

**Agreement between California Energy Commission  
and  
Cascade Clean Energy, Inc.**

**Title:** CASCADE Clean Energy System for CEC PIER ETDG in Water and Waste Water Projects  
**Amount:** \$400,000.00  
**Term:** 36 months  
**PIER Contact:** Anish Gautam  
**RD&D Committee:** 12/3/2009

**Funding**

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
08	Electric	IAW	Energy Efficiency	\$3,326,731	\$195,019	\$0	0%
09	Natural Gas	IAW	Natural Gas Efficiency RD&D for Industrial & Institutional Use	\$1,400,000	\$204,981	\$400,000	28%

For the 2008 fiscal year, the total Electric budget is \$62.5 million. Within the Electric program, the IAW program area budget is \$5.5 million and, from this amount, \$3.3 million was allocated to the Energy Efficiency budget initiative. If approved, the remaining initiative balance will be \$0.

For the 2009 fiscal year, the total Natural Gas budget is \$24 million. Within the Natural Gas program, the IAW program area budget is \$1.8 million and, from this amount, \$1.4 million was allocated to the Natural Gas Efficiency RD&D for Industrial & Institutional Use. If approved, the remaining initiative balance will be \$400,000.

**Recommendation**

Approve this agreement with Cascade Clean Energy, Inc. for \$400,000.00, with \$379,224.00 in match funding. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

**The Problem**

Wastewater treatment uses 5-7% of U.S. annual electrical output. Yet currently only 1% of U.S. treatment facilities recover energy from wastewater. The CASCADE Clean Energy System project is designed to demonstrate that the results of recovering energy from wastewater using select bacteria to clean wastewater more efficiently than existing processes while simultaneously maximizing recovery of renewable energy (methane, hydrogen or electricity) from wastewater and sludge that was demonstrated at a pilot scale in the laboratory are scalable to a commercially acceptable level.

## Proposed Research

This project will demonstrate the “Computer-Assisted Strain Construction & Development Engineering” (CASCADE) Clean Energy System technology at the Dublin San Ramon Service District (DSRSD) wastewater treatment facility in Dublin, CA. The patented CASCADE technology discovers the predictive relations between genomic fingerprints of an organism and its metabolic capabilities and then uses those relations to look for the best organisms to use in a particular application. The project will demonstrate that the CASCADE Methane Bioreactor and 1000-gallon digester at DSRSD can improve existing digester efficiency by 30% or more. DSRSD is one of the 1% of facilities that already have digesters to produce methane by a natural digestion process. The produced methane will be used by the onsite fuel cells to generate electricity for the facility.

## Research Justification and Goals

This project "[will develop, and help bring to market] increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers" (Public Resources Code 25620.1.(b)(2)), (Chapter 512, Statutes of 2006)); and supports California's goal to allow water and wastewater utilities to self generate and wheel power within their own systems per the Integrated Energy Policy Report 2005 by:

- Build a 1000-gallon demonstration prototype of the CASCADE Clean Energy System
- Integrate the system to the existing wastewater treatment at DSRSD
- Reduce hydraulic retention time by 50% with increased substrate utilization
- Measure, verify and document the performance and energy savings of the system

## Background

The proposal was submitted through competitive solicitation, Emerging Technology Demonstrations Grants Program (ETDG) Opportunity Notice 08-006. This opportunity notice was structured to solicit proposals under four categories 1) Data Center, 2) Energy Storage, 3) Industrial Energy Efficiency and 4) Water and Wastewater. This proposal was ranked 3 out of 12 proposals received through the solicitation under the Water and Wastewater category.

In 2008 there were 58 waste water treatment facilities (WWTF) in California that had digesters, 1% of the total facilities in the state. And these digesters were capturing only a fraction (est. 22.5%) of the wastewater energy available for recovery. California makes up 25% of the national market for WWTF with digesters, a market that is forecast to grow to 3,460 in 2013. In total there are approximately 16,700 municipal WWTF in the U.S. and another 24,000 private facilities (industrial, etc.)

Regulations have been implemented in 26 states requiring that WWTF must include digesters in new builds. By 2013 regulations will require all new construction of WWTF to include digesters but still only 20% of WWTF will have digesters with the capability to generate power.

Currently, 99% of current wastewater treatment facilities remove organics by aeration alone. Taken altogether, the WWTF aeration process costs \$25 billion in the U.S. annually. High waste water treatment energy consumption is a result of powering aerobic systems required for the delivery of oxygen for proper operation. Based on EPA reports, for every 10 million gallon per day (MGD) wastewater processed, it emits 10,000 lbs of carbon to the environment.

The CASCADE system focuses on anaerobic digestion in this demonstration project. Currently, anaerobic digesters use naturally grown bacteria. In an anaerobic system, the majority of the chemical energy contained within the starting organic material is released as methane (biogas) through a number of different processes, converting the complex organic molecules to intermediate molecules including sugars, hydrogen and acetic acid before finally being converted to the end product (methane gas). CASCADE is a critical innovation, enabling for the selection of microorganism systems based on different wastewater contents from different WWTF's or at different times of year under different climactic conditions rather than a trial and error method that is commonly applied.

The objective of the CASCADE solution is to reduce the harmful greenhouse gas emissions of the methane completely (from 22.5% to 0) and convert it to usable electricity, reduce the carbon in the solid waste thereby reducing damage to the environment due to landfill (from 33.0% to 22.0%), eventually eliminate energy consumption from aeration and maximize the energy net gain from the CASCADE system.

This scaled-up demonstration project will provide the industry with proven technical and performance data along with the economics of the system. The project will yield a functioning digester, design of the strain incubator and bioreactor, and the methane production rate. The demonstration site, Dublin San Ramon Service District is committed to providing assistance for the evaluation, documentation and confirming the performance of the CASCADE Clean Energy System.