Concerned with fluctuating energy costs and meeting clean-air requirements, publicly owned treatment works (POTWs) are turning to alternative energy to reduce their dependence on increasingly expensive power from traditional sources. In response, Carollo Engineers has been at the forefront of designing and implementing a wide range of on-site energy generation solutions including fuel cells, solar photovoltaic technology, internal combustion engines, gas turbines, and fat, oil, and grease (FOG) systems.

**Renewable Energy Benefits**

- Reduced operational costs and the stabilization of energy expenditures.
- A revenue stream from energy sold back to the grid.
- Reduced emissions to support local sustainability goals.
- Simplified air quality permitting.
- Greater flexibility in adapting to current and future greenhouse gas regulations.
- Improved power supply reliability and redundancy.

**Carollo's Alternative Energy Solutions**

Carollo's experience with alternative energy facilities is founded in our knowledge of water and wastewater treatment plants. Beginning in the 1960s with digester gas cogeneration feasibility plans and designs, Carollo's alternative energy services have expanded to include:

- Cogeneration
- Solar/photovoltaic systems
- FOG systems

Given our wide range of energy expertise, we can best analyze the energy needs of your facility and implement the right technology while maximizing project benefits.

**Cogeneration**

Cogeneration systems at wastewater treatment plants operate on biogas, as well as other fuels, to generate electricity and useable heat. The biogas or digester gas supplied to the cogeneration system is produced as a byproduct of the solids stabilization process. Cogeneration technologies currently being considered for use at treatment facilities include fuel cells, internal combustion engines, gas turbines, and microturbines.

Carollo has designed over 60 digester gas-fueled engines, gas turbines, and microturbines with a combined capacity well over 50 MW. Most of these projects have involved both design and project implementation and include services such as economic analyses, energy and heat balance considerations, electrical modification, emissions permitting, and standby power production.

For King County, Washington, Carollo completed a feasibility study and the preliminary and final design of a 9-MW gas turbine cogeneration facility and all the plant integration requirements.

**Fuel Cells**

Fuel cells are rapidly replacing reciprocating engines and gas turbines as the most environmentally-friendly distributed power source for wastewater treatment plants. A fuel cell combines hydrogen fuel from digester gas and oxygen from the air to produce electricity and usable heat with virtually no emissions.

An industry leader of this technology, Carollo has been actively involved in roughly 75 percent of all U.S. fuel cell projects currently operating or being planned, designed, or constructed at POTWs.
A fuel cell combines hydrogen fuel and oxygen from the air to produce electricity and useable heat.

For the Turlock Irrigation District (TID), Carollo performed a feasibility study, and prepared procurement and construction documents for a 1,200-kW fuel cell cogeneration system. We also prepared all associated interconnection and grant applications and assisted TID with all permitting associated with the project.

**Solar/Photovoltaic Systems**

Solar technologies are a particularly feasible energy solution for POTWs. Large-scale solar photovoltaic technology is easily implemented and operated in parallel with other on-site generation sources such as cogeneration. Moreover, energy consumption patterns exhibited by POTWs are generally coincident with solar energy production patterns, thus energy is available when it is most needed.

Carollo provides full photovoltaic project implementation services including technical and financial feasibility assessments, system design, administration of utility interconnection procedures, and electrical interconnection design.

Following a feasibility assessment by Carollo, the Kern County Water Agency Improvement District No. 4 implemented a 1-MW solar power generation system. Carollo prepared performance-based design documents to facilitate photovoltaic equipment procurement and installation. This project was the first approved reservation request under the California Solar Initiative Program. The plant will receive estimated incentive payments of $4.5 million per month over the next five years.

**FOG Systems**

FOG is a valuable resource that can substantially enhance the energy production of wastewater cogeneration facilities. Fats, oils, and grease collected from food service establishments are rich in highly biodegradable organic content and can be used to supplement the gas production of anaerobic digesters. While the treatment of FOG in digesters boosts energy production, it also reduces material wasted in landfills and resultant greenhouse gas emissions.

In recent years, Carollo has been involved in several FOG projects, including evaluating gas production, and providing engineering and design of delivery and storage systems. Carollo is currently working on a 45,000-gallon FOG delivery and storage system for the 80-mgd Fresno-Clovis Regional Wastewater Reclamation Facility.