Methane to Markets

A Canadian Experience in Anaerobic Digestion

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AD - the Past

- From the early 1970's to mid 1980's
  - Annotated bibliography of farm animal wastes, no farm-scale AD
  - Guidelines for AD: Methane gas production from animal wastes & Biogas production from animal manures
  - R&D on the chemistry and microbiology of AD by NRC in labs and pilot plants
  - Federal Government Support Programs:
  - Development and Demonstration of Resource and Energy
  - Conservation Technology to develop full scale operating model - EC
  - Energy Research and Development in Agriculture to support R&D on farms - AAFC

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Issues with Early AD Systems

- Inadequate mixing - solids settling, scum formation
- Corrosion of components
- Plugging and freezing of manure and gas lines
- Design deficiencies - accessibility to components difficult, retrofitting was not practical
- Appropriate equipment and expertise not available
- Limited or no payback

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Present Federal Activities in AD

Federal Government Departments actively promote the use of AD including: Natural Resources Canada (NRCan), Agriculture and Agri-Food Canada (AAFC), Environment Canada (EC), Industry Canada (IC), National Research Council (NRC)

R&D Programs Supporting AD:

- Energy Co-Generation of Agricultural and Municipal Wastes (AAFC)
- Environmental Technologies Assessment for Agriculture (AAFC)
- Technology Early Action Measure (NRCan)
- Industrial Research Assistance Program (NRC)
- Sustainable Development Technology Canada
- Green Municipal Fund (FCM)
- Agricultural Bioproducts Innovation Program (AAFC)

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Present Federal Activities on AD

Promoting the use of AD through R&D

- Feedstock recipes for farm scale digesters
- Digestion of source separated organics from MSW
- Opportunities for energy use and production at MWW plants
- Digestion of Pulp and Paper wastes
- Testing of biogas appliances such as micro turbines and stirling engines

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Present AD Activities in Ontario

- Government of Ontario
  - Standard Offer Program

    (11c/kWh for biomass base power, + 3.52 c/kWh at “peak hours”)
    - Mixing manures with off-farm co-substrates

      (exempting on-farm AD systems with Certificates of Approval)
      - Limit of 5000 m^3 of waste/year

        (resource utilization instead of waste disposal)

- Governments of Alberta and Manitoba
  - Setting up programs to support wider adoption of AD
  - Alberta has 5 AD running on feedlots (2), hog farms (2), and potatoe processing plant (1) for heat and electricity prod.

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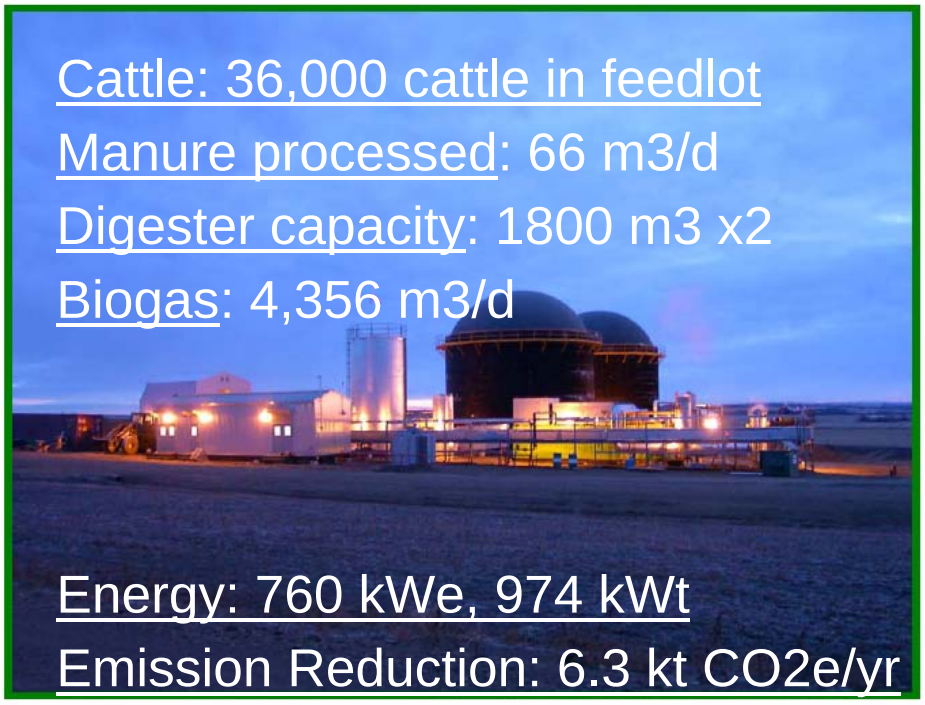
AD Energy Cogeneration - Pilot Plants



IMUS AD system

Himark Renewables Inc. - Alberta

- Develops and commercializes an Integrated Manure Utilization System (IMUS) to convert livestock manure to biogas using a **thermophilic** (55 °C) AD, and exporting electricity to the power grid. The system produces organic fertilizer and reusable water by recovery and concentration of nutrients in the digested beef manure.

