



California Energy Commission April 12, 2023 Business Meeting Backup Materials for Agenda Item No 14d: TS Conductor Corp.

The following backup materials for the above-referenced agenda item are available in this PDF packet as listed below:

- 1. Proposed Resolution.
- 2. Grant Request Form.
- 3. Scope of Work.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION: TS Conductor Corp

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-22-013 with TS Conductor Corp. for a \$3,000,000 grant to expand its manufacturing capabilities at its FutureWire facility in Huntington Beach, California. The facility will produce advanced, high-efficiency conductors that can reduce electricity line loss by 40 percent, allowing more generated electricity to reach load centers while lowering the carbon intensity of grid electricity. The project aims to design and commission a new manufacturing line capable of producing up to 2,300 miles of covered smart conductors per year and reduce manufacturing costs by 50 percent; and

FURTHER BE IT RESOLVED, that the Executive Director or their 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 12, 2023.

AYE: NAY: ABSENT: ABSTAIN:

Dated:

Liza Lopez Secretariat



GRANT REQUEST FORM (GRF)

A. New Agreement Number

IMPORTANT: New Agreement # to be completed by Contracts, Grants, and Loans Office.

New Agreement Number: EPC-22-013

B. Division Information

- 1. Division Name: ERDD
- 2. Agreement Manager: Molly Mahoney
- 3. MS-:None
- 4. Phone Number: 916-776-0790

C. Recipient's Information

- 1. Recipient's Legal Name: TS Conductor Corp.
- 2. Federal ID Number: 87-2516786

D. Title of Project

Title of project: FutureWire Manufacturing Facility

E. Term and Amount

- 1. Start Date: 4/17/2023
- 2. End Date: 8/31/2026
- 3. Amount: \$3,000,000.00

F. Business Meeting Information

- 1. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
- 2. The Proposed Business Meeting Date: 4/12/2023 .
- 3. Consent or Discussion? Discussion
- 4. Business Meeting Presenter Name: Molly Mahoney
- 5. Time Needed for Business Meeting: 5 minutes.
- 6. The email subscription topic is: EPIC (Electric Program Investment Charge).

Agenda Item Subject and Description:

TS Conductor Corp. Proposed resolution approving Agreement EPC-22-013 with TS Conductor Corp. for a \$3,000,000 grant to expand its manufacturing capabilities at its FutureWire facility in Huntington Beach, California, and adopting staff's determination that this action is exempt from CEQA. The facility will produce advanced, high-efficiency conductors that can reduce electricity line loss by 40 percent, allowing more generated electricity to reach load centers while lowering the carbon intensity of grid electricity. The project aims to design and commission a new manufacturing line capable of producing up to 2,300 miles of covered smart conductors per year and reduce manufacturing costs by 50 percent. (EPIC funding) Contact: Molly Mahoney. Staff presentation: 5 minutes.



G. California Environmental Quality Act (CEQA) Compliance

Is Agreement considered a "Project" under CEQA? Yes

If yes, skip to question 2.

If no, complete the following (PRC 21065 and 14 CCR 15378) and explain why Agreement is not considered a "Project":

2. If Agreement is considered a "Project" under CEQA answer the following questions.

a) Agreement IS exempt?

Yes

Statutory Exemption?

No

If yes, list PRC and/or CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

PRC section number: None

CCR section number: None

Categorical Exemption?

Yes

If yes, list CCR section number(s) and separate each with a comma. If no, enter "None" and go to the next question.

CCR section number: Cal. Code Regs., tit. 14, § 15301 ;

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

No

If yes, explain reason why Agreement is exempt under the above section. If no, enter "Not applicable" and go to the next section.

This project is categorically exempt from CEQA because the project activities are limited to and contained within a pre-existing facility that will be used to manufacture the technology. There are no planned expansions of the site, and there will be no excessive generation of noise or odors anticipated, and no hazardous waste involved.

b) Agreement **IS NOT** exempt.

IMPORTANT: consult with the legal office to determine next steps.

