable ClearView Power™ (CVP) window prototypes, perform manufacturing research and development (R&D) to develop window prototype assembly lines, and test produced window prototypes for energy efficiency, electricity generation, aesthetics, and durability.

B. Problem/ Solution Statement

Problem

Although premium low-emissivity (low-E) windows maximize the rejection of excessive heat from entering a building, it usually does so at an unwanted aesthetic tradeoff as seen in the windows having an undesired pink-purple color tint. Additionally, the solar heat being reflected back into the environment is not being captured as useful energy. To date, there is not a market ready window product that effectively prevents heat from entering the building through the windows, generates renewable energy, and is easily manufactured at an accessible price point.

Solution

CVP-coated windows provide energy efficiency comparable to premium low-E windows. However, CVP-coated windows have the potential to provide greater color neutrality and design freedom. In addition to advanced energy efficiency, CVP also utilizes transparent photovoltaic (PV) technology that greatly expands the potential application of solar technology. This agreement will expedite the commercialization of this groundbreaking technology.

C. Goals and Objectives of the Agreement

Agreement Goals

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

- Enabling the expanded deployment of solar PV resulting in less dependence on California's aging electricity grid infrastructure, particularly in day-time peak hours; and
- Lowering ratepayer costs by providing energy efficient insulation that lessens a building's reliance on HVAC systems, and renewable energy generation through solar PV technology.

[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).

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 scaling up and commercializing the multifaceted CVP technology. The scale-up will be completed by first developing an innovative manufacturing line framework for CVP. By establishing standardized manufacturing processes and procedures, these techniques will have the potential to migrate to a large-scale commercial glass manufacturing facility by the end of this EPIC-funded project.

Agreement Objectives

The objectives of this Agreement are to:

- Expedite the commercialization of CVP technology by developing three window prototype generations in a two and a half year period. It is expected that each generation of product will have significant improvements to energy efficiency, electricity generation, aesthetics, and durability from that of the previous generation.
- Develop processes, procedures and techniques to migrate the production of CVP technology from lab production to prototype assembly line production. Production will be continuously improved for yield, cycle time and cost-effectiveness by the integration of performance monitoring and lean manufacturing principles.
- Conduct rigorous testing of fabricated prototypes including field testing. Testing will ensure the prototypes are meeting commercially viable levels of energy efficiency, electricity generation, aesthetics, and durability.

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.

[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.

EXHIBIT A
Scope of Work

The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products

- Submit all data and documents required as products in accordance with the following:

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**
  - Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the Energy Commission's software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

  The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:
  - Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
  - Text documents will be in MS Word file format, version 2007 or later.
  - Documents intended for public distribution will be in PDF file format.
  - The Recipient must also provide the native Microsoft file format.
  - Project management documents will be in Microsoft Project file format, version 2007 or later.

- **Software Application Development**

  Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
  - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
  - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.

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

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

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

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

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

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

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

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM

concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.

- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

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

CAM Products:

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

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

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

Products:

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

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

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

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Reports

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

Subtask 1.6.1 Final Report Outline

The Recipient shall:

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

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

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

Products:

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

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

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

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

Products:

- Match Funds Status Letter
- Supplemental Match Funds Notification Letter *(if applicable)*
- Match Funds Reduction Notification Letter *(if applicable)*

Subtask 1.8 Permits

The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If 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.

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

Products:

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

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

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

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

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

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

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be

discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:
- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings
The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

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

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

EXHIBIT A
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III. TECHNICAL TASKS

TASK 2: CREATE MANUFACTURING INFRASTRUCTURE

The goals of this task are to (1) Identify and install all required manufacturing equipment; and (2) develop streamlined manufacturing processes and techniques.

Subtask 2.1 Identify and Source All Necessary Equipment

The goals of this subtask are to (1) identify and source all manufacturing equipment; and (2) establish components of the manufacturing process.

The Recipient shall:

- Work with equipment manufacturers to specify the processes and equipment for the pilot prototype manufacturing line.
- Prepare a *Consolidated List of Equipment Invoices*. The list will accumulate all invoices received for equipment purchases. It is expected that the invoice information may include the name of the equipment, the vendor name, and a brief description of the equipment. The consolidated list will provide CEC with a brief, yet informative overview of the materials being used in the manufacturing process. There will be a brief summary included in the beginning of the list explaining the major decision points on equipment purchases, how the decisions were made, and what customizations will be needed.
- Make any equipment customizations required for the process environment and particle reduction.
- Create CVP-specific fabrication processes for laser patterning and encapsulation components.

