



# GRANT REQUEST FORM (GRF)

## A) New Agreement # EPC-20-033 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Joshua Croft	51	925-452-7638

C) Recipient's Legal Name	Federal ID Number
Halo Industries, Inc.	38-3938036

D) Title of Project
Production Scale-Up of Conductive Silicon Carbide Wafer Technology for Electric Vehicle and Charging Infrastructure Power Electronics Cost Reduction

## E) Term and Amount

Start Date	End Date	Amount
5/1/2021	3/31/2025	\$ 3,000,000

## F) Business Meeting Information

ARFVTP agreements \$75K and under delegated to Executive Director

Proposed Business Meeting Date 4/14/2021  Consent  Discussion

Business Meeting Presenter Benson Gilbert Time Needed: 5 minutes

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

### Agenda Item Subject and Description:

Halo Industries, Inc. Proposed resolution approving Agreement EPC-20-033 with Halo Industries, Inc. for a \$3,000,000 grant to bring a silicon carbide wafer manufacturing method into LRIP and adopting staff's determination that this project is exempt from CEQA. This manufacturing method uses a patented laser-based slicing technology and dramatically lowers the cost of these wafers, which are necessary for advanced, next generation power electronics for a wide variety of applications. During the project, the recipient will complete manufacturing design and engineering work, develop a stable and scalable supply chain, and demonstrate the pilot production system. (EPIC funding) Contact: Benson Gilbert.

## G) California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?

Yes (skip to question 2)

No (complete the following (PRC 21065 and 14 CCR 15378)):



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## 2. If Agreement is considered a "Project" under CEQA:

a)  Agreement **IS** exempt.

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:

Cal. Code of Regs., tit. 14 § 15301 provides that projects consisting of the operation, repair, maintenance, or minor alteration of existing public or private structures, facilities, mechanical equipment involving negligible or no expansion of existing use is exempt from the CEQA. The project work includes engineering, design work, supply chain development work, pilot LRIP system construction work, pilot LRIP system validation work as well as other administrative, planning, logistics and management work. This project will use an already existing industrial facility that is already permitted for the manufacturing design, engineering, and production work involved in this project and will involve negligible or no expansion of the existing use. Therefore, the project falls within § 15301 and will not have a significant effect on the environment.

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

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

Legal Company Name:	Budget
	\$

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

Legal Company Name:



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## J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	FY 2019-20	301.001G	\$ 3,000,000

R&D Program Area: EDMFO: EDMF

TOTAL: \$ 3,000,000

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:

## K) Recipient's Contact Information

### 1. Recipient's Administrator/Officer

Name: Andrei Iancu

Address: 950 Commercial St

City, State, Zip: Palo Alto, CA 94303-4907

Phone: 562-225-2463

E-Mail: andrei@halo-industries.com

### 2. Recipient's Project Manager

Name: Andrei Iancu

Address: 950 Commercial St

City, State, Zip: Palo Alto, CA 94303-4907

Phone: 562-225-2463

E-Mail: andrei@halo-industries.com

## L) Selection Process Used

Competitive Solicitation #: GFO-20-302

First Come First Served Solicitation #:

## M) 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 |



STATE OF CALIFORNIA

# GRANT REQUEST FORM (GRF)

CEC-270 (Revised 12/2019)

CALIFORNIA ENERGY COMMISSION

*Joshua Croft* *[Signature]* 3/12/2021

\_\_\_\_\_  
**Agreement Manager**

*[Signature]*

\_\_\_\_\_  
3/11/2021

\_\_\_\_\_  
**Date**

3/12/2021

\_\_\_\_\_  
**Office Manager**

*Linda Spiegel*

\_\_\_\_\_  
**Date**

3/12/2021

\_\_\_\_\_  
**Deputy Director**

\_\_\_\_\_  
**Date**

**Exhibit A  
Scope of Work  
Halo Industries, Inc.**

**I. TASK ACRONYM/TERM LISTS**

**A. Task List**

<b>Task #</b>	<b>CPR<sup>1</sup></b>	<b>Task Name</b>
1		General Project Tasks
2	CPR #1	Pilot Production System Engineering and Design
3		Supply Chain Development and Pilot Production System Construction
4		Pilot Production System Validation
5		Evaluation of Project Benefits
6		Technology/Knowledge Transfer Activities

**B. Acronym/Term List**

<b>Acronym/Term</b>	<b>Meaning</b>
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
FRP	Full Rate Production
LRIP	Low-Rate Initial Production
SiC	Silicon Carbide
TAC	Technical Advisory Committee

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

**A. Purpose of Agreement**

The purpose of this Agreement is to fund the design, sourcing, construction and validation of a pilot production system for manufacturing conductive silicon carbide (SiC) wafers which can substantially decrease costs and improve the performance of high voltage SiC-on-SiC power electronics for diverse applications such as electric vehicle, industrial, electrified rail, and wind energy power electronics as well as electric grid transmission and electric vehicle charging infrastructure.

