

**Proposed Agreement between California Energy Commission
and
The Regents of the University of California on behalf of the
UC Irvine Campus**

Title: Self-Audit of Wastewater Treatment Processes to Achieve Energy Optimization, Phase 2
Amount: \$347,914.00
Term: 34 months
Contact: Paul Roggensack
Committee Meeting: 4/4/2011

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
10	Electric	IAW	Energy Efficiency and Emerging Technologies	\$5,250,000	\$347,914	\$0	0%

Recommendation

Approve this agreement with UC Irvine for \$347,914.00. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

Issue

A wastewater treatment facility contains many interactive unit operations where the efficiency of one process can affect the performance of another process. Inefficiency in up-front processes can have a cumulative effect in down-stream processes, and the most effective means of improving energy efficiency is a complete facility-wide evaluation of the interactive processes. A facility-wide evaluation typically would require a professional energy audit of the entire plant by a team with special knowledge and experience, and costs tens of thousands of dollars. Most wastewater treatment plants do not perform energy audits on a regular basis. The reasons are auditing is too complex to be done by an operator, no allocation in the O&M budget, or operators too busy or unwilling to take on this added responsibility.

Background

Previous work to benchmark wastewater treatment processes include a Pacific Gas and Electric (PG&E) study published in 2006, "Energy Baseline Study for Wastewater Treatment Plants". This study surveyed wastewater treatment facilities within PG&E's service territory to determine specific technologies being used in the industry. An analysis of the technologies established a baseline for each of those technologies to adopt energy efficiency measures (EEM) used for energy rebates. For example, the baseline for aerating secondary treatment sludge is coarse bubble diffusers. To qualify for a rebate by adopting an EEM, the facility would need to convert to a fine bubble diffuser. This benchmark study focuses on specific unit operations and provides no information on the efficiency of an actual facility. The proposal from the University of California, Irvine (UCI) differs from the PG&E study in that it will benchmark individual facility performance from actual facility data. The proposed project will also

make recommendations to improve energy efficiency that are unique to that facility. Like the PG&E study, the UCI project will be used to calculate energy rebates.

Another project that benchmarked energy use by wastewater treatment facilities is a PIER project jointly funded with the American Water Works Association Research Foundation (now the Water Research Foundation) titled "Energy Index Development for Benchmarking Water and Wastewater Utilities" completed in October of 2007. This project compiled survey data and permit information from the U.S. Environmental Protection Agency to correlate energy use to key parameters of wastewater facilities to develop a rating system, or energy index. The methodology used to develop the rating system is similar to that used by Energy Star for rating energy use by buildings. Energy Star has since adopted the rating system and incorporated it into its Portfolio Standard. The energy index differs from the UCI proposal in that it compares a facility to expected energy use for similar facilities. It will let a facility operator know whether a facility is performing poorly or not, but it will not provide detailed audit information to improve energy efficiency. Comparing the energy index project to the UCI proposal is analogous to comparing an auto manufacturer's estimated miles per gallon ratings for different models to a diagnostic on an individual car.

The proposed agreement is Phase 2 of the Self-Audit Of Wastewater Treatment Processes To Achieve Energy Optimization project. Phase 1 was completed under a PIER contract (500-08-008) with Southern California Edison (SCE). Phase 1 developed the auditing tool for the first portion of a wastewater treatment facility, which includes all the unit operations for primary and secondary treatment. Phase 2 will develop the auditing tool for all the unit operations after secondary treatment, which includes nutrient removal, disinfection, and sludge processing, including digestion.

Proposed Work

The proposed research is to develop benchmarking software for wastewater treatment plants to self-audit plant operations. Mathematical models will be developed for specific unit operations and then combined into a single model to determine optimum interaction. Actual facility data will be input into software to compare with mathematical models to evaluate energy savings, conduct life-cycle analysis, and make recommendations to improve energy efficiency. This project has two phases. Phase 1 developed the mathematical models for primary and secondary treatment. Phase 2 will follow a similar track to develop mathematic models for nutrient removal, disinfection, and sludge processing, including digestion.

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, Statues of 2006)); and supports California's goal to address potential savings throughout the water cycle, especially in Southern California where the energy intensity of water is greatest per the Integrated Energy Policy Report 2005.

This will be accomplished by:

- Developing user-friendly software to allow auditing an existing plant operation, evaluating electrical energy saving measures, and conducting life-cycle analyses.