Products:

- Consolidated List of Equipment Invoices

Subtask 2.2 Qualify Equipment

The goals of this subtask are to (1) install; and (2) integrate all purchased equipment at laboratory facilities.

The Recipient shall:

- Assemble all materials for pre-delivery qualifications.
- Visit supplier sites for training on proper usage of equipment, and pre-delivery equipment qualifications.
- Install equipment into the Recipient's on-site lab space.
- Fabricate appropriate coatings for testing the functionality of the equipment.
- Prepare a *Test Plan for Qualification of New Equipment*. This plan will be 20 pages or less and will give high level details on how the Recipient will evaluate the control uniformity of layers, optical color and transparency metrics of deposited films, laser scribing depth and positional accuracy, and the aesthetics and sealing integrity of laminate materials.

Products:

- Test Plan for Qualification of New Equipment

Subtask 2.3 Develop Manufacturing Process

The goal of this subtask is to develop the processes, techniques, and guidelines for the fabrication of prototypes. The majority of innovation and process development will be concentrated in this Subtask.

The Recipient shall:

- Optimize the process associated with each piece of equipment and all materials required by the new manufacturing process, including:
  - Optimizing the performance of sputtered buffer films;
  - Establishing the functionality of sputtered to electrode;
  - Assessing and optimizing the aesthetics of laser patterning.
- Integrate individual processes into a functional and optimized process flow.
- Create and submit to CAM a *Draft Manufacturing Process Report* that will be 20 pages or less. The report will include but is not limited to:
  - An executive summary section that details the manufacturing process from a high level, is graphic-heavy, and points out the innovative or unique features;
  - A step-by-step analysis of the manufacturing workflow;
  - The equipment utilized during each step of the manufacturing process;
  - Success criteria and results for process evaluations;
  - What about the process is unique, innovative, and/or improved; and
  - Any identified risks/issues and resolutions.
- Incorporate CAM feedback and submit to CAM a *Final Manufacturing Process Report*

Products:

- Manufacturing Process Report (draft and final)

Subtask 2.4 Develop Quality Monitoring System

The goals of this subtask are to (1) document the equipment Standard Operating Procedures (SOP); and (2) document the individual process capabilities of each item.

The Recipient shall:

- Create SOP that ensure the new pilot prototype manufacturing line meets materials deposition and handling requirements transferred from the R&D prototype module line.
- Establish metrologies for stabilizing operations using Statistical Process Control data collection and analysis.
- Establish process control data collection and tracking for the various manufacturing processes.
- Create a *Draft Quality Monitoring Report* that is 20 pages or less and includes but is not limited to:
  - An executive summary section that details the quality monitoring system from a high level, is graphic-heavy, and points out the innovative or unique features;
  - The SOP;
  - Defined metrics and tracking of key parameters to maintain tool operations;
  - Corrective and preventative actions for manufactured prototypes that fall below established metrics; and
  - Any other tools and information to assist the technical personnel in successfully maintaining process quality
- Incorporate CAM feedback and submit to CAM a *Final Quality Monitoring Report*

Products:

- Quality Monitoring Report (draft and final)

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TASK 3: FINALIZE AND SELECT R&D PROTOTYPES FOR TESTING
The goal of this task is to select up to 5 different R&D prototype configurations for pre-manufacturing testing.

Subtask 3.1 Screen R&D Prototypes for Manufacturing
The goal of this subtask is to evaluate the performance of select R&D prototype devices and coatings.

The Recipient shall:

- Select organic materials with the appropriate intrinsic energy levels, absorption, and mobility for the R&D prototype.
- Assemble R&D prototypes using pre-established specifications.
- Conduct initial tests measuring energy efficiency, optical color, light transmission, and reflection of R&D prototypes.
- Choose up to 5 different prototypes for fabrication (total selections will be dependent on resources).
- Create an *Information Sheet for Selected R&D Prototypes* that includes but is not limited to:
    - Performance specifications for each prototype (energy efficiency and aesthetics); and
    - Justification for the selection of R&D prototypes.

Products:

- Information Sheet for Selected R&D Prototypes

Subtask 3.2 Fabricate Selected R&D Prototypes
The goal of this subtask is to produce a sufficient number of R&D prototypes selected in the Subtask 3.1. Production will continue until R&D prototypes meet minimum performance requirements found in this subtask.

