Maximizing Benefits from Renewable Energy at Blue Plains AWWTP
RESIDUALS & BIOSOLIDS CONFERENCE 2010
SAVANNAH, GA

Alan B. Cooper, Leonard Benson, Walter Bailey, Ernest jolly and William Krill
Blue Plains AWWTP

- Can treat 370 mgd of wastewater from Washington DC metro area...about 4 M people

- Largest Advanced Wastewater Treatment Plant in the world.
Blue Plains AWWTP

- Current biosolids treatment is by Lime-Stabilization
- Biosolids capacity is 400 dry tons/day
- All biosolids beneficially used for land application with DC WASA’s award winning system
Existing Lime Stabilization Facilities at Blue Plains AWTP
Overview of DCWASA’s New Biosolids Management Plan

Gravity Thickeners -> DAFTs -> Pre-Dewatering

Blend Tanks

Dewatering

Lime

Mixer

Store & Load out

Final Dewatering

Recycle Processing

Load out

Class A

Class B

Biogas Treatment and CHP

Mesophilic Anaerobic Digestion

Steam

Power

Emissions

Enclosed Flares
Class A biosolids
Reduced volume
> 35% solids
> 60 V.S. destruction

Methane

Dewatering
30 to 33 %

Anaerobic Digester
60% C.O.D. conversion
50% reduction in digester volume
Increased gas production
Foaming eliminated

1. Solids dewatered to 18 %, then to Pulper
2. Solids mixed with return steam and water to 14%
3. Solids heated by direct steam addition to 320°F and 90 psi for 30 minutes
   - Class A per time & temp.
   - Organic compounds solubilized
4. Pressure in reactor reduced to 60 psi.
   - Steam is returned to Pulper
5. Reactor pressure is rapidly released, flashing solids to the flash tank
   - Flashing causes cells to rupture
   - Steam is returned to the Pulper Tank
   - Hydrolyzed solids have reduced viscosity

Flash Tank
Steam
Reactor Tank
Pulper Tank

9-10% solids digester feed at 100°F

Cambi™ Thermal Hydrolysis Process
CAMBI™ Thermal Hydrolysis for Blue Plains AWWTP

Four Trains for this program

Two Future Trains

Flash Tank

Six Reactors per Train… not five as shown

Pulper Tank

One storage Bin per train
PROPOSED LOCATION OF FACILITIES

- Digesters
  - 4 original
  - 4 future
- Dewatering
- Lime-Stabilization
- Existing Solids Processing Building
Elements of New Biosolids Facilities

- Biosolids Pre-Screening Facilities
- Biosolids Pre-Dewatering Facilities - Centrifuges
- Dewatered Solids Storage Bins - 1 per CAMBI™ train
- Four CAMBI™ Thermal Hydrolysis Process trains - 450 dt/d total average capacity
- Four Mesophilic Anaerobic Digesters - 3.8 MG/ea
- Final Dewatering Facilities - BFPs
- Digester Gas Cleaning Facilities
- CHP using three Mercury 50 Turbines
Reasons for considering TH+MAD

- Reduce the quantity of biosolids
- Reduce the use of lime-stabilization
- Reduce cost of Biosolids Management
- Expand beneficial uses and reduce haul distances
- Produce digester gas for heat & power
- Produce electrical power for emergency backup
- Reduce beneficial use risks
WASA’s Renewable Energy and Emissions Reduction Facility (REERF)

- A combined heat and power (CHP) system using digester gas burned in three gas turbines followed by heat recovery steam generators (HRSGs) producing steam for CAMBI™

One example visited by WASA in 2005 with Taurus 60 gas turbines and heat recovery system at Village Creek WRP-Fort Worth, Texas
Tight Air Emission requirements and the desire for maximum energy conversion led to selecting a modified turbine…the Mercury 50

38% conversion of energy to electricity w/another 32% conversion to steam to heat CAMBI

