

GRANT REQUEST FORM (GRF)New Agreement EPC-14-040 (To be completed by CGL Office)

Division	Agreement Manager:	MS-	Phone
ERDD	Zhiqin (Jessica) Zhang	43	916-327-1397

Recipient's Legal Name	Federal ID Number
Glint Photonics, Inc.	27-3734209

Title of Project
Self-Tracking Concentrator Photovoltaics for Distributed Generation

Term and Amount	Start Date	End Date	Amount
	5/15/2015	3/31/2019	\$ 999,940

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

Proposed Business Meeting Date	5/13/2015	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
Business Meeting Presenter	Zhiqin (Jessica) Zhang	Time Needed:	5 minutes

Please select one list serve. Select

Agenda Item Subject and Description

Proposed resolution approving agreement EPC-14-040 with Glint Photonics, Inc. for a \$999,940 grant to develop Self-Tracking Concentrator Photovoltaic (ST-CPV) modules. ST-CPV is a new solar panel technology that applies light-reactive optical materials on the panel to collect direct sunlight and internally concentrate sunlight onto small areas of high-efficiency photovoltaic (PV) cells. This technology is anticipated to improve energy efficiency and reduce the cost of concentrator PV systems. (EPIC funding) Contact: Zhiqin Zhang. (Staff presentation: 5 minutes)

California Environmental Quality Act (CEQA) Compliance

- Is Agreement considered a "Project" under CEQA?
 - Yes (skip to question 2) No (complete the following (PRC 21065 and 14 CCR 15378)): Explain why Agreement is not considered a "Project": Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because
- If Agreement is considered a "Project" under CEQA:
 - a) Agreement **IS** exempt. (Attach draft NOE)
 - Statutory Exemption. List PRC and/or CCR section number: _____
 - Categorical Exemption. List CCR section number: 14 CCR 15301 ("Existing Facilities"), 15303 ("New Construction or Conversion of Small Structures")
 - Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section:

Cal. Code Regs., tit. 14, sect. 15301 provides that projects which consist of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, and which involve negligible or no expansion of use beyond that existing at the time of the lead agency's determination, are categorically exempt from the provisions of the California Environmental Quality Act. The proposed activities funded under this agreement include laboratory testing and installation of four to nine linked ST-CPV Generation 3 (12 inch by 12 inch) prototype panels and inverter to produce alternating-current output and a resistive load that permits measurement of the system energy output. Temporary installation of panels will be located on the roof of the Recipient's office in Burlingame, CA and is estimated to require 100 SF. The proposed activities will be temporary and include minor alterations of an existing structure. The proposed minor alternations will not have a significant effect on the environment to the past, present, or reasonably foreseeable future actions.

Cal. Code Regs., tit. 14, sect. 15303 provides that projects which consist of construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure, are categorically exempt from the provisions of the California Environmental Quality Act. The proposed activities funded under this agreement include installation of an inverter to exterior walls of the building, temporary installation of new panels on the rooftop, and other minor modifications to the exterior of the structure and do not have a significant effect on the environment to the past, present, or reasonably foreseeable future actions.



Therefore, the project consists of minor alteration of existing facilities involving negligible change of use beyond that existing, installation of small new equipment, and construction of limited numbers of new, small structures where only minor modifications are made.

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

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

Legal Company Name: _____ Budget _____

3rd party testing of prototypes -TBD \$ 20,000

List all key partners: (attach additional sheets as necessary)

Legal Company Name: _____

Budget Information

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
EPIC	13-14	301.001A	\$999,940
R&D Program Area: EGRO: Renewables		TOTAL:	\$999,940
Explanation for "Other" selection _____			
Reimbursement Contract #:		Federal Agreement #:	

Recipient's Administrator/ Officer				Recipient's Project Manager			
Name:	Peter Kozodoy			Name:	Peter Kozodoy		
Address:	1520 GILBRETH RD			Address:	1520 GILBRETH RD		
City, State, Zip:	BURLINGAME, CA 94010-1605			City, State, Zip:	BURLINGAME, CA 94010-1605		
Phone:	(650) 646-4192	Fax:	(650) 561-8417	Phone:	(650) 646-4192	Fax:	(650) 561-8417
E-Mail:	peter@glintphotonics.com			E-Mail:	peter@glintphotonics.com		

Selection Process Used

Competitive Solicitation Solicitation #: PON-14-303
 First Come First Served Solicitation

The following items should be attached to this GRF

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

Agreement Manager _____ Date _____ Office Manager _____ Date _____ Deputy Director _____ Date _____