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

# **Exhibit A Scope of Work Halo Industries, Inc.**

## **B. Problem/ Solution Statement**

### **Problem**

By a large margin, the highest cost of next-generation, high-efficiency SiC-on-SiC power electronics is the cost of the conductive SiC material. The conductive SiC wafer, which is the base substrate that the individual power electronics are fabricated from, currently accounts for roughly 50% of the device end cost. Due to the high technical complexity associated with developing a process to replace the costly, traditional methods used in state-of-the-art wafer manufacturing, there have been no substantial, successful technological advances to reduce this wafer cost and enable large scale adoption of these next-generation power electronics. Currently, SiC power electronics cost roughly 3x traditional silicon electronics in large part due to the inefficient wire saw method for wafering SiC boules which wastes nearly half of the mass of the original workpiece as irrecoverable saw dust, damages the material as it cuts requiring substantial efforts to remove the defect-ridden SiC and furthermore takes many hours to slice while continuously using expensive consumables.

### **Solution**

The Recipient has successfully developed a full-scale prototype of a novel conductive silicon carbide wafer fabrication technology that drastically reduces cost, improves wafer quality, diminishes environmental impact of manufacturing, and enables next-generation wafer properties. The technology virtually eliminates the 50% kerf loss of the wire saw, minimizes damage to the SiC boule resulting in much simpler defect removal processes and improves the throughput to produce one wafer approximately every 10 minutes. Moreover, the technology reduces the carbon footprint of the SiC wafer manufacturing process by over 70 percent while additionally enabling entirely unique wafer form factors paving the way for even more advanced power electronics architectures. The Recipient will scale-up and validate that this technology can produce industry-standard 150 mm wafers and that it can do so with commercially relevant LRIP process metrics. The benefits will result in lower SiC-on-SiC power electronics pricing and increased energy efficiency in a broad category of products, such as electric vehicle, industrial, electrified rail, and wind energy power electronics as well as electric grid transmission and electric vehicle charging infrastructure components, which will lead to greater renewable energy adoption and lower financial burdens for California ratepayers.

## **C. Goals and Objectives of the Agreement**

### **Agreement Goals**

The goals of this Agreement are to:

- Scale-up and validate a novel conductive SiC wafer manufacturing technology to LRIP stage
- Decrease the costs associated with SiC-on-SiC power electronics and associated infrastructure
- Increase the efficiency of SiC-on-SiC power modules
- Reduce the environmental impact of the manufacturing of SiC-on-SiC power electronics
- Enable next-generation SiC-on-SiC power electronics and module architectures

## **Exhibit A Scope of Work Halo Industries, Inc.**

**Ratepayer Benefits:**<sup>2</sup> This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety by reducing the price and increasing the efficiency of electric grid transmission and electric vehicle charging infrastructure as well as enabling large-scale adoption of next-generation, high-efficiency power electronics architectures in electric vehicle, industrial, electrified rail and wind energy applications. The lower costs benefit is the most direct and visible as it will entail reductions in ratepayer monthly energy bills due to the enhanced electrical efficiency of a broad range of products as well as reductions in residential, commercial, and utility scale renewable energy costs. Greater reliability and safety are primarily due to the proven increases in reliability and safety of SiC-on-SiC compared to traditional power electronics, especially when considering next-generation product architectures uniquely enabled by Halo's technology. Increased safety is also achieved due to the increase in California's renewable electricity generation that will be driven by the benefits of this Agreement as well as the development of next generation, efficient, solid-state grid transmission hardware that is much less likely to fail.

**Technological Advancement and Breakthroughs:**<sup>3</sup> 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 demonstrating and validating a novel conductive silicon carbide wafer manufacturing technology and generating significant long-term benefits in the power electronics field including: a decrease in costs associated with SiC-on-SiC power electronics, an increase in the energy efficiency of a broad range of products, a reduction in the environmental impact of the manufacturing of conductive SiC wafers and the enabling of large-scale adoption of next-generation power electronics architectures. Since energy efficiency is at the heart of California's push to achieve its energy goals, these benefits will accelerate the timeline for achieving the targets, reduce the financial burden on the state and ratepayers associated with achieving the targets as well as reinvigorate the California manufacturing sector to provide additional high-skilled jobs and a resurgent technological leadership role in the high-tech materials industry.

