



**CALIFORNIA  
ENERGY COMMISSION**



**California Energy Commission  
September 13, 2023 Business Meeting  
Backup Materials for Agenda Item No 05c:  
Caliskaner Water Technologies, Inc.**

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: Caliskaner Water Technologies, Inc.**

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

**RESOLVED**, that the CEC approves agreement EPC-23-013 with Caliskaner Water Technologies, Inc. for a \$7,190,593 grant to implement and demonstrate three innovative advanced sludge separation treatment technologies to reduce wastewater treatment plant energy consumption and greenhouse gas emissions at a facility in Olivehurst; 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 September 13, 2023.

AYE:  
NAY:  
ABSENT:  
ABSTAIN:

Dated:

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Kristine Banaag  
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-23-013

### B. Division Information

1. Division Name: ERDD
2. Agreement Manager: Anish Gautam
3. MS-:51
4. Phone Number: 916-776-0759

### C. Recipient's Information

1. Recipient's Legal Name: Caliskaner Water Technologies, Inc.
2. Federal ID Number: 85-2235177

### D. Title of Project

Title of project: Demonstration of Advanced Sludge Separation Treatment Technologies for Decarbonization of Wastewater Treatment Plants

### E. Term and Amount

1. Start Date: 9/30/2023
2. End Date: 3/31/2028
3. Amount: \$7,190,593.00

### F. Business Meeting Information

1. Are the ARFVTP agreements \$75K and under delegated to Executive Director? No
2. The Proposed Business Meeting Date: 9/13/2023 .
3. Consent or Discussion? Discussion
4. Business Meeting Presenter Name: Michael Lozano
5. Time Needed for Business Meeting: 5 minutes.
6. The email subscription topic is: EPIC (Electric Program Investment Charge).

#### **Agenda Item Subject and Description:**

**Caliskaner Water Technologies, Inc.** Proposed resolution approving agreement EPC-23-013 with Caliskaner Water Technologies, Inc. for a \$7,190,593 grant to implement and demonstrate three innovative advanced sludge separation treatment technologies to reduce wastewater treatment plant energy consumption and greenhouse gas emissions at a facility in Olivehurst, and adopting staff's determination that this action is exempt from CEQA. (EPIC funding)  
Contact: Michael Lozano

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

#### 1. 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":



Agreement will not cause direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because:

**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.

Cal. Code Regs., tit. 14, Section 15301, Existing Facilities, provides an exemption for the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing structures, facilities, mechanical equipment or topographical features involving negligible or no expansion of use beyond that existing. The project involves temporary pipelines to divert wastewater and sludge between various demonstration units. All work will occur within the current Linda WWTP site boundaries. There will be negligible or no expansion of existing use. This work will not result in a serious or major disturbance to an environmental resource. Therefore, the project falls within Section 15301 and will not have a significant effect on the environment.

The project will not impact an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies; does not involve any cumulative impacts of successive projects of the same type in the same place that might be considered significant; does not involve unusual circumstances that might have a significant effect on the environment; will not result in damage to scenic resources within a highway officially designated as a state scenic highway; the project site is not included on any list compiled pursuant to Government Code section 65962.5; and the project will not cause a substantial adverse change in the significance of a historical resource. Therefore, none of the exceptions to categorical exemptions listed in CEQA Guidelines section 15300.2 apply to this project, and this project will not have a significant effect on the environment.

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
Linda County Water District	\$ 283,258	\$0
Beyond The Dome, Inc.	\$ 2,433,862	\$0
Aqua-Aerobic Systems, Inc.	\$ 98,988	\$0
Heron Innovators, Inc.	\$ 85,000	\$0
Process Wastewater Technologies, LLC	\$ 80,000	\$0
AECOM	\$ 300,844	\$0
George Tchobanoglous	\$ 25,000	\$0
Usafi Technologies, LLC	\$ 55,000	\$0
Water Environment Research Foundation	\$ 40,817	\$0
BASE ENERGY, Inc.	\$ 55,000	\$0
TBD - General Contractor	\$ 94,500	\$0
General Contractor - Mechanical (TBD)	\$ 96,000	\$0
General Contractor - Electrical (TBD)	\$ 93,000	\$0
General Contractor - Instrumentation & Controls	\$ 97,500	\$0
Specialized Sludge Management Contractor (TBD)	\$ 59,600	\$0

### 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
No vendors to report	\$	\$

**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.

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	21-22	301.0011	\$ 7,190,593

**TOTAL Amount: \$ 7,190,593**

R&D Program Area: EERB: IAW

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: Onder Caliskaner

Address: 2733 Brookshire Cir

City, State, Zip: Woodland, CA 95776-5534

Phone: 530-219-067

E-Mail: onder@cwatertech.com

**3. Recipient’s Project Manager**

Name: Onder Caliskaner

Address: 2733 Brookshire Cir

City, State, Zip: Woodland, CA 95776-5534

Phone: 530-219-067



E-Mail: [onder@cwatertech.com](mailto:onder@cwatertech.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-22-301
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”.

