Power Smart™
Bioenergy Optimization Program

Bioenergy Demonstration Projects
Biogas from Dairy Manure

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Outline

1. Bioenergy Optimization Program
2. Renewable energy from biomass
3. Anaerobic digestion basics
4. Why anaerobic digestion?
5. Biogas Demonstration Project
Bioenergy Optimization Program

Program Objective

Encourage and facilitate the installation, operation and maintenance of customer sited load displacement generation systems that employ combined heat and power (CHP) and renewable fuels; specifically biomass.
Bioenergy Optimization Program

Renewable Fuels

Biomass Attributes
- Sustainable
- GHG neutral
- Firm capacity

Biomass Sources
- Organic wastes
- Forestry by-products
- Livestock manure
- Crop residues
Improved business viability by converting disposal costs into:

- Avoided electricity purchases
- Avoided fossil fuel purchases
- Improved environmental performance
Biomass Energy Conversion

Solid Biomass (wood waste, ag residue)

Wet Biomass (manure, wastewater)

Thermochemical conversion

Gasification → syngas
Pyrolysis → pyrolysis-oil

Carbonization/Torrefaction → biocarbon
Direct Combustion

Reciprocating Engine

Steam cycle

Organic Rankine Cycle

Anaerobic digestion → biogas

Reciprocating Engine
Biogas Applications

On-farm anaerobic digesters
• Dairy, hog, poultry, beef manure

Industrial anaerobic digesters
• Food and beverage processing wastewater
• Slaughterhouse effluent

Wastewater treatment plants
• Supplemental to aerobic treatment

Landfill gas
• Capture methane from buried garbage
Anaerobic Digestion

Inputs
- Manure
- Wastewater
- Vegetable waste
- FOG

Outputs
- Biogas
  - Heat
  - Power
- Digestate
  - Fertilizer
  - Bedding (with solids separation)
Anaerobic Digestion
Terminology

Temperature
- Psychrophilic (15 to 25 C)
- Mesophilic (35 to 40 C)
- Thermophilic (50 to 60 C)

Digester design
- Complete mix – mechanically mixed or gas sparging
- Plug flow – higher solids
- Covered lagoon – low solids
- Sequential Batch Reactor (SBR) – unique design (no mixing)
- Industrial reactors

Co-substrates
- Feedstock added to manure to increase biogas yield
Anaerobic Digestion
Benefits

Economic benefits
• Energy – heat and power load displacement
• Digestate – fertilizer, solids for livestock bedding (with separation)
• Revenue from collection of co-substrates (ie. tipping fees)?

Environmental benefits
• Greenhouse gas reduction – destruction of methane
• Odour reduction
• Pathogen destruction
• Nutrient management

Operational benefits
• Reduction of flies
• Hydrogen sulphide safety
Anaerobic Digestion
Perceived Barriers

Economic barriers
• High capital cost
• Low energy costs
• Low value of carbon credits
• Challenging market conditions in livestock sector (ie. hogs, cattle)

Operational barriers
• Manitoba’s cold climate
• Operational complexity

Other barriers
• Uninformed government authorities and policy-makers
Bioenergy Optimization Program
Demonstration Projects

- Five projects aimed at demonstrating various pathways for conversion of raw biomass to combined heat and power
- Located at customer sites across the province
  - **Pyrolysis Oil** - Tolko Kraft Papers (The Pas), R&L Acres (Sperling), Assiniboine Community College (Brandon)
  - **Syngas** – Pineland Forest Nursery (Hadashville)
  - **Heat Recovery** – Spruce Products Ltd. (Swan River)
  - **Biogas** – Sweetridge Farms (Winkler)
  - **Biocarbon** – Rock Lake Colony (Grosse Isle)
- Partially funded by the federal Clean Energy Fund
Biogas Demonstration Component
Project Overview

Host Site:
• Sweetridge Farms, Winkler, MB
• 230 head dairy

Technology:
• Complete-mix, mesophilic digester
• 16 m diameter concrete tank
• 55 kWe CHP
• Solids separation
Biogas Demonstration Component
Technology Provider

PlanET Biogas Solutions
• Based in St. Catherine’s, ON
• German technology (over 150 projects in Europe)
• 5 projects in Ontario, 1 in BC
Questions or Comments

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