The Recipient shall:

- Prepare all manufacturing equipment and R&D materials prior to conducting fabrication of selected prototypes.
- Fabricate R&D prototypes.
- Evaluate prototype batches for optical, energy efficiency and electricity generation performance.
- Modify coating and manufacturing processes and/or re-fabricate prototype configuration, until the following performance characteristics are achieved unless otherwise specified by the CAM:
    - Solar Heat Gain Coefficient: <0.4
    - Peak Power: 50 Watts / meter squared
    - Transparency: >50%
    - Color: Neutral (a*<5, b*<5)
    - Product Lifetime: 10 years
- Create an *R&D Prototype Manufacturing Report* that is 10 pages or less and includes but is not limited to:
    - An executive summary section that details the manufacturing results from a high level, is graphic-heavy, and points out the innovative or unique features;
    - Total units produced during the fabrication process;
    - Key performance results and conclusions; and

- Any problems or potential problems realized during fabrication (if applicable).

Products:

- R&D Prototype Manufacturing Report

TASK 4: R&D PROTOTYPE TESTING

The goals of this task are to (1) evaluate the color and transparency of the fabricated R&D prototypes from subtask 3.2; (2) measure the window heat flow performance (i.e. energy efficiency) and electricity generation; (3) create a final R&D prototype testing report recommending up to 3 R&D prototypes configurations for fabrication of future larger size prototypes; and (4) conduct a Use Case Study to evaluate the potential impact of CVP technology on building energy efficiency via heat flow performance and electricity generation.

Subtask 4.1 Conduct Testing for Aesthetics and Electricity Generation

The goal of this subtask is to measure the aesthetics (color and transparency) and electricity generation of the fabricated R&D prototypes.

The Recipient shall:

- Prepare all prototypes and equipment for testing, as necessary.
- Create a *Test Plan for Internal R&D Prototype Testing*. This plan will be graphic-heavy, 20 pages or less, and outline the test objectives, procedures, conditions, facilities, and equipment used to measure aesthetics and electricity generation performance of R&D prototypes.

Products:

- Test Plan for Internal R&D Prototype Testing

Subtask 4.2 Validation of Prototype Performance

The goals of this task are to measure and validate (1) the window heat flow performance; and (2) electricity generation capability of the R&D Prototypes.

The Recipient shall:

- Execute the Test Plan for R&D Prototype Testing developed under subtask 4.1.
- Expand current International Glazing Database format (or similar program if approved by the CAM in writing) to allow for the storing of measured data that includes electricity generation portion.
- Modification of Lawrence Berkeley National Lab's WINDOW program (or similar program if approved by the CAM in writing) to utilize new glazing data and properly split heat and electricity generation of absorbed solar energy.
- Incorporate measured optical and thermo-physical data from test coupons into the database and conduct modeling to predict standard performance of proposed prototype configurations.
- Prepare extended data sets for modeling by formatting and incorporating measured data into the database.
- Create an *R&D Prototype Testing and Modeling Report* that includes but is not limited to:
    - An executive summary section that details the modeling results from a high level, is graphic-heavy, and points out the innovative or unique features;
    - Modeling and testing results;
    - Important measurements; and

- Model validation and results of modeling efforts.

Products:

- R&D Prototype Testing and Modeling Report

Subtask 4.3 Record and Summarize Internal R&D Prototype Testing and Evaluation Results
The goal of this subtask is to collect, analyze, and report the results of internal and external testing.

The Recipient shall:

- Collect and analyze test results from Internal R&D Prototype Testing and Evaluation.
- Create a *Draft R&D Prototype Testing Results Report* that includes but is not limited to:
  - An executive summary section that details the testing results from a high level, is graphic-heavy, and points out the innovative or unique features;
  - Results of Internal measurements of performance and aesthetics for each R&D prototype;
  - Results report from evaluation;
  - An analysis of how the test results deviate from desired results, and how this may impact future pilot prototypes and manufacturing; and
  - A justification for why R&D coatings and processes are recommended for integration into pilot prototypes
- Select up to 3 prototype coatings and processes for future pilot prototype fabrication.
- Incorporate CAM feedback and submit to CAM a *Final R&D Prototype Testing Results Report*

Products:

- R&D Prototype Testing Results Report (draft and final)

Subtask 4.4 Establish and Conduct Use Case Study Evaluation
The goal of this subtask is to (1) develop the appropriate use case use study; and (2) conduct a use case scenario study.

The Recipient shall:

- Establish the appropriate use case study. Appropriate use case scenarios will be determined based on R&D prototype performance and future projected performance.
- Conduct use case study. The use case study will outline the impact that the CVP technology can have on buildings for energy efficiency and electricity generation.
- Create a *Draft Use Case Study Report* that includes but is not limited to:
  - An executive summary section that details the impact that the CVP technology can have on buildings from a high level, is graphic-heavy, and points out the innovative or unique features;
  - The selected building and/or location for the case study analysis;
  - Estimates regarding total energy production provided by a theoretical CVP installation; and
  - An analysis of additional energy savings provided by low-E/insulation benefits.
- Incorporate CAM feedback and submit to CAM a *Final Use Case Study Report.*

Products:

- Use Case Study Report (draft and final)

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TASK 5: CONDUCT PROTOTYPE MANUFACTURING – 1ST PILOT GENERATION
The goals of this task are to (1) purchase materials needed to conduct manufacturing; (2) optimize and qualify the manufacturing process; and (3) build pilot prototypes.

