STATE OF CALIFORNIA
GRANT REQUEST FORM (GRF)
CEC-270 (Revised 12/2019) CALIFORNIA ENERGY COMMISSION

A) New Agreement # EPC-19-007 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Silvia Palma-Rojas	43	916-327-1716

C) Recipient's Legal Name	Federal ID Number
Jason Cotrell, dba RCAM Technologies	45-4511417

D) Title of Project
On-site 3D Concrete Printing for Next-Generation Low-Cost Wind Plants

E) Term and Amount

Start Date	End Date	Amount
5/1/2020	3/31/2024	$ 2,999,979

F) Business Meeting Information

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

Proposed Business Meeting Date 4/8/2020 ☐ Consent ☒ Discussion

Business Meeting Presenter Silvia Palma-Rojas Time Needed: 5 minutes

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

Agenda Item Subject and Description:
JASON COTRELL, DBA RCAM TECHNOLOGIES. Proposed resolution approving Agreement EPC-19-007 with Jason Cotrell dba RCAM Technologies for a $2,999,979 grant to design, manufacture, demonstrate, and test prototypes of wind tower sections and offshore wind energy components using an onsite three-dimensional concrete printed (3DCP) manufacturing process and design, and adopting staff's determination that this action is exempt from CEQA. The advancement in scientific knowledge in 3DCP materials, manufacturing methods and large-scale structural performance will facilitate the deployment of large land-based and offshore wind technologies that use 3DCP manufacturing methods to increase the cost-competitiveness of the wind energy generation needed to meet California's statutory energy goals.

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)):

   Explain why Agreement is not considered a "Project":

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: California Code Regs., tit 14, section 15301 exempts the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private

structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of existing or former use. The project involves design, engineering, and economic analyses of concrete wind turbine tower designs and manufacturing. Prototype concrete tower sections (5-meter height and 2-meter diameter) will be fabricated using a robotic arm and 3D printer, and will then be tested at an existing research testing civil engineering laboratory or manufacturing facility. The proposed project will have no significant effect on the environment and will involve negligible or no expansion of current or former use of the existing facilities and is therefore exempt.

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**
The Regents of the University of California, Irvine Campus	$ 1,040,000
WSP USA	$ 499,581
DNV GL	$ 30,000
KZO Sea Farms	$ 9,987
Fruanhofer Institute	$ 0
WSP Global Inc.	$ 5,000
	$
	$
	$
	$

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

Legal Company Name:
Siemens Corporation
The Regents of the University of California, Irvine Campus
WSP USA

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J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	18-19	301.001F	$2,999,979
			$
			$
			$
			$
			$

R&D Program Area: EGRO: Renewables TOTAL: $ 2,999,979

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:

K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Jason Cotrell

Address: 2372 Morse Ave

City, State, Zip: Irvine, CA 92614-6234

Phone: 303)886-8937

E-Mail: Jason.Cotrell@RCAMTechnologies.com

2. Recipient's Project Manager

Name: Jason Cotrell

Address: 2372 Morse Ave

City, State, Zip: Irvine, CA 92614-6234

Phone: 303)886-8937

E-Mail: Jason.Cotrell@RCAMTechnologies.com

L) Selection Process Used

☒ Competitive Solicitation Solicitation #: GFO-19-302

☐ First Come First Served Solicitation Solicitation #:

M) The following items should be attached to this GRF

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

_____ _____

Agreement Manager **Date**

_____ _____

Office Manager **Date**

_____ _____

Deputy Director **Date**

EXHIBIT A
Scope of Work
Jason Cotrell dba RCAM Technologies

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2	X	Conceptual and Preliminary Design of a 3DCP Foundation and Tower
3		Develop a Closed-loop Cycle Approach for a Next-Generation 3DCP Tower
4	X	Laboratory Printing, Pilot-Testing and Analysis Tall Tower Sub-Assembly
5		Outdoor Testing and Demonstration of On-Site 3D Concrete Printing of Wind Energy Components
6		Feasibility Analysis and Concept Fabrication of Offshore Floating Wind Plant Components
7		Development Of 3DCP R&D, Education, and Supply Chain Capabilities in California
8		Evaluation of Project Benefits
9		Technology/Knowledge Transfer Activities
10		Production Readiness Plan

