

GRANT REQUEST FORM (GRF)

CEC-270 (Revised 10/2015)

CALIFORNIA ENERGY COMMISSION

New Agreement ARV-18-024 (To be completed by CGL Office)

600 Fuels and Transportation Division	Messay Betru	6	916-654-4530
Technology & Investment Solutions LLC		61-1703675	
In-situ biomethanation in digesters using carbon dioxide and catalytically derived hydrogen from biogas			
05 / 15 / 2019	09 / 30 / 2021	\$ 2,000,000	

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

Proposed Business Meeting Date	05 / 08 / 2019	<input type="checkbox"/> Consent	<input checked="" type="checkbox"/> Discussion
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Business Meeting Presenter	Messay Betru	Time Needed:	5 minutes
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Please select one list serve. Altfuels (AB118- ARFVTP)

Agenda Item Subject and Description

TECHNOLOGY & INVESTMENT SOLUTIONS LLC. Proposed resolution approving Agreement ARV-18-024 with Technology & Investment Solutions LLC for a \$2 million grant to demonstrate a catalytic biogas reforming process to generate hydrogen syngas from food waste at an existing anaerobic digester in El Mirage, California. The use of this process is expected to create biogas with a higher methane content, which will reduce the capital and operating costs needed to clean up the gas for transportation fuel. The process will also capture and convert CO₂, eliminating the need for flaring.

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":

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:

☒ a) Agreement **IS** exempt. (Attach draft NOE)☐ Statutory Exemption. List PRC and/or CCR section number:☒ Categorical Exemption. List CCR §15301 – Sections 21084; 15301(b) section number:☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section:

The proposed project has been determined to not have a potential to cause significant adverse environmental effects as a result of any onsite unusual circumstances. Therefore, this proposed action is not forecast to cause any potential for significant adverse environmental impacts and qualifies with the requirements for a Class 1 Exemption. The equipment to be installed or modified are contained within the existing facility and will not significantly expand the use beyond that already existing. Therefore, the project falls within section 15301 and will not have a significant effect on the environment.

☐ b) Agreement **IS NOT** exempt. (Consult with the legal office to determine next steps.)

Check all that apply

☐ Initial Study☐ Negative Declaration☐ Mitigated Negative Declaration☐ Environmental Impact Report☐ Statement of Overriding Considerations

Legal Company Name:

Budget

Western Biogas

\$ 365,000

University of Southern California

\$ 397,740

KKC

\$ 98,000

GRANT REQUEST FORM (GRF)

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CALIFORNIA ENERGY COMMISSION



Legal Company Name:
Circle Green, INC
University of Southern California

Funding Source	Funding Year of Appropriation	Budget List No.	Amount
ARFVTP	17/18	601.118J	\$2,000,000
Funding Source			\$
Funding Source			\$
Funding Source			\$
Funding Source			\$
R&D Program Area: N/A			\$2,000,000
Explanation for "Other" selection			
Reimbursement Contract #:		Federal Agreement #:	

Name:	Christian Tasser	Name:	Christian Tasser
Address:	2913 El Camino Real #527	Address:	2913 El Camino Real #527
City, State, Zip:	Tustin, CA 92782	City, State, Zip:	Tustin, CA 92782
Phone:	714-702-4943	Fax:	- -
E-Mail:	christian@technology-investments.org	E-Mail:	christian@technology-investments.org

<input checked="" type="checkbox"/> Competitive Solicitation	Solicitation #: GFO-18-602
<input type="checkbox"/> First Come First Served Solicitation	

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

Agreement Manager	Date	Office Manager	Date	Deputy Director	Date
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Additional Subcontractors:

Subcontractor Name	Energy Commission Funds	Match Funds
Layfield or RCM - Mechanical contractor	\$50,000	\$ -
SAGA Automation	\$47,000	\$ -
Finley Industrial Services	\$60,000	\$20,000
Denali Water	\$-	\$20,000
Circle Green	\$-	\$512,915
Montrose Environmental/ES Engineering	\$90,000	\$ -