Item 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	Yes

**Approved By**

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

**Agreement Manager:** Anish Gautam

**Approval Date:** 7/31/2023

**Branch Manager:** Virginia Lew

**Approval Date:** 7/31/2023

**Director:** Virginia Lew for Angela Gould

**Approval Date:** 7/31/2023

**Exhibit A**  
**Scope of Work**  
**Caliskaner Water Technologies, Inc.**

**I. TASK ACRONYM/TERM LISTS**

**A. Task List**

<b>Task #</b>	<b>CPR<sup>1</sup></b>	<b>Task Name</b>
1		General Project Tasks
2		Design, Fabrication, and Installation of Advanced Sludge Separation Technologies
3		Monitoring of Baseline (Conventional) Treatment System
4	X	Operation and Monitoring of Advanced Sludge Separation Treatment Technologies
5		Performance Evaluation of Advanced Sludge Separation Treatment Technologies
6		Economic Evaluation of Advanced Sludge Separation Treatment Technologies Versus Conventional Systems
7		Project Measurement and Verification
8		Evaluation of Project Benefits
9		Technology/Knowledge Transfer Activities

**B. Acronym/Term List**

<b>Acronym/Term</b>	<b>Meaning</b>
AD	Anaerobic Digestion
APT	Advanced Primary Treatment
ASST	Advanced Sludge Separation Treatment
BEAM	Biosolids Emissions Assessment Model
BOD	Biological Oxygen Demand
BFT	Biosolids Filtration Thickener
CEC	California Energy Commission
COD	Chemical Oxygen Demand
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CPT	Conventional Primary Treatment
CPR	Critical Project Review
DAF	Dissolved Air Flootation Thickener
GT	Gravity Thickener
GHG	Greenhouse Gas
GPM	Gallons Per Minute
M&V	Measurement and Verification
MGD	Million Gallons Per Day
RDT	Rotary Drum Thickener
sCOD	Soluble Chemical Oxygen Demand
SCADA	Supervisory Control And Data Acquisition

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



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<b>Acronym/Term</b>	<b>Meaning</b>
SAF	Suspended Air Floatation
TAC	Technical Advisory Committee
TSS	Total Suspended Solids
Ultra-SCWO	Ultra-Super Critical Water Oxidation
VSS	Volatile Suspended Solids
VT	Volute Thickener
WAS	Waste Activated Sludge (from secondary treatment clarifiers)
WWTP	Wastewater Treatment Plant

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

**A. Purpose of Agreement**

The purpose of this Agreement is to demonstrate pilot-scale innovative advanced sludge separation treatment technologies (ASST), gather energy data, and promote technology to help achieve California’s goals. During the project, two sludge thickening technologies and one sludge destruction technology will be demonstrated under real-world conditions with independent third-party measurement and verification on energy savings, capital and operational costs, and overall treatment performance compared to currently used method of rotary drum thickeners, gravity thickeners and anaerobic digestion. By implementing ASST technologies, Wastewater Treatment Plants (WWTP) could operate beyond energy neutrality and into net energy production with significantly reduced GHG emissions. Additional benefits of ASST systems are increased treatment performance and capacity, and reductions in energy consumption and treatment footprint.

**B. Problem/ Solution Statement**

**Problem**

For many cities and towns, WWTPs are the largest energy consumers that account for up to 3 percent of global electricity consumption<sup>2</sup> and are among the largest GHG emitters at nearly 1.57 percent of global GHG emissions<sup>3</sup>.

Anaerobic Digestion (AD) is the commonly used conventional sludge treatment technology used at WWTPs. Unfortunately, AD process does not capture all the latent energy in wastewater, is not economically feasible for WWTPs smaller than 5 MGD in size and is a significant source of GHG emissions. AD produces biogas, a mixture of impure methane and carbon dioxide that often gets flared, but can also be used to produce energy at larger plants. To do so, methane gas needs to be separated from the carbon dioxide gas and then purified (e.g., removal of siloxanes) before being burned to produce electricity. Replacement of incumbent AD process

<sup>2</sup> Lu, L., Guest, J. S., Peters, C. A., Zhu, X., Rau, G. H., & Ren, Z. J. (2018). “Wastewater treatment for carbon capture and utilization”. *Nature Sustainability*, 1(12), 750-758.

<sup>3</sup> IPCC Climate Change 2014: Mitigation of Climate Change (eds Edenhofer, O. et al.) (Cambridge Univ. Press, 2014).

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with innovative and more efficient sludge treatment technologies is an essential step to take to achieve decarbonization of WWTPs.

Thickening technologies are used at WWTPs to condition the sludge. The wastewater treatment industry predominantly uses conventional thickening systems [e.g., rotary drum thickeners (RDT), gravity thickeners (GT), dissolved air floatation (DAF)] which rely mostly on gravitational forces and use of polymers. These conventional systems have lower solids capture rates (60 to 80%) and higher GHG emissions compared to advanced separation thickening technologies proposed in this project.

