

THE TREATMENT ROOM



Water treatment specialist Judith Herschell explores the various value propositions of creating energy from wastewater.

Value-added biotreatment beyond anaerobic digestion

According to the Water Environment Research Foundation, wastewater can contain up to 10 times the energy needed to adequately treat it. While our energy supply is in turmoil, more than 1,100 TeraWatt hours of energy are stored in waste molecules. The key is to harness this energy in a usable form.

There are multiple startup companies around the world, such as Emefcy and Arbsource, developing and promoting innovative “wastewater to value” solutions to access this energy. These technologies build on and improve upon the approach taken by traditional anaerobic digestion. As early-stage companies, they seek to clearly define the true value for their customers. Is value found in the production of electricity, the formation of beneficial by-products, the reduction in sludge and solids handling, the reduction in carbon footprint, the reduction of wastewater discharge and disposal, the reduction of energy use or in the reduction of fresh water consumption? All of these factors come into play, but what is the most influential factor, and does the value proposition change for customers with different types of wastewater? As with all technologies, focusing on the greatest value to the customer is the key to success.

The advantages of “Wastewater to Value” solutions include:

- 1) Effective wastewater treatment and odor control
- 2) Generation of direct current electricity
- 3) Near zero net energy consumption or, better yet, net energy production
- 4) Production of usable gases and chemicals (H₂, H₂O₂, ammonia, NaOH, etc.)
- 5) Reduction in sludge handling and disposal costs
- 6) Regulatory compliance
- 7) Reduction of carbon and fresh water footprints
- 8) Substantial reduction of CO₂ emitted to the environment
- 9) Compact systems, lending themselves to smaller, decentralized installations
- 10) Modularized systems for easy expansion to accommodate population growth

From these advantages, there are multiple revenue streams, cost-saving opportunities and operational advantages. Electrical costs, which can be 30 to 40 percent of the total operating cost, can be drastically reduced. Hydrogen sells for multiple times more than methane gas and can generate a significant revenue stream or function as a cost reduction measure if used by the producer. Sludge reduction and regulatory compliance are significant drivers for processing wastewater on site, while

carbon footprint reduction and renewable energy generation may qualify the owner for tax credits. According to industry expert and Arbsource CEO Mark Sholin, decentralized treatment is becoming more *en vogue* when compared to massive infrastructure investments, and communities are looking at smaller-scale, point-of-generation solutions to reduce the load on existing infrastructure. With population growth, the need for wastewater treatment and clean water will become more critical. This is an issue that modular treatment systems can address.

The primary objective of the offerings of early-stage companies in this space is to provide robust solutions for wastewater treatment. A secondary objective is to obtain viable by-products from the process, including energy. It has been a prevalent view that the electricity produced by biotechnological approaches to wastewater treatment offers the most value. The Holy Grail has been to realize near 100 percent energy efficiency by harnessing the chemical energy in the COD and harvesting current from the system. The innovations of these companies are poised to meet this technological challenge.

However, the value proposition is morphing and the best perceived value often lies in the chemical and gas by-products generated during the microbial process. The gases produced may be used in a variety of industries, including oil and gas, pharmaceutical, food & beverage and fertilizer manufacturing.

The \$450 billion-a-year water and wastewater industry comprises customers from various sectors who have vastly different interests and drivers influencing their wastewater treatment decisions. The most rapid return on investment is achieved from wastewater streams with high organic content, as they produce higher electrical output and larger volumes of chemical and gas by-products. As is always the case, there are myriad influences on the economics of an installation. Depending on the location and type of wastewater, there will likely be a market opportunity for many different solutions as the economics of wastewater treatment continue to change.

Wastewater is abundant and is a tremendous source of energy. The technologies needed to transform waste to energy exist today. Now is the time to tap into this under-utilized resource. As we move into the future, the words of Dr. Carl Safina during his May 2010 testimony to the House Subcommittee on Energy and Environment will come to bear on our culture, “Whoever owns the new sources of energy will own the future economy.” With evolving innovations, the energy found in wastewater can contribute to energy independence and positively influence our economy.

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