Exhibit A SCOPE OF WORK

TECHNICAL TASK LIST

Task #	CPR	Task Name
1		Administration
2	X	Design, Engineering, and Site Preparation
3		Construction
4		Procurement and Installation of Equipment
5	X	Commissioning
6		Data Collection and Analysis

KEY NAME LIST

Task #	Key Personnel	Key Subcontractor(s)	Key Partner(s)
1	Christian Tasser	None	None
2	Christian Tasser, Theo Tsotsis, Dick Prosser, Froi Aquino	USC - Viterbi School of Engineering	USC
3	Christian Tasser, Theo Tsotsis, Dick Prosser, Froi Aquino	USC - Viterbi School of Engineering	USC
4	Christian Tasser, Theo Tsotsis, Froi Aquino	USC - Viterbi School of Engineering	USC
5	Christian Tasser, Theo Tsotsis, Froi Aquino	KKC	USC
6	Christian Tasser, Theo Tsotsis, Froi Aquino	None	USC, Circle Green
7	Christian Tasser, Theo Tsotsis, Froi Aquino	USC - Viterbi School of Engineering	USC, Circle Green
8	Christian Tasser, Theo Tsotsis, Froi Aquino	None	USC, Circle Green

GLOSSARY

Specific terms and acronyms used throughout this scope of work are defined as follows:

Term/ Acronym	Definition
ARFVTP	Alternative and Renewable Fuel and Vehicle Technology Program
CAM	Commission Agreement Manager
CO2	Carbon Dioxide
CPR	Critical Project Review
CFM	Cubic Feet per Minute
DGE	Diesel Gallon Equivalents
FTD	Fuels and Transportation Division
Recipient	Technology & Investment Solutions LLC
CR	Catalytic Reformer (biogas reformer)
GGE	Gasoline Gallon Equivalents
NOx	Nitrogen Oxide
R-CNG	Renewable-Compressed Natural Gas

Exhibit A

SCOPE OF WORK

Background

Assembly Bill (AB) 118 (Núñez, Chapter 750, Statutes of 2007), created the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). The statute authorizes the California Energy Commission (Energy Commission) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change, clean air, and alternative energy policies. AB 8 (Perea, Chapter 401, Statutes of 2013) re-authorizes the ARFVTP through January 1, 2024. The ARFVTP has an annual budget of approximately \$100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and non-road vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

The Energy Commission issued solicitation GFO-18-602 for demonstration-scale advanced biofuels production facilities. To be eligible for funding under GFO-18-602, projects must also be consistent with the Energy Commission's ARFVTP Investment Plan, updated annually. In response to GFO-18-602, Technology & Investment Solutions (Recipient) submitted application 3, which was proposed for funding in the Energy Commission's Notice of Proposed Awards on January 18, 2019. GFO-18-602 and Recipient's aforementioned applications are hereby incorporated by reference into this Agreement in their entirety.

In the event of any conflict or inconsistency between the terms of the Solicitation and the terms of the Recipient's Application, the Solicitation shall control. In the event of any conflict or inconsistency between the Recipient's Application and the terms of the Energy Commission's Award, the Energy Commission's Award shall control. Similarly, in the event of any conflict or inconsistency between the terms of this Agreement and the Recipient's Application, the terms of this Agreement shall control.

Problem Statement:

The need for organics management to help achieve California's greenhouse gas reduction targets requires a more cost-efficient anaerobic digestion and biomethane upgrading system. This would make projects producing high-BTU vehicle fuels more economically viable, given the uncertainty of federal renewable fuel incentives. This project aims to significantly improve the economics of digester operations, with increased biomethane yields, and divert more organic waste from landfills in California, thereby reducing NOx emissions from trash and municipal waste sites. Conventional biogas production also flares waste biogas, which this project will aim to avoid.