**Solution**

Implementing ASST technologies is an essential step for decarbonization of WWTPs. With advanced and efficient technologies WWTPs could operate beyond energy neutrality and into net energy production while significantly reducing GHGs. Understanding this opportunity, several technology providers have developed advanced sludge separation, thickening and treatment technologies. The proposed project will demonstrate three promising ASST technologies. The proposed ASST technologies offer significant decarbonization reduction benefits for WWTPs by decreasing GHG emissions, energy consumption, polymer use, and footprint/concrete requirement compared to the conventional sludge thickening [e.g., via RDT, DAF, GT] systems followed by AD for sludge/biosolids treatment. ASST is a key strategic process in bringing about energy and GHG reductions while increasing resource recovery. In this project, ASST technologies will be demonstrated both for conventional primary treatment and advanced primary treatment systems. The ASST systems aim to replace the incumbent AD process for sludge treatment and inefficient conventional thickening technologies (rotary drum dryers and gravity thickeners). In this project a net-zero energy (towards energy positive) WWTP with significant GHG emission reductions (up to 35 percent) will be demonstrated. By contrast to the gas purification step required for AD, ultra-SCWO technology produces electricity by expanding the gas effluent that contains carbon dioxide free from impurities such as siloxanes. Some ultra-SCWO users could capture the carbon dioxide produced. In this project, a technology economic analysis will be conducted for bottling of carbon dioxide.

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

**Agreement Goals**

The goals of this Agreement are to:

- Demonstrate two advanced sludge thickening technologies [Biosolids Filtration Thickener (BFT) and Suspended Air Floatation (SAF)] for conventional and advanced primary and secondary treatment systems and compare their decarbonization, energy, treatment, and cost benefits against conventional sludge thickening technologies [e.g., RDT, GT, and DAF]
- Demonstrate an advanced sludge treatment / destruction technology [Ultra-Super critical Water Oxidation (Ultra-SCWO)] for conventional and advanced primary and secondary treatment systems and compare their decarbonization, energy, treatment, and cost benefits against the conventional sludge treatment technology - Anaerobic Digestion.
- Conduct independent measurement and verification study to evaluate if the ASST technologies proposed are technically viable and commercially attractive approaches against conventional sludge treatment technologies. The project's goals are to prove the

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following benefits for WWTPs:

- Decrease GHG emissions by at least 30 percent.
- Decrease energy usage by at least 25 percent.
- Decrease operational and maintenance costs by at least 15 percent.
- Decrease footprint by at least 60 percent.
- Increase sludge treatment performance by at least 20%

**Ratepayer Benefits:**<sup>4</sup> This Agreement will result in the ratepayer benefits for GHG reductions, greater electrical cost savings, electrical reliability, and operational & capital cost savings from using advanced and innovative sludge treatment technologies instead of less efficient conventional sludge treatment technologies including anaerobic digestion. Assuming a market penetration of 25% of advanced sludge treatment systems, *we expect 250,000 metric tons CO<sub>2</sub>e of GHG emission to be avoided and 0.38 TWh of energy to be saved every year.* The electricity savings from the implementation of ASST can also reduce the peak electric loads for WWTPs. Locally, this results in reduced congestion on utility distribution circuits and subsequent demand charges incurred by these facilities as large industrial customers. Grid-wide, this reduces reliance on more expensive, less efficient peaking power plants to balance the electric load, reducing the marginal cost of electricity. Reductions in electric load and increases in facility energy self-sufficiency increase the resilience of these facilities against disruptions from broader electric grid outages.

**Technological Advancement and Breakthroughs:**<sup>5</sup> This Agreement will lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory decarbonization and energy goals by improving sludge/biosolids treatment at WWTPs. Raw wastewater contains significant chemical energy [ $\sim 1.8$  kWh/lb chemical oxygen demand (COD)]<sup>6</sup>, that can be recovered to achieve energy self-sufficiency and reduce GHG emissions. The principal objective of this proposed project is to implement and demonstrate the application of three innovative and high efficiency advanced sludge separation treatment (ASST) technologies. ASST technologies are particularly strategic energy saving wastewater systems which can redirect this chemical energy, recover resources while, allowing WWTPs to operate beyond energy neutrality and achieve the goal of significantly reducing GHG emissions. Furthermore, additional benefits can be realized when ASST technologies are used alongside advanced primary treatment (APT) technologies.

**Agreement Objectives**

The objectives of this Agreement are to:

- Evaluate and quantify treatment removal performances of ASST technologies by monitoring influent and effluent sludge/biosolids data including organics destruction rates and solids concentrations (via continuous in-line analyzers and laboratory samples) and compare results against baseline (conventional) sludge treatment performance.
- Evaluate and quantify hydraulic performances of ASST technologies by monitoring sludge

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<sup>4</sup> California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, [http://docs.cpuc.ca.gov/PublishedDocs/WORD\\_PDF/FINAL\\_DECISION/167664.PDF](http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF)).

