WEF Residuals & Biosolids Committee
Bioenergy Technology Subcommittee

Biofuels Task Force

WEFTEC 2010
New Orleans, LA
Tuesday, October 5, 2010
Room #340-341
8:30-10:00 am

Nate Turner, Chair
Fernando Sarmiento, Vice-Chair

AGENDA

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1. Introduction:
   The Biofuels Technology Task Force was formed to help shape and inform the wastewater industry of the growing trend in recovering resources from wastewater streams in the form of Biofuels. Biofuels are defined as substances/products created from existing wastewater streams that can be sold to entities outside of the wastewater industry for use as an energy source. These products are generally viewed as a saleable or fungible commodity.

2. State of the Industry Report
   a. Task Force/Peer Review
   b. Presentation in Sacramento
   c. WEFTEC 2011 Workshop

3. Draft Technical Practices Update
   a. Deliverable/Draft presented at RSD 2011 in Sacramento, CA
   b. Establish Working Groups/ Peer Reviewers
   c. Develop Schedule

4. Establish Task Force Mission Statement, Goals & Vision
   a. Subgroup

5. Membership
   a. Goals
   b. Interact with other WEF committees/ task forces
   c. Establish Champions

6. Adjourn

WEF Residuals & Biosolids Committee
Bioenergy Technology Subcommittee

Biofuels Task Force

2010 Specialty Conference
Savannah International and Trade Convention Center
Savannah, GA
Tuesday, May 25, 2010
Greene Board Room @ 4:30 pm

Nate Turner, Co-Chair

Meeting Minutes

1. Attendees

Bill Toffey (Effluent Synergies)	Nate Turner (BlackGold Biofuels)
Dustin Craig (CDM)	Patrick Wootton (GE Power & Water)
Fernando Sarmiento (Greeley & Hansen)	Tim Williams (WEF)
Geoff Baldwin (CDM)	Tom Maestri (Synagro)
Natalie Sierra (San Francisco PUC)	

2. Introduction
The Bioenergy Subcommittee, under the leadership of Dave Parry, has designated a new Task Force at this Specialty Conference. The purpose of this new group is to help shape and inform the wastewater industry at large of the growing trend in recovering resources from wastewater streams in the form of Biofuels. Nate Turner and Emily Landsburg of BlackGold Biofuels have been designated as the inaugural co-chairs.

3. Biofuels Definition:
The Task Force agreed that biofuels for the purposes of this group would be defined as substances/products created by the wastewater industry from existing wastewater streams that can be sold to entities external to the wastewater industry for use as an energy source. These substances/products generally have a specification and are viewed as a saleable or fungible commodity. The list of Biofuels included under the task force umbrella is as follows.
   a. Biogas: includes Biogas, Biomethane, Bio-LNG & Bio-CNG
   b. Biodiesel: includes Biodiesel derived from FOG & Algae
   c. Dried Biosolids: includes Syngas, Biohydrogen & Direct Solids Combustion
   d. FOG: includes Yellow & Brown Grease

4. Membership:
   Meeting attendees agreed that the task force would be opened to all WEF membership, and a call for volunteers will be posted on the WEF blog. The Task Force would also be open to members of associations that oversee industries in which wastewater derived biofuels would be sold. Examples include among others the National Biodiesel Board, Biogas Council, DTE, and Biocycle. One goal of the Task Force will be to foster relations between WEF and these outside organizations.

