WILLAMETTE VALLEY BIOGAS PLANT CONVERTS FOOD WASTE TO ENERGY

JC-BIOMETHANE FIRST IN PACIFIC NORTHWEST TO TRANSFORM COMMERCIAL FOOD WASTE INTO RENEWABLE BIOGAS

JC-Biomethane, LLC, in Junction City, near Eugene, is the first biogas plant in the Pacific Northwest to produce energy from the digestion of post-consumer commercial food waste. Through anaerobic digestion, the plant transforms a mix of organic waste into methane-rich biogas, which is then used to generate electricity.

Anaerobic digestion is the process by which bacteria in an oxygen-free tank convert heated organic wastes into biogas, along with byproducts such as liquid fertilizer and fiber compost. While most biogas facilities process a single feedstock, often municipal wastewater solids or dairy manure, JC-Biomethane co-digests post-consumer commercial food waste, as well as smaller volumes of dairy waste and fats, oils and greases from food processing plants and other sources.

The biogas fuels a 16-cylinder reciprocating engine, similar to a locomotive engine, that generates electricity. With a 1.55 megawatt capacity, the co-generation engine is expected to produce 12,250 megawatt hours of electricity annually, energy equivalent to what would be needed to power about half the homes in Junction City for a year. The renewable power is sold to Portland General Electric through a wheeling arrangement with the Blachly-Lane County Cooperative Electric Association and Bonneville Power Administration.

Construction of the biogas plant started in late 2011. It began producing renewable gas and generating electricity in fall 2013. Designed and managed by Dean Foor of Essential Consulting Oregon, LLC, the facility is a clean and nearly odorless renewable energy plant.

Foor said he and his team recognized a distinct opportunity to develop a biogas plant that would convert food waste within their own community. He had recently developed an agriculture-based biogas plant, Stahlbush Island Farms near Corvallis, and knew financial and technical support was available from Energy Trust of Oregon and the Oregon Department of Energy.

"We were exceptionally fortunate to have backing from Energy Trust," Foor said. Energy Trust contributed $2 million toward the project's $16 million total cost.

The biogas project also qualified for approximately $4.7 million in federal grants and a $1 million Oregon Business Energy Tax Credit pass-through payment.

Energy Trust of Oregon

Dean Foor, managing member in Essential Consulting Oregon, LLC, and plant designer/operator.

The continuously stirred tank reactor, CSTR, where heated waste digests in an oxygen-free environment, takes shape on left. Smaller crane on right hoists inflatable top for the biogas storage tank.

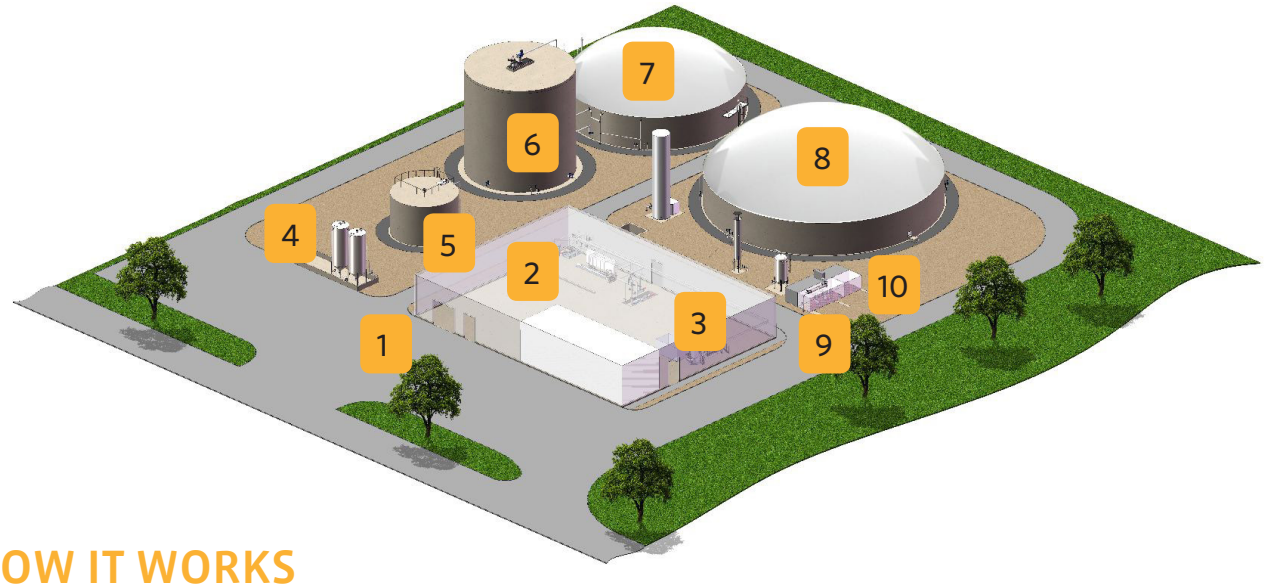
Food waste from post-consumer commercial sources is processed to remove contaminants such as metals and plastic as an initial step in producing biogas.