B. Acronym/Term List

Acronym/Term	Meaning
3D	3 Dimensional
3DCP	3D Concrete Printing
3DSA	3D Concrete Printed Suction Anchor
StEnSea	Storage Energy in the Sea, which is an underwater electrical energy storage system designed to store significant quantities of electrical energy offshore
3D StEnSea	A 3D concrete printed hybrid anchor/energy storage system for mooring and storing the energy from offshore wind plants
CapEx	Capital Expenditures
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPR	Critical Project Review
TAC	Technical Advisory Committee
UCI	University of California, Irvine
Energy Commission	California Energy Commission
Hybrid Tower	A wind turbine tower that has a large diameter concrete lower section and a smaller diameter steel upper section.
LCOE	Levelized Cost of Energy
MW	Megawatt
RCAM	Reinforced Concrete Additive Manufacturing

[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.

Acronym/Term	Meaning
Reference Turbine	A set of representative wind turbine parameters, assumptions, analytical relationships and computer models that can be used to aid in the design of a wind turbine components
TAC	Technical Advisory Committee
Tall Tower	A wind turbine tower with a hub height of between 120-m to 160-m.
TRL	Technology Readiness Level

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

A. Purpose of Agreement

The purpose of this agreement is to manufacture, demonstrate, and test wind tower sections and offshore wind energy components using an onsite three-dimensional concrete printed (3DCP) manufacturing process and design. The advancement in scientific knowledge in 3DCP materials, manufacturing methods and large-scale structural performance will facilitate the deployment of large land-based and offshore wind technologies that use 3DCP components to increase the cost-competitiveness of the wind energy generation needed to meet California's statutory energy goals.

B. Problem/ Solution Statement

Problem

The size of wind turbine towers is constrained by transportation size and weight making conventional towers prohibitively expensive for larger next-generation turbines in California. Overhead traffic signals, road width and weight regulations limit conventional steel tubular towers to sub-optimal diameters of 4.3 meters (14 feet.). As a result, the tallest wind turbine towers installed in California are 100-meter (m) tall with turbine capacity of 3.3-megawatts (MW).

Solution

Reinforced concrete additive manufacturing (RCAM) technology has the potential to reduce capital costs for land-based tall towers. RCAM is faster and safer than conventional concrete construction methods, while providing new transformative design possibilities that reduce cost and energy consumed by using less concrete than conventional construction and by eliminating concrete forms. The highly mobile 3DCP equipment and California's existing concrete supply chain can cost-effectively produce foundations and towers on-site in manufacturing lots of any size needed for California wind plants. 3DCP can also be used to manufacture low-cost offshore wind turbine foundations, anchors, and ocean energy storage systems in California ports for potential offshore wind deployments.

EXHIBIT A
Scope of Work
Jason Cotrell dba RCAM Technologies

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Advance the development of Recipient's on-site manufacturing technology and 3DCP tall (> 120m height) tower that lowers wind energy costs, reduces environmental lifecycle impacts, and improves the competitiveness and economic benefits of wind energy in California.
- Assess and reduce the environmental lifecycle impacts of 3DCP manufacturing
- Evaluate and expand California's R&D and commercial 3DCP capabilities and workforce potential needed to manufacture 3DCP wind energy components in California

Ratepayer Benefits:[2] This Agreement will result in the ratepayer benefits of greater electricity reliability, lower costs, and increased safety by manufacturing and conducting a pilot demonstration of low-cost RCAM tall (>120m in height) towers and offshore wind products on-site in California. The project will help provide important environmental and economic benefits for California electric ratepayers including (1) clean energy from land-based and offshore wind deployments, (2) wind energy manufacturing and operations jobs, (3) enhanced 3DCP educational and R&D capabilities, and (4) advancing a low-cost offshore wind components.

