California Energy Commission
Public Interest Energy Research (PIER) Program
TRANSPORTATION ENERGY RESEARCH

Steam Hydrogasification Project Demonstrates Promising New Waste-to-Energy Technology

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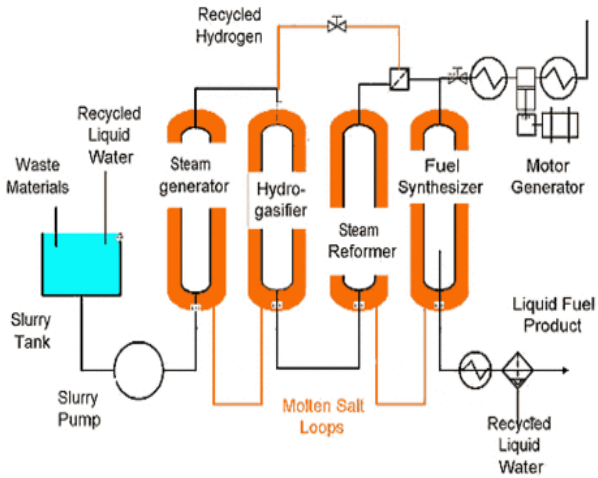
Fact Sheet

The Issue

California generates roughly 83 million dry tons of biomass waste per year, including agricultural and minicipal waste, which is mostly landfilled or burned, polluting the air and water. Considering sustainability and harvesting efficiency factors, 32.1 million tons of this biomass are available every year for fuel production. Further research and development are required to establish commercially viable waste-to-energy conversion technologies that can simultaneously contribute supplies of renewable transportation fuels and transform waste materials into renewable transportation fuels. Also, to meet the objectives of the *State Alternative Fuels Plan* for 2017, California will need to produce about 2.4 billion gasoline gallon equivalents per year of alternative transportation fuels. At present, however, California imports more than 95 percent of the biofuels used in-state. Ramping up in-state biofuel production without competing with existing cropland will be difficult unless other, noncrop biomass resources can be used.

Project Description

This research will cofund further development of a promising new waste-to-energy technology known as a *steam hydrogasification reactor*. A process demonstration unit applying steam hydrogasification reactor technology will be built and operated under this project by the College of Engineering - Center for Environmental Research and Technology at its University of California Riverside facilities. The primary biomass feedstock for this demonstration will be biosolids from the City of Riverside wastewater treatment system, comingled with other biomass feedstocks,



Schematic of Steam Hydrogasification Reactor Process
Source:spacedaily.com

which will be converted to a Fischer-Tropsch type gas-to-liquid fuel suitable for use in a diesel engine. (The Fischer-Tropsch process is a set of chemical reactions that convert a mixture of carbon monoxide and hydrogen into liquid hydrocarbons.) Partners in the project include University of California Riverside, City of Riverside, and Viresco Energy LLC of Riverside.

Specific objectives of this two-year project are to:

- Develop and operate a continuous feed pretreatment system that can convert biomass and biosolids feedstocks into a pumpable slurry.
- Design, construct, and operate a 10 pounds-per-hour process demonstration unit fluidized bed steam hydrogasification reactor that will convert the slurry feed into a high-methane-content synthesis gas.

- Integrate the steam hydrogasification reactor process with a gas clean-up system and a steam methane reformer for demonstrating continuous synthesis gas production using the above mentioned feedstocks.
- Design a 5 tons per day pilot plant to convert these feedstocks into synthesis gas.

Anticipated Benefits for California

This research will address two major barriers associated with the production of biofuels from locally available renewable biomass feedstocks: (1) prepare the feedstocks to allow continuous feed supply to the gasifier using a relatively uncomplicated and well-known technique such as slurry pumps; and (2) the high temperature conversion of diverse and wet feedstocks into clean synthesis gas.

This research will help achieve 11 percent penetration of alternative fuels into the transportation sector by the year 2017, as recommended by the *State Alternative Fuels Plan*. It will contribute to diverting carbon-rich wastes from being landfilled, thereby addressing the related environmental concerns and land limitation issues.

This research will also enhance the knowledge database and engineering capabilities necessary to achieve commercial-scale conversion of renewable feedstocks into transportation fuels with very low fuel cycle emissions. Developing such capabilities and knowledge base is critical in accomplishing the goal of clean transportation fuels from renewable and locally available feedstocks, including carbon-rich wastes.

Project Specifics

Contract Number: 500-09-008
Contractor: University of California, Riverside
Contract Amount: $1,000,000
City/County: Riverside/ Riverside County
Application: Nationwide
Cofunding: $281,218 UCR
$649,735 Viresco Energy LLC
$50,000 City of Riverside
Contract Term: June 2009 to April 2011

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