



SOUTH CAROLINA AGRICULTURE INDUSTRY



Identify the Numbers

The state of South Carolina is 34th in agriculture in the United States. With over 24,000 farms and a total value of shipments of \$1.89 billion dollars in 2006, agricultural industry is one of the largest industries within South Carolina. Approximately 10% of operating costs can be attributed to energy consumption in the agricultural industry.

Mid-Atlantic Co-operative, a co-op which coordinates information and contracts between the utilities and the co-op distributors, provided data on the daily energy usage of four undisclosed facilities within South Carolina. These facilities included two feed mills, a poultry processing plant, and a fruit and vegetable processing facility. The data included daily usage for all four facilities throughout 2007. Results found the average energy usage of these facilities was 679 kWh per day. If we assume this to be a reasonable average for South Carolina agricultural facilities, then the total agricultural industry in South Carolina consumes roughly 16,664 MWh of electricity; which equates to 6.1 TWh per annum.

Why is this market sector a good fit for CHP?

The reduction of energy costs is the principle reason for CHP implementation. There are two fuel sources readily available to farmers; crop residues (which are the waste materials such as shells, husks, stalks, bark, etc) and animal waste by which CHP can be employed. These potential fuel sources are available and could provide an inexpensive alternative to centrally generated electricity. Although animal waste and crops residues could be burned directly as biomass, for energy efficiency neither should be burnt directly. Both should be converted into gas.

Biomass gasifiers produce a gas by heating biomass (i.e. wood, wood waste, crop residues, etc) in low oxygen environments. This gas has less energy content than natural gas;

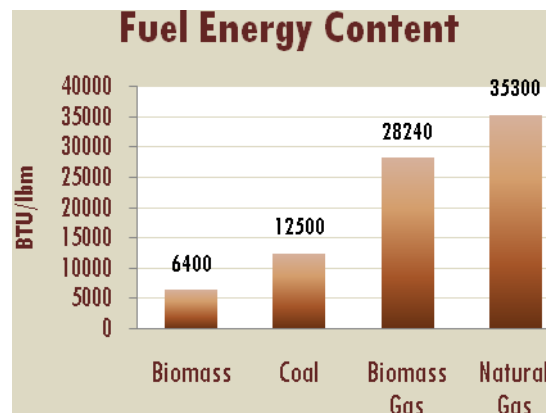


Table 1: Analysis of Molten Carbonate Fuel Cell Cost and Performance

roughly 150 - 800 Btu/ft³ compared to natural gas' 1000 Btu/ft³.ⁱ The energy efficiency of a gasifier is between 60% and 75%.ⁱⁱ Efficiencies at these levels would indicate energy has to be consumed to create the energy from the biomass gas. True, however, refer to Table 1:

Comparisons of Btu Content which compares the upper limits of energy content of biomass (burned directly) versus biomass which has been gasified. (For comparison convenience, all fuels have been converted to approximate Btu/lb-m.) Notice biomass gas provides much more energy content than the biomass alone, and is more favorable than coal. Traditionally, coal has been the more plentiful, inexpensive option, but as the price of coal increases, biomass gas becomes a viable alternative fuel for CHP applications.

What is the market potential for this sector?

Approximately 10% of operating costs are due to energy consumption in the agricultural industry. If this 10% operating costs could be reduced through CHP implementation, the South Carolina agriculture industry could recoup \$630 million spent on energy consumption. However, since it is unrealistic to assume all of the operating costs due to energy consumption would be realized, and in the absence of information concerning energy usage within agriculture, a more realistic goal of 10% to 30% energy savings (of the 10% operating costs) yields a financial recovery between \$63 million and \$190 million per year.

What are the potential benefits and uses?

South Carolina energy officials observe that CHP has more potential within the agricultural industry than is currently being utilized. Since there is a lack of information forthcoming from farms and food processing facilities, this is difficult to verify due to a lack of data on CHP implementation.

However, CHP can be employed within agriculture via animal waste or crop residues.

A digester uses animal waste to produce methane based biogas which is consumed in engine generators. Depending on the internal combustion engine used; heated air, steam, and/or electricity could be produced for sale or farm usage.

Some examples of sale or farm usage include:

- Heat processed through a reciprocating engine or a turbine could provide power while still providing hot water for the farm.
- In conjunction with a digester, a separator could be implemented so the solid waste byproducts could become an additional source of income, or a reduction in cost in bedding or compost materials.
- The liquid waste could then be returned to the digester (and associated lagoon) and/or passed to a secondary lagoon for increased waste/odor control or as an additional reservoir for crop/livestock consumption.

For facilities that do not have animal waste, biomass gas from crop residue could substitute as the fuel for the generator. This higher energy content is not as high as natural gas, and subsequently, past technologies were not developed to utilize biomasses such as crop residues. However, with rising energy costs new gasification systems are being developed to burn in smaller combustion turbines. As these new systems become more cost effective farms, mills, and processing plants will have alternatives to natural gas.

Getting Started

This market assessment was completed for the \$1.89 billion agricultural industry in South Carolina. The South Carolina agricultural industry is a large, energy intensive, multi-billion dollar market that accounts for more than 24,000 livestock ranches, floriculture and crop farms, and many food related industries.

While CHP may provide a cost saving, energy efficient option for farmers and food related manufacturers, change is slow to come in the industry due to the capital and energy intensive nature. For those farmers or food related manufacturers who are considering CHP implementation, the next step would be to conduct an engineering and economic analysis which will determine if a project using CHP technologies would be profitable to install. While initial costs associated with establishing CHP are viewed as relatively high, rising fuel costs may cast a more appealing light on such proposals and subsequently create a large market for CHP applications.

For interested parties, CHP technologies offer a potential opportunity for increased economic efficiency within the agricultural process. As such, there are numerous government, trade, and support organizations for the implementation of CHP equipment.

The Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) offers *Quick Plant Energy Profiler (Quick PEP)* software on its website to help determine how energy is currently being used and where opportunity exists to save cost and energy. The Department of Energy also sponsors *Industrial Assessment Centers (IACs)* which provide no-cost energy assessments for small and medium sized facilities.

ⁱ Christiansen, Ryan. "The Next Hot Commodity." Biomass Magazine Dec. 2008. Rpt. in . Grand Forks, ND: BBI International, 2008.

ⁱⁱ Food and Agriculture Organization of the United Nations. Wood Gas as Engine Fuel. 1986. 9 July 2009 <<ftp://ftp.fao.org/docrep/fao/t0512e/t0512e00.pdf>>.