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SCOPE OF WORK

Goals of the Agreement:

The goal of this Agreement is to demonstrate an innovative, low-energy, in-situ biogas upgrading technology that has virtually zero emissions and will eliminate CO₂ emissions and flaring of by-products from biogas upgrading. Specifically, this project will demonstrate the use of a hydrogen extraction process derived from biogas via a catalytic dry reformer. The hydrogen can be injected in a digester to create biomethane consisting of up to 90% methane. This demonstration will be the first in California to use this type of hydrogen injection technology, and the concept can potentially be built upon for mass-scale commercialization of wider applications in the future.

This project will be operated on a demonstration scale to generate representative data on operational costs and energy and water savings for national marketing of the technology to industrial and food waste biogas plants, dairy digesters, and municipal wastewater digesters. The project will also utilize CO₂ through reaction with hydrogen to avoid flaring CO₂ and other waste gases.

Objectives of the Agreement:

The objective of this agreement are to:

- Successfully demonstrate the hydrogen injection process into a digester via catalytic dry reforming of biogas using a small slip-stream of about 10% of the total biogas.

TASK 1 ADMINISTRATION

Task 1.1 Attend Kick-off Meeting

The goal of this task is to establish the lines of communication and procedures for implementing this Agreement. The CAM shall designate the date and location of this meeting and provide an agenda to the Recipient prior to the meeting.

The Recipient shall:

- Attend a "Kick-Off" meeting with the Commission Agreement Manager, the Grants Officer, and a representative of the Accounting Office. The Recipient shall bring its Project Manager, Agreement Administrator, Accounting Officer, and others designated by the Commission Agreement Manager to this meeting.
- Discuss the following administrative and technical aspects of this Agreement:
 - Agreement Terms and Conditions
 - Critical Project Review (Task 1.2)
 - Match fund documentation (Task 1.6) No reimbursable work may be done until this documentation is in place.
 - Permit documentation (Task 1.7)
 - Subcontracts needed to carry out project (Task 1.8)
 - The CAM's expectations for accomplishing tasks described in the Scope of Work
 - An updated Schedule of Products and Due Dates
 - Monthly Progress Reports (Task 1.4)
 - Technical Products (Product Guidelines located in Section 5 of the Terms and Conditions)
 - Final Report (Task 1.5)

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SCOPE OF WORK

Recipient Products:

- Updated Schedule of Products
- Updated List of Match Funds
- Updated List of Permits

Commission Agreement Manager Product:

- Kick-Off Meeting Agenda

Task 1.2 Critical Project Review (CPR) Meetings

CPRs provide the opportunity for frank discussions between the Energy Commission and the Recipient. The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and to identify any needed modifications to the tasks, products, schedule or budget.

The Commission Agreement Manager may schedule CPR meetings as necessary, and meeting costs will be borne by the Recipient.

Meeting participants include the CAM and the Recipient and may include the Commission Grants Officer, the Fuels and Transportation Division (FTD) biofuel lead, other Energy Commission staff and Management as well as other individuals selected by the CAM to provide support to the Energy Commission.

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient. These meetings generally take place at the Energy Commission, but they may take place at another location.
- Send the Recipient the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion on both match funding and permits.
- Conduct and make a record of each CPR meeting. Prepare a schedule for providing the written determination described below.
- Determine whether to continue the project, and if continuing, whether or not modifications are needed to the tasks, schedule, products, and/or budget for the remainder of the Agreement. Modifications to the Agreement may require a formal amendment (please see section 8 of the Terms and Conditions). If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Lead Commissioner for Transportation for his or her concurrence.
- Provide the Recipient with a written determination in accordance with the schedule. The written response may include a requirement for the Recipient to revise one or more product(s) that were included in the CPR.