EXHIBIT A Scope of Work

A. Task List

Task #	CPR ¹	Task Name
1		General Project Tasks
2		Design Optimization and Device Simulation
3		Techno-Economic Analysis
4		Process Development
5	X	Prototype Fabrication
6		Prototype Testing
7		Evaluations of ST-CPV Module and System
8		Evaluation of Project Benefits
9		Technology/Knowledge Transfer Activities
10		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
AM1.5D	Air Mass 1.5 Direct solar spectrum
ACF	Annual Capture Fraction - total annual light captured by the concentrator system and delivered to the solar cells, as a fraction of the total direct solar resource available for the year for a given location and mounting/tracking configuration
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
CPV	Concentrator Photovoltaic
LCOE	Levelized Cost of Energy
ST-CPV	Self-Tracking Concentrator Photovoltaic
S-ACF	Standard Annual Capture Fraction - Annual Capture Fraction for a specific location used as a standard for defining performance targets, currently assumed to be Bishop, CA
STC	Standard Test Conditions - direct sunlight incident at an intensity of 1000 W/m ² normal to the beam, AM1.5D spectrum
TMY	Typical Meteorological Year

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

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

A. Purpose of Agreement

The purpose of this Agreement is to fund the development and testing of Self-Tracking Concentrator Photovoltaic systems for distributed generation, a new concentrating solar module technology that can be installed without precision tracking.

B. Problem/ Solution Statement

Problem

Concentrator Photovoltaic (CPV) systems have the potential to significantly reduce the cost of solar energy by reducing solar cell area and increasing cell efficiency. Existing CPV technologies require a trade-off between concentration and tracking precision. Achieving high concentration, modern CPV systems requires highly precise mechanical tracking systems which dominate the overall system cost. These mechanical trackers are not only costly, but impractical for distributed generation systems where maintenance and installation is more difficult to perform and control. As a result existing CPV technologies have not proven to be cost competitive.

A CPV technology that allowed the benefits of concentration without the precise mechanical tracker could open new markets and increase consumer choice when designing distributed generation systems. Such systems could contribute significantly to the distributed energy generation targets that have been established for California.

Solution

The recipient will develop, test, and demonstrate Self-Tracking Concentrator Photovoltaic (ST-CPV) systems, a new concentrator photovoltaic technology that does not require a precision mechanical tracker to keep it aligned to the sun. The ST-CPV panel contains a thin layer of fluids that passively respond to the changing solar angle, automatically adjusting optical pathways within the device to ensure that incident sunlight is captured and concentrated over a wide range of angles. The passive internal tracking allows ST-CPV panels to be mounted in a stationary configuration or with a simple single axis tracker. This makes the system highly economical, greatly reduces installation and maintenance complexity, and enables distributed generation with higher efficiency CPV modules.

The concentrator panels may be mounted on buildings or land in various configurations. The potential performance of three specific designs will be investigated in this program, and a single design will then be chosen for prototype fabrication and evaluation in this program. In the first design, panels are mounted in a stationary configuration, such as on a residential rooftop. In the second and third designs, panels are mounted on low cost, low precision trackers with either one or two tracking axes, which provide higher efficiency and may be more desirable for commercial or industrial distributed generation installations. Additionally, coarsely tracked CPV systems have the advantage of more evenly distributed power generation throughout the day, resulting in significantly higher power output during peak loads than a comparably rated untracked system.

EXHIBIT A Scope of Work

This program is complementary to the recipient's ongoing technology-development effort funded by ARPA-E under Award No. DE-AR000332.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Develop a new technology for cost-effective distributed CPV.
- Meet California's distributed generation goals.
- Enable greater market penetration of CPV systems.
- Increase alignment between load and generation for distributed systems.
- Create lasting reductions in greenhouse gas emissions.

Ratepayer Benefits:² This Agreement will result in the ratepayer benefits of greater electricity reliability and lower costs by enabling low cost and high efficiency CPV modules for the distributed generation market. These panels will increase distributed power production, allowing for greater reliability and less dependence on central production. Additionally because CPV panels can be significantly more efficient than poly-silicon flat panels, the required area usage for a given production capacity is decreased. This will reduce installation costs for distributed photovoltaics.

ST-CPV systems can be designed to allow for better alignment between peak production and peak demand by carefully tuning the internal optics, this will allow distributed generators to produce more energy when they are using it the most and reduce strain on the grid.

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 pioneering a completely new approach to concentrator photovoltaics. The self-tracking concentrator would enable cost effective distributed generation CPV systems for the first time. This will contribute significantly to Governor Brown's distributed generation goals.⁴

The project aims to achieve DC module efficiency between 22 percent and 30 percent for the different design options, far higher than that provided by conventional polycrystalline Silicon panels. This efficiency is comparable to that achieved by large CPV systems that require precision tracking and are not suitable to distributed generation.

In locations with high direct solar resource, the targeted levelized costs of energy (LCOE) for commercial ST-CPV systems are about \$0.05/kWh for single-axis trackers, \$0.04/kWh for coarse two-axis trackers, and \$0.07/kWh for stationary ST-CPV configurations.