Lowest air emissions for turbines
What makes the Mercury 50 different?
Answer: A Recuperator
One of the Mercury 50 Turbines at Archbald, PA
Another Mercury 50 Gas Turbine located indoors
Concepts for Maximizing Benefits

Max. Volatile Solids destruction-60% vs. 50%
Max. Gas production-16.5 cf/lb vs. 16.0 cf/lb
Max. BTU prod-625 BTU/cf vs. 600 BTU/cf
Electrical energy production efficiency-38%
Overall energy production efficiency-70%
Land application savings
  No application fee as for Class B biosolids
  Shorter hauling distances due to improved options
  Potential to produce salable products such as artificial soils
High solids content in dewatered product-32%+
Concepts for Maximizing Benefits
(Continued)

Minimum use of Lime—for emergencies, transitions, peaks, and perhaps a small production amount

Minimum risks with high temp/time process well past Class A criteria

Max use of digesters due to high solids loadings

Even, steady flow to digesters

Possible expansion of CHP with natural gas

Use of steam for heat in buildings
Environmental benefits from WASA’s Biosolids Program

The production of 140 mm BTUs/day of renewable energy-Digester Gas

13 MW of electricity generated from Digester Gas in 2014 and 20 MW in year 2020, thereby reducing Green House Gas emissions from traditional energy forms used in DC area

Net energy from Biosolids Facilities could power critical processes at Blue Plains AWWTP

Reduces DCWASA’s GHG inventory by 130,000 to 160,000 metric tons of CO$_2$e per yr
Figure 1 - O&M Cost Comparison* of Digestion Project (Biosolids Program) vs. Lime Stabilization (continued and expanded) with 3% annual inflation.

Figure 2 - Total Annual Cost Comparison* of Digestion Project (Biosolids Program) vs. Lime Stabilization (continued and expanded) with 3% annual inflation.
Figure 3—Total Annual Cost Comparison* of Digestion Project (Biosolids Program) vs. Lime Stabilization (continued and expanded) with Deferred Bond Funding Considered.

Figure 4—Accumulated Cost Comparison* of Digestion Project (Biosolids Program) vs. Lime Stabilization (continued and expanded).
SUMMARY

- DC WASA has a very unique opportunity
  The proposed Biosolids Program can provide major environmental benefits over existing operations regarding biosolids quality, risks, energy and GHGs
  Very significant annual cost savings can offset the capital cost of facilities in short order
  Deferred bond funding during construction dramatically improves the public acceptability of the program
The End
Performance of Mercury 50 gas turbines on Natural Gas

### Estimated Power Island Emissions

**M50 multiple unit installation**
Quoted using data available as of March 25, 2009

<table>
<thead>
<tr>
<th>Gas Turbine Exhaust Emissions</th>
<th>Per Unit</th>
<th>Plant Total</th>
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</thead>
<tbody>
<tr>
<td>(3) Gas Fuel MERCURY 50-6000R with HRSGs</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOx</strong></td>
<td>ppm @ 15% O2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>lb/hr</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>CO</strong></td>
<td>ppm @ 15% O2</td>
<td>10</td>
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<tr>
<td></td>
<td>lb/hr</td>
<td>1.0</td>
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<tr>
<td><strong>UHC</strong></td>
<td>ppm @ 15% O2</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>lb/hr</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>PM_{10}</strong></td>
<td>lb/hr</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>SO_{2}</strong></td>
<td>lb/hr</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Taurus 60 Gas Turbine using Domnick Hunter gas cleaning
Siloxane Removal Vessels
Maximizing Benefits from Renewable Energy at Blue Plains AWWTP

Alan B. Cooper¹, Leonard Benson², Walter Bailey², Ernest Jolly² and William Krill³

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ABSTRACT

The District of Columbia Water and Sewer Authority (DC WASA) operates the Blue Plains Advanced Wastewater Treatment Plant (AWWTP) and can treat up to 370 mgd of wastewater as an average from the metropolitan Washington, DC area. It is the largest advanced wastewater treatment plant in the world. This project will maximize the use of renewable energy to produce power and steam at the Blue Plains AWWTP.