Subtask 5.1 Purchase Necessary Materials
The goal of this subtask is to identify and purchase all materials needed for manufacturing.

The Recipient shall:

- Select material and device coating of R&D prototype that met performance targets. If there is more than one option, multiple coatings will be selected for transfer to the pilot prototype manufacturing line based upon availability of resources.
- Transfer optimal R&D prototype processes (laser patterning, thin film encapsulation, lamination, insulated glass unit) into the pilot prototype manufacturing line.
- Identify all materials needed to begin fabricating pilot prototypes.
- Prepare a *Consolidated List of Materials Invoices – 1st Pilot Generation*. This list will accumulate all invoices received for materials purchases. It is expected that the invoice information may include the name of the materials, the vendor name, and a brief description of the materials. This consolidated list will provide the Energy Commission with a brief, yet informative overview of the materials being used in manufacturing as well as the major materials purchases decision points and how those decisions were made.
- Purchase all identified materials needed for pilot prototype fabrication.

Products:

- Consolidated List of Materials Invoices – 1st Pilot Generation

Subtask 5.2 Establish Manufacturing Process
The goal of this subtask is to establish the manufacturing process prior to building pilot prototypes.

The Recipient shall:

- Complete a risk mitigation exercise with screening batch fabrication. The exercise will certify that all processes transferred from the R&D prototypes are working as expected in the pilot prototype manufacturing line.
- Establish performance of product with resolution of risks (if required)
- Establish the speed and output capabilities of the manufacturing process including deposition rates, coating thickness and uniformities, and interface morphologies.
- Develop a *Manufacturing Screening Process Report – 1st Pilot Generation* that includes but is not limited to:
    - Results of the risk mitigation exercise; and
    - The measured performance of the screening batch fabrication.

Products:

- Manufacturing Screening Process Report – 1st Pilot Generation

Subtask 5.3 Qualify Manufacturing Process
The goal of this subtask is to qualify the performance of the manufacturing process prior to building pilot prototypes.

The Recipient shall:

- Fabricate multiple pilot prototype batches to address and mitigate yield and performance reproducibility.
- Sample batches to evaluate durability in humidity-temperature, light soak chambers.
- Identify the cause and implement solutions to any deviations in expected performance (if necessary)
- Create a *Draft Manufacturing Process Report – 1st Pilot Generation* that includes but is not limited to:
    - An executive summary section that details the manufacturing results from a high level, is graphic-heavy, and points out the innovative or unique features;
    - The results of yield and performance of the qualification batches;
    - Any identified production risks;
    - Risk mitigation solutions (where required); and
    - An assessment of the readiness of the pilot prototype manufacturing line.
- Incorporate CAM feedback and submit to CAM a *Final Manufacturing Process Report – 1st Pilot Generation*

Products:

- Manufacturing Process Report – 1st Pilot Generation (draft and final)

Subtask 5.4 Build Pilot Prototypes for Testing

The goal of this subtask is to produce the pilot prototypes to be tested in Task 6.

The Recipient shall:

- Fabricate pilot prototypes
- Create a *Pilot Prototype Manufacturing Report – 1st Generation* that is five pages or less and includes but is not limited to:
    - An executive summary section that details the manufacturing results from a high level, is graphic-heavy, and points out the innovative or unique features;
    - Total units produced during the fabrication process;
    - Materials used to fabricate R&D prototypes; and
    - Any problems or potential problems realized during fabrication (if applicable).

Products:

- Pilot Prototype Manufacturing Report – 1st Generation

TASK 6: PILOT PROTOTYPE TESTING – 1ST GENERATION

The goals of this task are to (1) select American Society for Testing Materials (ASTM)/International Electrotechnical Commission (IEC) test standards applicable to CVP technology pilot prototypes; (2) assign an external laboratory to perform selected standardized tests; and (3) conduct a field test of the pilot prototypes at testbed facilities.

Subtask 6.1 Establish Test Standards for Pilot Prototype Manufacturing Testing

The goal of this subtask is to establish the standards and requirements for the durability testing of pilot prototypes.