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).

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

⁴ California Energy Commission, Lead Commissioner's Report: 2012 Integrated Energy Policy Report Update, CEC-100-2012-001-LCF, January 2013.

EXHIBIT A Scope of Work

Because of the higher efficiency and lower cost, products based on the ST-CPV technology will overcome the drawbacks of existing CPV systems, which currently are not suitable for distributed generation. Significant research in high-efficiency solar cells would be leveraged in the distributed generation market thanks to the development of an effective concentrator for distributed systems. The ST-CPV device will not only open new markets for distributed generation, but also support the continued development of advanced solar cell technologies.

Agreement Objectives

The objectives of this Agreement are to:

- Develop optimized designs for ST-CPV systems.
- Develop fabrication procedures and a supply chain for ST-CPV prototypes meeting defined performance targets.
- Demonstrate the performance of ST-CPV prototypes through both laboratory tests and installation at an operating test site.
- Analyze the total energy savings and market potential of ST-CPV products.

II. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

The Recipient shall:

For products that require a draft version

- 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.
- Submit the final product to the CAM once agreement has been reached on the draft. The CAM will provide written approval of the final product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- If the CAM determines that the final product does not sufficiently incorporate his/her comments, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

For products that require a final version only

- Submit the product to the CAM for approval.

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- If the CAM determines that the product requires revision, submit the revised product to the CAM within 10 days of notice by the CAM, unless the CAM specifies a longer time period.

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).

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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.

NOTE: The Recipient has identified information it considers to be confidential in Attachment 1, Confidential Products and Project-Relevant Pre-Existing and Independently Funded Intellectual Property, of Exhibit C, EPIC Standard Grant Terms and Conditions. When submitting products containing confidential information, the Recipient must mark each page of any document containing confidential information as "confidential" and present it in a sealed package to the Contracts, Grants, and Loans Office, instead of to the CAM. The Recipient will also be required to submit a non-confidential version of the product containing no confidential information and present it to the CAM.

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.

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- 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.

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- 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.

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- 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 all Agreement activities conducted by the Recipient for the preceding month, including 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.
 - Provide a synopsis of the project progress, including accomplishments, problems, milestones, products, schedule, fiscal status, and any evidence of progress such as photographs.
- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions. In addition, each invoice must document and verify:
 - Energy Commission funds received by California-based entities;
 - Energy Commission funds spent in California (*if applicable*); and
 - Match fund expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. The CAM will review and approve 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 a Style Manual provided by the CAM.

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Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare both confidential and non-confidential versions of *Final Report Outline* in accordance with the *Style Manual* provided by the CAM.
- Submit the confidential version of the draft Final Report outline to the Contracts, Grants, and Loans office and the non-confidential version of the draft Final Report Outline to the CAM.
- Once agreement has been reached on the confidential and non-confidential versions of the draft Final Report Outline, submit the confidential version of the Final Report outline to the Contracts, Grants, and Loans office and the non-confidential version of the Final Report Outline to the CAM for review and comment.

The CAM shall:

- The CAM or a designated staff or technical expert will review and comment on the confidential and non-confidential versions of the draft Final Report Outline.
- The CAM will provide written approval of the final outlines within 10 days of receipt.

Recipient Products:

- Confidential Draft Final Report Outline
- Non-confidential Draft Final Report Outline
- Confidential Final Report Outline
- Non-confidential Final Report Outline

CAM Products:

- Style Manual
- Comments on Confidential Draft Final Report Outline
- Comments on Non-confidential Draft Final Report Outline
- Approval of Confidential Final Report Outline
- Approval of Non-confidential Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

- Prepare both confidential and non-confidential versions of *Final Report* for this Agreement in accordance with the approved Final Report Outline and the Style Manual provided by the CAM.
- Submit confidential version the draft Final Report to the Contracts, Grants, and Loans office and the non-confidential version of the Final Report to the CAM.
- Once agreement has been reached on the drafts, submit the confidential version of the Final Report to the Contracts, Grants, and Loans office and the non-confidential version of the Final Report to the CAM for review and comment.
- Submit one bound copy of the non-confidential version of the Final Report to the CAM.
- Submit one bound copy of the confidential version of the Final Report to the Contracts, Grants, and Loans Office.

EXHIBIT A Scope of Work

The CAM shall:

- The CAM or a designated staff or technical expert will review and comment on the confidential and non-confidential versions of the draft Final Report.
- Once agreement on the confidential and non-confidential versions of the draft report has been reached, the CAM will provide written approval of the non-confidential and confidential versions of the Final Report.