No

If yes, answer yes or no to all that applies. If no, list all as "no" and "None" as "yes".

| Additional Documents | Applies |
|--------------------------------|---------|
| Initial Study | No |
| Negative Declaration | No |
| Mitigated Negative Declaration | No |
| Environmental Impact Report | No |



| Statement of Overriding Considerations | No |
|--|-----|
| None | Yes |

H. Subcontractors

List all Subcontractors listed in the Budget (s) (major and minor). Insert additional rows if needed. If no subcontractors to report, enter "No subcontractors to report" and "0" to funds. **Delete** any unused rows from the table.

| Subcontractor Legal Company Name | CEC Funds | Match Funds |
|----------------------------------|------------|-------------|
| Build Momentum (d.b.a. Momentum) | \$ 300,000 | \$ 0 |
| CAP ARCHITECTURE INC. | \$0 | \$ 70,000 |
| TBD - HVAC Contractor | \$0 | \$ 300,000 |
| TBD | \$0 | \$95,000 |
| TBD | \$0 | \$95,000 |

I. Vendors and Sellers for Equipment and Materials/Miscellaneous

List all Vendors and Sellers listed in Budget(s) for Equipment and Materials/Miscellaneous. Insert additional rows if needed. If no vendors or sellers to report, enter "No vendors or sellers to report" and "0" to funds. **Delete** any unused rows from the table.

| Vendor/Seller Legal Company Name | CEC Funds | Match Funds |
|----------------------------------|-----------|-------------|
| TBD - (for facility upgrades) | \$811,048 | \$713,962 |

J. Key Partners

List all key partner(s). Insert additional rows if needed. If no key partners to report, enter "No key partners to report." **Delete** any unused rows from the table.

| Key Partner Legal Company Name |
|--------------------------------|
| No key partners to report |

K. Budget Information

Include all budget information. Insert additional rows if needed. If no budget information to report, enter "N/A" for "Not Applicable" and "0" to Amount. **Delete** any unused rows from the table.



STATE OF CALIFORNIA CALIFORNIA ENERGY COMMISSION

Grant Request Form CEC-270 (Revised 9/2022)

| Funding Source | Funding Year of Appropriation | Budget List Number | Amount |
|----------------|----------------------------------|-----------------------|--------------|
| EPIC | 21-22 | 301.0011 | \$ 3,000,000 |

TOTAL Amount: \$ 3,000,000

R&D Program Area: EDMFB: EDMF

Explanation for "Other" selection Not applicable

Reimbursement Contract #: Not applicable

Federal Agreement #: Not applicable

L. Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Jason Huang

Address: 15272-15282 Newsboy Circle

City, State, Zip: Huntington Beach, CA 92649

Phone: 866-437-7728

E-Mail: jason@tsconductor.com

3. Recipient's Project Manager

Name: Jason Huang

Address: 15272-15282 Newsboy Circle

City, State, Zip: Huntington Beach, CA 92649

Phone: 866-437-7728

E-Mail: jason@tsconductor.com

M. Selection Process Used

There are three types of selection process. List the one used for this GRF.

| Selection Process | Additional Information |
|--|------------------------|
| Competitive Solicitation # | GFO-21-304-09 |
| First Come First Served Solicitation # | Not applicable |
| Other | Not applicable |

N. Attached Items

1. List all items that should be attached to this GRF by entering "Yes" or "No".



| ltem Number | Item Name | Attached |
|----------------|--|----------|
| 1 | Exhibit A, Scope of Work/Schedule | Yes |
| 2 | Exhibit B, Budget Detail | Yes |
| 3 | CEC 105, Questionnaire for Identifying Conflicts | Yes |
| 4 | Recipient Resolution | No |
| 5 | Awardee CEQA Documentation | No |

Approved By

Individuals who approve this form must enter their full name and approval date in the MS Word version.

