CALIFORNIA's recycling law, which mandates that communities divert 25 percent of solid waste from landfills by 1995 and 50 percent by the year 2000, is helping to spur research into uses for biogas. A specific example is a pilot project now under development in Folsom, California, which incorporates an anaerobic digestion/aerobic composting process that could eventually supply enough biogas to a fuel cell. The Sacramento Municipal Utility District (SMUD) has two fuel cells in operation and is participating in the research project.

Recently, the California Prison Industry Authority (PIA) began operating a processing facility at the Folsom prison, designed for 100 tons/day of mixed waste from the City of Folsom. The 35,000 square foot Correctional Resource Recovery Facility (CRRF) uses minimum security inmates from Folsom's Return to Custody Facility to manually separate recyclables and compostable materials from the waste stream. The PIA will be using a new technology, high solids anaerobic digestion, to compost the organic fraction (representing approximately 60 to 70 percent of the waste stream). Construction began in June on a 40-foot wide by 120-foot long and 22-foot deep anaerobic digester.

Once the vessel is operational in 1995, the composting process and the gradual breakdown of organic material will produce biogas, which SMUD hopes to use to power an adjacent two megawatt fuel cell. The electricity generated will serve SMUD customers, including the waste facility and nearby correctional institutions. Thermal heat, a by-product from the electrical generation process, will be used to maintain the heat balances required to facilitate the anaerobic digestion process.

Folsom, California project will use organic fraction of municipal waste stream to generate energy for projected power plant.

Bob Wichert, Larry Wittrup, and Robb Robel

When the anaerobic digester begins operating in 1995, the Sacramento Municipal Utility District plans to use biogas to power a two megawatt fuel cell.
cells already in operation. The plants, manufactured by ONSI Corporation in South Windsor, Connecticut, convert natural gas directly into electricity and thermal heat. But SMUD's desire to use alternative and renewable fuel sources whenever possible is prompting its advanced resources and technologies division to study ways to supplant fossil fuels with biogas. The fuel cell can operate on biogas as a cogenerator, providing thermal heat (hot water) along with electricity for industrial hosts located adjacent to the fuel cells, such as hospitals, factories and schools.

SMUD is also a participant in the Santa Clara Demonstration Project, the world's first demonstration of a natural gas fueled molten carbonate fuel cell power plant being built in Santa Clara, California. By participating in the development of the power plant, SMUD will be eligible to purchase early production units of the fuel cells at $1,500 per kilowatt. The developer of the Santa Clara Demonstration Project, Energy Research Corporation of Danbury, Connecticut, has conducted successful tests using corn derived ethanol as fuel for the fuel cells.

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Approximately 100 tons per day of solid waste will be delivered by city trucks to the tipping/presort area of the facility.
University of California research confirms the efficiency of the anaerobic/aerobic process to use organic residuals for energy recovery.

the proper size for composting (less than an inch). The material will be mixed with wastewater biosolids and fed into the anaerobic digester, where it will remain for approximately 30 days. Digester contents will be mixed using large mixers according to temperature or time monitoring signals. The digester operates at thermophilic (~130°F to 140°F) conditions. Biogas will be produced along with wet digestate. Once removed, a bulking agent, such as wood chips, will be added to the material, then moved to the aerobic drying area. Currently, the organic fraction being separated from the 50 tons/day of incoming MSW (roughly 20 tons/day) is being aerobically digested on drying beds.

FEEDING THE FUEL CELL

As the digester is brought into operation in 1995, RS1 Associates, a SMUD subcontractor funded by a Western Area Power Administration (WAPA) grant, will develop an appropriate means of monitoring the biogas produced. RS1 also will suggest a biogas cleanup method and recommend a compatible fuel cell for the generation of electricity and useful heat.

Once the fuel cell is on line, incoming materials will be catalogued and digester offgas will be dynamically monitored and periodically "bottled" for subsequent contaminant analyses. As data is compiled, information will be provided to the Department of Energy and the WAPA for review. SMUD also will use this data to correlate offgas quality and quantity with input materials.

BRIDGE TO A NEW FUTURE

The biogas project is consistent with SMUD's energy generation plans. After voting to close the Rancho Seco Nuclear Power Plant in 1989, SMUD asked customers what type of energy sources they thought should replace the nuclear facility. The overwhelming response was power that was sensitive to the environment, but supportive of the economy. With that direction, SMUD's Board of Directors adopted an energy plan with more than half of SMUD's generation of electricity coming from renewable energy sources by the year 2000.

The Sacramento utility already is investing in solar and wind power and looking optimistically at biogas as a way to further diversify resources, while lowering costs and reducing air pollution. Biogas may prove to be an important ingredient in SMUD's new environmentally responsible power mix that is preparing Sacramento for a sustainable energy future.

Bob Wichert is supervisor of SMUD's advanced resources and technologies division. Larry Wittrup is the project manager for this energy project. Robb Robel is a division engineer with responsibilities to explore using biogas to power fuel cells.

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