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SCOPE OF WORK

The Recipient shall:

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work of the projects. This report shall be submitted along with any other products identified in this scope of work. The Recipient shall submit these documents to the CAM and any other designated reviewers at least 15 working days in advance of each CPR meeting.
- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

CAM Products:

- Agenda and a list of expected participants
- Schedule for written determination
- Written determination

Recipient Product:

- CPR Report(s)

Task 1.3 Final Meeting

The goal of this task is to closeout this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present the findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.
This meeting will be attended by, at a minimum, the Recipient, the Commission Grants Office Officer, and the Commission Agreement Manager. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the Commission Agreement Manager.
The technical portion of the meeting shall present an assessment of the degree to which project and task goals and objectives were achieved, findings, conclusions, recommended next steps (if any) for the Agreement, and recommendations for improvements. The Commission Agreement Manager will determine the appropriate meeting participants.
The administrative portion of the meeting shall be a discussion with the Commission Agreement Manager and the Grants Officer about the following Agreement closeout items:
 - What to do with any equipment purchased with Energy Commission funds (Options)
 - Energy Commission's request for specific "generated" data (not already provided in Agreement products)
 - Need to document Recipient's disclosure of "subject inventions" developed under the Agreement
 - "Surviving" Agreement provisions
 - Final invoicing and release of retention
- Prepare a schedule for completing the closeout activities for this Agreement.

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Products:

- Written documentation of meeting agreements
- Schedule for completing closeout activities

Task 1.4 Monthly Progress Reports

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the objectives of this Agreement on time and within budget.

The objectives of this task are to summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, and to form the basis for determining whether invoices are consistent with work performed.

The Recipient shall:

- Prepare a Monthly Progress Report which summarizes all Agreement activities conducted by the Recipient for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the Commission Agreement Manager within 10 days of the end of the reporting period. The recommended specifications for each progress report are contained in Section 6 of the Terms and Conditions of this Agreement.
- In the first Monthly Progress Report and first invoice, document and verify match expenditures and provide a synopsis of project progress, if match funds have been expended or if work funded with match share has occurred after the notice of proposed award but before execution of the grant agreement. If no match funds have been expended or if no work funded with match share has occurred before execution, then state this in the report. All pre-execution match expenditures must conform to the requirements in the Terms and Conditions of this Agreement.

Product:

- Monthly Progress Reports

Task 1.5 Final Report

The goal of the Final Report is to assess the project's success in achieving the Agreement's goals and objectives, advancing science and technology, and providing energy-related and other benefits to California.

The objectives of the Final Report are to clearly and completely describe the project's purpose, approach, activities performed, results, and advancements in science and technology; to present a public assessment of the success of the project as measured by the degree to which goals and objectives were achieved; to make insightful observations based on results obtained; to draw conclusions; and to make recommendations for further projects and improvements to the FTD project management processes.

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SCOPE OF WORK

The Final Report shall be a public document. If the Recipient has obtained confidential status from the Energy Commission and will be preparing a confidential version of the Final Report as well, the Recipient shall perform the following activities for both the public and confidential versions of the Final Report.

The Recipient shall:

- Prepare an Outline of the Final Report, if requested by the CAM.
- Prepare a Final Report following the latest version of the Final Report guidelines which will be provided by the CAM. The CAM shall provide written comments on the Draft Final Report within fifteen (15) working days of receipt. The Final Report must be completed at least 60 days before the end of the Agreement Term.
- Submit one bound copy of the Final Report with the final invoice.

Products:

- Outline of the Final Report, if requested
- Draft Final Report
- Final Report

Task 1.6 Identify and Obtain Matching Funds

The goal of this task is to ensure that the match funds planned for this Agreement are obtained for and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. Although the Energy Commission budget for this task will be zero dollars, the Recipient may utilize match funds for this task. Match funds shall be spent concurrently or in advance of Energy Commission funds for each task during the term of this Agreement. Match funds must be identified in writing and the associated commitments obtained before the Recipient can incur any costs for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the Commission Agreement Manager at least 2 working days prior to the kick-off meeting. 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 such 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 each cash match fund, its source, including a contact name, address and telephone number and the task(s) to which the match funds will be applied.
 - Amount of each in-kind contribution, a description, documented market or book value, and its 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 shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.