Agreement Manager: Molly Mahoney

Approval Date: 3/3/2023

Branch Manager: Anthony Ng

Approval Date: 3/3/2023

Director: Anthony Ng (for Jonah Steinbuck)

Approval Date: 3/3/2023

I. TASK ACRONYM/TERM LISTS

A. Task List

| Task # | CPR ¹ | Task Name |
|--------|------------------|--|
| 1 | | General Project Tasks |
| 2 | Х | Production Line Design, Procurement, Installation, and Testing |
| 3 | | Demonstration of Pilot Line Production |
| 4 | | Evaluation of Project Benefits |
| 5 | | Technology/Knowledge Transfer Activities |

B. Acronym/Term List

| Acronym/Term | Meaning |
|--------------|---------------------------------|
| CAM | Commission Agreement Manager |
| CAO | Commission Agreement Officer |
| CDR | Critical Design Review |
| CEC | California Energy Commission |
| CPR | Critical Project Review |
| CSC | Covered Smart Conductor |
| DOE | Design of Experiments |
| LRIP | Low-Rate Initial Production |
| OEM | Original Equipment Manufacturer |
| QC | Quality Control |
| Recipient | TS Conductor Corporation |
| TAC | Technical Advisory Committee |
| VOC | Volatile Organic Compound |

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 and commissioning of a Low-Rate Initial Production (LRIP) manufacturing line capable of producing covered smart conductors at a volume and cost that will meet the demanding needs of fire remediation circuits in California and globally.

B. Problem/ Solution Statement

Problem

The electrical grid is overly reliant on century-old conductor technology that has no selfmonitoring capability, poor efficiency, and limited capacity to handle the growing demands placed on the grid, related to additional renewable generation and electric vehicle integration.

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.

The extreme weather from climate change is disrupting the power grid in ways never seen before, as experienced in the recent Texas winter storm and California wildfires. As a result of unplanned outages, governments are mandating power system hardening for greater reliability, resiliency, and smart grid integration. Currently proposed solutions are cost prohibitive.

Solution

The Recipient has developed a novel "Covered Smart Conductor" (CSC) in response to customer discovery with California Investor-Owned Utilities (IOUs). The CSC is a lightweight, low sag, self-monitoring alternative to current conductor technology in use today. This is accomplished thanks to a strong composite core and integrated smart sensing fibers which are encapsulated and insulated with state-of-the art materials and manufacturing processes. The technology mitigates the risk of wide scale Public Safety Power Shutdown due to wildfires, in addition to making the grid more efficient and resilient. As a drop-in replacement for current conductors, it is significantly less expensive than any other proposed alternative.

C. Goals and Objectives of the Agreement

Agreement Goals

The goal of this Agreement is to design and commission LRIP manufacturing lines capable of producing the CSC in house at a volume, cost, and quality that will meet the demanding needs of California IOUs for fire remediation reconductoring.

Ratepayer Benefits:2

This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety by: (1) increasing the efficiency of the electricity grid by reducing the amount of line losses; (2) providing real-time data regarding power line conditions; (3) increasing the capacity of the electricity grid to deliver power from generating assets to load centers; and (4) reducing the ignition risk from powerline faults (e.g., due to vegetation contact).

Recipient's conductors are designed to improve the efficiency, affordability, safety, reliability, and resiliency of the electricity grid. By reducing line losses, ratepayers benefit from lower power generation and power delivery costs. Recipient's CSC is embedded with smart sensing capability, that produces real-time data on the status of the electricity grid that is not currently available, enabling a more reliable and resilient electricity grid. Recipient's conductors, with coating technology, offer the electricity grid up to 300% ampacity with structures in an existing right of way, reducing congestion and allowing for increased electric vehicle penetration and increased capacity for integrating renewable energy onto the grid. The insulation technology applied to the CSC also increases the safety of powerlines by reducing the ignition risk associated with a wide range of fault conditions.

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).

<u>Technological Advancement and Breakthroughs</u>.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 improving the efficiency, affordability, safety, reliability, and resiliency of the electricity grid. Recipient will develop new manufacturing processes to drive down costs and increase the supply of advanced conductors to enable the grid of the future which has more capacity for electric vehicle and renewable energy integration. New pultrusion, optical fiber insertion, and aqueous coating processes will be developed which provide a wide range of ratepayer benefits as discussed above.