Technological Advancement and Breakthroughs:[3] This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by advancing the technology readiness of Recipient's 3DCP tower technology. The agreement also assesses the feasibility and viability of using 3DCP to manufacture two components for offshore floating wind turbines: a 3DCP suction anchor (3DSA) and a 3DCP hybrid anchor / energy storage system (three-dimensional (3D) StEnSea).

Agreement Objectives

The objectives of this Agreement are to:

- Advance the technology readiness of Recipient's low-cost 3DCP 140-m tower from technology readiness level (TRL) 4 to TRL 6.
- Reduce the cost of towers up to 140 m by 50% compared to a steel tower.
- Reduce the environmental lifecycle impacts of concrete tall towers and foundations to that equal to or lower than steel towers.
- Prove the feasibility of using 3DCP to manufacture low cost tall towers in manufacturing lots as small as one turbine.

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

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

- Demonstrate on-site 3DCP at large scale in a relevant outdoor environment.
- Assess the feasibility of using 3DCP to manufacture offshore wind suction anchors and hybrid offshore energy storage systems that reduce installed CapEx 80% to 53%, respectively.
- Evaluate and expand the potential for California's research and development (R&D) and commercial 3DCP capabilities and workforce needed to manufacture 3DCP wind energy components in California.

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).** 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 Energy Commission's software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick or CD-ROM.

The following describes the accepted formats for electronic data and documents provided to the Energy Commission as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:

- Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
- Text documents will be in MS Word file format, version 2007 or later.
- Documents intended for public distribution will be in PDF file format.
- The Recipient must also provide the native Microsoft file format.
- Project management documents will be in Microsoft Project file format, version 2007 or later.

o **Software Application Development**

Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:

- Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up). Recommend 2010.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
- Microsoft SQL Reporting Services. Recommend 2008 R2.
- XML (external interfaces).

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

MEETINGS

Subtask 1.2 Kick-off Meeting

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

The Recipient shall:

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

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

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

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

The CAM shall:

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

Recipient Products:

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

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

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

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

The Recipient shall:

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

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* and a *List of Expected CPR Participants* in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a *Schedule for Providing a Progress Determination* on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

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

CAM Products:

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

Subtask 1.4 Final Meeting

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

The Recipient shall:

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

  The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.

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

Products:

- Final Meeting Agreement Summary *(if applicable)*

- Schedule for Completing Agreement Closeout Activities
- All Draft and Final Written Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices

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

The Recipient shall:

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

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

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

Subtask 1.6.1 Final Report Outline

The Recipient shall:

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

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Style Manual
- Comments on Draft Final Report Outline

- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The Recipient shall:

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

- Submit the revised Final Report and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period or approves a request for additional time.
- Submit one bound copy of the *Final Report* to the CAM along with *Written Responses to Comments on the Draft Final Report*.

Products:

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

CAM Product:

- Written Comments on the Draft Final Report

MATCH FUNDS, PERMITS, AND SUBCONTRACTS

Subtask 1.7 Match Funds

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

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

The Recipient shall:

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

  If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter:
  - A list of the match funds that identifies:
    - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.
    - The amount of each in-kind contribution, a description of the contribution type (e.g., property, services), the documented market or book value, the source (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient must identify its owner and provide a contact name, address, telephone number, and the address where the property is located.

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

Products:

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

Subtask 1.8 Permits

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

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
  - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
  - The schedule the Recipient will follow in applying for and obtaining the permits.
- The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

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

Subtask 1.9 Subcontracts

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

The Recipient shall:

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

Products:

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

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)

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

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
  - Technical area expertise;
  - Knowledge of market applications; or
  - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.

- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.

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

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

The Recipient shall:

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

Products:

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

Subtask 1.11 TAC Meetings

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

The Recipient shall:

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

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.