<sup>6</sup> Heidrich, E.S., Curtis, T.P, and Dolfing, J (2011) "Determination of the Internal Chemical Energy of Wastewater," Environ. Sci. Technol. 45, 827-832.

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- flow rates and treatment capacity.
- Calculate and evaluate the energy savings benefits of ASST technologies based on observed treatment and hydraulic performance data.
  - Calculate and evaluate the reductions in GHG emissions resulting from ASST technologies based on observed treatment and hydraulic performance data.
  - Conduct a measurement and verification (M&V) study to compare conventional sludge/biosolids treatment system's energy data to ASST system's energy data and quantify the energy savings and GHG emission reductions achieved by replacing conventional sludge treatment system (e.g., RDT followed by AD with Co-gen) with advanced sludge treatment system (e.g., SAF followed by Ultra-SCWO).
  - Conduct an economic evaluation using established and state of the art cost estimating methods with data obtained from operation and performance evaluation of the ASST systems. Operators logs, invoices for consumables and replacement parts, field PLC data on each system, and performance evaluation data will be utilized to conduct a life cycle analysis and estimate construction, capital and operational costs of the advanced treatment technologies.
  - Conduct technology transfer activities including workshops, a utility engagement program, webinars, end user and conference presentations, and publications.

### III. TASK 1 GENERAL PROJECT TASKS

#### PRODUCTS

##### Subtask 1.1 Products

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

##### The Recipient shall:

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

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

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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**

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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 technical portion of the meeting will include discussion of the following:

- The CAM’s expectations for accomplishing tasks described in the Scope of Work;
  - An updated Project Schedule;
  - Technical products (subtask 1.1);
  - Progress reports (subtask 1.5);
  - Final Report (subtask 1.6);
  - Technical Advisory Committee (TAC) meetings (subtasks 1.10 and 1.11); and
  - Any other relevant topics.
- Provide *Kick-off Meeting Presentation* to include but not limited to:
    - Project overview (i.e. project description, goals and objectives, technical tasks, expected benefits, etc.)
    - Project schedule that identifies milestones
    - List of potential risk factors and hurdles, and mitigation strategy
  - Provide an *Updated Project Schedule, Match Funds Status Letter, and Permit Status Letter*, as needed to reflect any changes in the documents.

**The CAM shall:**

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

**Recipient Products:**

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

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**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.

**The Recipient shall:**

- Prepare and submit a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

**The CAM shall:**

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

**Recipient Products:**

- CPR Report(s)

**CAM Products:**

- CPR Agenda(s)

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- 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



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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)

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- 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 no match funds were part of the proposal that led to the CEC awarding this Agreement and none have been identified at the time this Agreement starts, then state this in the letter.

If match funds were a part of the proposal that led to the CEC awarding this Agreement, then provide in the letter:

- A list of the match funds that identifies:
  - The amount of cash match funds, their source(s) (including a contact name, address, and telephone number), and the task(s) to which the match funds will be applied.

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- 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*.

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- 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 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.

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- 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.

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**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 section of the *Initial Project Benefits Questionnaire*, developed in the Evaluation of Project Benefits task, to the CAM.

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- 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 DESIGN, FABRICATION, AND INSTALLATION OF ADVANCED SLUDGE SEPARATION TREATMENT SYSTEMS**

The goal of this task is to maximize the utilization of existing equipment and infrastructure at the deployment site and design and install demonstration-scale ASST technologies.

**The Recipient shall:**

- Reach an agreement with the authorized representative(s) of the selected deployment site regarding the project timeline, space reserved for the project, equipment installation, permit and insurance, indemnity, and the Recipient's use of support staff and installation and removal of equipment.
- Work with the CAM to select new deployments site(s) if the selected deployment site becomes unavailable during the project term or to add additional deployment sites,
- Execute a Contract with Deployment Site that confirms the agreement reached above and provide a *Copy of Contract with Deployment Site* to the CAM.
- Design and install provisions to the existing equipment and infrastructure at the deployment site to support the operation of demonstration-scale ASST technologies.
- Design, fabricate, and install one BFT (Biosolids Filtration Thickener, with a capacity of approximately 100 gpm) for thickening of advanced primary treatment (APT) sludge.
- Design, fabricate, and install one SAF (Suspended Air Floatation, with a capacity of approximately 30 gpm) for thickening of conventional primary treatment (CPT), APT, and waste activated sludge (WAS, from secondary clarifier).
- Design, fabricate, and install one Ultra-SCWO (Ultra-Super Critical Water Oxidation, with a capacity of 4 gpm) to destruct thickened sludge from conventional systems and advanced thickening systems of BFT and SAF.
- Prepare and submit *Plans, Schedule, and Specifications Report* for each of the ASST systems. The report shall include but not be limited to:

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- Site-specific piping, mechanical, structural, and electrical requirements
- Identifying all required site-specific modifications necessary for demonstration of the ASST systems (BFT, SAF, Ultra-SCWO) and all associated support hardware(s) and software(s)
- For Ultra-SCWO – CO<sub>2</sub> bottling design and implementation summary report including disposition of the bottled CO<sub>2</sub>
- Prepare and submit *Design and Fabrication Summary Report* for each of the ASST systems. The report shall include but not be limited to:
  - Design criteria
  - Operational criteria
  - Maintenance requirements
  - Fabrication schedule
- Prepare and submit *Deployment Summary Report* for each of the ASST systems. The report shall include but not be limited to:
  - Deployment plan and strategies
  - Deployment schedule
  - Lessons learned and summary of corrective actions
- Prepare and submit *Ultra-SCWO CO<sub>2</sub> Report* to include but not be limited to:
  - CO<sub>2</sub> bottling design criteria
  - Operational criteria
  - Maintenance requirements
  - Implementation protocol
- Prepare and provide *Signed Letter of Acceptance* to be signed by deployment site that includes but is not limited to: 1) written documentation that installation of the demonstration systems are complete, 2) verification that demonstration systems are ready for start-up, operation, monitoring, and verification.

**Products**

- Copy of Contract with Deployment Site
- Plans, Schedule, and Specifications Report
- Design and Fabrication Summary Report for each of the ASST systems
- Deployment Summary Report for each of the ASST systems
- Ultra-SCWO CO<sub>2</sub> Report
- Signed Letter of Acceptance

**TASK 3 MONITORING OF BASELINE (CONVENTIONAL) SLUDGE TREATMENT SYSTEM**

The goals of this task are to collect and analyze data from the operation of the conventional sludge treatment system of RDT and AD systems at deployment site. The performance data obtained for RDT followed by AD will be used to establish baseline performance data for demonstration of the ASST systems to compare with and quantify the improved treatment, energy, and hydraulic performances.

**The Recipient shall:**

- Evaluate performance of the conventional RDT and AD systems at the demonstration site WWTP under normal operating conditions for at least 6 months. Baseline performance data will be obtained to include the following:
  - Solids content (for RDT and AD)



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- Solids capture rates (for RDT)
- GHG emissions: monitor for methane, nitrous oxide (for AD)
- VSS destruction rate (for AD)
- Total organics destruction rate (for AD)
- Emerging contaminants removed (for AD)
- Mass percent solid by-product removed
- Percent water recovery (for RDT)
- Quality of filtrate (RDT)
- Quality of AD Return Digestate (AD)
- Energy recovery
- Flowrate
- Conduct inline continuous field measurements related to sludge treatment performance.
- Conduct sampling for offsite laboratory analyses. Sludge and wastewater quality tests will be conducted to (1) evaluate treatment performance for specific constituents, (2) correlate and confirm electricity savings with the industry operating parameters, and (3) ensure that the overall sludge wastewater treatment processes are not negatively impacted by ASST demonstrations and necessary measurements/actions are taken on time if necessary.
- Prepare and provide a *Conventional System Baseline Report* to summarize findings from collection and analysis of the baseline performance data, field measurements, and sludge and wastewater quality tests.

**Products**

- Conventional System Baseline Report

**TASK 4 OPERATION, MONITORING AND DEMONSTRATION OF ADVANCED SLUDGE SEPARATION TREATMENT SYSTEMS**

First main goal of this task is to start-up and operate the ASST systems for conventional primary and secondary treatment systems. Sludge generated from CPT and WAS will be thickened using SAF and then the thickened sludge will be treated using Ultra-SCWO. The performance of SAF and SCWO will be demonstrated for conventional wastewater treatment systems and settings. Second main goal of this task is to start-up and operate the ASST systems for advanced primary and secondary treatment systems by conveying the primary filter sludge and secondary treatment waste activated sludge to the ASST systems. Sludge generated from APT system and WAS will be thickened using BFT and SAF systems to achieve solids concentrations ranging from 2 to 4 percent. Thickened sludge will then be treated with Ultra-SCWO. Performance of ASST systems will be evaluated for APT sludge and WAS at different solids concentration levels and for polymer addition (i.e., for thickening) procedures and criteria to reduce carbon footprint and GHG emissions.

**The Recipient shall:**

- Operate and demonstrate the conventional and advanced sludge treatment trains for conventional primary and secondary treatment systems.
  - In Baseline-1 demonstration phase CPT sludge and Waste Activated Sludge (WAS) will be thickened and stabilized using the existing conventional RDT and AD systems, respectively. The scope of Baseline-1 is to demonstrate the baseline performance of conventional sludge treatment.
  - In Proposed-1 demonstration phase, CPT sludge and WAS are thickened using advanced sludge thickening technology SAF without polymer addition, and thickened sludge is treated (i.e., destructed) using Ultra-SCWO. The scope of

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Proposed-1 demonstration include: (1) demonstrate the performance of SAF and SCWO in conventional wastewater treatment settings; (2) evaluate the performance of SAF without chemical addition; and (3) demonstrate the efficiency of SCWO at lower influent solid concentrations (2-4 percent).