Products:

- Confidential Draft Final Report
- Confidential Final Report
- Non-confidential Draft Final Report
- Non-confidential Final Report

CAM Products:

- Comments on Confidential Draft Final Report
- Comments on Non-confidential Draft Final Report
- Approval of Confidential Final Report
- Approval of Non-confidential 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

EXHIBIT A Scope of Work

owner and provide a contact name, address, telephone number, and the address where the property is located.

- A copy of a letter of commitment from an authorized representative of each source of match funding that the funds or contributions have been secured.
- At the Kick-off meeting, discuss match funds and the impact on the project if they are significantly reduced or not obtained as committed. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a *Supplemental Match Funds Notification Letter* to the CAM of receipt of additional match funds.
- Provide a *Match Funds Reduction Notification Letter* to the CAM if existing match funds are reduced during the course of the Agreement. Reduction of match funds may trigger a CPR meeting.

Products:

- Match Funds Status Letter
- 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*)

EXHIBIT A

Scope of Work

- 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;

EXHIBIT A

Scope of Work

- 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)

EXHIBIT A

Scope of Work

- TAC Meeting Back-up Materials
- TAC Meeting Summaries

EXHIBIT A Scope of Work

III. TECHNICAL TASKS

*Products that require a draft version are indicated by marking “(draft and final)” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. **Subtask 1.1 (Products)** describes the procedure for submitting products to the CAM.*

TASK 2 Design Optimization and Device Simulation

The goal of this task is to develop and optimize computer models of device designs for three different tracking configurations: (i) coarse 2-axis tracking, (ii) single axis tracking, and (iii) stationary. These three potential embodiments of the ST-CPV device will be compared in terms of optical performance and projected energy generation.

The Recipient shall:

- Develop simulation tools in order to analyze and predict the performance of all three embodiments of ST-CPV systems incorporating the following elements:
 - Optical raytrace simulation using ZEMAX EE software
 - Fluidic response simulation using finite element modeling software such as COMSOL and/or FLEX-PDE
 - Integration with climate model based on local Typical Meteorological Year (TMY) data in order to predict system output over the course of a year in 15-minute increments, for any given location within California
 - Simulation tools to be built on existing validated platform developed by the Recipient and integrated using Matlab or similar software
- Define metrics to use in setting ST-CPV system design goals and prototype performance targets. Preliminary metrics defined below may be altered as appropriate:
 - Panel size: Area of light-collecting optics
 - Geometric concentration: ratio of light-collecting area to light-output area
 - Optical efficiency: ratio of total output light power to total input light power
 - Standard Test Condition (STC): direct sunlight incident at an intensity of 1000 W/m² normal to the beam, Air Mass 1.5 Direct (AM1.5D) spectrum
 - Annual Capture Fraction (ACF): total annual light captured by the concentrator system and delivered to the solar cells, as a fraction of the total direct solar resource available for the year for a given location and mounting/tracking configuration
 - Standard Annual Capture Fraction (S-ACF): Annual Capture Fraction for a specific location used as a standard for defining performance targets, currently assumed to be Bishop, CA
- Define Use-Cases for ST-CPV design analysis. These are a group of not less than six representative installation cases, chosen to provide a representative range of potential installations within areas of California served by Investor Owned Utilities, each of which is characterized by:
 - Availability of TMY data on direct solar resource for location
 - Latitude and longitude of location (for calculation of solar incidence angles)
 - ST-CPV installation configuration:
 - Coarse 2-axis tracked ST-CPV mounted on a roof or level ground (coarse tracking allows tracking deviations up to 10° in any direction)
 - Single axis tracked ST-CPV mounted on a roof or level ground at latitude tilt, with tracking along East-West axis

EXHIBIT A

Scope of Work

- Stationary ST-CPV mounted on a roof or level ground facing South at latitude tilt
- Initial list of locations (subject to change based on further analysis):
 - Oakland
 - Burbank
 - Long Beach
 - San Diego
 - Bakersfield
 - Bishop
- Develop optimized designs for all three embodiments of ST-CPV systems using simulation tools. Optimized designs will specify targets for the following items:
 - Concentrator panel (separate designs for each embodiment of the ST-CPV device):
 - Geometry and optical characteristics of lens array
 - Geometry and material characteristics of slab lightguide
 - Geometry and response characteristics of fluidic cladding layer
 - Geometry and material characteristics of optical coupling feature
 - Coarse 2-axis and single axis tracker range
- Prepare *System Design Comparison Report* that includes but is not limited to the following:
 - A technical discussion of the optimized designs for ST-CPV systems with:
 - Coarse 2-axis tracking
 - Single axis tracking
 - No tracking (stationary)
 - STC optical efficiency for the three proposed system designs
 - Annual Capture Fraction for each of the 6 unique use-case locations for each of the three proposed system designs and associated mounting/tracking configurations (a total of 18 ACF calculations)
 - A technical discussion of the advantages and disadvantages of the different system designs

Products:

- System Design Comparison Report

TASK 3 Techno-Economic Analysis

The goal of this task is to refine existing ST-CPV cost/performance models for three different tracking configurations: (i) coarse 2-axis tracking, (ii) single axis tracking, and (iii) stationary. These models will calculate installed system cost, payback period, and LCOE for different system designs and use-case scenarios, and will be based on research by the Recipient, as well as industry and academic expert input.