Agreement Objectives

The objectives of this Agreement are to:

- Design and build LRIP lines capable of producing 1,700 to 2,300 miles per year of Covered Smart Conductor (CSC).
- Reduce the manufacturing cost of the CSC by 50% between prototyping production and LRIP.
- Validate manufacturing quality of CSC at LRIP production speeds.
- Increase the CSC LRIP manufacturing line capacity to accommodate a greater number of cores simultaneously (greater than 10 cores per machine).
- Increase the manufacturing line speed for small core conductors for CSC LRIP (at least 45 inches/minute for pultrusion and 1.65 kilometer/hour for encapsulation).
- Increase energy efficiency of the conductor from 30% to at least 35%.
- Develop proprietary LRIP manufacturing processes to consistently place fiber optic fibers such that signal loss is less than 3 decibels/kilometer.
- Upgrade manufacturing facility backup power system with solar + storage to accommodate batch processing requirements.

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.

³

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.

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);
- Match fund documentation (subtask 1.7);
- Permit documentation (subtask 1.8);
- Subcontracts (subtask 1.9); and
- Any other relevant topics.

The <u>technical portion</u> of the meeting will include discussion of the following:

- The CAM's expectations for accomplishing tasks described in the Scope of Work;
- o 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
 - o 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 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.

- 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(s)
- 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.
- 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. 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 on Draft Final Report 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.
- 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 on Draft Final Report
- 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 <u>no match funds</u> 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.
 - 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 <u>no permits</u> are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
 - The schedule the Recipient will follow in applying for and obtaining the permits.

The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.

- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a Copy of Each Approved Permit.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

- Permit Status Letter
- Updated List of Permits (*if applicable*)
- Updated Schedule for Acquiring Permits (*if applicable*)
- Copy of Each Approved Permit (*if applicable*)

Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

- 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.
- 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.

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.
- 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

IV. TECHNICAL TASKS

TASK 2 PRODUCTION LINE DESIGN, PROCUREMENT, INSTALLATION, AND TESTING

The goal of this task is to complete all engineering and design, procurement, installation, and testing for Recipient's CSC technology to enter low-volume initial production.

Subtask 2.1 Commission High Throughput Pultrusion Process for Covered Smart Conductor

The goals of this subtask are to upgrade the current manufacturing process to accommodate smaller cores, in addition to increasing throughput, improving product quality consistency, and reducing manufacturing costs.

Subtask 2.1.1 Install Environmental and Quality Control System for a Small Core System

The goals of this subtask are: (1) to Create a clean room environment to produce defect-free multiple small cores, and (2) to Improve the quality control (QC) system with an in-line quality video monitoring system capable of detecting deviations from technical and quality specifications (both pultrusion and encapsulation process).

The Recipient shall:

- Design an approximately 60,000 square foot clean room ambient to minimize pollution during small core production.
- Issue Request for Proposal to qualified contractors to design the following systems:
 - Heating, Ventilation, and Air Conditioning
 - Electrical and Lighting systems
 - Plumbing and ducting
- Develop acceptance criteria for the pultrusion process. These acceptance criteria may include but are not limited to:
 - Conductor diameter
 - Surface defect: size, location, or frequency per linear ft
 - Process exit temperature
- Design an upgraded QC system to monitor and provide alarms for detected deviations from product acceptance criteria developed earlier in this subtask. This upgrade will at a minimum include the following:
 - A 360-degree video monitoring system
 - Modification of current QC systems and processes to enable concurrent inspection on multiple cores.
- Install system and validate operational parameters that can detect deviations from specifications.
- Prepare and submit an *Environmental and Quality Control System Report* to include, but not limited to:
 - Design Criteria
 - Expected performance characteristics
 - Identified risk factors
 - QC audit metrics

Products:

• Environmental and Quality Control System Report

Subtask 2.1.2 Design and Install Low-Cost, High-Speed Resin System

The goals of this subtask are to (1) Install a resin system that is 2 times faster than the current one; (2) Resin system cost reduction by 50% compared to the baseline cost for covered conductor applications; (3) Improve system automation and reduce the labor cost involved; and (4) Improve product quality.