- Operate and demonstrate the conventional and advanced sludge treatment trains for advanced primary and secondary treatment systems.
  - In Baseline-2 demonstration phase, APT sludge and WAS sludge will be treated using the existing conventional RDT and AD systems at Linda WWTP.
  - In Proposed-2 demonstration phase, APT sludge is thickened using advanced sludge thickening technology BFT and WAS is thickened using SAF, both without polymer additions. Thickened sludge (2-4 percent solids concentration) is then conveyed to the advanced sludge treatment technology Ultra-SCWO. The scope of Proposed-2 demonstration include: (1) evaluate the performance of advanced sludge treatment with APT sludge and WAS; (2) test the performance of advanced sludge thickening technologies without polymer additions; (3) demonstrate the performance of SCWO with APT sludge at lower influent solid concentrations (2-4 percent).
  - In Proposed-3 demonstration phase, APT sludge and WAS are thickened to a higher solid concentration (4-5 percent) using the existing Volute Thickener (VT) system at deployment site before sending to Ultra-SCWO. The scope of Proposed-3 demonstration includes (1) evaluate the performance of SCWO at higher influent solids concentration (4-5 percent) in advanced wastewater treatment and (2) optimize polymer concentrations for VT to reduce carbon footprint and GHG emissions.
- Operate the ASST systems to compare with performance of Conventional Baseline System at Task 3 above. Following criteria will be monitored:
  - Solids content (for SAF and BFT), minimum performance two percent solids, target higher than three percent
  - Solids capture rates (for SAF and BFT), minimum performance 80 percent, target higher than 90 percent
  - Total organics destruction rate (for Ultra-SCWO), minimum performance 70 percent, target higher than 99 percent
  - Emerging contaminants removed (for Ultra-SCWO), minimum performance 90 percent, target higher than 99 percent
  - Mass percent solid by-product removed
  - Percent water recovery (for SAF and BFT)
  - Quality of filtrate (SAF and BFT)
  - Effluent Quality (for Ultra-SCWO)
  - Energy recovery (for ultra-SCWO); Net power production with conventional feed, target 31 kW; Net power production with advanced primary treatment feed, target 43 kW and indicate amount of load reduction this could represent for the deployment site.
  - Flowrate
  - Greenhouse gases emissions with conventional feed, removal of 960 tons CO<sub>2</sub>e/yr and indicate amount of GHG emission reduction this could represent for the deployment site.
- Prepare and submit *Demonstration System Test Plan* including information for each demonstration-phase.
- Conduct inline continuous field measurements related to sludge, wastewater treatment

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- performance, GHG emissions evaluations, and electrical power consumption.
- Conduct sludge and wastewater quality sampling for offsite laboratory analyses.
- Prepare and submit *Demonstration System Operational Report* including information for each demonstration phase at the conclusion of each demonstration. *Demonstration System Operational Report* must include performance criteria listed.
- Participate in CPR per Subtask 1.3 and prepare *CPR Report #1* describing project's status and products delivered.

**Products**

- Demonstration System Test Plan
- Demonstration System Operational Report
- CPR Report #1

**TASK 5 PERFORMANCE EVALUATION OF ADVANCED SLUDGE TREATMENT SYSTEMS COMPARED TO CONVENTIONAL SLUDGE TREATMENT SYSTEMS**

The goal of this task is to conduct a detailed performance analysis based on the results obtained from the operation of the ASST systems.

**The Recipient shall:**

- Compile all of the conventional/baseline sludge treatment system's (i.e., RDT followed by AD) performance data including inline field measurements and offsite laboratory sampling results.
- Prepare and submit *Energy, GHG, Treatment, and Capacity Performance Analysis Progress Report* including information for each ASST system. Under this task Energy, GHG, treatment, and Capacity performance data will be reviewed and evaluated for the baseline/conventional and advanced sludge treatment demonstration systems. The analysis will provide sludge quality and quantity results for thickening systems including: solids capture rates, solids contents, percent water recovery, quality of filtrate and thickened sludge for organic and inorganic contaminants (e.g., BOD, COD, sCOD, TSS, VSS, ammonia, and TKN). The analysis will provide sludge quality and quantity results for sludge treatment systems including: VSS destruction rates, total organics destruction rates, effluent quality (i.e., digested sludge for AD and water for Ultra-SCWO) for organic and inorganic contaminants (e.g., BOD, COD, sCOD, TSS, VSS, ammonia, and TKN). AD sludge return system will be analyzed for flow rates, quantity, and quality including ammonia, BOD, COD, sCOD, TSS, and VSS. Effluent from conventional and advanced sludge treatment systems will be analyzed for emerging contaminants including PFAS, microplastics and all other organic emerging contaminants and level of destruction comparison between conventional and advanced sludge treatment systems (i.e, partial versus complete destruction).
- Prepare and submit *GHG Reduction and Energy Analysis Report* including information for each ASST system and whether the goals and objectives in Section II.C (of GFO-22-301) were met. Under this task, GHG, power and energy data will be reviewed and evaluated for the baseline, full-scale and demonstration-scale systems. Power demand and energy consumption for the existing conventional sludge treatment system will be collected and evaluated. For each ASST technology, the power demand and duty cycles will be quantified and the energy consumption will be integrated. The energy cost will be calculated using demonstration WWTP's actual tariff structure. Other tariff structures will be considered to quantify the cost under different scenarios corresponding to other plant

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sizes and areas of California, to promote technology transfer and broaden the applicability of the project results.