Products:

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

EXHIBIT A
Scope of Work
Jason Cotrell dba RCAM Technologies

IV. TECHNICAL TASKS

TASK 2: CONCEPTUAL AND PRELIMINARY DESIGN OF A 3DCP FOUNDATION AND TOWER

The goal of this task is to develop a preliminary design for a 3DCP prototype foundation and tower in hub height of over 120 m and up to 140 m for a reference turbine of up to 7.5 MW, and to identify and quantify risks that can be addressed during the design process and in the subsequent testing and pilot demonstration phases. The activities will advance the conceptual design of the 3DCP foundation, tower, and manufacturing/assembly process for the reference turbine and tower.

The Recipient shall:

- Develop a final conceptual design for the 3DCP foundation and tower concept for the reference turbine and tower.
    - Select the reference turbine size up to 7.5-MW and tower hub height up over 120 m and to 140 m.
    - Review the 3DCP technology and evaluate how it aligns within current design codes and precast or cast-in-place concrete tower construction practices that include, but are not limited to material characteristics, reinforcement layout, fabrication sequencing and resulting internal stress states, geometric tolerances, construction logistics, and potential quality issues.
    - Develop a risk matrix based on the identified risks, uncertainties, improvement opportunities, and potential alternative concepts.
    - Update and validate the concept tower design for the reference turbine.
- Develop a conceptual standard circular concrete slab foundation design.
- Prepare a *Concept Tower Design Report* that includes, but is not limited to:
    - Findings of the technology review description of concept tower;
    - Considered alternatives;
    - Major risks and opportunities for improvements;
    - Design approach, basis of design;
    - Conceptual drawing set, and,
    - Sample design calculations.
- Develop a *Tower Manufacturing and Assembly Plan* that includes but not limited to:
    - A 3DCP Tower Component Fabrication Plan that includes but is not limited to:
        - Design of how the tower base and individual stay form segments will be printed onsite.
        - Identification of the technical metrics for 3DCP tower sections that meet wind tower quality standard requirements that include, but are not limited to International Electrotechnical Commission (IEC) 61400-1, American Concrete Institute Innovation Task Group (ACI ITG9R-16), and American Wind Energy Association, and American Society of Civil Engineers (2011ASCE/AWEA RP2011).
        - Description of the equipment, material supply, and labor and associated site logistics.

        - Estimate of costs for on-site manufacturing the 3DCP tower.
    - A conceptual foundation construction plan including cost estimate.
    - A tower assembly and turbine installation plan that includes but is not limited to:
        - Specification of equipment, logistics, and processes necessary for assembly of the reference turbines for the identified site.
        - Estimate the tower assembly and turbine installation costs based on standard wind farm construction methods.
    - A *Conceptual Manufacturing and Assembly Plan* that includes but is not limited to:
        - Probabilistic tower segment fabrication and assembly cost estimate.
        - Summarize all target metrics that support the feasibility of the manufacturing and assembly activities
- Perform a scaling study for the reference turbines and tower.
    - Scale up the turbine power rating of the National Renewable Energy Laboratory (NREL) 5-MW reference model to the selected reference turbine, while maintaining the 204m rotor to obtain specific power ratings more reflective of conventional turbines and turbines that are better suited for California's faster wind speeds and sites with more turbulent characteristics.
    - Obtain new tower and foundation loads based on wind turbine simulations.
    - Provide a summary of the general cost implication for the upscaling by proportionally scaling the material quantities and cost estimate of the original tower concept, demonstrating how the tower will achieve a cost of $200/kW.
    - Draft the *Turbine Scaling Study Report* that summarizes the reference turbine and wind plant specifications and loads for a representative California site.
- Subject the conceptual design to a third-party review and risk assessment workshop.
    - Subject the conceptual design and conceptual manufacturing to a third-party review that:
        - Identifies major cost drivers specifically related to the design of the tower, utilizing a high-level estimate of the bill of materials required for manufacturing, and based on field experience.
        - Determines improvements or changes to the conceptual design that may be considered to reduce cost or otherwise de-risk the concept design.
    - Organize a project review and risk assessment workshop to subject the tower design, fabrication and assembly to a thorough risk assessment. The workshop will also serve to evaluate the scaling study to select the reference turbine and hub height with the highest potential for commercialization in California to focus on in the preliminary design phase.
    - Based on the findings form the workshop, develop risk management solutions to identify follow-on structural testing and demonstration activities needed for field demonstration and commercialization of the 3DCP tower technology.
    - Prepare a *Risk Management Report* that summarize findings from the third-party review and risk assessment workshop that identify the outstanding technology risks and most beneficial risk mitigation measures.