The Recipient shall:

- Define system design priorities through independent research and consultation with partners and industry experts, including but not limited to the following:
 - Investigation of cost and manufacturability issues as they affect the optical design options
 - Analysis of the system tolerances to manufacturing variability
 - Examination of optimal size and power output for distributed generation systems for residential and commercial/industrial customers
 - Analysis of the market opportunity for each of the mounting/tracking configuration options and of adoption considerations for each design

EXHIBIT A Scope of Work

- Study of peak shifting requirements for residential and commercial/industrial customers
- Analysis of installation costs for each mounting/tracking configuration option
- Examination of the anticipated effect of energy-savings payback period on adoption rate
- Analysis of projected adoption trends in California and estimated impact on distributed energy generation statewide
- Refine the existing cost-model for ST-CPV systems in volume production that includes but is not limited to:
 - Cost of concentrator panels (per area)
 - Cost of high efficiency III-V solar cells
 - Cost of mounting/tracker hardware
 - Labor, capital equipment depreciation, and yield during manufacturing
 - Installation costs for both stationary ST-CPV and simply tracked ST-CPV systems
- Prepare *Cost/Performance Comparison Report* that includes detailed design goals for all three embodiments of ST-CPV systems. The report will include, but is not limited to
 - Summary of design input from industry engagement
 - Definition of use cases to be analyzed, and discussion of their choice
 - Definition of metrics to be used and discussion of their meaning and choice
 - Discussion of cost model for ST-CPV systems
 - Target design performance to metrics for ST-CPV systems with:
 - Coarse 2-axis tracking
 - Single axis tracking
 - No tracking (stationary)
 - Initial design targets, subject to change and expansion based on further analysis, are provided below:
 - Coarse 2-axis tracked ST-CPV systems:
 - Geometric concentration: at least 300x
 - STC optical efficiency: > 85%
 - S-ACF > 75%
 - Projected installed system cost < \$2/W
 - Projected capacity factor > 20%
 - Single axis tracked ST-CPV systems:
 - Geometric concentration: at least 300x
 - STC optical efficiency: > 80%
 - S-ACF > 70%
 - Projected installed system cost < \$2/W
 - Projected capacity factor > 15%
 - Stationary ST-CPV systems:
 - Geometric concentration: at least 200x
 - STC Optical Efficiency: > 65%
 - S-ACF > 70%
 - Projected installed system cost < \$2/W
 - Projected capacity factor > 8%

Products:

- Cost/Performance Comparison Report (draft and final)

EXHIBIT A Scope of Work

TASK 4 Process Development

The goals of this task are to (1) deepen relations with suppliers for key prototype components and (2) perform prototype process development and manufacturability research to determine the optimal process methods and tools for both prototyping and volume production. Vendors and suppliers located in California will be preferred whenever possible.

The Recipient shall:

- Prepare a *Custom Component Acquisition Plan Report*. The report will be provided in both confidential and non-confidential versions. The confidential report shall include technical details of components to be sourced and vendors to be utilized. The non-confidential report shall include, but is not limited to, the following:
 - A list of custom components that will be sourced from outside vendors, including PV cells, molded lens arrays, heat sinks, and other important custom components
 - Timeline for specifying and acquiring the custom components
 - Testing and evaluation procedures to be used in analyzing custom components for adherence to specifications
 - Selection criteria used to pick preferred suppliers, including which suppliers are located in California
- Perform manufacturability studies to refine manufacturing processes and identify key manufacturing issues for ST-CPV devices including, but not limited to, the following:
 - Optimization of fabrication process steps for the core fluid & optical components common to all the designs under consideration
 - Fabrication of proof of concept prototype structures to demonstrate manufacturability of ST-CPV prototypes and to quantify uniformity and process precision for key geometric and material parameters
 - Discussion with experts in related manufacturing industries about scale-up considerations for manufacturing processes
 - Demonstrate capability to effectively prototype ST-CPV devices that have been optimized for:
 - Coarse 2-axis tracking
 - Single axis tracking
 - No tracking (stationary)
- Prepare a *System Design Manufacturability Report* to identify the key manufacturing challenges and approaches used in the production of ST-CPV at both prototype and volume manufacturing scales. The report will be provided in both confidential and non-confidential versions. The confidential report shall include discussion of preferred fabrication processes for final products. The non-confidential report shall include, but is not limited to, the following:
 - Summary of industry expert input
 - Discussion of preferred prototyping process for ST-CPV devices that have been optimized for:
 - Coarse 2-axis tracking
 - Single axis tracking
 - No tracking (stationary)
 - Discussion of projected volume manufacturing process for each category of ST-CPV device and identification of any major volume manufacturing concerns
 - Summary of current prototype fabrication capabilities available to Recipient