- Prepare and submit *Process Computer Model Report* for deployment WWTPs using conventional and advanced sludge treatment systems included in the project. Establish, calibrate, and use a computer process model using the process performance results to simulate performance and benefits for full flow rates of demonstration WWTP and ultimate expansion (i.e., plant capacity of 5.5 MGD and ultimate expansion of 15 MGD). Simulations will be conducted for the following scenarios to compare performance of conventional sludge treatment systems versus the 3 proposed sludge demonstration trains described above. Simulations will be conducted to compare performance of ASST systems when operated with conventional versus advanced primary and secondary treatment systems. The modeling objectives are to (1) assess sludge treatment performances, (2) estimate energy recovery/production amounts, (4) estimate impacts on the overall treatment and capacity performance of the liquid process trains, and (5) estimate the overall energy efficiency.
- Use an industry accepted GHG emissions prediction model (e.g., BEAM) to estimate the benefits of implementation of ASST systems (i.e., BFT, SAF, and Ultra-SCWO) compared to using conventional sludge treatment system involving the use of AD with Co-gen. The GHG model will first be calibrated and established baseline conditions using the performance results obtained under Task 3 for conventional sludge treatment systems. GHG emissions will be compared from conventional and advanced sludge treatment scenarios presented in the sludge treatment demonstration trains described above. The factors that have the greatest impact on increasing or reducing GHG emissions will be analyzed.
- Prepare and submit *General California WWTP Process Computer Model Report* to evaluate the impacts of ASST systems for plants using different main process treatment trains and at different flow rates: Establish, calibrate, and use the computer process model for four (4) other main WWTP types in California with the following characteristics: 1) WWTP with a flow capacity of 10 MGD which is designed to achieve BOD removal and nitrification, 2) WWTP with a flow capacity of 10 MGD which is designed to achieve BOD removal only, 3) WWTP with a flow capacity of 100 MGD which is designed to achieve BOD removal and nitrification, 4) WWTP with a flow capacity of 100 MGD which is designed to achieve BOD removal only.

**Products:**

- Energy, GHG, Treatment, and Capacity Performance Analysis Progress Report
- GHG Reduction and Energy Analysis Report
- Process Computer Model Report
- General California WWTP Process Computer Model Report

**TASK 6 - ECONOMIC EVALUATION OF ADVANCED SLUDGE SEPARATION TREATMENT SYSTEMS VERSUS CONVENTIONAL SYSTEMS**

The goal of this task is to estimate construction/capital and operational costs of the ASST technologies based on results obtained from the project and the Advancement of Cost Engineering (AACE) guidelines.

**The Recipient shall:**

- Determine the capital costs for each ASST technology. Cost estimating framework will

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utilize a five level Class System (5, 4, 3, 2, and 1) which corresponds to estimate types prepared at various stages of project development. With the five class levels defined as follows:

- Class 5 cost estimates are developed at project conception when little project information or scope has been developed.
- Class 4 level cost estimate (with -30 to +50 percent level accuracy) would be suitable for project sites with pilot testing or modeling results obtained with ASST technologies and additional information including: process flow diagram, design criteria, general site layout, pipeline corridors, preliminary equipment list, preliminary electrical loads.
- Class 3 level cost estimate (with -20 to +30 percent level of accuracy) is conducted for 30 to 60 percent level design projects and includes information on: semi-detailed unit costs with assembly level line items, final equipment list, site layout, building facility plans, major sections, concrete quantities, final process and instrumentation diagrams, electrical single lines.
- Class 1 and 2 estimates are based on detailed unit costs and take off estimates with complete or near complete scope definition (60 percent to 100 percent design stages of actual construction projects).
- Develop and submit *Capital Cost Estimations Report* to summarize the above findings.
- Evaluate the operational and cost savings of Ultra-SCWO versus AD, and evaluate the operational and cost savings of BFT and SAF versus conventional thickening method of RDT or DAF. Operational costs will be closely monitored for the conventional treatment system and the ASST systems during each demonstration phase. The following will be utilized to evaluate and quantify operational costs: 1) daily logs to track operator time for routine operations and maintenance activities as well as specialized maintenance tasks, 2) troubleshooting logs that record breakdowns and/or out of spec operation and associated costs to bring the system back online, 3) invoices for consumables such as chemicals, 4) invoices for replacement parts, 5) labor and material costs will be recorded for each APT technology during the demonstration period. If costs are not significant, the project team will coordinate with the manufacturers to estimate remaining lifetime and associated costs.
- Develop and submit *Operational and Cost Savings Report* to summarize the above findings.
- Conduct life cycle cost analysis using the capital, operational, and maintenance costs for conventional and advanced sludge treatment systems over a 30-year period at net discount rate of 3% or other rate with concurrence from the CAM.
- Estimate rate of return for each ASST technology
- Develop and submit *Life Cycle Cost Analysis Report* to summarize the above findings.