  - Revise conceptual design for the 3DCP foundation and tower as appropriate based on the findings from the third-party review and risk assessment workshop.
- Develop dynamic tower design loads for preliminary design.
  - Develop the dynamic wind loads for the selected turbine as a basis for the preliminary design.
  - Run wind turbine simulations to develop tower section loads for service and ultimate load conditions and estimate the probability of different outcomes of tower section loads for fatigue load conditions. For the analysis, model the tower with a stiffness close to the conceptual 3DCP tower scaled to the new turbine size and hub height.
  - Prepare a *Load Table for Basis of Design* that summarize the loads to be appended to the basis of design.
- Develop a preliminary design of the tower and foundation.
  - Preliminary design the tower and foundation for service and strength conditions to include, but not be limited to:
    - Develop a finite element model of the tower and foundation based on shell and solid elements to distinguish between 3D-printed concrete and concrete infill.
    - Analyze the tower for dynamic wind loads, seismic loads, and internal stress states such as differential creep/shrinkage between 3D-printed and infill concrete, thermal gradient, and hydrostatic pressure from placing the infill concrete.
    - Validate the soil/foundation interface for uplift and sliding.
    - Evaluate principal stresses at critical locations for service and compare to design criteria.
    - Evaluate ultimate moments and shear demand ratios of tower and foundation sections with non-linear section analyses.
    - Preliminarily validate critical tower details for strength.
    - Identify additional risks and improvement opportunities and revise risk matrix.
  - Preliminary design the tower for fatigue conditions to include, but not be limited to:
    - Validate concrete compression fatigue based on principal stresses from loads defined by the estimate of the probability of different outcomes of tower section loads using accumulated damage theory.
    - Validate fatigue strength of typical reinforcement and post tensioning tendons.
    - Validate fatigue strength of critical shear interfaces such as horizontal tower segment joints and vertical 3DCP/infill interfaces.
  - Reevaluate dynamic characteristic of tower.
  - Conceptually design tower internals such as doorways, ladders, power electronics, and power cables.
  - Validate the dynamic behavior of the unfinished tower due to vortex shedding.
  - Develop a preliminary design drawing set of tower and foundation.

  - Prepare a *Preliminary Tower Design Report* that includes, but not limited to describe the tower design and analysis, and include the preliminary drawing set, updated risk matrix, preliminary basis of design, and sample calculations.
- Develop capital expenditures (CapEx) and levelized cost of energy (LCOE) estimates for the 3DCP tower.
  - Perform a techno-economic analysis (CapEx and LCOE estimates) of the 3DCP tower and foundation in comparison to conventional tower technologies.
  - Prepare an *LCOE Report* that summarizes the CapEx and LCOE estimates.
- Prepare a *CPR Report #1* in accordance with subtask 1.3
- Participate in a CPR meeting.

Products:

- Concept Tower Design Report (Draft and Final)
- Conceptual Manufacturing and Assembly Plan (Draft and Final)
- Turbine Scaling Study Report (Draft and Final)
- Risk Management Report (Draft and Final)
- Load Table for Basis of Design
- Preliminary Tower Design Report (Draft and Final)
- LCOE Report (Draft and Final)
- CPR Report #1

TASK 3 DEVELOP A CLOSED-LOOP CYCLE APPROACH FOR A NEXT-GENERATION 3DCP TOWER

The goal of this task is to develop sustainable solutions for the next generation 3DCP-based tall tower technologies that consider a closed-loop cycle approach.