   The Task Force will also reach out to the following WEF Committees/Task Forces in order to foster collaboration and identify any overlap in scope.
   a. Algae Task Force
   b. Sustainability Community of Practice
   c. Climate Task Force
   d. Emerging Technologies Task Force

5. Activities:
   Attendees agreed that activities to be completed in the next year included the following:
   a. Development of a State of the Industry Report. This will summarize the current state of each major biofuels technology listed in #3 above, as well as where these technologies are being utilized. This report will be completed for review by WEFTEC 2011.
   b. The State of the Industry report will be the base for a Technical Practice Update (TPU) to be included in the annual update of the Biosolids Manual. The Task Force will aim to complete this TPU within one year and submit it for review at RSD 2011 in Sacramento.
   c. Establish Task Force Mission Statement, Goals & Vision
6. Schedule:
   a. Monthly Conference Calls
      i. First to be held <u>June 25th @ 3:00 EST / Noon PST</u>
   b. Meeting time for New Orleans
      i. TBD
7. Action Items:
   a. Call for Volunteers [Nate Turner]
   b. State of the Industry Report
      i. Biogas [Dustin Craig]
      ii. Biodiesel [Nate Turner]
      iii. Dried Biosolids [Tom Maestri]
      iv. FOG [Natalie Sierra]
   c. Proposal for Workshop RSD 2011 due July 23rd [Fernando Sarmiento, Bill Toffey]
   d. Assignment of Vice Chair [Nate Turner, Dave Parry]

TOPIC : Biofuels from Wastewater [Biogas, Dried Biosolids, Biodiesel]

The purpose of this State of the Industry update is to provide an overview of emerging trends in the wastewater sector and identify benefits, challenges, and future pathways of new energy and resource recovery solutions that utilize waste streams. Engineers, operators, utility managers, and regulators should regard this State of the Industry as an introduction to biofuel production from wastewater streams and not as a comprehensive technical document.

I. **BIOGAS & BIOMETHANE**

II. **DRIED BIOSOLIDS**

III. **BIODIESEL**

Background

Biodiesel production from waste streams is part of a growing trend in the renewable energy industry. Recently, components of wastewater have been identified as viable raw material sources (feedstock) for successful biodiesel production, including fats, oils and grease (FOG) and algae. Some utilities are recognizing that separating and processing these waste components into biodiesel can benefit treatment plant and collection system operations, infrastructure, and budget.

What is biodiesel? Biodiesel is a low-carbon renewable fuel made from biological based fats and oils, and can be utilized as a direct replacement for petroleum based diesel fuel in any diesel equipment, without equipment modifications. It has fewer emissions and carbon footprint than petro-diesel.

Relevance of Issue

FOG: As energy prices rise, regulatory pressures increase, and the importance of energy and resource recovery takes a more prominent role in wastewater treatment strategy, utilities will look to control their energy costs and to beneficially reuse waste materials. Biodiesel is typically made from plant oils and used fryer oils, but the expense of these commodities has driven biodiesel producers to investigate alternative feedstocks. Using FOG from wastewater (scum, lift station grease, and trap grease) to produce biodiesel is a promising solution.

FOG management and disposal is a major financial liability for waste treatment facilities, potentially costing millions of dollars per year. FOG builds up in collection systems, leading to sewer overflows, corrosion of sewer pipe, and significant operations to mitigate these issues. FOG requires significant aeration energy to breakdown, adding to operating budgets. Currently, most utilities dispose of FOG and do not capture the potential energy of the FOG material. However, conversion of FOG into biodiesel could not only produce a clean-burning, high-value fuel for sale or use by the utility, but may improve FOG handling compliance due to high visibility recycling of the material. Furthermore, the creation of a new and lucrative revenue stream in the form of tipping fees (from accepting grease from external sources) and biodiesel sales can help utilities turn current waste liabilities into financial assets.

Algae: The conversion of algae into biodiesel has also garnered significant attention in the biofuels industry. While algal oils are generally still in the research & development stage, some wastewater utilities have identified algae production as a potential win-win for the improvement of treatment plant performance. Since high nutrient content in wastewater is an excellent medium for algae growth, algae reactors could be utilized for highly-effective, low-energy nutrient removal. Additionally, CO_2 emissions from the wastewater treatment plant (or from nearby CO_2 emitters) could be directed to the algae reactors to be utilized for algae growth. The resulting algae biomass, which has high oil content, could then be harvested, refined and converted to biodiesel. Similar to FOG, algae could be turned into a lucrative revenue stream and reduce treatment costs.