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- Provide a copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured. For match funds provided by a grant a copy of the executed grant shall be submitted in place of a letter of commitment.
- Discuss match funds and the implications to the Agreement if they are reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide the appropriate information to the Commission Agreement Manager if during the course of the Agreement additional match funds are received.
- Notify the Commission Agreement Manager within 10 days if during the course of the Agreement existing match funds are reduced. Reduction in match funds must be approved through a formal amendment to the Agreement and may trigger an additional CPR meeting.

Products:

- A letter regarding match funds or stating that no match funds are provided
- Copy(ies) of each match fund commitment letter(s) (if applicable)
- Letter(s) for new match funds (if applicable)
- Letter that match funds were reduced (if applicable)

Task 1.7 Identify and Obtain Required Permits

The goal of this task 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. Although the Energy Commission budget for this task will be zero dollars, the Recipient shall budget match funds for any expected expenditures associated with obtaining permits. Permits must be identified in writing and obtained before the Recipient can make any expenditure for which a permit is required.

The Recipient shall:

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the Commission Agreement Manager at least 2 working days prior to the kick-off meeting. If there are no permits required at the start of this Agreement, then state such in the letter. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies the:
 - Type of permit
 - Name, address and telephone number of the permitting jurisdictions or lead agencies
 - The schedule the Recipient will follow in applying for and obtaining these permits.
- Discuss the list of permits and the schedule for obtaining them at the kick-off meeting and develop a timetable for submitting the updated list, schedule and the copies of the permits. The implications to the Agreement 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 the Progress Reports and will be a topic at CPR meetings.

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- If during the course of the Agreement additional permits become necessary, provide the appropriate information on each permit and an updated schedule to the Commission Agreement Manager.
- As permits are obtained, send a copy of each approved permit to the Commission Agreement Manager.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the Commission Agreement Manager within 5 working days. Either of these events may trigger an additional CPR.

Products:

- Letter documenting the permits or stating that no permits are required
- A copy of each approved permit (if applicable)
- Updated list of permits as they change during the term of the Agreement (if applicable)
- Updated schedule for acquiring permits as changes occur during the term of the Agreement (if applicable)
- A copy of each final approved permit (if applicable)

Task 1.8 Obtain and Execute Subcontracts

The goal of this task is to ensure quality products and to procure subcontractors required to carry out the tasks under this Agreement consistent with the Agreement Terms and Conditions and the Recipient's own procurement policies and procedures. It will also provide the Energy Commission an opportunity to review the subcontracts to ensure that the tasks are consistent with this Agreement, and that the budgeted expenditures are reasonable and consistent with applicable cost principles.

The Recipient shall:

- Manage and coordinate subcontractor activities.
- Submit a draft of each subcontract required to conduct the work under this Agreement to the Commission Agreement Manager for review.
- Submit a final copy of the executed subcontract.
- If Recipient decides to add new subcontractors, then the Recipient shall notify the CAM.

Products:

- Draft subcontracts
- Final subcontracts

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TECHNICAL TASKS

TASK 2 DESIGN, ENGINEERING, AND SITE PREPARATION

The goal of this task is to design the test system. The goal is to design a biogas catalytic reformer system (patented) rated at 2 CFM, a syngas production system, a hydrogen injection system using nanobubbles allowing a high mass transfer of hydrogen, and a renewable natural gas (R-CNG) treatment system with a capacity of at least 50 gas gallon equivalents (GGE) per day of R-CNG that will comply with SAE J1616 for use as a vehicle fuel.

