

## ALTERNATIVE SOURCES OF ENERGY – ON-FARM OPTIONS

Steve Clarke, P Eng.  
Ontario Ministry of Agriculture, Food and Rural Affairs  
59 Ministry Road, Kemptville, Ontario, K0G 1J0  
E-mail: [steve.clarke@ontario.ca](mailto:steve.clarke@ontario.ca)

### WHAT IS BIOGAS?

Anaerobic digestion (AD) is the process by which organic materials in an enclosed vessel are broken down by micro-organisms, in the absence of oxygen. Anaerobic digestion produces *biogas* (consisting primarily of methane and carbon dioxide). AD systems are also often referred to as “biogas systems.”

Depending on the system design, biogas can be combusted to run a generator producing electricity and heat (called a co-generation system), burned as a fuel in a boiler or furnace, or cleaned and used as a natural gas replacement.

The AD process also produces a liquid effluent (called digestate) that contains all the water, all the minerals and approximately half of the carbon from the incoming materials.

Many agri-food AD systems are located on farms. Farm-based AD systems work well with liquid manure. AD systems provide a valuable manure treatment option.

For hog operations:

#### Cons:

- Concern that high nitrogen content in manure will inhibit AD process
- Recipe is key (probably not pure hog manure) - add off farm material
- Typical under barn storage: not fresh manure, need long term storage

#### Pros:

- Decent biogas output: (m<sup>3</sup>/tonne wet material)
  - Liquid hog manure: 20-35 m<sup>3</sup>/t
  - Dairy manure: 20-30 m<sup>3</sup>/t
- Potential use for heat byproduct in new barns

### ENERGY CROPS/ OFF FARM MATERIAL

- High energy-density compared to manure
- Greatly increases energy production compared to manure system
  - Corn silage: 170-200 m<sup>3</sup>/t
  - DAF from meat plant: 35-280 m<sup>3</sup>/t
  - Restaurant and bakery waste: 50-480 m<sup>3</sup>/t

## **CHALLENGES OF ANAEROBIC DIGESTION OF MANURE**

Although the fundamentals of AD systems are very simple, the operation and control can be complex. Management considerations include:

- mixing primarily fresh organic material (<1 week old) so that optimum organic matter is available for digestion
- maintaining a narrow temperature range suitable for digestion — adding material that has already cooled down in the barn or storage will increase the heating requirements
- completing proper physical design of the system to eliminate plugging, crusting or foaming problems
- optimizing the “recipe” to generate sufficient and consistent biogas production to make the economics work
- installing and managing an interrelated group of systems to safely handle heating of the tank, material flow, hydrogen sulphide reduction, methane transfer, heat production, electrical production, interconnection with the electrical grid and surplus heat management

## **ELECTRICITY CONSIDERATIONS**

### **Interconnection to the Electricity Grid**

When AD systems are designed for electrical production, the system typically generates more energy than can be used on that one site. Even in cases where energy production matches on-site energy needs, an interconnection with the grid is useful. Energy demands at most facilities are not typically static or linear. Under normal conditions, there are peaks in energy demand that the AD co-generation system may not be responsive enough to supply. Instead, the grid essentially acts as a large battery, with the AD system putting energy in and the local facility drawing energy out.

### **Net Metering**

Net metering is an agreement where the energy generator (the AD operator) pays the electricity distributor only for the net amount of electricity consumed. This allows the AD facility to generate electricity at any time, send it into the grid and then use electricity at any other time. The net billing or reconciliation is typically within a specified period of time (1 year in Ontario). The electricity distributor bills the facility for the net amount used. See the Ministry of Energy’s Net Metering brochure for more information: [www.energy.gov.on.ca/english/pdf/renewable/NetMeteringBrochure.pdf](http://www.energy.gov.on.ca/english/pdf/renewable/NetMeteringBrochure.pdf).

### **Standard Offer Program**

The Renewable Energy Standard Offer Program (RESOP) gives some renewable energy system operators, including AD system operators, the option to sell or replace electricity at fixed rates for a period of 20 years. At the time of writing, the value of the electricity is

around 11¢/kWh for non-peak electrical consumption periods and around 14.52¢/kWh for peak periods (2,000 hr/yr). These values will inflate at 20% of the Consumer Price Inflation Index. For more details, see the OMAFRA Factsheet *Anaerobic Digestion and the Renewable Energy Standard Offer Program*, Order No. 07-051, or visit the Ontario Power Authority (OPA) website.

### **On-Farm Mixing of Off-Farm Source Material**

Mixing of off-farm source material with manure in an “on-farm mixed anaerobic digester” may increase biogas production. Some European jurisdictions allow mixing of up to 25% of off-farm source materials such as fats, oils and greases, pre-consumer food wastes, and other food products or byproducts. As a result of the high carbon content of these materials, biogas production can be doubled or tripled depending on the quantity and quality of the feedstock. Proper storage of off-farm source materials is necessary to minimize the potential for odour nuisance. In addition, a blend tank may be necessary, depending on the type of AD system used. There are two regulatory systems to bring most off-farm source materials to a farm for mixing with manure in a digester: a Certificate of Approval under the *Environmental Protection Act*, or an approval under the Nutrient Management Regulation 267/03. Both of these regulatory systems have requirements for the facility and for the land to receive the end product.