The Recipient shall:

- Incorporate supplementary cementitious materials from industrial wastes or by-products to partially supplement cement in the 3D printing concrete material design and reduce the total material production energy consumption and environmental impacts.
- Optimize the design of 3DCP tower segment onsite manufacturing, post-tensioning, assembly process, and logistics to minimize total material usage, wastes generation, and manufacturing time.
- Explore an approach for reusing the recycled concrete aggregates collected from demolition sites for tower foundation design.
- Conduct an economic and environmental assessment of 3DCP tower and foundation system that includes all the life cycle phases of the product with a loop-cycle perspective.
- Conduct a third-party validation of the results from the economic and environmental life cycle assessment.

- Prepare an *Economic and Environmental Life Cycle Assessment Report* that includes, but is not limited to study assumptions, results, interpretation, third-party validation, and discussions from Task 3 activities described above. This assessment will incorporate a cradle-to-cradle perspective, and compare the economic and environmental performance of the proposed technology with conventional technology.

Product:

- Economic and Environmental Life Cycle Assessment Report (Draft and Final)

TASK 4 LABORATORY PRINTING, PILOT-TESTING AND ANALYSIS OF TALL TOWER SUB-ASSEMBLY

The goal of this task is to demonstrate 3D concrete printing manufacturing processes that meet the quality and performance requirements for a wind turbine tower through high-fidelity laboratory testing under fatigue and monotonic loading at sub-assembly scales.

The Recipient shall:

- Design the test unit (sub-assembly) as a section of the prototype tower located at a certain height, based on the magnitude of tower loads and the loading capacity of the structural testing facilities.
- Design post-tensioning and interface joints at test unit to verify code requirements for allowable stress limits.
- Install instrumentation on the test unit, such as strain gages and linear variable displacement transducers layout to measure strain, displacement and deformation.
- Assess the effects of 3DCP manufacturing process and material properties on the quality and mechanical behavior, especially the fatigue behavior of 3DCP specimens.
- Perform cyclic loading followed by monotonic loading on the 3DCP tower sub-assembly to test fatigue behavior, damage characteristics, stiffness degradation properties, failure pattern and ultimate strength.
- Perform finite element analysis on the test unit (3DCP tower subassembly) that incorporate the testing results from Task 3 and perform finite element analysis on full-scale 3DCP tower.
- Prepare a *3DCP Pilot Test, Demonstration, and Validation Report* that includes, but not limited to the summary of the high-fidelity laboratory testing results and finite element analysis results.
- Prepare a *CPR Report #2* in accordance with subtask 1.3
- Participate in a CPR meeting.

Product:

- 3DCP Pilot Test, Demonstration, and Validation Report (Draft and Final)
- CPR Report #2

TASK 5: OUTDOOR TESTING AND DEMONSTRATION OF ON-SITE 3D CONCRETE PRINTING OF WIND ENERGY COMPONENTS

The goal of this task is to conduct an outdoor onsite manufacturing test and pilot demonstration of large-scale 3DCP tower sections.

The Recipient shall:

- Prepare *Outdoor On-Site Demonstration Plan* for on-site manufacturing demonstrations at a relevant outdoor environment. Plan shall include demonstration that the functional prototypes meet the quality standard requirements and specifications for the proposed wind tower and the viability of using the proposed advanced manufacturing approach for developing functional prototypes.
- Procure the necessary mobile 3DCP equipment.
- Install and commission the mobile 3DCP equipment in a commercial large-scale staging and trial printing facility.
- .Perform 3DCP trial printing of a wind turbine tower section at large scale in the trial printing facility.
- Perform a large-scale on-site 3DCP printing demonstrations of tower sections at the outdoor printing site.
- Obtain video and pictures of the process to support technology knowledge transfer activities.
- Deconstruct and recycle the large-scale 3DCP demonstration.
- Prepare a *Large-Scale On-Site 3DCP Demonstration Report* that includes, but not limited to the summary of the demonstration experience, technical challenges and solutions, and lessons learned.