The Recipient shall:

- Prepare and provide a Design and Engineering Report to the CAM for the biogas catalytic reformer system, the syngas production system, the hydrogen injection system and R-CNG treatment system. The report shall include engineering specifications for:
 - Design Drawings
 - Mass Balance
 - Layouts
- Prepare and provide a Site Preparation Plan to the CAM for the facility that will outline the budget and schedule for the items necessary to complete construction and installation activities.
- Implement Site Preparation Plan.
- Prepare and provide a Written Notification of Site Preparation to the CAM.

Products:

- Design and Engineering Report
- Site Preparation Plan
- Written Notification of Site Preparation

[CPR WILL OCCUR DURING THIS TASK. See Task 1.2 for details.]

TASK 3 CONSTRUCTION

The goal of this task is to complete construction of the biogas reformer and the hydrogen injection system using nozzles connected to the digester feed line to create a large surface area using very small gas bubbles.

The Recipient shall:

- Prepare and provide a Construction Management Plan for the biogas reformer and the hydrogen injection system that will outline the items necessary to complete construction and installation activities. The Construction Management Plan will include, but is not limited to:
 - A list of construction and installation milestones.
 - A list of preferred equipment vendors and a timeline for equipment procurement.
 - A Gantt chart and detailed project schedule.
 - A plan for quality control and quality assurance.
- Implement the Construction Management Plan.
- Prepare and provide a Construction Report for the facility that will evaluate the actual construction activities compared to the Construction Management Plan. The Construction Report will include, but is not limited to:

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- A final schedule of completed milestones.
 - A description of lessons learned.
 - A summary of major project changes.
- Prepare and provide Written Notification of Completion of Construction for the facility that will notify the CAM that construction activities have been completed. Inspect the systems.
- Provide photographs of the major construction activities.

Products:

- Construction Management Plan
- Construction Report
- Written Notification of Completion of Construction
- Photographs of Major Construction Activities

TASK 4 PROCUREMENT AND INSTALLATION OF EQUIPMENT

The goal of this task is to install and conduct the preliminary testing of the biogas reformer at the proposed test site, and perform a 6-month (500 hours) operation and associated monitoring to gather all necessary data to meet the project goals and objectives.

The Recipient shall:

- Prepare and provide to the CAM a Procurement Plan for the facility that will detail the process for procurement of equipment, materials, and services.
- Execute the Procurement Plan.
- Prepare and provide an Installation Report for the facility that will evaluate equipment installation activities. The Installation Report will include, but is not limited to:
 - A list of construction and installation milestones.
 - A list of preferred equipment vendors and a timeline for equipment procurement.
 - A Gantt chart and detailed project schedule.
- Prepare and provide Written Notification of Completion of Installation for the facility that will notify the CAM that installation activities have been completed.
- Provide photographs of the major installation activities.

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Products:

- Procurement Plan
- Installation Report
- Written Notification of Completion of Installation
- Photographs of Major Installation Activities

TASK 5 COMMISSIONING

The goal of this task is to produce a detailed test plan for the demonstration-scale testing that will be conducted at the Meadowbrook Dairy digester for 500 hours and a 6-month period, and to conduct the preliminary testing at the proposed test site, according to the Test Plan.

The Recipient shall:

- Prepare and provide a Test Plan to the CAM. The Test Plan will include, but is not limited to:
 - An operation schedule for the biogas reformer.
 - A description of equipment to be tested.
 - A description of the methodology to test the identified equipment.
 - A list of goals and objectives for the test.
 - An optimization plan for the biogas reformer.
 - An optimization plan for the hydrogen injection system.
 - A description of the quality control and quality assurance practices for the test methodology.
- Implement the Test Plan.
- Prepare and provide an Energy Auditing Plan with the energy consultant to the CAM. The Energy Auditing Plan will be used to determine the life cycle analysis and carbon intensity of the fuel produced.
- Implement the Energy Auditing Plan.
- Prepare and provide Written Notification of Completion of Commissioning for the facility that will notify the CAM that commissioning activities have been completed and that the facility is ready to commence commercial operations.
- Prepare and provide a Commissioning Report. The Report will include, but is not limited to, information about how and if the facility:
 - Achieved a methane content above 65% in the raw digester gas using high strength waste substrates.
 - Increased the methane content on the digester gas after hydrogen injection to be methane > 75%.
 - Used nanobubble diffusion of hydrogen optimize the mass transfer efficiency to result in efficient conversion of hydrogen and CO₂ to methane.
 - Optimized the performance of the biogas reformer conversion efficiency of methane to hydrogen of > 75%.
 - Verified operational demonstration scale digester (5 tons per day of food waste).
 - Verified operational biogas reformer system (for over 500 hours) to generate in-situ biomethane in the digester.
 - Verified biomethane production of 5 cfm at demonstration scale for future expansion.