**Products:**

- Capital Cost Estimations Report
- Operational and Cost Savings Report
- Life Cycle Cost Analysis Report

**TASK 7 PROJECT MEASUREMENT AND VERIFICATION**

The goal of this task is to conduct an independent third-party measurement and verification (M&V) to measure and quantify project benefits.

**Exhibit A**  
**Scope of Work**  
**Caliskaner Water Technologies, Inc.**

**The Recipient shall:**

- Evaluate energy savings by utilizing a third-party energy audit firm. Third party energy audit firm will conduct a Measurement and Verification (M&V) study to quantify the energy savings associated with ASST by comparing the energy consumption for existing plant's baseline and for the replacement of AD with Ultra-SCWO and conventional thickening (e.g., RDT) with BFT or SAF. The M&V process will be utilized to confirm electrical energy savings associated with using ASST both with conventional and advanced primary/secondary treatment systems.
- Identify and confirm the specific project benefits to be measured. At a minimum this will include pre- and post-project energy use (kilowatt hours, kilowatts, therms), and calculations of energy cost savings and GHG emissions. This can include pre- and post-measurements of water use (million gallons) and other project benefits, and calculations of the resulting cost savings and GHG reductions.
- Enter into agreement with a M&V vendor.
- Coordinate site visits with the M&V firm at the demonstration site(s) identified.
- Develop M&V Plan for **pre-install** measurement of: electrical energy consumed by conventional sludge treatment system (i.e., AD followed by RD) system through plant supervisory control and data acquisition (SCADA) or data logging.
- Perform pre-install measurements based on the M&V Plan for pre-install.
- Develop M&V Plan for **post-install** measurement of: Electrical energy consumed by ASST systems.
- Perform post-install measurements based on M&V Plan for post-install.
- Evaluate audited energy consumption values to quantify the energy savings associated with ASST by comparing the energy consumption for existing plant's baseline and for the replacement of AD with Ultra-SCWO and conventional thickening (e.g., RDT or DAF) with BFT or SAF. The M&V process will be utilized to confirm electrical energy savings associated with using ASST both with conventional and advanced primary/secondary treatment systems.
- The M&V Plans will also include the energy consumption measurements as a function of the variations in sludge quality measurements (e.g., for solids concentration, capture efficiency, and VSS destruction).
- Prepare *M&V Findings Report* that includes M&V Plans for pre- and post-install measurements, analysis, and results performed in this task.

**Products:**

- M&V Findings Report

**TASK 8 EVALUATION OF PROJECT BENEFITS**

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

**The Recipient shall:**

- Complete *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

**Exhibit A**  
**Scope of Work**  
**Caliskaner Water Technologies, Inc.**

- New media and publications
- Company growth
- Follow-on funding and awards received
- Complete the *Final Project Benefits Questionnaire*. The Final Project Benefits Questionnaire shall be completed by the Recipient with 'Final' selected for the 'Relevant data collection period' and submitted to the CAM for review and approval.
- Respond to CAM questions regarding the questionnaire drafts.
- Complete and update the project profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://www.energizeinnovation.fund), and provide *Documentation of Project Profile on EnergizeInnovation.fund*, including the profile link.
- If the Prime Recipient is an Innovation Partner on the project, complete and update the organizational profile on the CEC's public online project and recipient directory on the [Energize Innovation website \(www.energizeinnovation.fund\)](http://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 9 TECHNOLOGY TRANSFER ACTIVITIES**

The goal of this task is to ensure the technological learning that resulted from the demonstration(s) is captured and disseminated to the range of professions that will be responsible for future deployments of this technology or similar technologies.

**The Recipient Shall:**

- Develop and submit a *Project Case Study Plan* that outlines how the Recipient will document the planning, construction, commissioning, and operation of the technology or system being demonstrated. The Project Case Study Plan should include:
  - An outline of the objectives, goals, and activities of the case study.
  - The organization that will be conducting the case study and the plan for conducting it.
  - A list of professions and practitioners involved in the technology's deployment.
  - Specific activities the recipient will take to ensure the learning that results from the project is disseminated to those professions and practitioners.
  - Presentations/webinars/training events to disseminate the results of the case study.
- Present the draft *Project Case Study Plan* to the TAC for review and comment.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the draft *Project Case Study Plan*. This document will identify:

**Exhibit A**  
**Scope of Work**  
**Caliskaner Water Technologies, Inc.**

- TAC comments the recipient proposes to incorporate into the final *Technology Transfer Plan*.
- TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit the final *Project Case Study Plan* to the CAM for approval.
- Execute the final Project Case Study Plan and develop and submit a Project Case Study.
- When directed by the CAM, develop presentation materials for a CEC sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California 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.