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The Recipient shall:

- Establish and select the correct and applicable ASTM and/or IEC standards for the CVP technology enabled prototypes.
- Prepare a *Test Plan for Pilot Prototype Testing – 1st Generation*. The Test Plan will outline the test objectives and follow selected ASTM and/or IEC protocols, procedures, conditions, facilities, and equipment to be used during each test.

Products:

- Test Plan for Pilot Prototype Testing – 1st Generation

Subtask 6.2 Identify External Test Laboratories

The goal of this subtask is to select external laboratories that can accommodate the testing needs outlined in Subtask 6.1's Test Plan for Pilot Prototype Testing – 1st Generation.

The Recipient shall:

- Search for local laboratory facilities that can accommodate the testing requirements in the Test Plan for Pilot Prototype Testing – 1st Generation from Subtask 6.1.
- Prepare a *List of Proposed Laboratories – 1st Generation*. This list will provide the name, location, and a basic description of the capabilities for the proposed laboratory. The list will also detail how the laboratory facility allows the recipient to achieve the objectives in the Test Plan for Pilot Prototype Testing – 1st Generation.
- Select the laboratory that best meets the needs of the recipient and is approved in writing by the CAM.

Products:

- List of Proposed Laboratories – 1st Pilot Generation

Subtask 6.3 Conduct Standardized Durability Testing at External Laboratory of 1st Generation Pilot Prototypes

The goal of this subtask is to perform pilot prototype durability testing at the external laboratory facility selected in Subtask 6.2.

The Recipient shall:

- Designate the technical staff and materials (if necessary) needed to perform the lab testing.
- Work with the selected lab on supplying fabricated pilot prototypes and standard durability tests to be conducted (as outlined in subtask 6.1 test plan).
- Conduct 1st generation pilot prototype testing at the lab.
- Create an *External Testing Report – 1st Pilot Generation* that includes but is not limited to:
    - Results of the test objectives set forth in the test plan created in subtask 6.1*;* and
    - An in-depth analysis of the test results, and the cause(s) of the test results.

Products:

- External Testing Report – 1st Pilot Generation

Subtask 6.4: Field Testing of 1st Generation Pilot Prototypes

The goal of this task is to evaluate the performance of the pilot prototypes in a field test condition.

The Recipient shall:

- Deliver pilot prototypes for a monitored full-scale field test using testbed facilities, as appropriate for the size and condition of specimen. Activities will include:
    - Preparing the testbed facility for the performance evaluation, including performing necessary calibrations, as appropriate.
    - Measuring HVAC loads, lighting energy, thermal comfort, and daylight illuminance at agreed upon time step (e.g., 1-min), as appropriate from the size of the delivered prototypes.
- Prepare a *Pilot Prototype Measurement Report – 1st Generation*, including:
    - An executive summary section that details the performance results from a high level, is graphic-heavy, and points out the innovative or unique features;
    - A description of the test set-up, window design, instrumentation, and test configurations; and
    - A description of the methods, results, analysis and conclusions on the high temperature (HT) window's energy, thermal and visual comfort relative to a reference window.

Products:

- Pilot Prototype Measurement Report - 1st Generation

TASK 7: EVALUATION AND ASSESSMENT OF PILOT PROTOYPES TESTING AND COMMERCIAL FEASIBILITY – 1ST GENERATION

The goals of this Task are to (1) evaluate the results of Task 6 pilot prototype testing; (2) assess the next steps for improvement as required for meeting test requirements and market requirements for commercialization; (3) inform the TAC of the results and present a supplementary plan for 2nd generation pilot prototype fabrication; and (4) evaluate and explore the commercial viability of prototype manufacturing costs and product pricing.

Subtask 7.1 Evaluate and Assess Pilot Prototype Testing Results

The goal of this subtask is to evaluate the pilot prototype testing results from Task 6.

The Recipient shall:

- Gather and organize all testing results from Task 6.
- Create a *Draft Production and Commercial Feasibility Report – 1st Pilot Generation* that includes but is not limited to:
    - An executive summary section that details the overall performance, manufacturing and risk results from a high level, is graphic-heavy, and points out the innovative or unique features;
    - An analysis of the performance (energy efficiency, electricity generation, aesthetics, and durability) of the manufactured prototypes and compare to performance targets;
    - A summary of manufacturing outcomes (e.g. process, yield, etc.);
    - The identification of future risks in the manufacturing process; and
    - A determination of the commercial viability of the pilot prototypes for both costs and projected pricing of a mass produced window product.
- Incorporate CAM feedback and submit to CAM a *Final Production and Commercial Feasibility Report – 1st Pilot Generation*

Products:

- Production and Commercial Feasibility Report – 1st Pilot Generation (draft and final)