At the Blue Plains AWWTP wastewater is converted into stabilized biosolids, a renewable resource used as a soil amendment. Lime is used to produce these stabilized biosolids. However, a new project is being developed for the Blue Plains AWTP to utilize thermal hydrolysis and mesophilic anaerobic digestion (TH+MAD) to replace lime stabilization. Once implemented, this new process would provide the following advantages:

- Digester gas (140 mm BTU/day) would produce heat & power simultaneously.
- Heat and power from digester gas would reduce existing air emissions onsite and from commercial power sources.
- Electrical power from digester gas (13 MW, year 2014) closely matches critical process requirements for the AWWTP, providing a reliable standby source of power when needed.
- Thermal Hydrolysis with Anaerobic Digestion reduces final biosolids by nearly 50%, dramatically reducing diesel fuel for hauling. (1,275 gal/day saved)
- Lime stabilization is reduced to relatively infrequent peak conditions, reducing the use of lime which requires high energy to produce. (40 tons/day of lime saved)
- Thermal Hydrolysis with Anaerobic Digestion produces a Class A product, expanding beneficial uses and reducing hauling.

WASA’s Renewable Energy and Emissions Reduction Facility (REERF) is a combined heat and power (CHP) system using digester gas burned in gas turbines (GTs) followed by heat recovery steam generators (HRSGs) followed by steam turbines (STs). A steam boiler will also be utilized to ensure adequate steam production. Steam will heat the...
Thermal Hydrolysis/Anaerobic Digestion process scheduled for mid-2014 completion and replace some existing natural gas heaters currently used at the AWWTP.

Detailed cost evaluations were done to establish the most effective choices considering annual costs and capital costs. This led to creative funding options such as deferred bond payments after the facilities are built and operating to capitalize on the major annual operating cost savings.

This paper will describe the key features being planned for the Blue Plains AWWTP and how the production of electricity and steam will be maximized.

KEY WORDS

Biosolids, renewable energy, cogeneration, power, steam, costs, anaerobic digestion, thermal hydrolysis, Class A, greenhouse gases.

PROGRAM HISTORY

The DCWASA biosolids program has evolved over the past decade. An evaluation of solids management options in the late 1990s led DCWASA to plan for anaerobic digestion at Blue Plains AWTP. The primary goal…to reduce the quantity of Class B biosolids material produced and transported (EPMC IV, 2001). Minimizing product quantity reduces DCWASA’s cost increases, and risks from hauling longer and longer distances over time. At an average production of 1100 wet tonnes/day (1200 wet US tons/day) of Class B, lime-stabilized biosolids, DCWASA operates one of the largest land application and biosolids beneficial use programs in North America.

In 2007, an updated evaluation of biosolids management options was initiated by DCWASA. The team included experts in a variety of biosolids management and anaerobic digestion issues. Renewed examination of solids processing alternatives included several digestion options that had advanced in recent years. These alternatives included thermal hydrolysis and acid/gas phased digestion approaches. Thermal hydrolysis with mesophilic anaerobic digestion (TH + MAD) was selected. See DCWASA’s Biosolids Management Plan Update Report, December 2008.

Using the CAMBI™ Thermal Hydrolysis Process, the recommended option (TH + MAD) at 410 dry tonnes/day (450 dry US tons/day) requires four process trains with six reactors per train and four large anaerobic digesters (3.8 MG/each). This facility will have capacity to process biosolids at the average and peak month loading rates. However, the existing lime stabilization process is required to remain in service to handle higher peak solids. The biosolids program at DCWASA is budgeted at $407 million, including engineering and construction costs, construction management and startup functions. One key element of DC WASA’s Biosolids Program is to produce and use power and steam at the Blue Plains AWTP using renewal energy.
Solids Projections

The solids production estimates since 2003 have steadily climbed, showing that a 20 percent increase in average solids production is now planned for the same future, 370-mgd design condition (see listing below). Some of this increase is caused by mandates to remove additional nitrogen from the wastewater.