### **Agreement Objectives**

The objectives of this Agreement are to:

- Complete the engineering and design work needed to achieve the target pilot production metrics
- Develop a stable, scalable supply chain and construct the pilot silicon carbide wafer production system
- Validate the end-to-end pilot production process with an existing, committed first customer as an impartial third party
- Comprehensively and objectively evaluate the project benefits
- Effectively communicate the project outcomes to the public and other stakeholders

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

# Exhibit A

## Scope of Work

### Halo Industries, Inc.

### III. TASK 1 GENERAL PROJECT TASKS

#### PRODUCTS

##### Subtask 1.1 Products

The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V)**. All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations. All technical tasks should include product(s). Products that require a draft version are indicated by marking “**(draft and final)**” after the product name in the “Products” section of the task/subtask. If “(draft and final)” does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, “**days**” means working days.

##### The Recipient shall:

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

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

##### For products that require a final version only

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

##### For all products

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

##### Instructions for Submitting Electronic Files and Developing Software:

##### ○ **Electronic File Format**

Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the California Energy Commission’s (CEC) 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.



## **Exhibit A Scope of Work Halo Industries, Inc.**

The following describes the accepted formats for electronic data and documents provided to the CEC 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.
  - 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 CEC'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 CEC 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;
- Invoicing and auditing procedures;
- Administrative products (subtask 1.1);
- CPR meetings (subtask 1.3);

## **Exhibit A Scope of Work Halo Industries, Inc.**

- 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 (subtask 1.5);
  - Final Report (subtask 1.6);
  - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
  - Any other relevant topics.
- Provide *Kick-off Meeting Presentation* to include but not limited to:
    - Project overview (i.e. project description, goals and objectives, technical tasks, expected benefits, etc.)
    - Project schedule that identifies milestones
    - List of potential risk factors and hurdles, and mitigation strategy
  - Provide an *Updated Project Schedule, Match Funds Status Letter, and Permit Status Letter*, 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:**

- Kick-off Meeting Presentation
- Updated Project Schedule (*if applicable*)
- Match Funds Status Letter (subtask 1.7) (*if applicable*)
- Permit Status Letter (subtask 1.8) (*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 CEC 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 CEC 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 CEC.

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

## **Exhibit A Scope of Work Halo Industries, Inc.**

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 CEC, 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 and submit 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.
- 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* with 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)

### **CAM Products:**

- CPR Agenda
- 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 CEC 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.

## **Exhibit A Scope of Work Halo Industries, Inc.**

- 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 procured equipment.
  - The CEC’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 copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

### **Products:**

- Final Meeting Agreement Summary (*if applicable*)
- Schedule for Completing Agreement Closeout Activities
- All Final 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 Funds and in-state expenditures.

### **Products:**

- Progress Reports
- Invoices

### **Subtask 1.6 Final Report**

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement.

## Exhibit A Scope of Work Halo Industries, Inc.

When creating the Final Report Outline and the Final Report, the Recipient must use the CEC 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 *Energy Commission Style Manual* provided by the CAM.

#### Recipient Products:

- Final Report Outline (draft and final)

#### CAM Product:

- Energy Commission 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, Energy Commission 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)
- Submit a draft of the Executive Summary to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* received on the Executive Summary. For each comment received, the recipient will identify in the summary the following:
  - Comments the recipient proposes to incorporate.
  - Comments the recipient does propose to incorporate and an explanation for why.
- 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.

## Exhibit A Scope of Work Halo Industries, Inc.

- Incorporate all CAM comments into the *Final Report*. If the Recipient disagrees with any comment, provide a *Written Responses to Comments* explaining why the comments were not incorporated into the final product.
- Submit the revised *Final Report* electronically with any *Written Responses to Comments* within 10 days of receipt of CAM's *Written Comments* on the Draft Final Report, unless the CAM specifies a longer time period or approves a request for additional time.

### Products:

- Summary of TAC Comments
- Draft Final Report
- *Written Responses to Comments (if applicable)*
- 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 CEC 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 CEC 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 CEC 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.

## Exhibit A Scope of Work Halo Industries, Inc.

- 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

## **Exhibit A Scope of Work Halo Industries, Inc.**

- 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 each 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.
- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.



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- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate, to the extent the TAC members feel is appropriate, on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

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.

## **Exhibit A Scope of Work Halo Industries, Inc.**

### **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.

### **The TAC shall:**

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.
- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

### **Products:**

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

### **Subtask 1.12 Project Performance Metrics**

The goal of this subtask is to finalize key performance targets for the project based on feedback from the TAC and report on final results in achieving those targets. The performance targets should be a combination of scientific, engineering, techno-economic, and/or programmatic metrics that provide the most significant indicator of the research or technology's potential success.