Subtask 7.2 Market Feedback on Production and Commercial Feasibility Report
The goal of this subtask is to get feedback from the window industry based on the results contained in the Report from subtask 7.1

The Recipient shall:

- Meet and discuss results with at least ten potential window product customers (e.g. residential developers, architects, building owners, and window manufacturers).
- Create a *Market Feedback Feasibility Survey – 1st Pilot Generation* that includes but is not limited to requests for:
    - Feedback on the performance (energy efficiency, electricity generation, aesthetics, and durability) of all manufactured prototypes; and
    - Feedback on costs and pricing of future mass produced products.
- Generate *Market Feedback Survey Report – 1st Pilot Generation* summarizing discussions and feedback from potential customers. This report will be 10 pages or less and will be graphic heavy.
- Prepare a *Task 7 CPR Report* to include, but not be limited to a summary of the administrative and technical needs and accomplishments of the project.
- Participate in a CPR Meeting in accordance with Subtask 1.3

Products:

- Market Feedback Survey – 1st Pilot Generation (draft and final)
- Market Feedback Survey Report – 1st Pilot Generation (draft and final)
- Task 7 CPR Report

TASK 8: CONDUCT PROTOTYPE MANUFACTURING – 2ND PILOT GENERATION
The goal of this task will be to conduct the 2nd generation of pilot prototype manufacturing which will require the recipient to (1) purchase materials needed to conduct manufacturing; (2) optimize and qualify the manufacturing process; and (3) build pilot prototypes. This 2nd pilot generation manufacturing will build on the lessons learned and market feedback from the 1st generation.

Subtask 8.1 Purchase Necessary Materials
The goal of this subtask is to identify and purchase all materials needed for manufacturing.

The Recipient shall:

- Select material and device coating of R&D prototype that met performance targets. If there is more than one option, a number of coatings will be selected for transfer to the pilot prototype manufacturing line based upon availability of resources.
- Transfer optimal R&D prototype processes (laser patterning, thin film encapsulation, lamination, insulated glass unit) into the pilot prototype manufacturing line.
- Identify all materials needed to begin fabricating pilot prototypes.
- Prepare a *Consolidated List of Materials Invoices – 2nd Pilot Generation*. This list will accumulate all invoices received for materials purchases. It is expected that the invoice information may include the name of the materials, the vendor name, and a brief description of the materials. The consolidated list will provide the Energy Commission with

a brief, yet informative overview of the materials being used in manufacturing. Purchase all identified materials needed for pilot prototype fabrication.

Products:

- Consolidated List of Materials Invoices – 2nd Pilot Generation

Subtask 8.2 Establish Manufacturing Process

The goal of this subtask is to establish the manufacturing process prior to building pilot prototypes

The Recipient shall:

- Complete a risk mitigation exercise with screening batch fabrication. The exercise will certify that all processes transferred from the R&D prototypes are working as expected in the pilot prototype manufacturing line.
- Establish performance of product with resolution of risks (if required)
- Establish the speed and output capabilities of the manufacturing process including deposition rates, coating thickness and uniformities, and interface morphologies.
- Develop a *Manufacturing Screening Process Report – 2nd Pilot Generation* that includes but is not limited to:
    - Results of the risk mitigation exercise; and
    - The measured performance of the screening batch fabrication.

Products:

- Manufacturing Screening Process Report- 2nd Pilot Generation

Subtask 8.3 Qualify Manufacturing Process

The goal of this subtask is to qualify the performance of the manufacturing process prior to building pilot prototypes.

The Recipient shall:

- Fabricate multiple pilot prototype batches to address and mitigate yield and performance reproducibility.
- Sample batches to evaluate durability in humidity-temperature, light soak chambers.
- Identify the cause and implement solutions to any deviations in expected performance (if necessary)
- Create a *Draft Manufacturing Process Report – 2nd Pilot Generation* that includes but is not limited to:
    - The results of yield and performance of the qualification batches;
    - Any identified production risks;
    - Risk mitigation solutions (where required); and
    - An assessment of the readiness of the pilot prototype manufacturing line.
- Incorporate CAM feedback and submit to CAM a *Final Manufacturing Process Report – 2nd Pilot Generation*

Products:

- Manufacturing Process Report – 2nd Pilot Generation (draft and final)

Subtask 8.4 Build Pilot Prototypes for Testing

The goal of this subtask is to produce the pilot prototypes to be tested in Task 9.

