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FACT sheet

Wastewater Sludge: A New Resource for Alternative Energy and Resource Recovery

Wastewater treatment plants are net users of energy. In the U.S. they consume an estimated 21 billion kilowatt hours per year. There are important reasons for this energy use, as society demands increasingly intensive treatment to remove nutrients and chemicals from wastewater before it is discharged back into waterbodies or is reused. But energy use is coming under increasing scrutiny, with the financial cost of energy and the environmental cost of energy generation driving new interest in the conversion of sewage sludge to energy.

Sustainable wastewater treatment, with a reduced carbon footprint, is now becoming a goal of technical exploration and experimentation. The view of municipal sewage has shifted, from a waste to be treated and disposed of, to a resource that can be processed for recovery of energy, nutrients, and other constituents.

A new study, *State of Science Report: Energy and Resource Recovery from Sludge*, presents an assessment of international practices and examines the processes from a technical perspective. Recognizing the importance of the issue in the public policy arena, the researchers also look at the data with an eye to the "triple bottom line"—the social, economic and environmental performance of the technology. The need for this examination is clear. The U.S. is among the world's largest producers of sludge, due to a number of factors, including designs and levels of wastewater treatment.

Sewage contains 10 times the energy needed to treat it, and it is technically feasible to recover energy from sludge. As renewable energy, it can be directly used in wastewater treatment, reducing the facility's dependency on conventional electricity. The greater the quantity of energy produced by the industry, the more the industry can help reduce emissions of greenhouse gases. Using solids as a resource rather than a waste may help stressed public budgets as well. Wastewater solids must be processed prior to disposal, and solids handling accounts for as much as 30% of a wastewater treatment facility's costs.

The U.S. produces 6.5 million tons of dry solids annually

Number of public wastewater treatment facilities in the U.S.	16,583
Population receiving centralized wastewater treatment (74.9%)	222,840,915
Annual mass sludge per capita	64.4 pounds
Estimated production of dry solids per year	6.5 million metric tons
Current sludge end uses	
Combined disposal (incineration and landfills)	45%
Land application	49%
Reuse (not land application)	6%

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Source: *State of Science Report: Energy and Resource Recovery from Sludge*, stock no. OWSO3R07

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Converting solids to energy is feasible and desirable, from a treatment perspective. The challenge is finding a process that is also affordable, cost-effective, and acceptable to the public.

While the current technology is promising, none of the processes can fully extract all the energy available in wastewater. New technological developments, or improvements of current technologies, are necessary to take advantage of the maximum energy available in sewage and sludge.

The technologies can be divided into established and emerging technologies. The established technologies are full-scale commercial applications, as well as those that can potentially be commercialized. The emerging technologies have only been demonstrated in pilot projects or on a bench (laboratory) scale. All of them are looking at physical, mechanical, biological, and chemical processes which can be used to produce or contribute to energy recovery from sludge.

Getting the terms right

Sewage: Water that carries wastes from homes, businesses, and industries through sewers to a treatment plant. Sewage contains both dissolved and solid materials. The preferred term is wastewater.

Sludge: Wastewater's solid matter that settles to the bottom of septic tanks or treatment plant sedimentation. The term *sludge* is generally used before treatment for beneficial reuse. Also called wastewater solids or residuals.

Biosolids: The nutrient-rich organic materials resulting from the treatment of sludge at a wastewater treatment facility. Biosolids meet government criteria for beneficial use, such as for fertilizer.

Assessing the technology

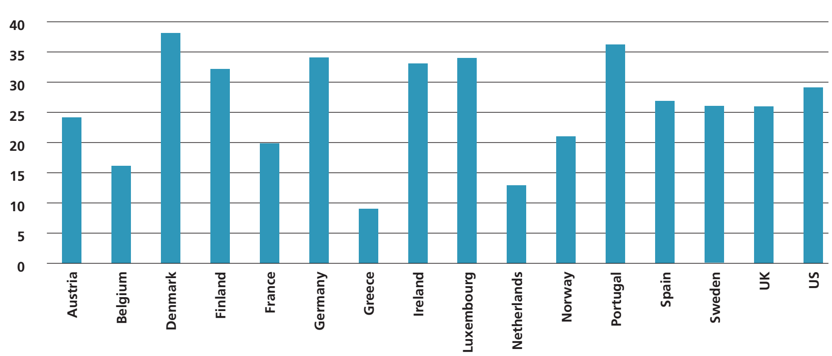
To be attractive, technologies for energy and resource recovery must meet social, economic, and environmental objectives, as well as being affordable and cost effective. For instance, chemical use may be required in certain processes, but it may not always be the best option in terms of health protection and life cycle impacts (energy use and emissions during production and transportation). In addition, technologies with high potential for pollutant emissions, either upstream or onsite, will have less public acceptance.

LCAMER model helps cities make informed decisions

There are about 2,000 central sludge processing facilities in the U.S. As of 2004, 650 of those facilities used anaerobic digesters to process its sludge. When sludge is digested, it produces methane gas. As an aid for municipalities considering energy recovery from digester gas, a Water Environment Research Foundation project developed the Life Cycle Assessment Manager for Energy Recovery (LCAMER, 01CTS18UR) model. This model enables the cities and their engineers to make informed decisions on the feasibility of recovering energy from anaerobic digestion of wastewater solids based on site specific design and operating conditions, and energy pricing.

Some examples of current technology:

- Watsonville, CA uses restaurant grease to increase sludge digester gas production by over 50%.
- Thermally dried biosolids substitute for 5-10% of coal used to fuel a cement kiln in Maryland.
- Methane as source of hydrogen to produce energy with molten carbonate fuel has been demonstrated at King County (WA) South Treatment Plant.
- In 2005 in the U.K., waste (including sewer sludge) combustion and biogas production accounted for 10.8% and 4.2% respectively of all UK renewable energy.
- In 2005, an average of 113% of the electricity used by a German plant was generated onsite by gas engines.
- A Swedish treatment plant produces and sells biogas to Stockholm's bus company, which uses it to run at least 30 buses.
- Stockholm's energy company uses heat recovery pumps to extract heat from treated sewage to provide hot water and heating to 80,000 apartments.
- The Sewerage Bureau of Tokyo Metropolitan Government turns dewatered sewage sludge into fuel charcoal for thermal power generation.



Current annual sludge production in kg dry solids per capita

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