EXHIBIT A Scope of Work

Products:

- Combination of Confidential Custom Component Acquisition Plan and Confidential System Design Manufacturability Report
- Non-confidential Custom Component Acquisition Plan Report
- Non-confidential System Design Manufacturability Report

TASK 5 Prototype Fabrication

The goals of this task are (1) to prepare a CPR report that will select a single ST-CPV embodiment to pursue based on work completed to date, and (2) to fabricate a series of ST-CPV prototypes of that embodiment meeting defined performance targets. Processes for fabrication and assembly of the prototypes will be developed and optimized. Three generations of ST-CPV prototypes will be fabricated and evaluated.

- Prepare a *CPR Report* in accordance with subtask 1.3 (CPR Meetings). In addition to the regularly required materials the report will include:
 - Discussion of anticipated performance for ST-CPV devices with:
 - Coarse 2-axis tracking
 - Single axis tracking
 - No tracking (stationary)
 - Analysis of tradeoffs in angular tracking range, optical efficiency, cost, and manufacturability
 - Initial prototype performance targets for each potential embodiment. Initial estimates for STC optical efficiency and projected S-ACF are detailed below but are subject to change with additional analysis:
 - Gen 1 & 2 panel size – 4" x 4"
 - Gen 3 panel size – 12" x 12"
 - Coarse 2-axis tracked ST-CPV concentrator:
 - Gen 1 STC optical efficiency > 50%, projected S-ACF > 35%
 - Gen 2 STC optical efficiency > 60%, projected S-ACF > 45%
 - Gen 3 STC optical efficiency > 75%, projected S-ACF > 65%
 - Single axis tracked ST-CPV concentrator (panel at latitude tilt):
 - Gen 1 STC optical efficiency > 40%, projected S-ACF > 25%
 - Gen 2 STC optical efficiency > 50%, projected S-ACF > 35%
 - Gen 3 STC optical efficiency > 65%, projected S-ACF > 55%
 - Stationary ST-CPV concentrator (panel at latitude tilt):
 - Gen 1 STC optical efficiency > 30%, projected S-ACF > 15%
 - Gen 2 STC optical efficiency > 40%, projected S-ACF > 25%
 - Gen 3 STC optical efficiency > 55%, projected S-ACF > 45%
 - Recommended ST-CPV design and tracking embodiment to pursue for the remainder of the program
- Participate in a CPR meeting, in addition to regular tasks this meeting will include:
 - Discussion and selection of a preferred ST-CPV system design and tracking embodiment
 - Discussion and selection of prototype performance targets
- Purchase custom-fabricated optical/electronic parts according to the optimized designs (California vendors to be given preference).
 - Lens arrays
 - Micromolded coupling facet arrays
 - PV cells & heat sinks

EXHIBIT A

Scope of Work

- Fabricate initial prototype ST-CPV concentrator panels meeting the specifications of Gen 1 prototypes as determined in the CPR Meeting
 - Prepare *Gen 1 Prototype Fabrication Report* in both confidential and non-confidential versions. The confidential report shall include discussion of optimized fabrication procedure developed to-date and discussion of remaining process challenges. The non-confidential report shall include but is not limited to the discussion of performance results on Gen 1 prototype ST-CPV prototypes and comparison to Gen 1 performance targets
- Fabricate second-generation prototypes meeting the specifications of Gen 2 prototypes as determined in the CPR Meeting
 - Prepare *Gen 2 Prototype Fabrication Report* in both confidential and non-confidential versions. The confidential report shall include discussion of optimized fabrication procedure developed to-date and discussion of remaining process challenges. The non-confidential report shall include but is not limited to the discussion of performance results on Gen 2 prototype ST-CPV prototypes and comparison to Gen 2 performance targets
- Fabricate third-generation prototypes meeting the specifications of Gen 3 prototypes as determined in the CPR Meeting
- Develop procedures for attachment of PV cells to concentrator panels, optimized for both light-coupling efficiency and bond durability
 - Prepare *Gen 3 Prototype Fabrication Report* in both confidential and non-confidential versions. The confidential report shall include discussion of optimized fabrication procedure developed to-date, discussion of integration of PV cells into prototype devices, and discussion of remaining process challenges. The non-confidential report shall include but is not limited to the discussion of performance results on Gen 3 prototype ST-CPV prototypes and comparison to Gen 3 performance targets
- Participate in CPR Meeting per Task 1.3, and prepare a *CPR Report*

Products:

- CPR Report on Design Selection
- Combination of Confidential Gen 1, Gen 2, and Gen 3 Prototype Fabrication Reports
- Non-confidential Gen 1 Prototype Fabrication Report
- Non-confidential Gen 2 Prototype Fabrication Report
- Non-confidential Gen 3 Prototype Fabrication Report

TASK 6 Prototype Testing

The goals of this task are (1) to develop test capabilities and protocols for optical testing of ST-CPV prototypes and (2) to execute testing of prototypes. Testing will include (i) laboratory evaluation of optical efficiency as a function of incident light angle and intensity, (ii) extended outdoor testing to evaluate optical efficiency in sunlight and stability over time, (iii) accelerated aging evaluation of materials and devices to test for UV-induced degradation.

