Agenda

• Bio-Energy Project Objectives and Drivers
• Bio-Energy Plant Overview
• Piscataway Renewable Gas Production
• Piscataway and Montgomery County Gas Reqmts
• Projected Bio-Energy Initial Operations
• Renewable Fuel Standard Program and RIN Market
• Projected Cost and Revenue Comparison
• Questions
WSSC Water Service Area (Maryland)

- (2) Water Filtration Plants
- (5) Water Resource Recovery Plants
- (13) Water Pumping Stations
- (50) Wastewater Pumping Stations
- (10) Field Offices/Lab/HQ

- Serves population of 1.8 million
- Serves Montgomery and Prince George’s Counties
- Provides 170 MGD drinking water
- Collects 200 MGD wastewater
- Treats 70 MGD wastewater
- Supplies DC Water with 130 MGD wastewater
Existing Biosolids Management Practices

- Individual handling at 5 WSSC WRRF (WWTP)
- Class B land application
  - Meet EPA requirements
  - Land sites in VA
- Western Branch
  - Landfills in Virginia
Drivers for Change

- Increased regulations will lead to higher costs for Class B disposal
- Fewer restrictions on more highly treated Class A biosolids (better product)
- Reduced quantity of biosolids to be land applied
- Recovered energy (resource) during the process
Bio-Energy Project- Objectives

• Save rate payer dollars through reduced operating costs
• Minimize the quantity of biosolids material
• Develop Class A (pathogen-free) biosolids material
• Maximize return on investment and energy recovery from biosolids, fats, oils and grease
• Reduce greenhouse gas emissions
• Improve power reliability
• Reduce nutrient loads to Chesapeake Bay
Renewable Biogas - Piscataway

• Biogas production: ~12 MMBtu-LHV/hr in mid-2023
• Site consumption: ~26 MMBtu-LHV/hr, also in mid-2023
• Biogas production qualifies for renewable fuel credit (RIN) if delivered for transportation use
• WGL constructing new gas service that allows Piscataway to sell biogas to other system users
• Any licensed energy supplier can deliver Piscataway renewable gas to any customer
WSSC Piscataway Bioenergy Program
Potential NG Use and rNG Injection Quantities

Projected Initial Operation

- **Biogas**
- **Upgrading**
- **Washington Gas Pipeline**
- **Meter 1**: Ave: 26 MMBtu-LHV/hr.
- **Meter 2**: Ave: 12 MMBtu-LHV/hr.
- **N.C.**
- **Montgomery County Transit Meter 3**: Ave: 12 MMBtu-LHV/hr.
- **Vehicle Fuel**
- **Piscataway Sludge**
- **Transported Sludge**
- **Digesters**
- **Land Application**
- **Biogas Upgrading**
- **THP**
- **Engine**
- **Use 10 to 15 MMBtu-LHV/hr. per Engine**

**WASHINGTON GAS SYSTEM**
Biogas and Natural Gas Delivery – Montgomery County & WSSC

WSSC & Montgomery County Bus Balance (as seen by WGL):

- Piscataway rNG Production/Injection: -12 MMBtu-LHV/hr rNG
- Piscataway NG Consumption: +26 MMBtu-LHV/hr NG
- Montgomery County Bus Total Gas Consumption: +26 MMBtu-LHV/hr NG+rNG
- Amount of NG Supplied through WGL Gates: +40 MMBtu-LHV/hr Gas

Pipelines Serving WGL:
- Transco: Zone 6, Non-New York
- Dominion
- WSSC
- WSSC Gen
- Piscataway

Montgomery County Bus

12 MMBtu-LHV/hr rNG
+14 MMBtu-LHV/hr NG
Renewable Fuel Standard (RFS) Program Structure

• Created under the Energy Policy Act of 2005 (EPAct)

• Amended the Clean Air Act (CAA)

• Energy Independence and Security Act of 2007 (EISA) further amended the CAA by expanding RFS program

• EPA implements the program in consultation with the US Department of Agriculture and the Department of Energy
Pathways II Improved on Pathways I

• Pathways I originally classified Biogas (from Landfills, sewage and waste treatment plants, manure digesters) as for D5 (Advanced) RINs

• RFS Pathways II was published on July 18, 2014

• Pathways II added Pathway Q that provided D3-RIN (cellulosic) designation for any:
  • “Renewable Compressed Natural Gas, Renewable Liquefied Natural Gas, Renewable Electricity”
  • produced from “Biogas from landfills, municipal wastewater treatment facility digesters, agricultural digesters, and separated MSW digesters; and biogas from the cellulosic components of biomass processed in other waste digesters.”
Fuel Nesting Summary for RFS

Conventional renewable fuel (D6)
Example feedstock: Corn starch
Required lifecycle GHG reduction: 20% or more

Advanced biofuel (D5)
Example feedstocks: Sugarcane, biobutanol, bionaphtha
Required lifecycle GHG reduction: 50% or more

Cellulosic biofuel (D3)
Example feedstocks: Corn stover, wood chips, miscanthus, biogas
Required lifecycle GHG reduction: 60% or more

Biomass-based diesel (D4)
Example feedstocks: Soybean oil, canola oil, waste oil, animal fats
Required lifecycle GHG reduction: 50% or more

Each D3 or D4 is also counted as a D5
And each D5 is also counted as a D6
Renewable Fuel Volume Obligations (RVO)

Congressional Volume Target for Renewable Fuel

- **36 Billion Gallons of Renewable Fuel by 2022**

**Key**
- Cellulosic (D-3)
- Advanced (D-5)
- Biodiesel (D-4)
- Renewable (D-6)

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<thead>
<tr>
<th>Year</th>
<th>Billion Gallons</th>
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<tr>
<td>2008</td>
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<td>2012</td>
<td>15</td>
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<td>2017</td>
<td>20</td>
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<td>2022</td>
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Required Volumes of RINs

Data presented are taken from Table I.A.1-1 of the RFS2 Rule, 2009.