The Recipient shall:

- Perform a Design of Experiments (DOE) to optimize the processing conditions for a small core with the current resin formulation.
 - Work with manufacturing partners to develop a custom resin system for small core products.
 - Identify multiple resin system manufacturers to assess cost-performance benefits.
 - Design and build prototype resin system.
- Travel to resin system Original Equipment Manufacturer (OEM) for factory testing (as required) and test if the equipment is capable of meeting requirements.
 - Prepare a *Factory Acceptance Test Report* that summarizes findings from equipment trials at OEM.
- Prepare and submit *Resin System Design Report* and incorporate any minor revisions as required.
 - Down select the production resin system tailored for covered conductor applications
- Install resin system.
 - Test and validate resin system performance under various operating conditions.
 - Prepare and submit a *Resin System Commissioning Report* that provides details regarding the installation, testing, and verification of equipment operation.

Products:

- Factory Acceptance Test Report
- Resin System Design Report
- Resin System Commissioning Report

Subtask 2.1.3 Design and Install a Small Core Pultrusion Platform

The goals of this subtask are to (1) Integrate a pultrusion platform capable of 5x throughput as compared to larger core production; (2) Increase the number of cores that can pass thru the Pultrusion Machine (target 10+ cores per machine); (3) Increase the Pultrusion machine capacity for the core size of 3.5 millimeters or smaller; and (4) Install the Pultrusion equipment capable of 10+ cores.

- Perform preliminary design analysis comparing the following approaches:
 - Modify currently installed pultrusion equipment.
 - Make minor modifications to Commercial Off the Shelf system modifications from a single supplier.
 - Custom system design from the ground up using multiple OEMs for subsystems.
- Design pultrusion dies for small cores less than 5mm in diameter.

- Perform optimization and production implementation of multi-core winders with independent control.
 - Design multi-core winders
 - Design a control system
 - Qualify equipment
- Conduct a Critical Design Review and prepare the associated *Critical Design Review Report*.
- Perform optimization of the pultrusion die for high-speed multi-core pultrusion.
 - Perform optimization of multi-core winders with independent control and implement the production process.
 - Integrate the pultrusion platform into the manufacturing line.
- Design multi-die system including PLC monitoring system.
- Design QC system with auto-learning and automatic adjustment of parameters during runtime.
- Build and install at Recipient's facility and instrument for testing and validation of platform design.
 - Test prototype equipment and modify design and installation procedures as required.
 - Prepare and submit a *Commissioning Report* that provides details regarding the installation, testing, and verification of equipment operation.

Products:

- Critical Design Review Report
- Commissioning Report

Subtask 2.2 Implement Productivity Enhancements for Encapsulation Process

The goal of this subtask is to enable multiple lines for smaller cores and increase manufacturing throughput.

Subtask 2.2.1 Upgrade Encapsulation Line Speed

The goals of this subtask are to (1) Increase the productivity of existing encapsulation machines; (2) improve the flexibility and robustness of encapsulating multiple-stranded core conductors.

- Customize tooling for high-speed encapsulation with a small composite core.
 - Design high speed encapsulation machine(s).
 - Build prototype equipment for test and verification purposes.
 - Remove and replace existing encapsulation equipment (as applicable).
- Customize tooling for single encapsulation with multi-core configuration.
 - Design new dies and tooling to accommodate higher loads.
 - Perform load analysis on existing machines.
 - Determine structural reinforcement requirements.
 - Design and implement modifications (as required).
 - Verify product quality after the modifications have been made to ensure product specs are being met.

• Prepare and submit *Encapsulation Installation and Commissioning Report* that provides details regarding the installation, testing, and verification of equipment operation.

