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Digester Gas Energizes New Hampshire Waste Water Plant

Engine/generator set makes process nearly self-sufficient

Reclaiming wastewater is an energy- and time-consuming process that's constantly being re-evaluated with an eye to greater efficiency and reduced cost. To meet these goals, the city of Nashua, NH, is well on its way to completing an anaerobic digester project that will transform the gas that is a by-product of sludge treatment to electricity, thereby making a big part of its operation energy self-sufficient. As an added bonus, the treatment plant will soon send far less sludge to local landfills.

The city's water utility has the essential, but unenviable, job of treating and cleansing wastewater before it's allowed to join the nearby Merrimack River. A wastewater treatment plant since the 1940s, it is rated at 50 million gallons treatment capacity. The plant serves a highly populated area including Nashua, population 81,500, and handles 12 to 18 million gallons of wastewater per day.

Sludge into Energy

Through a sludge-digesting process, methane gas, a usable by-product in this instance, is made available to fuel an engine/generator set that provides electricity and hot water to the facility. Designed by environmental engineers and scientists at Stearns & Wheeler, Burlington, MA, the anaerobic digester project came on-line late this year. Using proven technology from Europe (where newer generations are already in use), digesters also are being built around Boston and Baltimore, as well as in Pennsylvania, Nebraska, and California. Experts say more are coming in the future. These digesters, like the one in Nashua, are novel because they are using an egg-shaped digester chamber.

Smelly, slimy sludge is a by-product of treating wastewater. In the past, dried sludge would be disposed of in landfills, but these facilities are quickly running out of room. Therefore, transforming sludge into dry compost, a marketable product, is a much better idea. De-watering is part of a composting process, which reduces bulk by about 30%. The compost can be used by golf courses, for state road projects, and given away to locals.

Usable Methane Gas Produced

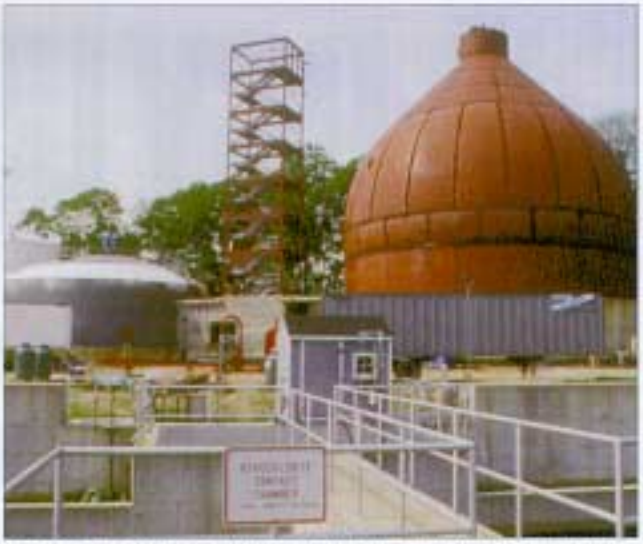
However, you can't compost "undigested" sludge, and the digestion process requires electricity and heat. Happily, a by-product of the sludge digestion process—methane gas—can be used to power the process. At Nashua, the gas will be used to run a large engine linked to a generator to provide electricity to power the digestion process and other parts of the treatment facility. The engine will also provide heat, which is needed by the anaerobic bacteria to produce the methane gas.

The engine was set in place at the Nashua wastewater treatment plant and a brick structure was built around it.

At the water treatment facility, sludge taken from settling ponds is first treated by primary and secondary clarifiers and then thickened before it's sent to the large, egg-shaped digester. In the controlled environment of an anaerobic (without air or oxygen) digester, micro-organisms destroy biodegradable pollutants. It's similar to what occurs naturally in stagnant water; the digester controls and speeds up this natural process. The leftover material, bio-solids or digested sludge, is then separated from the water and thickened before being used as compost or fertilizer.

Undigested sludge is pumped into the digester and stored for around 17 days at a temperature of 100°F. The egg-shaped

Dan Brassard, project manager at the Nashua digester site.



The egg-shaped digester, where methane gas is produced, is a new concept in the U.S. but has been used in Europe for 25 years.

digester has four 20 hp circulating pumps and one 20 hp circulating mixer that are kept running on alternating cycles, depending on the requirements of the digester.

According to Dan Brassard, the project manager at the digester site, "without regular sludge circulation, the digester will 'die' and what you wind up with is a 1.3 million-gallon holding-tank full of smelly, worthless sludge."

Dual-Fuel Engine

For heat and electricity, the digester plant relies on a Waukesha VGF series engine/generator package. The dual-fuel, 12-cylinder engine produces 365 kW of continuous power at 1200 rpm. The engine was purchased through W. A. Kraft, Woburn, MA, the local authorized Waukesha Engine distributor, who also helped with engine controls system.