Ave. Solids Production at 370-mgd flow*

<table>
<thead>
<tr>
<th>Estimate made in</th>
<th></th>
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<tbody>
<tr>
<td>2003</td>
<td>330 dry tons/day</td>
</tr>
<tr>
<td>2007</td>
<td>370 dry tons/day</td>
</tr>
<tr>
<td>2009</td>
<td>397 dry tons/day</td>
</tr>
</tbody>
</table>

*at digester feed location, in all cases, to be comparable

Peak solids production estimates have also been modified from earlier estimates. This has been the result of more detailed examination of solids production data at Blue Plains, more complete concepts about future loads coming to the plant, better predictive tools, and additional data from other large wastewater plants with similar characteristic service areas.

MAXIMIZING BENEFITS FROM RENEWABLE ENERGY

As previously described for the Blue Plains AWTP, wastewater is converted into stabilized biosolids which are a renewable resource used as a soil amendment. Lime is used to produce these stabilized biosolids. DCWASA has a long, successful history with this procedure. However, the new program previously described (TH + MAD) will replace lime stabilization and provide the following advantages:

- New anaerobic digestion will produce digester gas (60% methane, 140 million BTUs/day).
- Heat and power produced from digester gas replaces natural gas and electricity used at the AWTP and reduces existing air emissions from commercial power sources.
- Electrical power from digester gas (13 MW initially in 2014) closely matches critical process requirements for the AWTP, thereby providing reliable standby power during outages of commercial power supply.

DC WASA’s Biosolids Program will:

1. Produce 13 MW of clean renewable electricity (Green Power) in 2014 using digester gas at less cost than currently paid. Production increases over time to 20 MW in 2030. Twenty six thousand homes can be powered by 13 MW.
2. Reduces DCWASA’s GHG inventory by 130,000 to 160,000 metric tons of CO2e per year
3. Significantly reduces Green House Gas emissions from electricity and natural gas usage at the Blue Plains AWTP
4. Provides thermal hydrolysis/anaerobic digestion of biosolids thereby reducing trucking by half and produces Class A biosolids.
• Thermal Hydrolysis with Anaerobic Digestion reduces biosolids by nearly 50%,
dramatically reducing land applications costs and diesel fuel consumption for
hauling. (1,275 gal/day of diesel fuel saved)*

• Lime stabilization is nearly eliminated, greatly reducing the use of lime which
requires high energy to produce. (40 tons/day of lime saved)

• Thermal Hydrolysis/Anaerobic Digestion produces a Class A product, superior to
Class B currently produced. This expands beneficial uses and reduces hauling
distances.

*Based upon 55-58% vss destruction per pilot testing at Virginia Tech, 75% vss content,
32% vs 28% final dewatering and the elimination of 40 dtpd of lime. Credit for reduced
hauling distances for Class A product or product value increases not included.

A combined heat and power facility in the Biosolids Program (CHP) will burn digester
gas in gas turbines (GTs) followed by heat recovery steam generators (HRSGs) and
possibly steam turbines (STs). A steam boiler will be provided to ensure steam
production. Steam will heat the Thermal Hydrolysis/Anaerobic Digestion process and
could replace existing natural gas heaters currently used at the AWTP and begin
centralized steam heating.

The CHP will start-up in mid-2014 to ensure steam production for Thermal
Hydrolysis/Anaerobic Digestion. During initial operations with natural gas, the CHP
offloads coal-and-oil-derived commercial power. The gas turbines produce electricity at
about 38 percent efficiency with overall combined heat & power production efficiencies
approaching 70%.

DC WASA will retain ownership of the CHP with the design, construction and operation
of the facility in a single DBO contract.