Products:

• Encapsulation Installation and Commissioning Report

Subtask 2.2.2 Design Multiple Encapsulation of Cores in Single Pass

The goal of this subtask is to increase the capacity of the encapsulation process to keep up with speed upgrades to other parts of the production line.

The Recipient shall:

- Design customized tooling for making multiple encapsulated cores on a single pass through the encapsulation machine.
 - Design tooling.
 - o Install prototype modifications on encapsulation equipment.
 - Instrument and test modifications.
 - Make modifications (as required).
- Develop a next-generation Encapsulation machine capable of supporting multiple cores.
 - Design equipment.
 - Build tooling and fixtures to test critical unit operations (as required).
 - Revise design (as required).
 - Identify and protect Intellectual Property (IP) via patent filings and/or trade secrets (as applicable). This may include but is not limited to drafting and submitting patent applications, documenting trade secret processes, and establishing/updating trade secret policies and procedures.
 - Perform CDR and finalize the design.
- Prepare and submit a *Multi-Encapsulation Commissioning Plan* that provides details regarding the installation, testing, and verification of equipment operation.

Products:

• Multi-Encapsulation Installation and Commissioning Plan

Subtask 2.2.3 Commission New High-Yield Encapsulation Process and Integrated QC System

The goal of this subtask is to ensure consistent quality at a higher throughput as guaranteed by high-level automatic QC.

- Install new production tooling and equipment developed in subtask 2.2.2.
- Test new machine operation and line performance in accordance with the Commissioning Plan.
- Adjust operating parameters and make modifications to equipment as required.
- Integrate QC system in-line to alert and adjust process parameters during running.
- Upgrade encapsulation machinery capable of supporting multiple cores.
- Prepare and submit a *Multi-Core Encapsulation Line Commissioning Report* that provides details regarding the installation, testing, and verification of equipment operation.

Products:

• Multi-Core Encapsulation Line Installation and Commissioning Report

Subtask 2.3 Implement Production Process for Smart Sensing Fiber Insertion

The goal of this subtask is to optimize the manufacturing process to enable the field performance of conductors with smart sensing capability.

Subtask 2.3.1 Design for Manufacturing and Assembly of Optical Fiber Optimized for Reliable Sensing of Composite Core

The goals of this subtask are to (1) Ensure continuous guaranteed optical fiber with high reliability for sensing; (2) Ensure optimal insertion of optical fiber in composite core with the acceptable signal-to-noise ratio.

The Recipient shall:

- Develop the Optical Fiber Manufacturing Specifications, including:
 - Optimize the optical fiber surface condition for compatibility with pultrusion cure temperature.
 - Design and perform a DOE to optimize manufacturing recipes. Parameters to be evaluated may include, but are not limited to coating recipe, manufacturing temperature, and mechanical properties of fiber required for the production manufacturing process.
- Optimize fiber placement for easy retrieval of the optical fiber as may be required for field maintenance, including.
 - Produce test pieces with all feasible fiber insertion locations for evaluation.
 - Evaluate manufacturing process and product quality for various configurations.
- Explore the suitability of jacked optical fiber in the pultrusion of a small composite core.
 - Perform literature review.
 - Source and qualify vendor(s).
 - Procure test samples from vendor(s).
 - Perform testing in Research & Development lab against acceptance criteria.
 - Produce test samples for testing and validation purposes.

Products:

• Optical Fiber Manufacturing Specifications

Subtask 2.3.2 Implementation of Optical Fiber Insertion for Optimal Signal-to-Noise Ratio

The goal of this subtask is to ensure the optical fiber in the composite core with acceptable signal loss.