Requirements for Biodiesel beyond 2013 and other renewable fuels beyond 2022 will be determined by EPA rulemaking but must be greater or equal to the last numeric quantity.
### Proposed, Final, and Originally-Legislated D3/D5/D6 RIN Volumes (in millions); with Downturn Starting in 2018

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<td><strong>D3</strong></td>
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<td>14</td>
<td>8 to 30</td>
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<td>312</td>
<td>238</td>
<td>381</td>
<td>540</td>
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<td>Final</td>
<td>0</td>
<td>6</td>
<td>33</td>
<td>123</td>
<td>230</td>
<td>311</td>
<td>288</td>
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<td>none</td>
<td>4,000</td>
<td>4,240</td>
<td>4,880</td>
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<td>2,000</td>
<td>2,750</td>
<td>2,670</td>
<td>2,880</td>
<td>3,610</td>
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<td>2,000</td>
<td>2,750</td>
<td>3,750</td>
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<td>7,250</td>
<td>9,000</td>
<td>11,000</td>
<td>16,000</td>
<td>15,000</td>
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<td><strong>D6</strong></td>
<td>Proposed</td>
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<td>16,550</td>
<td>15,000 to 15,500</td>
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<td>none</td>
<td>18,800</td>
<td>19,240</td>
<td>19,880</td>
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<td>15,200</td>
<td>16,550</td>
<td>18,150</td>
<td>20,500</td>
<td>22,250</td>
<td>24,000</td>
<td>26,000</td>
<td>28,000</td>
<td>30,000</td>
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What Happens After 2022?

• The statutorily-prescribed phase-in period ends in 2012 for biomass-based diesel and in 2022 for cellulosic biofuel, advanced biofuel, and total renewable fuel.

• Beyond these years, EISA requires EPA to determine the applicable volumes.

• However, the statute requires that the biomass-based diesel volume in 2013 and beyond must be no less than 1.0 billion gallons, and that advanced biofuels (which include Cellulosic) in 2023 and beyond must represent at a minimum the same percentage of total renewable fuel as it does in 2022.
Value of RINS (contrast between D3 and D5)

- D3s have historically been worth 2 to 4 times D5s
## Comparison of Biogas CHP and NG CHP + rNG Export: Operating Parameters

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Biogas CHP</th>
<th>NG CHP + rNG Export</th>
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<tbody>
<tr>
<td>Biogas Production</td>
<td>MMBtu-LHV/hr</td>
<td>12</td>
<td>12</td>
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<tr>
<td>Biogas Treatment Recovery</td>
<td>% of Biogas</td>
<td>99%</td>
<td>98%</td>
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<tr>
<td>Renewable Fuel</td>
<td>MMBtu-LHV/hr</td>
<td>11.9</td>
<td>11.8</td>
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<tr>
<td>D3 (Cellulosic) RIN Production</td>
<td>D3-RINs/Day</td>
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<td>3,665*</td>
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<tr>
<td>NG LHV Purchases</td>
<td>MMBtu-LHV/hr</td>
<td>4.6</td>
<td>26.0</td>
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<tr>
<td>NG HHV Purchases</td>
<td>MMBtu-HHV/hr</td>
<td>5.1</td>
<td>28.9</td>
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<tr>
<td>Net Electric Efficiency</td>
<td>% of Fuel</td>
<td>38.2%</td>
<td>38.2%</td>
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<tr>
<td>Net Power Production</td>
<td>MW, avg</td>
<td>1.33</td>
<td>2.62</td>
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</tbody>
</table>

* D3-RINs/Day = $\text{MMBtu-LHV/hr} \times 24$
  77000 Btu/RIN
Comparison of Biogas CHP and NG CHP + rNG Export: Unit Costs, Revenues, and Savings

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Biogas CHP</th>
<th>NG CHP + rNG Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net RNG Sale (energy rev. &amp; injection cost)</td>
<td>$/MMBtu-HHV</td>
<td>-$2.10</td>
<td>$2.10</td>
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<tr>
<td>Net NG Purchase (energy &amp; delivery costs)</td>
<td>$/MMBtu-HHV</td>
<td>-$4.00</td>
<td>-$4.00</td>
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<tr>
<td>Net Electric Savings (energy savings, REC rev., &amp; CHP O&amp;M cost)</td>
<td>$/kWh</td>
<td>$.105</td>
<td>$.09</td>
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<tr>
<td>Full D3-RIN Value</td>
<td>$/D3-RIN</td>
<td>$1.00</td>
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<tr>
<td>RIN Revenue Recovery</td>
<td>% Full Value</td>
<td>85%</td>
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Comparison of Biogas CHP and NG CHP + rNG Export: Annual Savings or Revenues (>0) and Costs (<0)

<table>
<thead>
<tr>
<th>Description</th>
<th>Biogas CHP</th>
<th>NG CHP + rNG Export</th>
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<tbody>
<tr>
<td>Net RIN Revenue</td>
<td>$0</td>
<td>$1,140,000</td>
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<td>Net RNG Revenue</td>
<td>$0</td>
<td>$240,000</td>
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<tr>
<td>Net NG Costs</td>
<td>-$180,000</td>
<td>-$1,010,000</td>
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<tr>
<td>Net Electric Savings</td>
<td>$1,220,000</td>
<td>$2,060,000</td>
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<tr>
<td>Total Annual Savings</td>
<td>$1,040,000</td>
<td>$2,430,000</td>
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$1,390,000
Questions?