ENVIRONMENTAL BENEFITS

Clean, renewable, cost-effective electricity. Using digester gas for heat and power at
the Blue Plains AWTP avoids fuel costs. Power costs to DC WASA from the CHP
will be less than commercial rates. Digester gas avoids escalating energy prices and
savings to DC WASA will increase in future years.

Heat for Thermal Hydrolysis and Anaerobic Digestion. Thermal Hydrolysis
operates at temperatures between 150 to 170 degrees C. The CHP can meet these
process heat needs with steam remaining for other uses in the AWTP.

Green House Gas (GHG) reductions. When digester gas is used in the CHP, power
and steam production have limited or no reportable GHG emissions, in contrast to
current fossil-fuel derived power in the District of Columbia with a carbon intensity of
power at 1200 lbs. of CO2e/MWh (Higher than national average). A reduction in the
AWTP’s GHG inventory will have a significant positive impact on the District’s
overall GHG inventory. The digester gas fueled CHP results in a carbon reduction of
about 48,000 metric tons of CO2e per year.
During the initial period from early 2014, the natural-gas-fueled CHP also operates at a reduction in GHGs over current power sources.

Table 1-Environmental Benefits of DC WASA’s Biosolids Program (see notes)

<table>
<thead>
<tr>
<th>Emission Source</th>
<th>2007-2008 Average Annual Emissions Estimate, Metric Tons CO₂e</th>
<th>Projected Annual Emissions after Cambi Digestion Upgrades*, Metric Tons CO₂e</th>
<th>Overall Predicted Reduction, Metric Tons CO₂e</th>
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<tbody>
<tr>
<td><strong>Scope 1</strong></td>
<td></td>
<td></td>
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<tr>
<td>Natural Gas</td>
<td>2,976</td>
<td>2,976</td>
<td>0</td>
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<tr>
<td>Vehicle (fuel usage)</td>
<td>2,788</td>
<td>2,788</td>
<td>0</td>
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<tr>
<td>Refrigerants</td>
<td>125</td>
<td>125</td>
<td>0</td>
</tr>
<tr>
<td>Nitrification/Denitrification (process emissions)</td>
<td>3,472</td>
<td>4,687</td>
<td>-1,215</td>
</tr>
<tr>
<td>Effluent Discharge (process emissions)</td>
<td>1,736</td>
<td>1,736</td>
<td>0</td>
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<tr>
<td><strong>Total of Scope 1</strong></td>
<td>11,096</td>
<td>12,312</td>
<td>-1,215</td>
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<td><strong>Scope 2</strong></td>
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<tr>
<td>Electricity</td>
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<tr>
<td>DSS</td>
<td>10,237</td>
<td>10,237</td>
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<tr>
<td>DWS</td>
<td>10,178</td>
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<td>0</td>
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<td>DWT</td>
<td>133,387</td>
<td>85,356</td>
<td>48,031</td>
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<tr>
<td><strong>Total of Scope 2</strong></td>
<td>153,802</td>
<td>105,771</td>
<td>48,031</td>
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<td><strong>Total of Scopes 1 and 2</strong></td>
<td>164,898</td>
<td>118,083</td>
<td>46,816</td>
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<tr>
<td><strong>Scope 3</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Biosolids Hauling (fuel usage/distance traveled)*</td>
<td>4,154</td>
<td>1,853</td>
<td>2,301</td>
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<tr>
<td>Lime Production</td>
<td>14,547</td>
<td>727</td>
<td>13,819</td>
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<td>Methanol Production</td>
<td>7,167</td>
<td>9,676</td>
<td>-2,509</td>
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<td>N2O Emissions from Land Applicationb</td>
<td>50,437</td>
<td>35,306</td>
<td>15,131</td>
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<tr>
<td>Methane Emissions from Landfilling Biosolids</td>
<td>260</td>
<td>149</td>
<td>142</td>
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<td><strong>Scope 3 GHG Emission Offsets</strong></td>
<td></td>
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<tr>
<td>Carbon Sequestration Land Applicationc</td>
<td>-28,886</td>
<td>-28,886</td>
<td>0</td>
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<tr>
<td>Compostingd</td>
<td>-12,837</td>
<td>-12,837</td>
<td>0</td>
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<td>Carbon Sequestration Landfillc</td>
<td>-56</td>
<td>-56</td>
<td>0</td>
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<tr>
<td>N2O Offsets from Avoided Chemical Fertilizers</td>
<td>-50,437</td>
<td>-35,306</td>
<td>-15,131</td>
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<tr>
<td>Fertilizer Credits Direct Applied Biosolids (N and P)</td>
<td>-6,812</td>
<td>-4,768</td>
<td>-2,044</td>
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<tr>
<td>Fertilizer Credits Composted Biosolids (N and P)</td>
<td>-1,054</td>
<td>-738</td>
<td>-316</td>
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<td><strong>Total Scope 3 Emission Offsets</strong></td>
<td>-23,487</td>
<td>-34,880</td>
<td>11,393</td>
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<tr>
<td><strong>GRAND TOTAL (Scopes 1, 2, &amp; 3 w/Offsets)</strong></td>
<td>141,412</td>
<td>83,203</td>
<td>58,209</td>
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</table>