Product:

- Outdoor On-Site Demonstration Plan (Draft and Final)
- Large-Scale On-Site 3DCP Demonstration Report (Draft and Final)

TASK 6: FEASIBILITY ANALYSIS AND CONCEPT FABRICATION OF OFFSHORE FLOATING WIND PLANT COMPONENTS

The goal of this task is to determine the feasibility and prove the manufacturing concept for a 3DCP suction anchor (3DSA) and a 3DCP hybrid energy storage and anchoring system (3D StEnSea).

The Recipient shall:

- Define reference environmental (metocean and soil) conditions for a preliminary concept-level design of a conventional suction anchor for a reference turbine.
- Design a 3DSA through an analytical approach, incorporate an assessment of the loads during embedment, requirements and expected costs for the pneumatic system, and a preliminary analysis of buoyancy requirements for wet-tow transport.
- Fabricate a 3DSA proof of concept component at lab-scale, assess whether the 3DSA can be effectively produced with 3D printing, and provide detailed steps to include but

not be limited to, the assembly, launch, transportation phases, and alternatives to anchor-handling vessels.

- Assess possible limitations associated with the deployment of the innovative anchoring system in deeper or shallower sites.
- Update the capital cost estimates associated with manufacturing, transporting, and installing the conventional steel suction anchors for a selected California reference site.
- Perform LCOE modeling of the offshore floating wind plant to quantify the cost reduction impacts of 3DSA.
- Advance the 3D StEnSea concept to a conceptual design.
- Identify viable 3DCP construction and reinforcement methods for the 3D StEnSea sphere and suction anchor.
- Print a 3D StEnSea proof of concept at subscale.
- Assess the cost to manufacture 3D StEnSea in a selected California port compared to using conventional concrete methods.
- Assess the cost to transport and install 3D StEnSea for a reference floating wind plant.
- Evaluate total capital and operational costs of storing energy in a 3D StEnSea.
- Identify risks and future development activities required for 3D StEnSea
- Prepare a *Feasibility Analysis of 3DSA and 3DStEnSea Fabrication Concepts Report* that includes an assessment of the feasibility, fabrication results, and risks and future development needs for 3DSA and 3D StEnSea as described in Task 6 above. This Report must also include photographs and/or videos documenting various stages in the performance of Tasks 4 – 6.

Product:

- Feasibility Analysis of 3DSA and 3DStEnSea Fabrication Concepts Report

TASK 7: DEVELOPMENT OF 3DCP R&D, EDUCATION, AND SUPPLY CHAIN CAPABILITIES IN CALIFORNIA

The goal of this task is to evaluate California's 3DCP labor and supply chain capabilities and need for on-site manufacturing of land-based wind and potential offshore wind deployments to enable establishment of commercial large-scale facilities in California.

The Recipient shall

- Evaluate California's 3DCP labor and supply chain needs for on-site manufacturing of land-based wind and offshore deployments
    - Identify relevant information on concrete supply chain, port infrastructure, and 3DCP technology for wind energy applications.
    - Identify California's existing concrete workforce and supply chain capabilities, and potential on-site and near-site manufacturing sites needed for land-based and offshore manufacturing.

