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Considering alternative fuels

Sustainable energy systems will put greenhouse operations ahead of the game

By Michael Kovalycsik

Many biomass boilers run on wood chips and debris.

Record oil prices are making everyone nervous this year, including growers who experienced a brutal winter and an abnormally wet spring. It's natural to start looking for alternative energy sources to replace or at least augment conventional systems and help save money on fuel.

Investing in sustainable energy systems can put greenhouse operations ahead of the game by meeting growers' needs now, without compromising our world's natural resources. Sustainable energy includes all renewable energy sources like solar, wind, geothermal and biomass energy, as well as technologies that improve energy efficiency.

To help you decide if sustainable energy is feasible for your operation, here is a look at the realities of several popular sustainable solutions, including return on investment, benefits and drawbacks.

Biomass energy

Growers with biomass systems appreciate the advantage they have over other growers reliant on unstable fuel costs, allowing them to provide customers with unchanging prices and potentially expanding their market share.

Biomass is biological material from living, or recently living organisms, such as wood, waste, (hydrogen) gas, and alcohol fuels. Biomass is commonly plant matter grown to generate electricity or produce heat, and may also include biodegradable wastes that can be burnt as fuel. Direct incineration is the most conventional way in which biomass is used.

Industrial biomass can be grown from numerous types of plants, including miscanthus, switchgrass, hemp, corn, sorghum, sugarcane and a variety of tree species, including poplar and willow.

All biomass is not created equal, however, with sources like wood holding higher Btus than manure, for example. Growers can prevent problems by burning high-quality material.

The most common way to harvest solar energy is to use solar panels.

Photo Courtesy of Blooming Nursery

Pros

+ Biomass energy is an unlimited and renewable energy source.
+ It is cost effective. Generally, the energy is generated and supplied in the same area, eliminating the need to install large pipelines.
+ There is surplus of organic waste and agricultural waste generated everyday, so biomass is an easily available resource.
+ Available grants and tax incentives can help growers pay off investment in biomass boiler equipment in less time.

Cons

— Some of the gases like carbon dioxide, methane and nitrous oxide are emitted into the atmosphere during biomass production, which may damage the ozone layer.
— The accumulation, harvesting and storage of raw biomass materials can be expensive compared to that of fossil fuels.
— Capital investment in a biomass boiler is very high, and when natural gas prices are low, it makes the payback time hard to calculate.

Solar energy

Solar radiation, along with secondary solar-powered resources such as wind and wave power, hydroelectricity and biomass, account for most of the available renewable energy on earth. Only a minuscule fraction of the available solar energy is used.

Solar-powered electrical generation relies on heat engines and photovoltaics. The most common way to harvest solar energy is to use solar panels. Solar technologies are characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include orienting a building toward the sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

Some growers, like Grace Dinsdale of Blooming Nursery in Cornelius, Ore., are significantly reducing natural gas usage with solar panels. Dinsdale said she projects her operation will use less than 5 percent of the natural gas previously burned. Payback is estimated to take less than four years, accounting for tax incentives and annual savings of energy generation.

Pros

+ Solar energy is an unlimited resource of renewable energy that has just begun to be used.
+ Growers can choose from solar thermal panels for heat or solar voltaic panels for electricity. Both are efficient and effective in large and small-scale greenhouses.
+ Surplus energy can be sold back to the public electric grid and credits can be banked during sunny summer months.
+ Even on cloudy days, solar energy systems still produce power.
+ Many grants and tax incentives exist to help growers pay for their initial investment. With the help of these resources and annual savings on energy, solar energy offers a quick ROI.
+ Solar energy systems are long-lasting, with an expected life of the major components between 30 and 50 years,

Cons

— Without the aid of grants and tax incentives, solar panels are very expensive and cost prohibitive.

Geothermal energy

Growers with geothermal heating have found their systems to be reliable and efficient, supplying over 80 percent of their heating needs while reducing their operations' carbon output.

Geothermal energy is thermal energy generated and stored in the Earth, originating from the formation of the planet, radioactive decay of minerals, volcanic activity and solar energy absorbed at the surface. The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface. Geothermal power is considered to be sustainable because the heat extraction is small compared with the Earth's heat content.

Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, opening a potential for widespread exploitation.

Pros

+ Geothermal energy is an unlimited and renewable energy source.
+ It is cost-effective and reliable, making its capacity factor or

Hydronic heating

More of an efficient energy tool than a fuel source, hydronic heating systems use water as a heat transfer medium in heating systems, with a boiler to heat water and a pump to circulate the hot water in rubber tubes that are either buried underground for field growing, embedded in concrete for radiant floor heating, or installed in greenhouse bench systems. Separated radiant heat zones are controlled by one thermostat and served by a manifold, which distributes the flow of hot water to the individual circuits of tubing within each zone.

The process works through thermal radiation, which travels in invisible waves through empty space. Radiant heat is absorbed by the objects in its path, rather than in the air. This makes it more effective than forced air heating because it uses heat transfer, along with a superior conductor of heat in the form of a liquid, versus forced air, which relies solely on convection and air. The result is a consistent, comfortable temperature that makes the greenhouse feel warmer at lower air temperatures than are required with conventional heating systems.

Pros

+ Heats the greenhouse starting at the plant roots, resulting in faster crop production and healthier plants.
+ Saves 20-30 percent in energy bills through more efficient energy use over the long-term.
+ Allows flexibility in boiler fuel choices, and the ability to supplement with renewable resources like solar and geothermal heaters.
+ Requires little electricity to run, ideal for areas with high electric fees.

Cons

— Hydronic heating systems cost significantly more up front than traditional, forced-air systems.

output very large.
+ Geothermal energy is more widely available, allowing more growers to use this resource.

Cons

— Geothermal wells release greenhouse gases trapped deep within the Earth, but these emissions are much lower per energy unit than those of fossil fuels.
— In colder climates, some greenhouse ranges cannot depend on geothermal heat year-round, and need to supplement with other sources in the winter.

Wind energy

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity and windmills for mechanical power.

Wind energy, as an alternative to fossil fuels, is plentiful, renewable, widely distributed, clean, and produces no greenhouse gas emissions during operation. The intermittency of wind rarely creates problems when using wind power to supply a low proportion of total demand, but as the proportion rises, increased costs, a need to upgrade the grid, and a lowered ability to supplant conventional production may occur. Power management techniques such as exporting and importing power to neighboring areas or reducing demand when wind production is low, can mitigate these problems.

Wind power has no fuel costs but a high capital cost. The estimated average cost per unit incorporates the cost of construction of the turbine and transmission facilities, borrowed funds, return to investors (including cost of risk), estimated annual production and other components, averaged over the projected useful life of the equipment, which may be in excess of 20 years.

Pros

+ Wind energy is an unlimited and a renewable energy source.
+ Wind power does not require fuel, making it sustainable and earth-friendly, emitting zero air pollution. The energy consumed to manufacture and transport the materials used to build a wind power plant is equal to the new energy produced by the plant within a few months of operation.
+ Tax credits are available for each kilowatt-hour (kWh) of wind power produced. Other incentives include exemption from property tax, accelerated depreciation, and additional markets for green credits.

Cons

— Costing about $250,000 each, wind turbines are a huge investment, but the grant money and tax incentives available currently have helped growers cut utility bills by approximately 80 percent and pay them off in five to six years. **GM**

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Photo Courtesy of Eagle Creek Growers