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The Pros of Co-Locating

David Kuack



As increasing pressure is put on companies to operate more sustainably, controlled environment growers have an opportunity to not only show their customers how they're trying to produce "greener" crops by reducing greenhouse gases, but also by saving on energy costs.

Pictured: Pictured above: The New Jersey Ag Experiment Station at Rutgers University began operating a 1-acre greenhouse next to the Burlington County landfill in 1995. The permitted capacity of the landfill is expected to last until 2027.

"There is an increasing interest by controlled environment growers to co-locate their facilities adjacent to industrial parks, data centers, power plants, landfills and food waste generators," said Tom Bourgeois, director of U.S. Department of Energy's NY/NJ CHP Technical Assistance Partnerships and director of Policy Research at Pace Land Use Law Center for Sustainability at Pace University. "This a good example of what might be called a circular economy. Greenhouse operators are seeking to become more conscious of their carbon footprint. These co-location opportunities offer an advantage for controlled environment facilities and the other businesses they co-locate next to."

Recycling for energy

New York State has enacted a stringent food waste recycling law, the Food Donation and Food Scraps Recycling Law, that impacts large generators of food scraps. This includes restaurants, grocery stores, hotels, colleges, malls and event centers.

Tom is working with two New York greenhouse operations looking to take the food waste from these businesses and combining it with the crop waste from their facilities to generate a renewable energy source.

"These greenhouses would take the food waste and use cogeneration to produce heat and electricity to operate their facilities," Tom said. "An anaerobic digestor would be used to produce biogas gas (methane) that could be used to heat the greenhouses and generate electricity to power equipment, including supplemental lighting. U.S. Dept. of Energy offers a Combined Heat & Power (CHP) e-catalog, which

includes equipment that has been vetted by DOE. This CHP cogeneration equipment runs on biogas. In the U.S., 23% of all cogeneration sites are using some form of biogas or biomass waste."

Another example of recycling residual waste includes the conversion of clean urban wood waste such as pallets, tree limb clippings, etc. into biogas. Tom said there are often large recycling centers located in areas where it might be possible to construct a greenhouse.

"Rather than dumping this clean wood waste into a landfill and allowing it to decompose, there may be an opportunity to convert it into biogas," he added. "By locating a greenhouse nearby, the renewable gas produced could be used to power and heat the growing facility."

Landfill opportunities

The New Jersey Ag Experiment Station at Rutgers University began operating a 1-acre greenhouse next to the Burlington County landfill in 1995. Rutgers EcoComplex Clean Energy Innovation Center, which is part of the research station, is focused on clean energy technology.

"When the greenhouse was being considered, it was driven by the desire to utilize the landfill gas in some beneficial manner for economic development and for agriculture," said David Specca, assistant director at the EcoComplex.

Initially, the greenhouse was used for trial tomato production technology that was developed at Rutgers University. After about eight years, the tomato research was scaled back and the greenhouse was used as an incubator facility for potential new businesses.

"There are people interested in getting into the greenhouse business, but who can't afford to build a structure or find it difficult to secure greenhouse space that isn't owned by commercial growers who are using all the space to operate their own businesses," David said. "Since 2019, the greenhouse has been managed by the Occupational Training Center. The center is a nonprofit organization in Burlington County focused on finding employment for people with both physical and mental disabilities."

Landfill limitations and benefits

Although the greenhouse co-located with the Burlington County landfill has been operating for 28 years, David said the biogas produced by landfills usually runs out after 15 to 20 years.

"Landfill gas eventually will run out," he said. "It depends on the design of the landfill and how much organic matter is in it. Typically, a landfill will continue to produce gas at relatively high levels for five to 10 years after it is closed.

"The challenge with contracting for landfill gas is that the landfills can't always predict how much gas they are going to be able to produce. There are times when the gas delivery is going to have to be shut off because repairs have to be made to the pipeline or operating equipment. There are going to be gaps in the landfill gas supply."

He added it may be difficult to get a landfill operator to commit to a certain number of Btus per month or per year, and an operator may be hesitant to sign a contract, knowing it may be difficult to deliver a specific amount of biogas when it's needed.

David said a reliable source of landfill gas can help growers to lower their energy costs and ensure energy price stability. This is particularly helpful when other energy sources like natural gas and oil can double or

triple in price in a year. Having a heating system with dual fuel capability is important because it provides growers and landfills with some flexibility.

“Being able to receive half the fuel from the landfill waste heat source and making up the difference with natural gas or oil makes it much easier to come up with a contract,” David said. “Landfill gas cannot be stored. Because of its low Btu content, high humidity and corrosivity, the gas has to be used almost immediately or burned off. In landfills, the gas is actively pulled out of a series of networked wells that are drilled down into the waste, much like a well that is driven for water.



Pictured: When the Rutgers EcoComplex greenhouse began operating in 1995 it was used for trial tomato production technology that was developed at Rutgers University. Photos courtesy of David Specca, Rutgers EcoComplex.

Almost all landfills have a flare and much of the time the gas is burned off, David said, and added one of the popular uses for landfill gas is to convert it into compressed natural gas for vehicle fuel. If a landfill doesn’t co-locate with another company to use the methane gas, the alternative is to flair the gas to prevent the methane from escaping into the atmosphere.

“By locating with a greenhouse there is a revenue stream from the investment the landfill has made in the gas collection system,” he noted. “This means less time operating the flare, which can translate into improved sustainability and better public relations.”

Other sources of biogas and heat

Another source of biogas that controlled environment growers could co-locate their facilities next to are anaerobic digestors, which are just like landfills, but with a more consistent generation rate of gas.

“Bacteria break down organic matter to create methane gas,” David said. “In anaerobic digestors or bioreactors, they use a lot of very quickly broken-down organic matter, including food waste, human waste from water treatment plants or animal waste from dairies. As long as there is organic waste that can be fed into the digestor, it should be a reliable source of methane gas.”

Another potential waste heat source that growers could use to heat their facilities is data centers, which are relatively reliable in providing a heat source.

“Most data centers operate 24-7 and can’t be shut down,” David said. “These centers are always going to be operating chillers that are used to cool the facilities, generating waste heat.”

David Kuack is freelance technical writer in Fort Worth, Texas. He can be reached at dkuack@gmail.com.

More Resources

- U.S. Department of Energy’s Combined Heat & Power e-catalog: chp.ecatalog.ornl.gov
- Pace Land Use Law Center for Sustainability: energy.pace.edu
- Rutgers EcoComplex Clean Energy Innovation Center: ecocomplex.rutgers.edu

• Landfill Methane Outreach Program (LMOP): www.epa.gov/lmop
(LMOP is a voluntary program that works cooperatively with industry stakeholders and waste officials to reduce or avoid methane emissions from landfills. The program encourages the recovery and beneficial use of biogas generated from organic municipal solid waste.)
• AgSTAR Biogas Recovery in the Agriculture Sector: www.epa.gov/agstar
(AgSTAR is a collaborative program sponsored by EPA and USDA that promotes the use of biogas recovery systems to reduce methane emissions from livestock waste)