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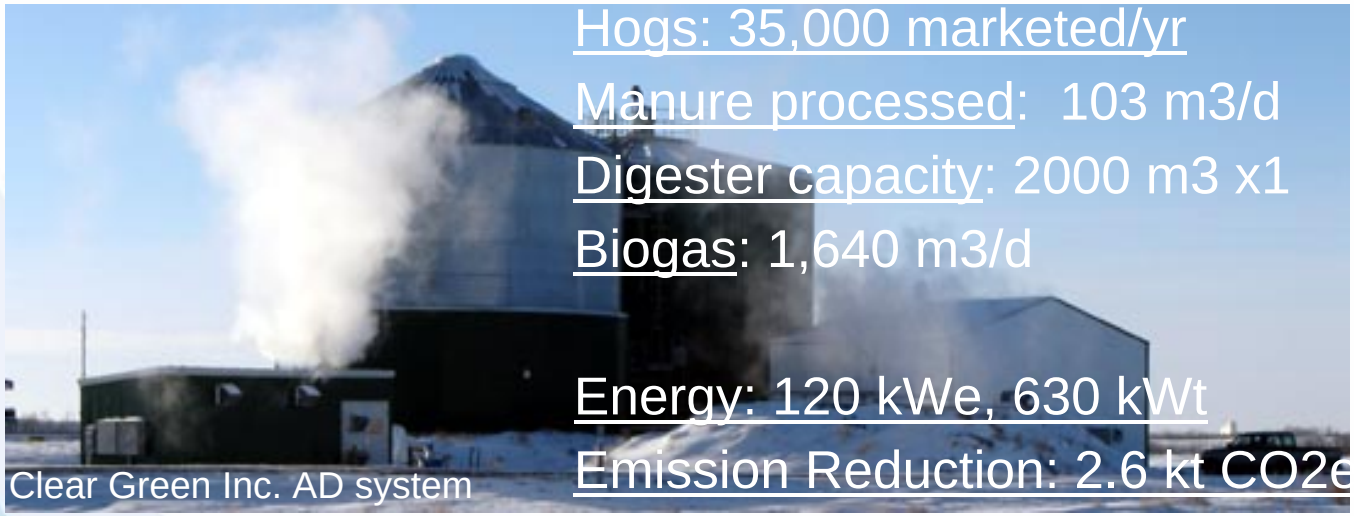

Clear Green Inc. AD system

Clear Green Inc. - Saskatchewan

- To demonstrate a **mesophilic** anaerobic digester (AD) system for hog manure coupled with a novel nutrient separation and recovery technology
- To produce biogas for energy cogeneration in a micro turbine owned and operated by SaskPower

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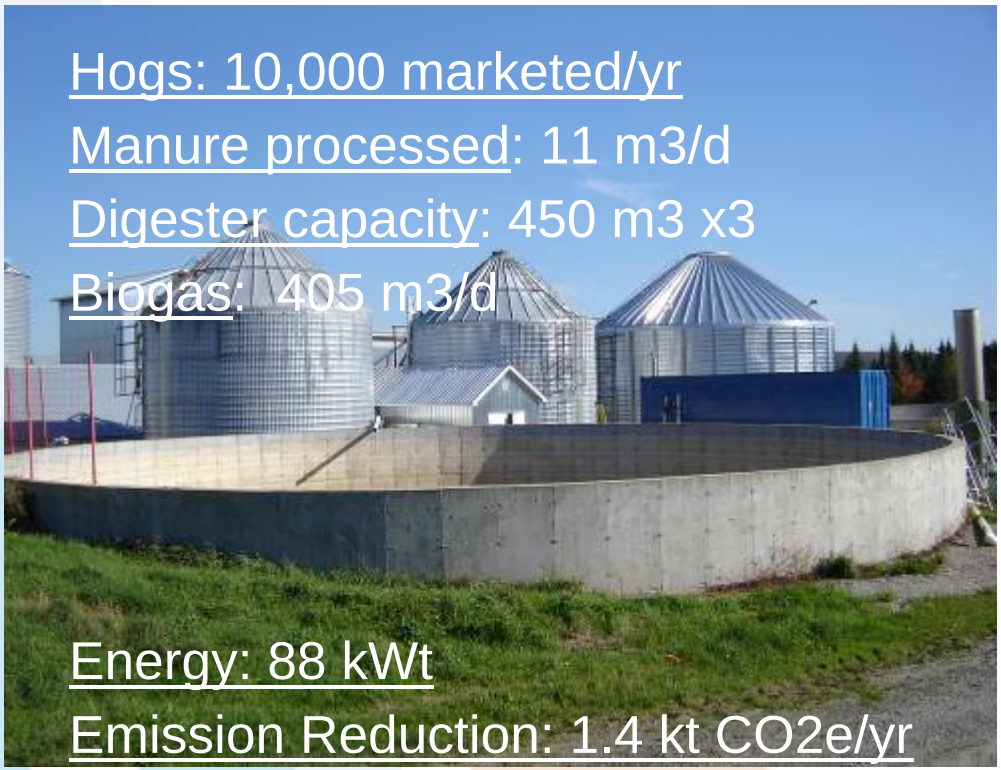
AD Energy Cogeneration - Pilot Plants



