INFORMATION SHEET
RENEWABLE DEVELOPMENT FUND

Investing in Renewable Energy

HIGH PERFORMANCE BIOGAS TREATING

Project Description

Anaerobic digestion is a well known process for converting organic matter into biogas. While biogas is a very useful renewable energy source, combustion of untreated biogas for the removal of hydrogen sulfide (H_2S) contributes to acid rain and is corrosive to combustion engines. This project investigated a technology that will selectively remove H_2S without generating a waste stream or creating new atmospheric emissions of sulfur dioxide (SO_2) or related compounds.

Methodology

Phase 1 - A laboratory study was conducted using 'simulated' biogas consisting of a three gas blend of methane (CH_4), carbon dioxide (CO_2) and H_2S. A chemisorbent was sprayed into a chamber, which came into contact with the simulated biogas that was flowing in an opposite direction from the chemisorbent. Results supported the position that the proposed technology would remove H_2S at an adequate rate.

Phase 2 - A field demonstration using a slip stream of biogas generated from a commercial scale source was conducted at a municipal wastewater treatment facility. The treatment unit was scaled up to handle a larger volume of biogas and operated for six months.

Executive summary

This research project investigated a technology that can selectively remove H_2S from biogas without generating a waste stream or emitting SO_2 to the atmosphere. Anaerobic digestion of organic materials generates biogas that is primarily comprised of methane, CO_2, H_2S, and water vapor. Other contaminants may also be present such as siloxanes. Unless these contaminants are removed, such as H_2S which is the most deleterious, biogas has fairly limited utility.

Grantee: Production Specialties
Project Dates: 10/16/2005 – 11/16/2009
RDF Funding Cycle: 2nd
Project Funding: $228,735 RDF Grant (Total project cost $492,502)
Project ID: RD-72
RDF Mission: To increase renewable energy market penetration, assist renewable energy projects and companies, and support emerging renewable energy technology through research and development.

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There are several treatment methods which remove H_2S from biogas, but virtually all result in the generation of a waste stream, require a sulfur recovery unit or release SO_2 emissions. These treatments also require very large volumes of gas (typically, more that 30 million cubic feet per day) to economically justify the cost to build a facility. As a result, treating biogas from a smaller anaerobic digester operating on agricultural waste (manure and litter) and waste from municipal wastewater treatment plants would be a good market for this technology.

Benefits

The project showed that a selective chemisorbent can be used to reduce the concentration of H_2S to very low levels (concentrations less than 250 ppmv) and therefore increase the utility of biogas as a renewable energy resource. When this technology is applied:

- Reduced operating costs for treating biogas
- No solid waste created as a result of treating the biogas
- Greenhouse gas emissions will be reduced
- Biogas can be used to produce usable energy, as opposed to flaring the biogas, which could displace fossil fuel use

Lessons learned

- The chemisorbent solution must be stored in a sealed container to limit degradation from the reaction with air and oxygen
- The cost to remove H_2S can be done for less then $0.50/mmbtu

Outcomes

The key outcome was confirmation of the chemisorbent system's usefulness to improve the quality of biogas improving the quality of biogas. This included:

- Support for municipal waste water treatment facilities as an 'under served' market
- Regulating low pressure gas flow may require compressing the gas to a level greater than 15 psig and then using a flow control valve to feed the treater system
- Successfully demonstrated that the treating system could remove more than 97 percent of the H_2S from a stream containing as much as 3,500 ppm H_2S

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