  - Identify potential actionable items by California's concrete supply chain, regional and state stakeholders to accelerate the potential benefits of 3D concrete printing.
  - Provide a *3DCP Technical Report,* which includes but is not limited to, labor and supply chain needs, site visits, interviews with 3DCP subject matter experts, assessment of conventional concrete, wind energy industries, conference proceedings, peer-reviewed articles, participation in American Concrete Institute 3DCP committees, and the stakeholder risk assessment workshop.
- Expand 3DCP R&D and education capabilities that include, but are not limited to:
  - Organize 3DCP seminars and create 3DCP related materials for informational outreach events.
  - Develop a *3DCP Informational Materials Brochure and Webpage*

Products:

- 3DCP Technical Report
- 3DCP Informational Materials Brochure and Webpage

TASK 8 EVALUATION OF PROJECT BENEFITS

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

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:

  - <u>For Product Development Projects and Project Demonstrations:</u>
    - Published documents, including date, title, and periodical name.
    - Estimated or actual energy and cost savings and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
    - Greenhouse gas and criteria emissions reductions.
    - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
    - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.

- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
- Additional Information for Product Development Projects:
    - Outcome of product development efforts, such copyrights and license agreements.
    - Units sold or projected to be sold in California and outside of California.
    - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
    - Investment dollars/follow-on private funding as a result of Energy Commission funding.
    - Patent numbers and applications, along with dates and brief descriptions.
- Additional Information for Product Demonstrations:
    - Outcome of demonstrations and status of technology.
    - Number of similar installations.
    - Jobs created/retained as a result of the Agreement.

o For Information/Tools and Other Research Studies:

- Outcome of project.
- Published documents, including date, title, and periodical name.
- A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
- The number of website downloads.
- An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
- An estimate of energy and non-energy benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.

- Respond to CAM questions regarding responses to the questionnaires.

The Energy Commission may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

Products:

- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

TASK 9 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES

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

The Recipient shall:

- Prepare an *Initial Fact Sheet* at start of the project that describes the project. Use the format provided by the CAM.
- Prepare a *Final Project Fact Sheet* at the project's conclusion that discusses results. Use the format provided by the CAM.
- Prepare a *Technology/Knowledge Transfer Plan* that includes:
  - An explanation of how the knowledge gained from the project will be made available to the public, including the targeted market sector and potential outreach to end users, utilities, regulatory agencies, and others.
  - A description of the intended use(s) for and users of the project results.
  - Published documents, including date, title, and periodical name.
  - Copies of documents, fact sheets, journal articles, press releases, and other documents prepared for public dissemination. These documents must include the Legal Notice required in the terms and conditions. Indicate where and when the documents were disseminated.
  - A discussion of policy development. State if project has been or will be cited in government policy publications, or used to inform regulatory bodies.
  - The number of website downloads or public requests for project results.
  - Additional areas as determined by the CAM.
- Conduct technology transfer activities in accordance with the Technology/Knowledge Transfer Plan. These activities will be reported in the Progress Reports.
- When directed by the CAM, develop *Presentation Materials* for an Energy Commission-sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California Energy Commission.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.
- Prepare a *Technology/Knowledge Transfer Report* on technology transfer activities conducted during the project.

Products:

- Initial Fact Sheet (draft and final)
- Final Project Fact Sheet (draft and final)

- Presentation Materials (draft and final)
- High Quality Digital Photographs
- Technology/Knowledge Transfer Plan (draft and final)
- Technology/Knowledge Transfer Report (draft and final)

TASK 10 PRODUCTION READINESS PLAN

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

The Recipient shall:

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

Products:

- Production Readiness Plan (draft and final)

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

RESOLUTION NO: 20-0408-9a

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: JASON COTRELL, DBA RCAM TECHNOLOGIES

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-19-007 with Jason Cotrell dba RCAM Technologies for a $2,999,979 grant to design, manufacture, demonstrate, and test prototypes of wind tower sections and offshore wind energy components using an onsite three-dimensional concrete printed (3DCP) manufacturing process and design. The advancement in scientific knowledge in 3DCP materials, manufacturing methods and large-scale structural performance will facilitate the deployment of large land-based and offshore wind technologies that use 3DCP manufacturing methods to increase the cost-competitiveness of the wind energy generation needed to meet California's statutory energy goals; 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 Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the CEC held on April 8, 2020.

AYE:
NAY:
ABSENT:
ABSTAIN:

_____
Cody Goldthrite
Secretariat