Elements for proposed (non-accepted) methodologies are designated with an asterisk (*).

* Lime stabilization will be used to process 5 percent of the sludge production.

+ Nitrification/denitrification N₂O emissions and methanol consumption are estimated to increase by 35% to treat additional ammonia recycle from dewatering of digested biosolids.

\[ \text{Based on } 1.145 \text{ MT CO}_2\text{e/MWh consolidated carbon intensity of power.} \]

\[ \text{Effluent N}_2\text{O Reductions or electricity and/or methanol increases from ENR are not included in comparison.} \]

\[ \text{Blue Plains electrical consumption averaged 29.26 MW in 2007 and 2008. Assumptions include addition of 2.2 MW of new load associated with the Cambi digestion upgrades; 1.5 MW of aeration energy for recycle nitrification; and 1.3 MW of load reduction associated with lime equipment that will no longer be in service. For the relatively small fraction of sludge processed using lime stabilization, it is assumed that the lime processing electrical load is added to the digestion facility load.} \]

\[ 13 \text{MW will be produced from digester gas, having entirely biogenic CO}_2\text{ emissions.} \]

\[ \text{Truck trips of biosolids will be reduced from 65 to 28 trucks per day.} \]

\[ \text{Assumes 30 percent reduction land-applied nitrogen and no reduction in phosphorus.} \]

\[ \text{Assumes no change in sequestered carbon on a mass basis.} \]

Program Beneficiaries

This project will benefit the Washington, DC metropolitan area, i.e. residents of Prince Georges and Montgomery Counties in Maryland, Fairfax and Loudoun Counties in Virginia and the District of Columbia. In total, 2.2 million people are currently served by
the Blue Plains AWTP. This is estimated to be 2.7 million in year 2030. The CHP will reduce air emissions in the entire DC metropolitan area with its population of 4.5 million people due to the highly efficient gas/steam turbines with low emissions. Energy costs will be reduced for DC WASA customers.

**Phased approach to Achieve Cost Savings and Energy Reduction**

Initial operation of the CHP will use natural gas for commissioning and then convert to digester gas as soon as Thermal Hydrolysis and Anaerobic Digestion facilities produce digester gas. Once Thermal Hydrolysis and Anaerobic Digestion are online in 2014, the CHP will use digester gas. Digester gas contains about 60% methane of biogenic origin, with no global warming impact when fully oxidized to CO₂ during combustion in turbines.