What Has Been Done And What We Know

FOG: A number of wastewater treatment plants have installed waste receiving facilities, which typically receive grease trap waste and other industrial wastes from commercial waste haulers. The receiving facility provides utilities with additional revenue and the surrounding community with a disposal site for otherwise unwanted wastes. In most cases, this FOG is eventually mixed with finished biosolids and disposed of along those established disposal routes. A few wastewater utilities have recognized the intrinsic energy content available in FOG and pursued its utilization as a feedstock for biodiesel production. This technology is being commercialized now.

The East Bay Municipal Utility District (EBMUD) and the San Francisco Public Utilities Commission (SFPUC) have each undertaken a FOG-to-biodiesel pilot study in 2005 and 2010, respectively. The SFPUC study is ongoing and utilizes a patented process from BlackGold Biofuels. EBMUD published their findings in 2008, utilizing conventional biodiesel acid-base catalysis processes, with an additional acid esterification step. The results of this two-year bench scale and pilot study concluded that, though challenges

were met removing certain contaminants, biodiesel could be produced from FOG received at the wastewater treatment plant, and that the biodiesel produced could be utilized in the utility's diesel trucks without performance issue.

Algae: Algae is a promising biodiesel feedstock due to its high oil content and scalable production; however, specific strains of algae are needed and oil extraction technology is still in its infancy. Regardless, some wastewater treatment plants are honing their ability to grow algae with the nutrients available in wastewater. Algae growth is also currently utilized as an additional polishing step for wastewater effluent.

The City of Austin, Texas has an algae-to-biodiesel research and development facility owned and operated by Sunrise Ridge Algae Inc. at the City's Hornsby Bend WWTP. At this facility, researchers have been able to demonstrate that algae can effectively remove nutrient pollutants from wastewater effluent and are working to integrate carbon dioxide consumption and bio-oil production. This has the potential to provide wastewater utilities with a highly efficient process for removing regulated pollutants from wastewater while generating revenues from biodiesel sales and "greening" plant operations.

What is Not Known and Future Directions

Meeting biodiesel quality standards proved challenging in the EBMUD study, and it was concluded that further study would be necessary to identify a cost effective method for conversion and polishing. The goal of the SFPUC study is to tackle and overcome these issues. Most utilities are not aware of the cost FOG has on their operating budgets and infrastructure. Given financial constraints faced by utilities, there is an urgent need to quantify the lifecycle costs of FOG and the cost-savings associated with this beneficial reuse, particularly as regulations continue to limit other disposal options.

The commercialization of algal biodiesel is dependent on the ability to reduce infrastructure costs and real estate footprints for growing algae in ponds or photobioreactors, identify the best strains for commercial production, reduce the energy demands for photobioreactors, and develop low-cost systems for harvesting, dewatering, and extracting oil from the algae. Many private companies are tackling these challenges, and pilot studies should be undertaken in partnership with these companies to accelerate the application of this technology in the wastewater industry.

In general, the lack of visible installations and familiarity with renewable energy technologies can lead to perceptions of greater technical risk than is merited. Building awareness within the industry is important component of adoption.

References

- "What is Biodiesel?." Biodiesel 101. Web. 31 Aug 2010. http://www.biodiesel.org/resources/biodiesel_basics/.
- Santhanam, Narsi. "Oilgae Guide to Algae-based Wastewater Treatment" *www.oilgae.com*. Oilgae, 2007. Web. 31 Aug 2010.
- Chakrabarti, Alicia. "Waste Grease Biodiesel Production at a Wastewater Treatment Plant." WEFTEC®.08. (2008): 2770-2789.
- Nelson, Yarrow. "Production of Biodiesel from Algae applied to Agricultural Wastewater Treatment." *EPA National Center for Environmental Research*. (2007).