The Recipient shall:

- Fabricate pilot prototypes
- Create a *Pilot Prototype Manufacturing Report – 2nd Generation* that includes but is not limited to:
    - Total units produced during the fabrication process;
    - Materials used to fabricate R&D prototypes; and
    - Any problems or potential problems realized during fabrication (if applicable).
    - A comparison of results between the 1st and 2nd generation and how those results address the market feedback.
- Select up to 3 pilot prototype configurations for testing.

Products:

- Pilot Prototype Manufacturing Report – 2nd Pilot Generation

TASK 9: PILOT PROTOTYPE TESTING – 2ND GENERATION

The goal of this task is essentially conduct a repeat of Task 6 with the newer generation of pilot prototypes. The selected standardized tests from Task 6 will be carried out on the 2nd generation pilot prototypes by the same certified external testing laboratories that performed the testing in task 6. Additionally, a field test of the 2nd generation pilot prototypes will be conducted at testbed facilities.

Subtask 9.1 Establish Test Standards for Pilot Prototype Manufacturing Testing

The goal of this subtask is to establish the standards and requirements for the durability testing of pilot prototypes.

The Recipient shall:

- Establish and select the correct and applicable ASTM and/or IEC standards for the CVP technology enabled prototypes.
- Prepare a *Test Plan for Pilot Prototype Testing – 2nd Generation.* This plan will outline the test objectives and follow selected ASTM and/or IEC protocols, procedures, conditions, facilities, and equipment to be used during each test.

Products:

- Test Plan for Pilot Prototype Testing – 2nd Pilot Generation

Subtask 9.2 Identify External Test Laboratories

The goal of this subtask is to select external laboratories that can accommodate the testing needs outlined in Subtask 9.1's *Test Plan for Pilot Prototype Testing – 2nd Generation.*

The Recipient shall:

- Search for local laboratory facilities that can accommodate the testing requirements in the Test Plan for Pilot Prototype Testing – 2nd Generation (if there is no change in testing needs, this document will state this and will summarize why this is so).
- Prepare a *List of Proposed Laboratories.* This list will provide the name, location, and a basic description of the capabilities for the proposed laboratory. The list will also detail how

the laboratory facility allows the recipient to achieve the objectives in the Test Plan for Pilot Prototype Testing – 2nd Generation.
- Select the laboratory that best meets the needs of the recipient and notify the CAM within one week of selection.

Products:
- List of Proposed Laboratories – 2nd Pilot Generation

Subtask 9.3 Conduct Standardized Durability Testing at External Laboratory of 2nd Generation Pilot Prototypes

The goal of this subtask is to perform pilot prototype durability testing at the external laboratory facility selected in Subtask 9.2.

The Recipient shall:
- Designate the technical staff and materials (if necessary) needed to perform the lab testing.
- Work with the selected lab on supplying fabricated pilot prototypes and standard durability tests to be conducted (as outlined in Test Plan for Pilot Prototype Testing).
- Conduct 2nd generation pilot prototype testing at the selected lab.
- Create an *External Testing Report – 2nd Pilot Generation* that includes but is not limited to:
    - Results of the test objectives set forth in the Test Plan for Pilot Prototype Testing – 2nd Generation*;* and
    - An in-depth analysis of the test results, and the cause(s) of the test results.
    - A comparison of test results compared to the 1st Pilot Generation and how it relates to market feedback.

Products:
- External Testing Report - 2nd Pilot Generation

Subtask 9.4: Field Testing of 2nd Generation Pilot Prototypes in Testbed Facilities

The goal of this task is to evaluate the performance of the pilot prototypes in a field test condition.

The Recipient shall:
- Deliver pilot prototypes to field test facilities for a monitored full-scale field test, as appropriate for the size and condition of specimen. Activities will include:
    - Preparing the testbed facility for the performance evaluation, including performing necessary calibrations, as appropriate.
    - Measuring HVAC loads, lighting energy, thermal comfort, and daylight illuminance at agreed upon time step (e.g., 1-min), as appropriate from the size of the delivered prototypes.
- Prepare a *Pilot Prototype Measurement Report – 2nd Generation*, including:
    - A description of the test set-up, window design, instrumentation, and test configurations; and
    - A description of the methods, results, analysis and conclusions on the HT window's energy, thermal and visual comfort relative to a reference window.

Products:
- Pilot Prototype Measurement Report – 2nd Generation

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TASK 10: EVALUATION AND ASSESSMENT OF PILOT PROTOYPES TESTING AND COMMERCIAL FEASIBILITY – 2ND GENERATION

The goals of this Task are to (1) evaluate the results of Task 9 pilot prototype testing including evaluation of how the results improved from the 1st generation; (2) assess the next steps for improvement as required for meeting test requirements and market requirements for commercialization; (3) inform the TAC of the results and present a supplementary plan for 2nd generation pilot prototype fabrication; and (4) evaluate and explore the commercial viability of prototype manufacturing costs and product pricing.

