BioFuels
Washington, LLC.

Washington State Recycling Association
“Washington Waste Fuels the Future”
Landfill Gas-to-Energy Project
At the LRI Landfill in Graham, Washington

June 26, 2014
Project Participants

- Pierce County Recycling, Composting and Disposal, LLC d/b/a LRI (Waste Connections)
- New Energy Capital & North Sky Capital
- SCS Energy
- Michael Minor Associates
- Puget Sound Power
- VCCC (Joint Venture of VCORE and CCC Industries)
- General Mechanical & Madsen Electric
- ENERGYneering Solutions, Inc (ESI)
Presentation Summary

- Development and Implementation Timeframe
- Virtual Tour of the LRI Landfill Gas to Energy Facility
- Puget Sound Energy’s Involvement
- Phase Development—Future Green Energy Options
- Project Benefits
- Green Fuel Options
- Obstacles to the development of Green Fuel Options from LFG
- Potentially Supportive Regulatory/State Gov’t Action
Project Development Schedule

**Project Development Activity (Phase 1)**

- Executed Non-Disclosure Agreement
- Executed LFG Sale & Purchase Agreement
- Submit Air Permit Application
- Power Contract with Puget Sound Energy
- Revised Land-Use Permit Application
- Complete Project Design
- Interconnection Agreement with PSE
- Secure Air Permits
- Complete Public Facilities & Solid Waste Permit
- Begin Construction
- Project Startup Began
- Full-time Operation

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<tr>
<td>October 2008</td>
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<td>June 2010</td>
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Pre-Construction View from Landfill facing NW
Pre-Construction View from Landfill facing NW
View of Landfill from 304th Street
BioFuels Washington, LLC (“BFE”) executed an LF Gas Contract with LRI for the long term (20 years) rights to the LRI Landfill gas and accompanying site lease. (June 2010)

- BFE generating 4.5 MW of electricity that is contracted for sale to Puget Sound Energy in Phase 1a of the project
- BFE will purify landfill gas to the California Standard for Compressed Natural Gas for use as a transportation fuel
- BFE is looking to secure Washington State customers to purchase CNG transportation fuel.
- CNG will be (i) transported off-site via tube trailers and/or via (ii) a 9.7 mile pipeline to Williams Northwest Pipeline with a receipt metering station near Fort Lewis or (iii) on-site fueling station
LFG to Energy Site Layout
Site Location

- Electricity project site
- Proposed CNG load-out site
Puget Sound Energy’s Involvement

- Twelve Year Power Purchase Agreement (Phase 1a)
- Electrical Interconnect Agreement executed based on:
  - Completed System Impact Study
    - Facility Study completed in October 2012
  - Construct the Electric Interconnect to the PSE Kapowsin substation operated by PSE
- Operation and Maintenance of the Electric Interconnect
- 2013 & 2014 Purchaser of Renewable Energy Credits (RECs)
Blower System

The first phase of the project utilizes approximately 50% of the 3200 scfm of the landfill gas presently being generated. The landfill gas is approximately 50% methane and that is the fuel component for the generating units. The balance of the excess gas is still being flared with the intent to utilize all generated gas in future project phases. The first step in the process of preparing the landfill gas for use as an engine fuel is pressurization. The multistage blower pictured accomplishes that purpose by raising the pressure of the gas from a slight vacuum to approximately 7psig. The pressurized landfill gas stream is then cooled and put through a liquid knockout to remove any entrained liquid droplets.
Gas Cleanup

The second step in the process is to remove hydrogen sulfide (H2S) that is present within the gas. The system is designed to take gas with varying concentrations of H2S and reduce them to below 25ppm at the outlet of the system. From here the third step is for the gas to be cooled and dried further. Dropping the temperature of the gas by utilizing chilled water causes the vaporized liquid to coalesce and drop out. A good portion of other contaminants including heavier VOC’s also drop out of the gas at this time. Thereafter the gas is heated prior to being sent to the engines for power generation.
Each engine package includes an external radiator which removes heat from the engine coolant. Each engine also utilizes a custom silencer that has been oversized for this particular application and location. These keep the exhaust noise well below the allowable permit threshold for ambient noise. The facility also includes storage for the glycol and oil.
Location relative to site boundaries

- Distance to east site boundary: 575 ft
- Distance to north site boundary: 1,560 ft
- Distance to west site boundary: 1,645 ft
Noise Monitoring Locations

Compliance Monitoring will be located at maximum probable impact.

Background Data will be used for Noise Modeling.
NOISE CONTROL

- Acoustical expert was engaged (Michael Minor & Associates)
- A Facility Baseline Noise Study was conducted
- Existing natural wooded vegetation will buffer adjoining land & promote compatibility between land uses & reduce noise
- The renewable energy facility was designed to minimize noise impacts & abatement strategy will keep noise below County Standards (60 dba daytime/50 dba night)
  - Major Noise generating equipment will be located inside the main building
  - Specialized intake louvers will be utilized on engine stacks
  - Building insulated to suppress (absorb) noise
  - Exhaust piping oriented away from closest property boundary
  - Extreme-grade exhaust silencers utilized.

