

# Fuel for Thought: Alternative Energy Sources for Agriculture

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Today, there are numerous energy alternatives available to the agriculture industry to help reduce the dependence on traditional energy supplies. The deciding factor behind an alternative energy option is based primarily on the economics of the system. Potential environmental and social benefits will also play a large role in the decision to implement alternative energy technology into a livestock producer's current facility. Alberta Agriculture, Food and Rural Development (AAFRD) is investigating energy options available to producers.

## ■ Understanding Your Situation

Before converting a traditional heating or electrical supply system to an alternative energy source, the producer must have a clear understanding of their current situation. This includes the current and future demands of the facility as well as requirements of the potential technology.

## ■ Options

There are a variety of alternative energy options that are being investigated. Some of the options include:

- Ground Source Heat Pumps
- Biogas Production
- Wind Energy
- Solar Energy
- Biodiesel
- Hydroelectric Power
- Cogeneration

- Fuel Cells
- Microturbines

The following questions must be answered before implementing an alternative energy technology:

1. What are the current/future electricity and heating requirements of the facility?
2. Is the site acceptable for the new technology under consideration?
3. Do the economic and environmental benefits outweigh the traditional energy source benefits?

The following information provides a general background for some of the alternative technologies being investigated and will assist in answering the questions above.

### ***Ground Source Heat Pumps***

Ground source heat pumps can be used for heating and cooling of a building. This type of technology uses a consistent earth or groundwater temperature to heat or cool air and water. It works in the same manner as your refrigerator. A heat pump can extract heat from the ground to heat a building and reversing the pump can move hot air out of a building and down into the ground. This is a practical option that can be implemented into most heating systems.

### ***Biogas***

Biogas is a gas produced by the anaerobic digestion of organic material such as manure. This gas can be used for heat or electricity. The basic concept behind an anaerobic digester is that manure is fed into the digester and heated. The digester produces biogas naturally by decomposing or fermenting the manure. This gas is then captured and used to create electricity and/or thermal energy. This type of production is typically applicable to large livestock operations because of economic considerations.

### ***Wind Energy***

Wind energy is generated from a turbine system that converts kinetic energy into mechanical energy or electricity. The amount of power harnessed from the wind depends on the average annual wind speed, which is influenced by topography and obstacles. A wind power system usually requires a minimum average annual wind speed of at least 15km/hr. Generally it is recommended to collect at least one year of weather data before setting up a wind turbine.

### ***Solar Energy***

The sun provides an unlimited supply of energy in the form of electromagnetic radiation. Capturing enough solar energy for effective use depends on available solar energy, weather conditions, location, and the application. Some of the solar applications for producers include electricity production and heating of water for the facility.

### ***Biodiesel***

Producers using diesel motors or tractors can look at the nearest Canola field and find a source of clean burning, high-performing fuel. Biodiesel is derived from plant or animal oil. It is similar to petroleum diesel and does not require changes to existing engines, fuel infrastructure or storage. Biodiesel engines deliver similar mileage, torque and horsepower. Currently biodiesel is not available for retail sale and current production economics require careful consideration prior to utilizing this fuel.

### ***Hydroelectric Power***

Hydroelectric power comes from the natural flow of water. The energy is produced by the fall of water turning the blades of a turbine. The turbine is connected to a generator that converts the energy into electricity. The amount of electricity a system can produce depends upon the quantity of water passing through the turbine and the height from which the water falls. This is a clean and renewable and inexpensive electricity source. The obvious drawback to utilizing this technology is the proximity to an available water supply.

### ***Cogeneration***

Cogeneration uses a single energy source and has an output of electricity and thermal energy in the form of hot water or steam. Such a plant generally consists of an electric generator driven by an internal combustion engine or a combustion turbine. The fuel source can be traditional sources such as natural gas or diesel, or non-traditional fuel sources such as hydrogen for a fuel cell.

### ***Microturbine***

Microturbines are an adaptable, low-emissions power generation system. A gas turbine-driven high-speed generator is coupled with power electronics that allow the system to operate either connected to the grid or in stand-alone modes. This cogeneration technology can produce electricity efficiently and utilize the heat from the system. It can operate on multiple fuel sources including low-pressure and high-pressure natural gas, propane, diesel and up to 7% H<sub>2</sub>S "sour" gas.

### ***Fuel Cell***

A fuel cell is an electrochemical energy conversion device that converts hydrogen and oxygen into electricity and heat. It is very much like a battery than can be recharged while you are drawing power from it. Instead of recharging using electricity, this technology uses hydrogen and oxygen. This technology can provide a DC voltage that can be used to power motors, lights or any number of electrical appliances. Fuel cells are a developing technology that should be a feasible alternative within the next decade for a variety of applications.

### ■ **Fuel for Thought**

More energy alternatives are coming online all the time, with varying degrees of practicality for current agricultural operations. Producers will continue to adopt economically viable and environmentally sustainable options that fit their operation.

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