- Design, optimize, and implement the critical pultrusion process parameters, including fiber tension during pultrusion to minimize microlending in optical fibers, as measured via signal-to-noise ratio.
 - Design tensioning tools for optical fiber
 - Produce prototype tool(s)
 - o Perform pultrusion trials and laboratory testing on temperature sensing
 - Revise/Modify the design (as required)

- Standardize and implement the processing parameters on optical fiber insertion.
- Prepare a *Smart Sensing Validation Report* which validates the optical performance and ease of retrieval.
- Develop a QC system to guarantee uninterrupted fiber integrity through the whole core.
 - Develop manufacturing recipe(s) and draft *Manufacturing Specifications* Summary.
 - Develop QC procedure(s) and train relevant QC staff on new procedures.

Products:

- Smart Sensing Validation Report
- Manufacturing Specifications Summary

Subtask 2.3.3 Build Optical Lab for QC of Optical Fibers

The goal of this subtask is to develop the ability to measure the characteristics of optical fibers and connectors against manufacturing specifications.

The Recipient shall:

- Build an optical lab capable of measuring the optical characteristics of conductors with smart sensing capabilities.
 - o Develop the required Optical Lab Equipment List.
 - Design facility upgrades to the QC lab at the manufacturing facility to accommodate requirements such as vibration isolation and environmental control.
 - Prepare and submit *Optical Lab Construction Plan* for review.
 - Construct the lab.
 - Install the equipment.
 - Test and validate equipment performance.
- Prepare and submit an *Optical Lab Commissioning Report* that provides details regarding the installation, testing, and verification of equipment operation.

Products:

- Optical Lab Equipment List
- Optical Lab Construction Plans
- Optical Lab Commissioning Report

Subtask 2.4 Install High-Temperature Capable Insulation Coverage Over Encapsulated Composite Core or Stranded TS Conductor

The goals of this subtask are to (1) increase the speed and throughput of stranding and insulation processes; (2) eliminate the need for outsourced processing of the manufactured Covered Smart Conductor; (3) develop a domestic supply chain for critical raw materials.

- Develop, source, and qualify domestic vendor(s) for Cross-linkable high-density polyethylene.
- Evaluate insulation materials of higher thermal resistance based on availability, processability, cost, and field performance.

- Prepare an *Approved Insulation Vendor List* for inclusion in the manufacturing quality management system.
- Design custom insulation coverage machinery in collaboration with OEM to fit manufacturing facility constraints and Recipient's specifications.
- Install machinery at Recipient's manufacturing facility.
- Identify additional raw material suppliers (as required) and acquire line trial materials.
- Qualify the machine for production.
- Procure and commission the polymer extrusions for adding insulation and cover layers to the encapsulated or stranded conductor for fire remediation applications.
- Develop automated QC systems to guarantee and record the consistency of insulation.
- Prepare and submit an *Insulation Commissioning Report* that provides details regarding the installation, testing, and verification of equipment operation.

Products:

- Approved Insulation Vendor List
- Insulation Commissioning Report

Subtask 2.5 Implement Environmentally Friendly High Emissivity Coating Process

The goal of this subtask is to implement an aqueous coating process that is free of Volatile Organic Compounds (VOCs) and provides for online in-situ curing. This subtask will include optimizing coating chemistry with proprietary pigments, that are VOC-free and aqueous which is suitable for online in situ curing. The coating also needs to be flexible (bending), durable (outdoor environment), and hydrophilic (controlling corona noise).

The Recipient shall:

- Develop and optimize the coating chemistry for a VOC free, and Hydrophilic Coating
 - Identify and evaluate several coating raw material and equipment suppliers to source environmentally friendly aqueous-based, VOC-free coating processing.
- Develop and optimize the in-situ coating and curing process.
 - Establish specifications and processes for the input reel pay-off system.
 - Select the most suitable coating material.
 - Evaluate online curing process approaches such as hot air or infrared system in a closed system. With a target of at least a speed of 10 meters per minute.
- Perform performance verification and optimization of the coating layer to ensure target characteristics are met.
- Install equipment, including the following,
 - Source and trial equipment and associated processing procedures based on its ability to meet recipient's coating specifications.
 - The trial equipment and recipient specification which will have propitiatory elements mixed in the coating material shall be tried out on pilot equipment. Several experiments will have to be conducted with material, equipment and curing system to set the right procedures and standard operating procedures.
- Prepare *Coating Process Commissioning Report* that provides detail on the entire coating system, its processes, design, installation, and optimization.