**Alternative Project Delivery**

This project will be implemented as a design-build-operate (DBO) contract which will allow DC WASA to obtain experts in power generation and steam production-both of which are not DC WASA’s core business. As such, the prime contract would be held by the DBO Contractor. DC WASA and the Biosolids Management Program will be working closely with the DBO contractor to ensure compliance with the design & operational intent of the facilities as well as compliance with key standards and performance criteria.

**Estimated Construction Costs**

DC WASA’s overall Biosolids Management Program costs are budgeted at $407 million. The estimated construction cost for the CHP is $59.5 million.

**Economic Viability**

WASA’s Biosolids Program has strong economic viability over current operations due to reduced land application costs, reduced use of lime and the economic production of electricity and heat using digester gas. Cost models developed for the Biosolids Program predict that annual O&M costs for the recommend program from 2014 onward can be about 40% of annual O&M costs for continued use and expansion of current lime stabilization of biosolids. These dramatic savings provide the funding to pay for the required capital improvements. With deferred bond funding, Annual Cash Flow for the Biosolids Program (aka Digestion Project) becomes positive from 2014 onward after the facilities become operational. As time passes the savings increase.
Figure 1-O&M Cost Comparison* of Digestion Project (Biosolids Program) vs. Lime Stabilization (continued and expanded) with 3% annual inflation.

Figure 2-Total Annual Cost Comparison* of Digestion Project (Biosolids Program) vs. Lime Stabilization (continued and expanded) with 3% annual inflation.
Figure 3-Total Annual Cost Comparison* of Digestion Project (Biosolids Program) vs. Lime Stabilization (continued and expanded) with Deferred Bond Funding Considered

Figure 4-Accumulated Cost Comparison* of Digestion Project (Biosolids Program) vs. Lime Stabilization (continued and expanded).
Meeting Air Emissions Requirements and Insuring Adequate Steam Supply

The biosolids program must meet air quality and air permitting requirements, and the portion of the project that has the greatest potential for air permitting challenges is the Combined Heat and Power facility (CHP). The CHP must provide the steam requirements for the thermal hydrolysis process, and can produce electric power to offset major power purchases needed for the Blue Plains AWTP. NOx production is perhaps the greatest permitting challenge for a project of this type located within the Washington DC Metro area which is a non-attainment area for ozone.

Different prime movers and steam generation systems were evaluated in the development of the biosolids program, and the decision to utilize combustion gas turbines was highly influenced by the low NOx emissions that these units can achieve. The turbines utilize Heat Recovery Steam Generators (HRSGs) to produce the steam requirements. Recent advances in gas turbine designs utilizing recuperative exhaust now offer very high energy conversion (38%) and reduced air pollutants emissions. Solar’s Mercury 50 is one example. Steam at about 12-bar (180 psi) is required for thermal hydrolysis, and about one ton of steam is required per ton of solids throughput. Gas turbines are highly reliable if proper digester gas quality and consistent supply is provided. Siloxane treatment of the digester gas will be needed.

A steam boiler is being included to insure high reliability of steam supply. The boiler could be operated on either digester gas or natural gas. Therefore, the risks for air permitting problems have been kept to a minimum, and the overall energy output is maximized.

SUMMARY

DCWASA has a very unique opportunity. Although the addition of new thermal hydrolysis and mesophilic anaerobic digestion facilities will require significant capital expenditure ($407M), the annual costs savings in operations will provide the savings needed to rapidly repay this debt and stabilize future costs. Deferred payment of bonds until after the facilities are in operation and yielding these savings further enhances the viability of this program.

Maximizing the benefits from renewable energy is central to the savings for DCWASA’s biosolids program. When the production of 13 MW of power without purchasing fuel is considered coupled with the production of enough heat for thermal hydrolysis, extra for plant uses, the near elimination in lime addition and approximately 50% reduction in biosolids quantities…the cost savings potential is obvious. The facts that these facilities will produce Class A biosolids and that reliable standby power for critical plant process is inherently available are major bonuses.
REFERENCES

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