FARM-SCALE ANAEROBIC DIGESTION OF BEEF AND DAIRY CATTLE MANURE FOR ENERGY COGENERATION AT TWO FARMS IN CANADA

N. PATNI1, C. MONREAL2, XIAOMEI LI3, A. CROLLA4, C. KINSLEY5, J.BARCLAY6

1 Retired Research Scientist, Agriculture and Agri-Food Canada, patninp@rogers.com
2 Research Scientist, Agriculture and Agri-Food Canada
3 Research Scientist, Highmark Renewables Research
4 Professor, Alfred Campus, University of Guelph
5 Professor, Alfred Campus, University of Guelph
6 Emerging Fuel issues Engineer, Environment Canada

CSBE101052 – Presented at Section IV: Rural Electricity and Alternative Energy Sources Conference

ABSTRACT Anaerobic digestion of beef and dairy cattle manure for biogas production, and its combustion for electrical and thermal energy cogeneration was studied since 2003-2005 at beef and dairy cattle farms in Canada. Manure from about 7500 beef cattle at a feedlot was digested at thermophilic temperature (55 deg. C) in two 1800 m³ above-ground digesters with a hydraulic retention time (HRT) of 14 days. The biogas with average 58 % methane content was combusted in a General Electric Jenbacher 999 kW cogeneration system. At the second farm, manure from about 165 lactating cows, 110 heifers and 40 calves was digested at mesophilic temperature (40 deg. C) in a 500 m³ below-ground digester with a HRT of 28 days. A unique feature of this digester is that it was retrofitted in a pre-existing larger slurry storage tank. Biogas with average 65 % methane content was combusted in a 75 kW (100 Horse-power) Perkins diesel engine, capable of running on either diesel or biogas, connected to a 65 kW Schnell generator. Addition of fats, oils and grease (FOG) restaurant waste residue to manure fed to the digester in 2007 increased biogas production by about 300% and electrical energy generation by 180 %. Both systems have operated year-round from December to February at average ambient temperatures that ranged from -9 to -12 degrees Celsius. The paper will present results on biogas as well as electrical and thermal energy production. This information will be useful for development of long-term sustainability options for animal farm operations.

Keywords: Anaerobic Digestion, Biogas, Bioenergy, Cattle Manure, Energy Cogeneration