Enhancing Profitability through Co-Located Anaerobic Digestion Systems

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What we do:

Technology Commercialization
• Portfolio includes the market-leading AD technology
• Deploying our technology globally where it enhances our clients’ economics and operations

Technology Development
• Developing technologies that maintain our differential advantage in AD
• Enhancing the value proposition of technologies through integrating with other biofuel technologies.

Who we are:

• Bern & Mike Kotelko
  o Founders
• Evan & Shane Chrapko
  o CEO’s

• A growing team of business professionals, scientists, engineers and technologists
• Offices in Canada (HQ), USA, China, the Middle East and North Africa

Making waste the renewable solution
Trending Green

- In 1995 HFL began investigating alternatives for processing manure
  - The initial driver was the global trend towards environmental and nutrient management regulations for intensive livestock operations.

- Highmark Renewables was founded in 2001
  - R & D project began to develop a process that could handle dry, high solids manure produced at the volumes and conditions in North American style feedlots.
  - In February 2005 the only Thermophilic AD plant of its kind was up and running at HFL.
Anaerobic Digestion

AD converts organic WASTE to ENERGY

• Nearly any organic waste is suitable feedstock

Natural process - harnessed and optimized

• Biological, similar to brewing or yogurt-making, but continuous

Low energy, low cost baseload power

• More efficient and effective than gasification, pyrolysis, composting

Produces bioGas

• Substitute for Natural Gas
• Methane (CH₄) is the main component
• CO₂, H₂O(g), H₂S, other micro components

Co-produces ‘organic’ bio-based fertilizer/soil amendment

Environmental & social win

• Reduce GHGs
• Reduce odors
• Completely Eliminate Common Pathogens
• Improve soil quality
• Maximize value of “waste”
• Provides a sustainable nutrient management tool
IMUS™ Technology

IMUS™ technology package

• Treat high-solid waste from:
  o Livestock operations including open-pen feedlots and dairies!
  o Food & beverage processing
  o Crop residues
  o BioFuels production
  o Other agricultural & industrial waste
  o Municipal SSO & wastewater

• High Solid In-Feed System (HiSIS™) allows feeding of nearly any feedstock or combination of feedstocks

• Clean-Slate™ System minimizes downtime

• Customized designs at any scale

• Produces renewable energy in the form of polished bioGas, which can generate heat and electricity

• Produces bio-based soil amendments & bioProducts

• Reduces GHG emissions

Making waste the renewable solution
Co-Location with Ethanol

Configuration Options

• **Thermal Replacement Only**
  - Biogas used to generate steam for ethanol process and biogas process, zero-out natural gas cost line in opex
  - Lowest capital investment, additional electrical costs in opex

• **Electrical Only**
  - Biogas used to generate electricity for ethanol and biogas process, zero-out electrical cost in opex
  - Electrical Generation yields sufficient thermal energy for biogas process requirements
  - Higher capital investment

• **Total Energy Independence (and beyond)**
  - Split use of biogas: 100% electrical replacement for both processes and 100% thermal. Zero-out both cost lines. Possible to export energy.
  - Most efficient (energy and capital)
  - Highest Capital Investment, Highest Return

Making waste the renewable solution
Case Studies

Making waste the renewable solution
Configuration:

• Alberta, Canada
• New 10MMgal/year ethanol production (Wheat, Triticale or Sorghum)
• 36,000 head co-located feedlot (existing)
• Waste from nearby municipalities and businesses
• IMUS™ facility capable of full energy offset + export of additional electrical energy
  • 2 x 7,200m³ (new) + 2x1600m³ (existing) Primary Digesters
  • HiSIS™, Clean Slate™ and Active Access™
  • 2.5MW of power generation (1.5 new, 1 existing)
  • Remainder of biogas to fuel ethanol boilers
• **Ethanol likely to qualify for D5 RINs if exported to USA**
• Construction on latest phase started in Q4, 2011
• Expected production of ethanol in Q4 2012
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GPHH

Making waste the renewable solution
Configuration:

- Kansas, USA
- Existing 50MMgal/year ethanol production (Sorghum)
  - Already one of the most energy efficient ethanol plants running
- 50,000 head near-by feedlot (existing)
- Waste from other nearby feedlots, municipalities and businesses, syrup from ethanol plant
- IMUS™ facility capable of complete thermal energy offset
  - 4 x 7,200m³ Primary Digesters
  - Large Tertiary digesters
  - HiSIS™, Clean Slate™ and Active Access™
  - Biogas to fuel ethanol boilers
  - Future expansion to produce full electrical offset possible
- **Ethanol likely to qualify for D5 RINs**
- Engineering started in Q4 2011
- Expected production of biogas in Q4 2012
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Integration of Energy and Food Production

Taking Green the next step

Making waste the renewable solution
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