The Recipient shall:

- Define laboratory test protocols for the use of solar simulator in estimation of prototype performance to target specifications as determined in the CPR meeting
 - Tests to be performed using the Recipient's 12" highly-collimated Class AAA solar simulator

EXHIBIT A Scope of Work

- Test protocol specifies a set of test conditions to be used on each prototype, where each set includes:
 - Prototype tilt angles on each axis
 - Light intensity
- Validate through simulation that the test protocols allow accurate prediction of ACF for the use cases to be studied
- Define protocols for extended outdoor testing of ST-CPV prototypes at the Recipient's outdoor test facility, including long-duration testing with a period exceeding six months.
- Define protocols for accelerated aging testing in the Recipient's UV aging testbed.
- Prepare *Prototype Test Plan* that includes but is not limited to:
 - Description and justification of laboratory test protocols
 - Discussion of outdoor test protocols
 - Discussion of accelerated aging protocols
- Perform laboratory testing on all prototype ST-CPV devices to quantify performance and compare to target specifications
- Perform extended outdoor testing on prototype concentrator devices including, but not limited to prototypes meeting the performance targets defined in the CPR meeting
 - Compare outdoor performance to the results of laboratory tests
 - Record light output measurements over extended periods
 - Determine variation with environmental conditions and solar incidence
 - Identify and quantify any performance degradation over time
- Perform accelerated aging tests on ST-CPV materials and devices
 - Vary UV intensity and temperature to control acceleration factor
- Prepare *ST-CPV Test Results Report Gen 1* in both confidential and non-confidential versions. The confidential report shall include technical details of laboratory testing results, extended outdoor testing results, and accelerated aging testing results, as well as description of any failure modes identified and of design changes that may be warranted in the next generation of devices. The non-confidential report shall include but is not limited to:
 - Discussion of overall laboratory testing results, including optical efficiency as a function of incident light angle and intensity, compared to target specifications
 - Discussion of overall extended outdoor testing results, including optical efficiency and stability, and implications for performance compared to target specifications
 - Discussion of overall accelerated aging testing results of materials and devices to test for UV-stability, and implications for performance compared to target specifications
- Prepare *ST-CPV Test Results Report Gen 2* in both confidential and non-confidential versions. The confidential report shall include technical details of laboratory testing results, extended outdoor testing results, and accelerated aging testing results, as well as description of any failure modes identified and of design changes that may be warranted in the next generation of devices. The non-confidential report shall include but is not limited to:
 - Discussion of overall laboratory testing results, including optical efficiency as a function of incident light angle and intensity, compared to target specifications
 - Discussion of overall extended outdoor testing results, including optical efficiency and stability, and implications for performance compared to target specifications
 - Discussion of overall accelerated aging testing results of materials and devices to test for UV-stability, and implications for performance compared to target specifications

EXHIBIT A Scope of Work

Products:

- Prototype Test Plan
- Combination of Confidential ST-CPV Prototype Test Report Gen 1 and Gen 2
- Non-confidential ST-CPV Prototype Test Report Gen 1
- Non-confidential ST-CPV Prototype Test Report Gen 2

TASK 7 Evaluations of ST-CPV Module and System

The goals of this task are to test an array of Gen 3 prototype ST-CPV devices in (1) third-party laboratory test facilities and (2) install and test a ST-CPV system at an evaluation test site operated at the Recipient's offices. These tests will evaluate useful electricity produced by full, mounted prototype module systems. The third-party testing will validate prototype performance in an independent laboratory facility. Evaluation at the test site will feature extended operation of installed prototypes in a commercial space that is in regular use, in order to gauge energy and cost savings provided by the distributed generation system.