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- Prepare and provide a System Training and Safety Manual to the CAM.
- Prepare and provide an As-Built Process Flow Chart

Products:

- Test Plan
- Energy Auditing Plan
- Written Notification of Completion of Commissioning
- Commissioning Report
- System Training and Safety Manual
- As-Built Process Flow Chart

[CPR WILL OCCUR DURING THIS TASK. See Task 1.2 for details.]

TASK 6 DATA COLLECTION AND ANALYSIS

The goal of this task is to collect operational data from the project, to analyze that data for economic and environmental impacts, and to include the data and analysis in the Final Report.

The Recipient shall:

- Develop a data collection plan.
- Troubleshoot any issues identified.
- Collect at least six months of data, including:
 - Throughput, usage, and operations data
 - Normal operating hours, up time, down time, and explanations of variations
 - Feedstock supply summary
 - Maximum capacity of the new fuel production system in gas gallon equivalents (GGE) and ordinary units
 - Gallons of gasoline and/or diesel fuel displaced (with associated mileage information), along with value converted into GGE
 - Record of wastes from production processes (waste water, solid waste, criteria emissions, etc.)
 - Expected air emissions reduction:
 - Non-methane hydrocarbons
 - Oxides of nitrogen
 - Non-methane hydrocarbons plus oxides of nitrogen
 - Particulate Matter
 - Formaldehyde
 - Specific jobs and economic development resulting from this project
 - Levelized Cost of Fuel and Finished fuel price
 - Analysis of total facility costs, operation and maintenance costs, marginal abatement costs
- Provide a written record of registering with the Low Carbon Fuel Standard and Renewable Fuel Standard programs.
- Identify any current and planned use of renewable energy at the facility.
- Describe any energy efficiency measures used in the facility that may exceed Title 24 standards in Part 6 of the California Code Regulations.
- Provide data on potential job creation, economic development, and increased state revenue as a result of expected future expansion.

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- Provide a quantified estimate of the project's carbon intensity values or provide an Air Resources Board approved pathway carbon intensity.
- Estimate annual life-cycle greenhouse gas emission reduction.
- Compare any project performance and expectations provided in the proposal to Energy Commission with actual project performance and accomplishments.
- Collect data, information, and analysis described above and include in the Final Report.

Products:

- Data collection information and analysis to be included in the Final Report.

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: TECHNOLOGY & INVESTMENT SOLUTIONS LLC

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

RESOLVED, that the Energy Commission approves Agreement ARV-18-024 from GFO-18-602 with Technology & Investment Solutions LLC for a \$2 million grant to demonstrate a catalytic biogas reforming process to generate hydrogen syngas from food waste at an existing anaerobic digester in El Mirage, California. The use of this process is expected to create biogas with a higher methane content, which will reduce the capital and operating costs needed to clean up the gas for transportation fuel. The process will also capture and convert CO₂, eliminating the need for flaring; and

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

CERTIFICATION

The undersigned Secretariat to the Commission does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the California Energy Commission held on May 15, 2019.

AYE: [List of Commissioners]

NAY: [List of Commissioners]

ABSENT: [List of Commissioners]

ABSTAIN: [List of Commissioners]

Cody Goldthrite,
Secretariat