

THINKING BIOGAS

THINK ALBERTA!



BIOGAS (METHANE) OVERVIEW

What is Biogas?

Biogas is “renewable natural gas” containing approximately 70% methane (CH₄) and roughly 30% carbon dioxide and trace amounts of other gases.

Potential agricultural feedstocks for biogas production include manure (hog, dairy, beef and poultry), food processing (byproducts of meat processing, potato, dairy, cheese whey, sugar beet, pea hulls, and vegetables); and energy crops cut as silage (wheat, barley, triticale, clover, alfalfa, ryegrass, turnips and corn).

Benefits of Biogas

Methane yields from agriculture feedstocks are in the 50% to 70% range. Manure has the lowest yield with energy crops and food processing having the highest yields. Much potential exists to blend feedstocks to achieve desirable methane yields and solve environmental issues at the same time.

Commercial products from biogas production include methane, electricity, heat, steam, fertilizer, chemical recovery, odor reduction, water recycling, CO₂ and potentially carbon credits and greenhouse gas credits.

Challenges of Biogas

Deciding to market the electricity, renewable natural gas directly, or combined heat and power depends on the location of the end users and the cost of meeting market standards:

- The capital cost of linking to the electricity grid

(cogeneration units, metering etc.) varies from \$60,000 to \$350,000, depending on the scale of the project;

- Upgrading the biogas to meet the gas quality requirements of low pressure natural gas gathering pipelines will require capital costs in the range of \$4 to \$5 Million per MW of output to remove the CO₂; finding opportunities to use existing fossil-fuel based upgrading systems for other types of natural gas sources will greatly reduce these costs;
- Using the heat and power on site or at nearby facilities, be they agricultural or other types of operations, is cost effective; excess power/gas/heat can be sold on the market;
- New generation cooperatives who seek to collaborate on the infrastructure and/or processing costs of biogas and other types of bioenergy installations (integrated ethanol-feedlot-biodiesel and processing facilities) could enhance the economies of scale.

Current Technologies & Investment

Anaerobic biodigestors can be either wet fermentation or dry fermentation. Wet biodigestors must be cleaned out every 1 to 3 years with a life expectancy of the digester being approximately 10 years. Dry biodigestors do not have to be cleaned out as often and have a life expectancy of approximately 20 years.

Capital cost for a biogas facility that produces one (1)



megawatt of power would be in the \$4 to \$6 Million range depending on the level of infrastructure at the site. Liquid systems that are already set up for collection and handling, may require intermediary processing and holding before entering the digester. Solid systems will have to develop the infrastructure to increase manure collecting and handling to feed the digester – manure collection frequency will have to increase to at least 4 times a year to feed the digester with relatively ‘fresh’ material.

The availability of turnkey technology, expected to develop in the future, will help reduce the capital costs. Biogas facilities, at this juncture, can expect the following capital and installation costs for a 1 MW unit¹ to be:

- Manure Collection and System Processing – \$100,000 to \$600,000 range (June 2006 pricing)
- Digestion System – \$300,000 to 500,000 range
- Solid-Liquid Separation of Digestate – \$200,000 to \$300,000 range depending on need for secondary storage (nutrient recovery/water recycling not included)
- Biogas Utilization – \$3 to \$3.5 Million for hydrogen sulphide scrubbing systems, cogeneration units, metering, grid connection, and flare system (add on an additional \$1M for CO₂ removal if gas is preferred over electricity marketing);
- Post-Digestion System (secondary storage of digestate with further biogas collection), without solid-liquid separation) - \$200,000 to \$400,000.

To realize a 100 kW to 5MW size biogas facility,

running on manure only, the following sizes of confined feeding operations would be needed :

Size of Operation (MWe)	0.1	0.3	0.5	1.5	5
Animal Requirement (head)					
Beef Feeder	2,186	6,558	10,930	32,791	109,302
Beef Finisher	1,053	3,158	5,263	15,790	52,633
Dairy Cows	421	1,264	2,107	6,322	21,072
Hog Farrow to Finisher	3,445	10,336	17,226	51,678	17,2261
Hog Farrow to Wean	364	1,091	1,818	5,453	18,179
Layers	9,541	28,624	47,707	143,120	477,066
Broilers	37,431	112,294	187,157	561,470	1,871,568

To ensure a consistent supply of renewable natural gas/electricity, to the electrical grid or natural gas pipelines, a recommended number of biodigester units at each site would be two to three.

Project developers should factor in the cost for engineering designs for biogas facilities to be between 10 and 15 % of the total cost of the project.

Project developers need to go through two avenues to develop projects:

1. Application to “Alberta Environment” for an environmental approval, which will deal with transportation of waste to the facility and any air/

¹Note – this is for a 1 MW output of electricity; based on June 2006 pricing – all figures are subject to change.

²If manure is to be mixed with other feedstocks, the methane yield can be boosted substantially, lowering the animal number threshold. Analysis by a qualified lab can determine the appropriate blends of feedstocks.



water emissions from the project. Steps to follow are:

- a. Applicant must contact the Approvals Manager in the region they want to build the plant in. These contacts are on Environment's website:
 - b. <http://environment.gov.ab.ca>
 - c. Fill out an approvals application describing the process, inputs/outputs, and other information as required
 - d. A public posting is part of the process - statements of concern may arise. If no statement of concern, then go to point e.
 - e. Statements of Concern may trigger an Environmental Appeals Board hearing.
 - f. Once the public posting/Appeals Board issues are dealt with the approvals writer will take all of the information and make a recommendation to the Approvals Director in the region. An approval is granted if all is in order.
 - g. Process may take 3 months if no public concerns, or 6 months to a year if appeals need to be dealt with.
2. Application to the Energy and Utilities Board for a Power Plant approval, if the facility is generating over 1 MW. A similar process occurs at this level.

The government of Alberta is working collaboratively to raise the 1 MW threshold to 5 MW before the more comprehensive environmental or EUB approval process is triggered.

Potential Research and Development funds for new projects (Precommercial, Demo) could possibly be obtained from the "Alberta Funding Consortium" (Government of Alberta) or from Government of Canada research and development funds. Projects that are funded would have to be for new ideas only.

Websites for Biogas Information:

<http://www.climatechangecentral.com>

Type into the search engine "Biogas Conference"

- Provides all the speakers, presentations and case studies as given by speakers from Europe, the USA and Canada
- The "Alberta Biogas Conference" was held April 2 to 4, 2006 in Edmonton.

<http://www.gov.ab.ca/home/index.cfm>

<http://environment.gov.ab.ca/>

<http://www.highmark.ca>

<http://www.enermac.com/SEGI.htm>

<http://www.ecbna.com>

<http://www.celprojects.com/>

<http://www.gensolutions.ab.ca>

<http://www.waterouspower.com>

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