The Recipient shall:

- Prepare a *System Installation Test Plan* that shall include, but is not limited to:
 - Plan for installation of ST-CPV system(s) including:
 - Number and size of systems. It is anticipated that one system will be installed, consisting of between four and nine linked Gen 3 (12" x 12") prototype panels.
 - Location of concentrator panels on building. It is anticipated these will be mounted on the roof of Recipient's office in Burlingame, CA.
 - Mounting configuration. The panels will either be mounted on stationary supports or on a ruggedized tracker, dependent upon the design selected in the Task 5 CPR.
 - Monitoring hardware to install for reference measurements of incident light
 - Electrical interface with load for measuring energy output. It is anticipated that this will include an inverter to produce alternating-current output and a resistive load that permits measurement of system energy output.
 - Monitoring hardware to measure building energy usage with resolution of 15 minute increments or better
 - Timing and minimum duration of test evaluation (not to be less than three months)
 - Strategy for analyzing potential grid energy usage displacement that shall include, but is not limited to:
 - Analysis of energy output from ST-CPV system installed. Peak DC output power is anticipated to be above 300 W/m² if the panel is dual-axis tracked, above 260 W/m² if the panel is single-axis tracked, and above 220 W/m² if the panel is stationary. Inverter losses are anticipated to be less than 15%.
 - Analysis of capacity factor of the prototype system. For the Recipient location in Burlingame, the annual capacity factor is anticipated to be above 17% for single- or dual-axis tracked panels and above 14% for stationary panels.
 - Analysis of facility electrical usage compared to average grid load
 - Analysis of alignment between generation peak and load peak and the time value of energy produced by the system

EXHIBIT A

Scope of Work

- Analysis of overall energy savings to be expected from a grid connected system
- Comparison of energy usage with the same time period in previous years
- Execute *the System Installation Test Plan*
- Determine a vendor for third-party laboratory testing of the ST-CPV module. Initial discussions have taken place with National Renewable Energy Laboratory, but a variety of testing partners will be considered with preference for a California partner
- Prepare *Third-Party Product Test Plan* of ST-CPV module to include:
 - Choice of third-party laboratory for test evaluation
 - Detailed protocol for module testing and comparison to the Recipient's measurements to include:
 - Incident power levels, spectrum, collimation during testing
 - Incident light angles on both axes
 - Temperature during tests
- Execute *Third-Party Product Test Plan*, at chosen test site
- Prepare *Draft ST-CPV Module and System Performance Report* in both confidential and non-confidential versions. The confidential report shall include technical details of results from third-party testing of ST-CPV systems, and technical details of results from test site evaluation of ST-CPV systems. The non-confidential report shall include, but is not limited to:
 - Discussion of preliminary results from third-party testing of ST-CPV systems
 - Discussion of preliminary results from the test site evaluation of ST-CPV systems
 - Discussion of any changes or improvements made to the system as a result of initial results
- Prepare *Final ST-CPV Module and System Performance Report* in both confidential and non-confidential versions. The confidential report shall include technical details of final results from third-party testing of ST-CPV systems, and technical details of final results from test site evaluation of ST-CPV systems. The non-confidential report shall include, but is not limited to:
 - Discussion of final results from third-party testing of ST-CPV systems
 - Discussion of final results from test site evaluation of ST-CPV systems

Products:

- System Installation Test Plan
- Third-Party Product Test Plan
- Confidential Draft ST-CPV Module and System Performance Report
- Non-confidential Draft ST-CPV Module and System Performance Report
- Confidential Final ST-CPV Module and System Performance Report
- Non-confidential Final ST-CPV Module and System Performance Report

TASK 8 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,

EXHIBIT A

Scope of Work

baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:

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

EXHIBIT A

Scope of Work

- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- 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 9 Technology/Knowledge Transfer Activities

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

The Recipient shall:

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

EXHIBIT A

Scope of Work

- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

TASK 10 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 *Production Readiness Plan*. The degree of detail in the plan should be proportional to the complexity of producing or commercializing the proposed product, and to its state of development. As appropriate, the plan will discuss the following:
 - Critical production processes, equipment, facilities, personnel resources, and support systems needed to produce a commercially viable product.
 - Internal manufacturing facilities, supplier technologies, capacity constraints imposed by the design under consideration, design-critical elements, and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes."
 - The estimated cost of production.
 - The expected investment threshold needed to launch the commercial product.
 - An implementation plan to ramp up to full production.
 - The outcome of product development efforts, such as copyrights and license agreements.
 - Patent numbers and applications, along with dates and brief descriptions.
 - Other areas as determined by the CAM.

Products:

- Production Readiness Plan (draft and final)

IV. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: GLINT PHOTONICS, INC.

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

RESOLVED, that the Energy Commission approves Agreement EPC-14-040 with **Glint Photonics, Inc.** for a **\$999,940** grant to develop Self-Tracking Concentrator Photovoltaic (ST-CPV) modules. ST-CPV is a new solar panel technology that applies light-reactive optical materials on the panel to collect direct sunlight and internally concentrate sunlight onto small areas of high-efficiency photovoltaic (PV) cells. This technology is anticipated to improve energy efficiency and reduce the cost of concentrator PV systems; 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 May 13, 2015.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Harriet Kallemeyn,
Secretariat