Foor explained that JC-Biomethane is a product of a passionate team driven to make a difference in their community. "The field of waste management seemed reluctant to embrace the technology of processing food wastes into biogas," Foor said. "The technology needed a push to make it happen and show its potential. That's what Essential Consulting Oregon did with the JC-Biomethane facility."

Methane, comprising about 60 percent of the biogas, is a greenhouse gas approximately 20 times more potent than carbon dioxide. Burning the biogas to generate renewable energy prevents methane from being released to the atmosphere while also offsetting electric power generation from fossil fuels.

The organic materials feeding the biogas plant typically are landfilled. Without JC-Biomethane, 25,000 tons of organic materials per year would be shipped to traditional landfills. Diverting these materials to the biogas plant prevents the release of methane. Nutrients found in the organic materials, including inorganic nitrogen and phosphorus, are recovered and sold as agricultural fertilizer.

> **"We are anaerobically fermenting organic material to create methane-rich biogas, which we consume in an engine to turn a turbine to create electricity."**
>
> Dean Foor, managing member
> Essential Consulting Oregon



HOW IT WORKS

1 **Truck waste:** Trucks bring up to 80 tons of organic waste daily into a receiving warehouse. Most is post-consumer commercial food waste from the Willamette Valley and Portland. The plant is located adjacent to Lane Forest Products, which produces compost from organic material. Trucks transport Lane products north and are filled with food waste for the return trip south.

2 **Receiving building:** A large receiving building with translucent fabric walls and roof accepts the food waste. The facility excels at odor control, exceeding state and federal regulations. It is the first U.S. biogas plant to employ ozone for odor control.

3 **Bioseparator:** Inside the receiving building, a Swiss-made Hybag Bioseparator breaks down the waste and removes hard contaminants like metal and plastic from the organic waste. It is the first known application of this technology in the U.S.

4 **Liquid waste tanks:** Separate tanks receive limited amounts of liquid fats, oils and greases that are added to the digester in moderate volumes because of their high energy content.

5 **Homogenization tank:** With contaminants removed, the waste is pumped into a homogenization tank, where it sits for several days.

6 **Digester tank:** From the homogenization tank the material is pumped into a large, continuously stirred oxygen-free tank reactor, CSTR, for 30 days of anaerobic digestion. The tank is insulated to maintain a constant 105 degree Fahrenheit temperature. "This is where the magic happens," according to Foor. As the material circulates through the oxygen-free tank, bacteria convert the organic waste to biogas, which rises to the top of the tank.

7 **Post-digester tank:** From the CSTR the processed material, now called "digestate," is pumped into a post-digester tank. A distinctive inflatable top collects the biogas. From there the biogas is piped into a cleaning tower, where bacteria remove gas contaminants. Solids move through a screw press to extract excess liquid and create clean-smelling fiber, one of the plant's commercial byproducts.

8 **Liquid digestate tank:** Odor-free liquid digestate is pumped from the post-digester into the largest tank on the site, capable of holding up to six months of the product. It is sold as liquid fertilizer for replacement of 2,000 acres of conventional fertilizer.

9 **Co-generation unit:** From the post-digester, the biogas travels through underground pipes to remove water content and through three small tanks adjacent to the co-generation unit for final cleaning. It is now ready to fuel the 2G-CENERGY combined heat and power unit—a 16-cylinder, 2,000 horsepower MWM co-generation engine. Combustion of the biogas turns a generator, converting mechanical energy into electricity and completing the JC-Biomethane operation.

10 **Engine heat:** Heat created in the engine during combustion is directed back into the CSTR as needed to maintain a constant temperature. Excess heat may someday be sold to nearby businesses.

11 **Power interconnection (not pictured):** Electricity from the generator is interconnected via Blachly-Lane County Cooperative Electric Association distribution lines and then wheeled to Bonneville Power Administration transmission lines for purchase by PGE.

A look at the engine inside the co-generation unit and some of its 16 cylinders. The engine turns a generator to create electricity.

PROJECT-AT-A-GLANCE

Project team

- Essential Consulting Oregon, LLC
- Energy Trust
- Oregon Department of Energy
- Portland General Electric
- Blachly-Lane County Cooperative Electric Association
- Bonneville Power Administration
- Lane Forest Products
- FormTec GMBH

Project benefits

- Generates approximately 12,250 megawatt hours of electricity annually from a clean, renewable biogas fuel
- Reduces emissions of methane and nitrous oxides
- Produces odorless liquid fertilizer and dry fiber for compost
- Retains four jobs in biomass logistics, and creates eight permanent jobs and 60,000 person-hours of construction work
- Potential to use excess heat from co-generation in nearby commercial operations

Financial analysis

- $16 million total project cost
- $2 million Energy Trust cash incentive
- Approximately $3 million federal grant in lieu of an Investment Tax Credit
- $1.7 million in federal funding through the American Recovery and Reinvestment Act of 2009
- $1 million Oregon Business Energy Tax Credit (third party pass-through amount)

Estimated annual earnings

- About $1 million in power sales
- About $1 million from waste processors and sales of byproducts

Learn more about Energy Trust assistance and incentives for biopower projects, visit **www.energytrust.org** or call **1.866.368.7878**.

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