Subtask 10.1 Evaluate and Assess Pilot Prototype Testing Results

The goal of this subtask is to evaluate the pilot prototype testing results from Task 10.

The Recipient shall:

- Gather and organize all testing results from Task 10.
- Create a *Draft Production and Commercial Feasibility Report – 2nd Pilot Generation* that includes comparison to the 1st generation pilot prototypes, but is not limited to the following:
    - An executive summary section that details the overall performance, manufacturing and risk results from a high level, is graphic-heavy, and points out the innovative or unique features;
    - An analysis of the performance (energy efficiency, electricity generation, aesthetics, and durability) of all manufactured prototypes and compare to performance targets;
    - A summary of manufacturing outcomes (e.g. process, yield, etc.);
    - The identification of future risks in the manufacturing process; and
    - A determination of the commercial viability of the pilot prototypes for both costs and projected pricing of a mass produced window product.
- Incorporate CAM feedback and submit to CAM a *Final Production and Commercial Feasibility Report – 2nd Pilot Generation*

Products:

- Production and Commercial Feasibility Report – 2nd Pilot Generation (draft and final)

Subtask 10.2 Market Feedback on Production and Commercial Feasibility Report

The goal of this subtask is to get feedback from the window industry based on the results contained in the Report from subtask 10.1

The Recipient shall:

- Meet and discuss results with potential window product customers (e.g. residential developers, architects, building owners, and window manufacturers).
- Create a *Market Feedback Survey – 2nd Pilot Generation* that includes but is not limited to requests for:
    - Feedback on the performance (energy efficiency, electricity generation, aesthetics, and durability) of all manufactured prototypes; and
    - Feedback on costs and pricing of future mass produced products.
- Generate *Market Feedback Survey Report – 2nd Pilot Generation* summarizing discussions and feedback from potential customers.

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Products:

- Market Feedback Survey – 2nd Pilot Generation (draft and final)
- Market Feedback Survey Report – 2nd Pilot Generation (draft and final)

TASK 11: 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:

    - o <u>For Product Development Projects and Project Demonstrations:</u>
        - Published documents, including date, title, and periodical name.
        - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
        - Greenhouse gas and criteria emissions reductions.
        - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
        - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
        - A discussion of project product downloads from websites, and publications in technical journals.
        - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
        - <u>Additional Information for Product Development Projects</u>:
            - 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.
        - <u>Additional Information for Product Demonstrations</u>:
            - Outcome of demonstrations and status of technology.
            - Number of similar installations.
            - Jobs created/retained as a result of the Agreement.

    - o <u>For Information/Tools and Other Research Studies:</u>
        - 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 12: TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES
The goal of this task is to develop a plan to make the knowledge gained, experimental results, and lessons learned available to the public and key decision makers.

The Recipient shall:
- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
  - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
  - A description of the intended use(s) for and users of the project results.
  - Published documents, including date, title, and periodical name.
  - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
  - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
  - The number of website downloads or public requests for project results.
  - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.

- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(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)

TASK 13: PRODUCTION READINESS PLAN

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

The Recipient shall:

- Prepare a *Draft Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. The plan will discuss the following the following at minimum unless otherwise specified by the CAM in writing:
  - An executive summary section that details the overall production readiness from a high level, is graphic-heavy, and points out the innovative or unique features;
  - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
  - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
  - The estimated cost of production.
  - The expected investment threshold needed to launch the commercial product.
  - An implementation plan to ramp up to full production.
  - The outcome of product development efforts, such as copyrights and license agreements.
  - Patent numbers and applications, along with dates and brief descriptions.
  - Other areas as determined by the CAM.
- Incorporate CAM feedback and submit to CAM a *Final Production Readiness Plan*

Products:

- Production Readiness Plan (draft and final)

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

RESOLUTION NO: 2019-0119-7b

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: UBIQUITOUS ENERGY, INC.

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

RESOLVED, that the Energy Commission approves Agreement EPC-18-004 with Ubiquitous Energy, Inc. for a $2,998,055 grant to scale its ClearView Power technology to meet the size requirements and specifications needed for window production. ClearView Power is a transparent solar coating that, when applied to glass, selectively absorbs and converts non-visible light to electricity while also blocking the infrared light that causes heat gains in buildings. As part of this project, Ubiquitous Energy will demonstrate that the solar coating application can be integrated into a standard glass manufacturing process; 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 January 9, 2019.

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

Cody Goldthrite,
Secretariat