### **The Recipient shall:**

- Complete and submit the project performance metrics from the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.
- Present the draft project performance metrics at the first TAC meeting to solicit input and comments from the TAC members.

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- Develop and submit a *TAC Performance Metrics Summary* that summarizes comments received from the TAC members on the proposed project performance metrics. The *TAC Performance Metrics Summary* will identify:
  - TAC comments the Recipient proposes to incorporate into the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
  - TAC comments the Recipient does not propose to incorporate with and explanation why.
- Develop and submit a *Project Performance Metrics Results* document describing the extent to which the Recipient met each of the performance metrics in the *Final Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task.
- Discuss the *Project Performance Metrics Results* at the Final Meeting.

**Products:**

- TAC Performance Metrics Summary
- Project Performance Metrics Results

# Exhibit A Scope of Work Halo Industries, Inc.

## IV. TECHNICAL TASKS

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

### **TASK 2: PILOT PRODUCTION SYSTEM ENGINEERING AND DESIGN**

The goal of this task is to complete the engineering and design work needed to determine and achieve target pilot production metrics using both in-house capabilities and outsourced expertise. This will involve multiple iterations of analysis, simulation and design with the goal of converging to a system configuration that is capable of achieving the target metrics with a substantial buffer to take into account unexpected downstream challenges.

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

- Identify and engage the external expertise, if any, needed to successfully complete the engineering and design work associated with this task.
- Complete a thorough engineering analysis, in conjunction with a committed first customer, to determine the pilot production metrics that should be targeted for LRIP.
- Complete a formal design process to determine an optimal system configuration capable of achieving the target pilot production metrics.
- Prepare a non-confidential *Pilot Production System Engineering and Design Report* that includes but is not limited to the following:
  - A description of the external expertise, if any, engaged to assist with the completion of this task along with the rationale for the selection or lack of selection;
  - A discussion of the results of the engineering analysis and the target pilot production metrics; and
  - A discussion of the final pilot production system design and how it achieves the target pilot production metrics.
  - This report will be 3-10 pages, will include graphics and figures, and will have an executive summary that is written for a non-technical audience.
- Prepare *CPR Report #1* and participate in a CPR meeting in accordance with subtask 1.3 (CPR Meetings).

#### **Products:**

- Pilot Production System Engineering and Design Report
- CPR Report #1

### **TASK 3: SUPPLY CHAIN DEVELOPMENT AND PILOT PRODUCTION SYSTEM CONSTRUCTION**

The goal of this task is to develop a stable, scalable supply chain and construct the pilot production system to the design specifications determined in task 2. This will involve a thorough effort to engage with potential suppliers, evaluate their products, source the optimal components and build the pilot system.

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

- Identify and engage the external expertise, if any, needed to successfully complete the supply chain development work associated with this task.

## **Exhibit A Scope of Work Halo Industries, Inc.**

- Complete a thorough supply chain analysis to identify all potential suppliers for each element of the pilot production system design finalized in task 2 and assess their capabilities.
- Complete an impartial, rational, quantitatively-driven supplier selection process for all elements of the pilot production system.
- Place orders for all elements of the pilot production system with the selected suppliers.
- Receive and unit test all elements of the pilot production system working with suppliers to correct deficiencies as needed.
- Complete construction of the pilot production system.
- Prepare a non-confidential *Pilot Production System Construction Report* that includes, but is not limited to, the following:
  - A description of the external expertise, if any, engaged to assist with the completion of this task along with the rationale for the selection or lack of selection;
  - A discussion of the results of the supply chain analysis and the supplier selection process; and
  - A discussion of the pilot production system construction process, the issues encountered and the lessons learned.
  - This report will be 3-10 pages, will include graphics and figures, and will have an executive summary that is written for a non-technical audience.

### **Products:**

- Pilot Production System Construction Report

### **TASK 4: PILOT PRODUCTION SYSTEM VALIDATION**

The goal of this task is to validate the end-to-end pilot production process with an existing, committed first customer as an impartial third party. This will primarily involve developing a thorough test plan, executing it and analyzing the results.

