WEF MA - Accelerating Resource Recovery - june'17
Words: 1108

MA Newsletter Article from WEF Headquarters
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June 2017

Headline: **Accelerating resource recovery**
Deck: Biosolids can be used to create valuable products at water resource recovery facilities

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Biosolids produced during wastewater treatment commonly are land applied. While this method is a great option to provide an excellent fertilizer that helps promote healthy soils, biosolids also hold much potential to help mitigate climate change, foster sustainability, and achieve zero waste. Resource recovery from biosolids represents an exciting opportunity and potentially can provide additional value while promoting meaningful change.

Utilities hoping to recover resources face questions and roadblocks when seeking the best decisions for their communities. Policies and regulations vary among states and the national level and may hinder recovering resources from biosolids. Likewise, many current resource recovery technologies are not yet established and present more risk than utilities are accustomed to. And lastly, communicating the value of a product derived from biosolids to the public can be challenging.

But solutions exist and others have already blazed many of these trails. To help utilities overcome these challenges and to promote recovering resources from biosolids, WEF has updated the 2013 publication, *Enabling the Future: Advancing Resource Recovery from Biosolids*.

The 2017 update, released in April, is titled *Accelerating Resource Recovery: Biosolids Innovations and Opportunities* (https://www.e-wef.org/Default.aspx?TabID=251&productId=58093345 or http://bit.ly/2017-biosolids-rr). This guide aims to help promote biosolids as a valuable resource to help meet renewable energy needs, promote innovative technologies, and accelerate resource recovery.

Energy recovery

The energy contained in wastewater and biosolids is five times the amount of energy needed to treat it; this means that water resource recovery facilities (WRRFs) are potential energy generators. The latent energy in wastewater solids combined with energy management and conservation in the facility offers an excellent opportunity for WRRFs to save money by producing energy on site to offset facility costs.

Anaerobic digestion is a long-established technology that can turn solids to energy by converting digested sludge to biogas via microorganisms. The process has many different designs and can be varied by adjusting temperature, implementing a pretreatment step, co-digesting the solids with other wastes and more. The generated biogas has an excellent energy potential and can be burned for electricity or upgraded to other fuels.

On the other hand, thermal conversion is a developing technology that uses heat to generate energy from biosolids. While thermal conversion has a higher energy output potential

than anaerobic digestion, it requires more energy to remove the moisture from the solids, resulting in a lower net energy recovery. New technologies in development are looking to incorporate thermal conversion with higher moisture solids. This combination, it is hoped, would reduce energy costs and derive a higher energy potential.

Nutrient recovery

Currently, most agricultural nutrients — specifically, nitrogen (N) and phosphorus (P) — come from non-renewable, energy intensive sources. Yet at WRRFs, utilities remove these nutrients from wastewater to meet discharge limits. The utilities face high resource and energy costs to remove them as well as a waste stream that must be disposed of. Herein lies an opportunity to recover instead of remove these nutrients. The result would be a renewable, valuable product that can help offset costs and generate money for the utility.

To recover nutrients, N and P first must be concentrated either biologically (using microorganisms to accumulate N and P), physically (implementing a process like adsorption or ion exchange), or chemically (using a metal salt addition to precipitate out P). The concentrated nutrients then are released (typically biologically) before being extracted.

One example of a potential recovered product is struvite (magnesium ammonium phosphate). Struvite is generated by controlling pH and then adding a chemical precipitant. The process removes high concentrations of N and P and generates a product that can be sold as a commercial fertilizer.

Each nutrient removal method has positives and negatives. And each utility must determine how economically feasible each technology would be for their utility to adopt these systems.

Potential roadblocks

Though the potential rewards of resource recovery are great, so are the challenges. Regulations and policies have the potential to help or hinder biosolids resource recovery. Some, federal regulations, such as the 40 *CFR* Part 503 biosolids rule, have helped outline the importance of biosolids and set in place incentives for their beneficial use. On the other hand, regulations also can hinder. Examples include limiting where biosolids can potentially be applied (USDA Code 590) or changing the Renewable Fuel Standard (RFS) and lowering the value of renewable identification numbers (RIN) for biogas.

Likewise, state regulations and policies help or hinder. Elements of solids handling such as odors, phosphorus content, and co-digestion all can be specific to states, and, therefore, regulated differently — both positively and negatively.

One of the best ways to ensure that regulations and policies help biosolids usage is to have interagency cooperation to help address issues. This could mean joining voluntary programs to promote biosolids, such as the National Biosolids Partnership (NBP) or pollution prevention programs, and encouraging research into topics that could become issues in the future.

New and innovative technologies are needed to enhance resource recovery from biosolids. There are many promising companies attempting to generate valuable products from biosolids and wastewater. These products include fertilizers, biodegradable plastics, and biofuels; but many are still in their infancy. Not only does the high moisture content make it difficult to develop an economically viable technology, but the variable nature of the solids means a universal technology isn’t possible; each utility must find its own solution.

Research into a typical utility's efficiency, cost, energy balance, and recovered product is nonexistent; this means each utility must do this on its own. This increases costs and makes the barrier to entry higher. The Water Environment Federation (Alexandria, Va.) and Water Environment & Research Foundation have developed the Leaders Innovation Forum for Technology (LIFT) program to help fill this gap. LIFT promotes research into resource recovery technologies, creates a clearinghouse of information, and takes some of the risk away. But there are more hurdles to leap to bring these solutions to market.

Looking to the future

Recovering resources from biosolids represents an exciting opportunity for utilities to promote the beneficial use of biosolids while generating valuable consumer products. It begins at utilities, where professional development and skills must be developed and fostered. With this knowledge, biosolids programs can thrive and increase the quality of their products for consumers.

Effective communication with consumers is paramount. When they understand the benefits of biosolids, they will rightfully translate that into a better perception of the products. A commitment to research and development is key to develop technologies that can expand the resource recovery of biosolids.

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