Bio-Terre AD system – Peloquin farm

Bio-Terre Systems Inc. - Quebec

- Develops a market-ready AD system for the production of biogas, and cogeneration of electricity and heat from hog manure using a **psychrophilic** (23 °C) sequencing batch reactor.

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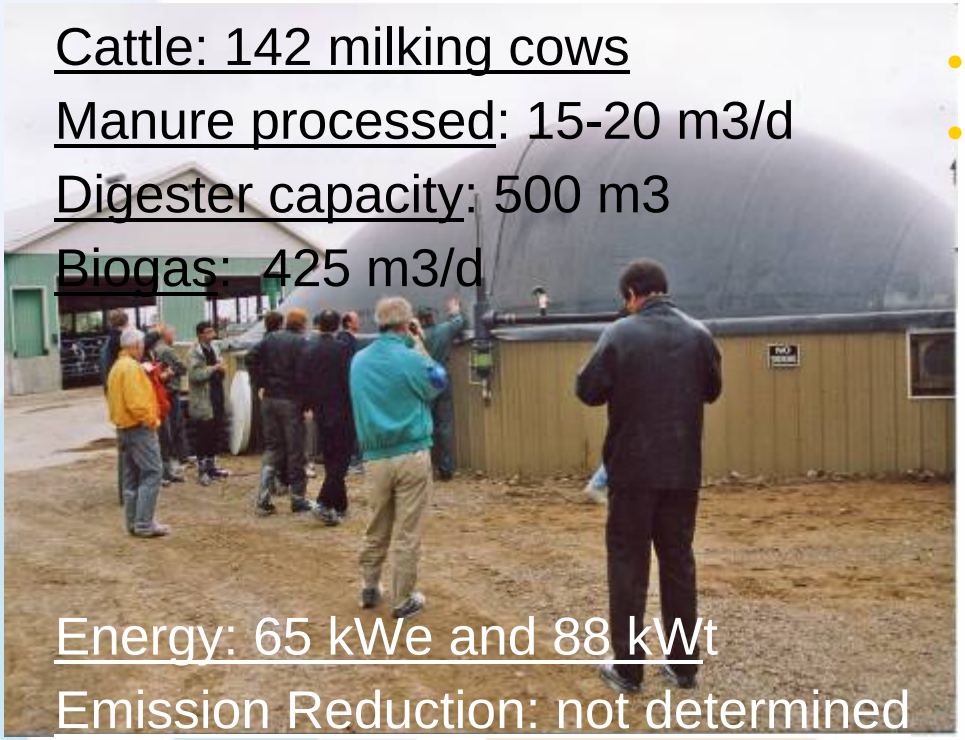
AD Energy Cogeneration - Pilot Plants

Klaesi Brothers Farm - Ontario



- A **mesophilic** AD at a dairy farm
- Biogas used for electrical and thermal energy production using a 100 Hp Perkins dual diesel/biogas engine.

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Barriers for Adoption of AD

- Economic
  - high initial capital investment for AD systems
  - private capital - limited availability
  - development of biofertilizers & bioproducts
  - find new markets for biofertilizer & bioproducts

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Barriers for Adoption of AD

- Technical
  - removal of H_2S – (corrosive)
  - temperature control, mixing, gas handling & utilization
  - adaptation of AD system components to ILOs
  - utilization of thermal E - (Greenhouses, Ethanol plants)
  - need technology to produce high grade biofertilizer
- Policy/Regulatory/Infrastructure
  - lack of domestic carbon trading system
    - provincial regulation: i.e, 250 kW min. to access grid
    - insurance, zoning, cost of grid connection
    - areas with transmission grid limitations

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Future Opportunities

- Use mixed feedstocks for biogas production
- Producing biofuels: i.e., biohydrogen & methanol
- Improve the fertilizer value of animal manures
- Integration with other conversion technologies i.e., ethanol plant; or with pyrolysis to produce chemicals, aliphatic polyesters for bioplastics, lipids.
- Socio-economic and Life Cycle Analysis

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Thank you

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