- Post-construction monitoring (once a month for 4 months). Each monitoring event will be for three days. Reports submitted to TPCHD.
The electrical switchgear pictured supplies power to the site. The paralleling switchgear contains specialized equipment that senses the voltage and frequency of the utility grid, and drives each engine to match prior to bringing them online. It also controls the amount of power output being sent to the utility. Before the energy is exported to the Puget Sound Energy electrical grid the voltage is transformed up to 12.47 kV from the 4160 volts that it is initially generated at. All of the energy generated by the facility is exported. The parasitic energy load required by the landfill blowers and other facility auxiliary systems is imported from PSE via a separate service. The meter for tracking such incoming power can be seen in Incoming Power Service photos. All incoming power is fed through two on-site motor control centers which house individual motor starters, VFDs, and breakers.
Engine Room

The building is fitted with custom designed intake and exhaust fans that provide filtered air to the engine room. This keeps the room at the appropriate temperature and also keeps noise levels well below Pierce County requirements. The three Caterpillar G3520 engines, that produce 1500 KW each, are housed in a custom designed steel building designed for the purpose of mitigating sound and keeping the engines at an optimal operating temperature. The room is furnished with a 3 ton electric bridge crane to aid in maintenance and servicing.
# Renewable Energy Phase Development

**Phase 1A - Commercial Operation December 31st, 2013**

## Phase 1

<table>
<thead>
<tr>
<th>2160 scfm</th>
<th><strong>A)</strong> 1590 scfm - 4.5 MW Electrical Generation (3 x CAT 3520 engines)</th>
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<td><strong>B)</strong> 570 scfm - CNG = fuel for 159 trucks @ 25,000 miles/yr @ 4.5 mi/gal</td>
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## Phase 2 (Pending Economic Viability)

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<th>1590 scfm</th>
<th><strong>A)</strong> CNG (fuel for additional 443 trucks) or</th>
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<td><strong>B)</strong> Additional 1.5 MW (1 x CAT 3520) + fuel for 295 trucks or</td>
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<td></td>
<td><strong>C)</strong> Additional 3 MW (2 x CAT 3520) + fuel for 148 trucks or</td>
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<td><strong>D)</strong> Additional 4.5 MW (3 x CAT 3520)</td>
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## Phase 3 (Future Approximately 2022)

| 2033 scfm | **A)** CNG/engine mix as per above. Could be fuel for additional (566 trucks) or 6.0 MW |

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The CNG Development Alternative

- LFG will be piped from the existing blower-flare station at the project site (NE side of the landfill).
- Landfill gas will be processed to remove moisture, Carbon Dioxide, Hydrogen Sulfide, Nitrogen, Hydrogen, and other trace compounds.
- Clean, concentrated gas will then be either:
  A) compressed and injected into a new pipeline at the site and connected to either the Williams Northwest or Puget Energy Systems Pipeline system, or
  B) piped to the on-site CNG load-out facility (West side of the landfill) and loaded into tube trailers and distributed to other locations for use as vehicle fuel.
RINS from High BTU “Renewable Gas”

- The EPA Renewable Fuel Standard (RFS2) mandates that fuel refiners obtain renewable fuel credits to meet a minimum percentage of renewable fuel production.

- Renewable Fuel Credits are called RINS (Renewable Identification Number), and represent 77,000 BTUs of fuel (13 RINS per MMBTU)(1.7 RINS/DGE CNG).

- CNG produced from landfill gas qualify for RINS.

- BFW can sell High BTU gas via natural gas pipeline to a CNG station, or construct a fueling station at the landfill or deliver the CNG via tube trailer to a fueling station.

- The “pathway” from producer to user must be approved by EPA; uncertain future of regulation; RIN buyers require extensive documentation and credit support.
Project Benefits

- Waste Gas presently being Flared (burned on-site)
- Renewable Energy generation for approximately 3,375 homes (Phase 1a)
- Local Construction and Operation Jobs – Electrical, Mechanical, and Civil bid packages
- Improved Air Quality – Reduction in GHG Emissions
- Increased Tax Revenues
- Reduce Diesel Consumption (precursor carcinogen)

Phase 1b will produce enough CNG to fuel 160 trucks/year @ 25,000 mi/year @ 4.5 MPG

- Phase 1b, II, & III – up to an additional 11 MW or CNG for 1000 trucks (or combination)
Impediments to the Development of Green Fuel Options from Landfill Gas

- Difficulty in Securing long term commitment to purchase of CNG fuel in sufficient quantities to support capital investment.
- Fluctuation and uncertainty surrounding the long term value and the very existence of RINS (environmental attributes)
- Relatively low cost of Natural Gas as a competing product (primarily due to recent Fracking technology and production)
- Long Distance and High Cost of installing a Gas Distribution piping (8 miles – excess of $10M)
- Less proven technology to clean-up LFG to pipeline and CNG spec versus LFGTE
- Changing Regulatory Environment (gas spec.; greenhouse gas value; recycling targets- impact on organic deposition LFG generation curves, etc)
- Regulatory Constraints- Inability to transmit power to Customer for purposes of electrical vehicle charging
Potential Supportive “Green Fuel” Regulatory Actions

- State Backstop the purchase of renewable CNG to allow implementation and availability for market development and/or commit to 10 year contracts for fuels in fleet
- Regulatory approval for utilities to ratebase investment in “green fuel” pipelines
- Create state environmental bank for purchase of greenhouse gas credits and long term sale of RINS. (See California AB 2390 as example)
- Allow non-regulated entities to sell renewable power solely for the purpose of electrical vehicle charging