Products:

• Coating Process Commissioning Report

Subtask 2.6 Upgrade and Install Facility's Backup Power System

The goal of this subtask is to ensure uninterrupted manufacturing operations and reduce electricity costs by integrating onsite renewable generation.

Subtask 2.6.1 Design and Install Backup Power System

The goals of this subtask are to (1) Ensure 24 hours of uninterrupted power to support operations and eliminate business disruption; (2) a Renewable energy backup option is strongly preferred to minimize carbon footprint in manufacturing, which might also offset expensive grid electricity costs to support operations and stay competitive in a very tight margin product business.

The Recipient shall:

- Identify and qualify Uninterruptable Power Supply system vendors.
- Perform an electricity outage study to determine optimal backup power requirements.
- Design an automated control system to guarantee a minimum of 30 minutes of uninterrupted power while the facility switches to an onsite generation/storage system.
- Design / integrate onsite energy management system to leverage renewable generation and storage capacity during times of high electricity cost.
- Prepare a *Backup Power System Design Report* that provides detail on system design and installation.
- Procure equipment: solar panels, inverters, batteries, and other ancillary subsystems.
- Commission system to ensure the system is capable of meeting design requirements.
- Prepare and submit a *Backup Power System Installation and Commissioning Report* that provides details regarding the installation, testing, and verification of equipment operation.
- Prepare a CPR Report #1 in accordance with subtask 1.3 (CPR Meetings).
- Participate in a CPR meeting.

Products:

- Backup Power System Design Report
- Backup Power System Installation and Commissioning Report
- CPR Report #1

TASK 3 DEMONSTRATION OF PILOT LINE PRODUCTION

The goal of this task is to troubleshoot and demonstrate that the production sub-processes were integrated properly, and all achieve low-rate initial production targets. During this task a test method will be developed to ensure processing rates are acceptable and product quality is replicable.

- Establish verification and testing methods to demonstrate:
 - Low-rate initial production
 - o Product quality
- Create a Testing and Verification Plan that includes but is not limited to an outline of:
 - The tests being conducted.
 - o Critical metrics being validated in accordance with the agreement objectives.

- Measurement tools for verification
- Desired certifications
- Prepare a single *Manufacturing Line Layout and Integration Plan Summary Report* that includes a detailed plan to set up equipment in a strategic method suitable for LRIP goals for all the tools.
- Prepare a Draft Pilot Line Demonstration Report which includes but not limited to:
 - High-level executive summary discussing:
 - Process and results of the final demonstration
 - Testing of the product
 - Technical issues

Lessons learned for this phase in the project

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• Submit the *Final Pilot Line Demonstration Report* to the CAM for feedback and incorporate changes as requested.

Products:

- Testing and Verification Plan
- Manufacturing Line Layout and Integration Plan Summary Report
- Draft Pilot Line Demonstration Report
- Final Pilot Line Demonstration Report

TASK 4 EVALUATION OF PROJECT BENEFITS

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

- 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 January 31st of each year. The Annual Survey includes but is not limited to the following information:
 - Technology commercialization progress
 - News 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 <u>Energize Innovation website</u> (<u>www.energizeinnovation.fund</u>), and provide *Documentation of the 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 <u>Energize Innovation website</u> (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 5 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

The goal of this task is to ensure the learning that resulted from this project is captured and 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, establishment, and operation of the project. The *Project Case Study Plan* should include:
 - An outline of the objectives, goals, and activities of the case study.
 - The organization that will be conducting the case study and the plan for conducting it.
 - A list of professions and practitioners involved in the project's development.
 - 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 Technology Transfer Plan*.
 - TAC comments the recipient does not propose to incorporate an explanation of 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* (*draft and final*)
- When directed by the CAM, develop presentation materials for a 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 and final)
- Summary of TAC Comments
- Project Case Study (draft and final)

• High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.