## **FUNDING PROGRAMS**

### **Ontario Biogas Systems Financial Assistance Program Field Day**

The Ontario Biogas Systems Financial Assistance Program is a \$9-million investment that will help farmers and agri-food businesses develop and build generating systems that produce clean energy, reduce electricity costs and contribute to local economies. Funding is on a first come basis.

- There are two phases to the program. Phase 1 funding will cover up to 70 per cent of the eligible costs of carrying out a feasibility study, to a maximum of \$35,000. Last date to apply is September 30, 2008.
- Phase 2 funding will cover up to 40 per cent of eligible construction and implementation costs. The maximum total feasibility and construction cost funding is \$400,000 for each anaerobic digester system. Last date to apply is September 30, 2009.

### **Applications**

Program guidelines and application forms for the program are now available online or by contacting:

Ontario Biogas Systems Financial Assistance Program, Ontario Ministry of Agriculture, Food and Rural Affairs. 1 Stone Road West, Guelph, Ontario N1G 4Y2, Tel: 1-888-466 -2372, E-mail: [biogas.program@ontario.ca](mailto:biogas.program@ontario.ca), Website: [www.ontario.ca/biogas](http://www.ontario.ca/biogas).

## **ELECTRICITY RETROFIT INCENTIVE PROGRAM (ERIP) - HYDRO ONE**

### **Agriculture Program:**

- Swine heat pads (less than 100watts), (\$45-\$90) heat pads controllers, (\$140) and high temperature cut off thermostats (\$90)
- Livestock water bowls (under 250 watts, minimum of 2 ' insulation) (\$40)
- Ventilation fans (24 ") (\$ 50)
- Photocell and timer for lighting control (\$25)

Contact Information : Contact person: Paola Silli  
Program Coordinator, Conservation & Demand Management  
Tel: (416) 345-6036 Fax: (416) 345-5911 E-mail: Paola.Silli@HydroOne.com

### **Industrial/Commercial /Institutional Solar Thermal Heating Grants**

The Ontario government is making \$14.4 million available over four years to encourage the industrial/commercial/institutional sector to convert to solar thermal heating. Ontario businesses, industries, schools, universities, municipalities and hospitals would receive 25 per cent of the cost of the installation of a solar thermal heating system from the province to a maximum of \$80,000.

The program is linked with the federal government's ecoENERGY Renewable Heat Program which will also provide a contribution of 25 per cent to a maximum of \$80,000. It is estimated that the program will generate 500 installations over four years. **To access the provincial grant you must first access the federal grant program.**

Qualifying details (and other key FAQ's) can be found at: [www.ecoaction.gc.ca/ecoenergy-ecoenergie/heat-chauffage/conditions-eng.cfm#3](http://www.ecoaction.gc.ca/ecoenergy-ecoenergie/heat-chauffage/conditions-eng.cfm#3).

### **Class 43.1/43.2 Accelerated Capital Cost Allowances (ACCA) and The Canadian Renewable And Conservation Expenses (CRCE)**

Class 43.1 and Class 43.2, in Schedule II of the Income Tax Regulations, allow taxpayers an accelerated write-off of the capital cost of certain equipment that produces energy efficiently or produces energy from certain alternative renewable sources. The write-off rates for Class 43.1 and Class 43.2 are 30 percent and 50 percent respectively, on a declining balance basis.

## **RESOURCES**

- Biogas Program Website, Q&A - [www.ontario.ca/biogas](http://www.ontario.ca/biogas)
- General Biogas System Info - OMAFRA Energy Website: [www.omafra.gov.on.ca/english/engineer/energy.html](http://www.omafra.gov.on.ca/english/engineer/energy.html)
- OMAFRA staff (engineering, climate change, livestock, crop, food, land use planning, economic development, etc.)

- Agricultural Information Contact Centre Tel: 1-877-424-1300
- U.S. Environmental Protection Agency's AgSTAR Program
- Ontario Power Authority (OPA)  
<http://www.everykilowattcounts.ca/HTML/BusinessPrograms/Agriculture/agriculture.shtml>
- OMAFRA. Poop Power 2004. Video outlining the operation of an on-farm Ontario anaerobic digester. Available on the OMAFRA website at [www.ontario.ca/agengineering](http://www.ontario.ca/agengineering), under Alternative Energy — Anaerobic Digestion — Video
- AgriEnergy Producers' Association of Ontario (APAO). Associate Member Organization under the auspices of the Ontario Sustainable Energy Association (OSEA) since April, 2007.  
 Tel: (613) 224-8308 Fax: (613) 224-1642 Website: [www.apaeo.ca](http://www.apaeo.ca)