### **The Recipient shall:**

- Prepare a non-confidential *Pilot Production System Test Plan* that includes, but is not limited to, the following:
  - A description of the test objectives;
  - A description of the test procedures;
  - A description of the test inputs, outputs and conditions; and
  - A description of the how test data will be acquired and analyzed.
  - This plan will be 3-10 pages, will include graphics and figures, and will have an executive summary that is written for a non-technical audience.
- Execute the *Pilot Production System Test Plan* to produce a set of conductive silicon carbide wafers and associated production process metrics.
- Validate the results of the pilot production process in partnership with an existing, committed customer by thoroughly analyzing the produced wafers and process metrics to ensure they conform to expectations and industry specifications.
- Perform engineering and validation iterations until all expectations and industry specifications are reasonably met.
- Prepare a non-confidential *Pilot Production System Validation Report* that includes but is not limited to the following:
  - A thorough description of the results of the end-to-end pilot production process test;

## **Exhibit A**

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- An analysis of how the results compare to expectations and existing industry standards; and
- A discussion of the issues encountered, lessons learned, the next steps necessary to begin LRIP and the plan to transition to FRP.
- This report will be 3-10 pages, will include graphics and figures, and will have an executive summary that is written for a non-technical audience.

#### **Products:**

- Pilot Production System Test Plan
- Pilot Production System Validation Report

#### **TASK 5: EVALUATION OF PROJECT BENEFITS**

The goal of this task is to report the benefits resulting from this project.

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

- Complete the *Initial Project Benefits Questionnaire*. The Initial Project Benefits Questionnaire shall be initially completed by the Recipient with 'Kick-off' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Complete the *Annual Survey* by December 15th of each year. The Annual Survey includes but is not limited to the following information:
  - Technology commercialization progress
  - New media and publications
  - Company growth
  - Follow-on funding and awards received
- Complete the *Final Project Benefits Questionnaire*. The Final Project Benefits Questionnaire shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete and update the project profile on the CEC's public online project and recipient directory on the [Energize Innovation website](http://www.energizeinnovation.fund) (www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the [Energize Innovation website](http://www.energizeinnovation.fund) (www.energizeinnovation.fund), and provide *Documentation of Organization Profile on EnergizeInnovation.fund*, including the profile link.

#### **Products:**

- Initial Project Benefits Questionnaire
- Annual Survey(s)
- Final Project Benefits Questionnaire
- Documentation of Project Profile on EnergizeInnovation.fund
- Documentation of Organization Profile on EnergizeInnovation.fund

#### **TASK 6: KNOWLEDGE TRANSFER ACTIVITIES**

The goal of this task is to ensure the learning that resulted from this project is captured and

## **Exhibit A Scope of Work Halo Industries, Inc.**

disseminated so that similar efforts build on the lessons learned.

### **The Recipient shall:**

- Develop and submit a *Project Case Study Plan* that outlines how the Recipient will document the planning, construction, commissioning, and operation of the technology or system being demonstrated. The *Project Case Study Plan* should include:
  - An outline of the objectives, goals, and activities of the case study.
  - The expected impact if that learning is applied to future deployments.
  - The organization that will be conducting the case study and the plan for conducting it.
  - A list of professions and practitioners involved in the technology's deployment.
  - Specific activities the recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
  - Presentations/webinars/training events to disseminate the results of the case study.
- Present the *Draft Project Case Study Plan* to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the *Draft Project Case Study Plan*. This document will identify:
  - TAC comments the recipient proposes to incorporate into the *Final Project Case Study Plan*.
  - TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit the *Final Project Case Study Plan* to the CAM for approval.
- Execute the *Final Project Case Study Plan* and develop and submit a *Project Case Study*
- When directed by the CAM, develop presentation materials for an CEC- sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the CEC.
- 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.

### **Products:**

- Project Case Study Plan (Draft/Final)
- Summary of TAC Comments
- Project Case Study (Draft/Final)
- High Quality Digital Photographs

## **V. PROJECT SCHEDULE**

Please see the attached Excel spreadsheet.

**STATE OF CALIFORNIA**

**STATE ENERGY RESOURCES  
CONSERVATION AND DEVELOPMENT COMMISSION**

RESOLUTION - RE: HALO INDUSTRIES, INC.

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

**RESOLVED**, that the CEC approves Agreement EPC-20-033 with Halo Industries, Inc. for a \$3,000,000 grant to bring a silicon carbide wafer manufacturing method into LRIP. This manufacturing method uses a patented laser based slicing technology and dramatically lowers the cost of these wafers, which are necessary for advanced, next generation power electronics for a wide variety of applications. During the project, the recipient will complete manufacturing design and engineering work, develop a stable and scalable supply chain, and demonstrate the pilot production system; and

**FURTHER BE IT RESOLVED**, that the Executive Director or his/her designee shall execute the same on behalf of the CEC.

**CERTIFICATION**

The undersigned Secretariat to the CEC 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 CEC held on April 14, 2021.

AYE:

NAY:

ABSENT:

ABSTAIN:

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Patricia Carlos  
Secretariat