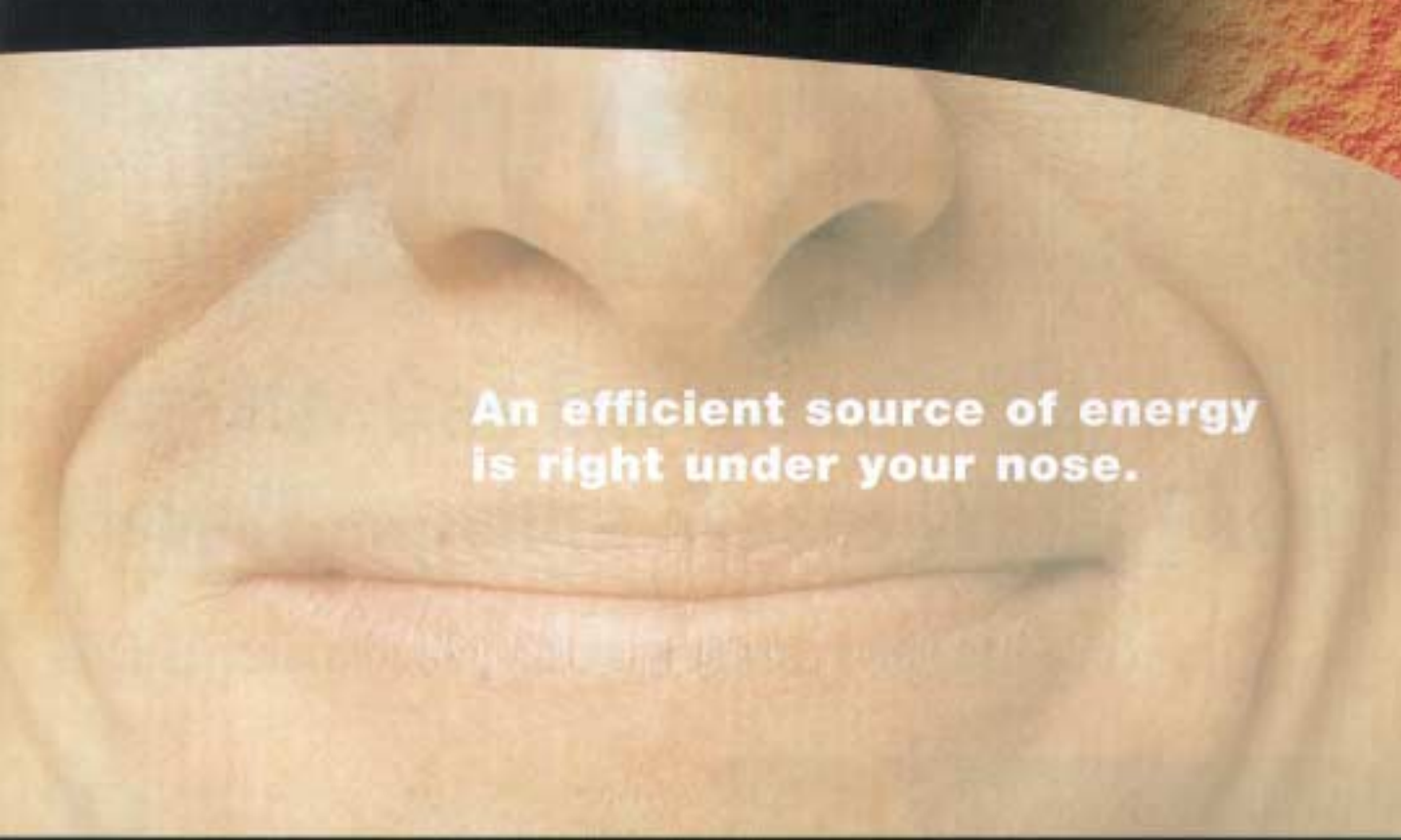
The spark-ignited, low-emission engine is designed for gaseous-fuel applications. Because of their size-to-power ratio and high-speed, continuous-duty capability, VGF engines have shown themselves to be cost-effective in similar applications. The engine also uses a patented combustion system, allowing the VGF to meet clean air standards.

"The ideal we're striving toward is for the engine/generator package to provide electrical power 24/7," Brassard says. "On days when not enough gas is being produced, we can use natural gas as backup power."

Anaerobic digestion creates heat, but needs a "jump start" to get the process going. Once under way, 55° to 60°F sludge is introduced to the egg. Depending on the quantity added it may or may not have to be heated further because the microbes that do the digesting also cause heat. Should more heat be required to maintain the process, it's crucial that the Waukesha engine is ready at all times. Two gas-fired boilers are on standby to help with the heating. Methane gas is collected into a storage tank; excess gas not needed by the engine will be harmlessly flared off into the atmosphere. Although methane gas will be produced immediately, it may not always be a sufficient quantity to keep the engine running. Therefore, natural gas is available as a back-up fuel.

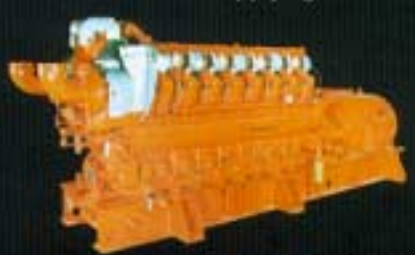
Initially, "seed sludge" from another anaerobic digester will be used to begin the process. Waste heat is captured from the engine's 180° coolant, as well as from the exhaust, and is used to heat the sludge to the required 100° operating temperature. Hot jacket water from the engine is pumped through a heat exchanger located in the digester area and is further heated by a heat exchanger linked to the engine's exhaust. There is the primary egg-shaped digester and secondary storage digesters on site.

The theory is to give the sludge at least a 17-day mean cell-residence time for proper digesting. However, the ongoing environment in the digester will determine the actual detention time. After digesting, the sludge is pumped into storage tanks and de-watered. The process then begins again, saving landfill space and providing fuel that makes the digester facility and other areas of the treatment plant energy self-sufficient. *EUN*



An efficient source of energy is right under your nose.

At Waukesha Engine, we've perfected the use of gaseous-fuel engine technology and applied it to the wastewater industry. Our engines can actually operate on your plant's digester gas (and many other gases), supplying heat back to your digesters and electricity throughout your facility.



Besides meeting your power requirements and helping you conserve energy, Waukesha Engine offers total service and support, round the clock. Whether you need spare parts or a full Operating & Maintenance contract, the solution is as plain as the nose on your face: Waukesha Engine.

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For information and for the name of a distributor near you, call 1-262-547-3311 or visit us at www.waukeshaengine.com.