Recovery Act funds helped develop a 32.5 MW electricity generating facility at the Olinda Alpha Landfill in Brea, California.
Photo courtesy of Broadrock Renewables, LLC

Tapping Landfill Gas to Provide Significant Energy Savings and Greenhouse Gas Reductions

Recovery Act Funding Supports Two Large Landfill Projects

BroadRock Renewables, LLC built two high efficiency electricity generating facilities that utilize landfill gas in California and Rhode Island. The two projects received a total of $25 million in U.S. Department of Energy funding from the American Recovery and Reinvestment Act (ARRA) of 2009. Private-sector cost share for the projects totaled approximately $186 million.

The new facilities are among the largest landfill-gas-to-electricity facilities in the United States:

- The 33.4 MW combined cycle plant at the Central Landfill in Johnston, Rhode Island (near Providence), is the second largest such facility in the United States; and
- The 32.5 MW combined cycle plant at the Olinda Alpha Landfill in Brea, California (in Orange County), is the third largest in the nation.

Because of each plant's relatively large size, adding a steam turbine to utilize the waste heat from four gas turbines was a cost-effective solution.

The 33.4 MW electricity generating facility at the Central Landfill in Johnston, Rhode Island, also received Recovery Act funding.
Photo courtesy of BroadRock Renewables, LLC

Energy Department funding enabled BroadRock Renewables to move forward with the large capital investment projects at a time when the economic climate made such projects difficult to finance.

Photos courtesy of BroadRock Renewables, LLC

"I've worked at many other power plants during my career, but the sheer level of cutting edge technology at this [Providence] plant is hard to comprehend!"

– Rob Noiseux, Operations Manager at Providence Plant

"We've really assembled fine teams at both Olinda and Providence. Since there is nothing like these plants anywhere in the world, our hires were picked, in part, on their enthusiasm and fit with these innovative facilities."

– Kevin Hubanks, Vice President of Operations at BroadRock Renewables LLC

Estimated Benefits

	Olinda Plant	Providence Plant
Efficiency	45% electrical efficiency	45.6% electrical efficiency
Emissions Reductions	1.2 million tons of CO_2 equivalents per year 153,000 tons of CO_2 per year (indirect)	1.27 million tons of CO_2 equivalents per year 158,000 tons of CO_2 per year (indirect)
Energy Savings	2.2 trillion Btu annually	2.1 trillion Btu annually
Electricity	Delivered to the local transmission grid	Delivered to the local transmission grid

What the Facilities Include

BroadRock Renewables installed the following system components at both facilities.

- **Collection system:** A series of wells and a network of collection pipes to collect the landfill gas
- **Clean up and compression:** Systems to remove impurities inherent in landfill gas and to compress the gas
- **Pipeline:** Transports the gas to the power plant
- **Power plant:** A combined cycle generating facility comprised of combustion turbine generators, heat recovery steam generators, and a steam turbine generator
- **Substation:** Delivers the generated electricity to the local grid

Significant Greenhouse Gas Reductions

Due to decomposition of organic matter in landfills, a large amount of landfill gas is released into the air. Landfill gas consists of approximately equal portions of methane and carbon dioxide (CO_2). Methane, which is the primary component of natural gas, is an excellent fuel for electricity generation. It is also a powerful greenhouse gas—21 times more potent than CO_2. Thus, capturing and utilizing landfill gas is an effective way to reduce greenhouse gas emissions. By destroying methane emitted by the landfills, these two projects will reduce annual emissions by an estimated 2.47 million tons of CO_2 equivalents.

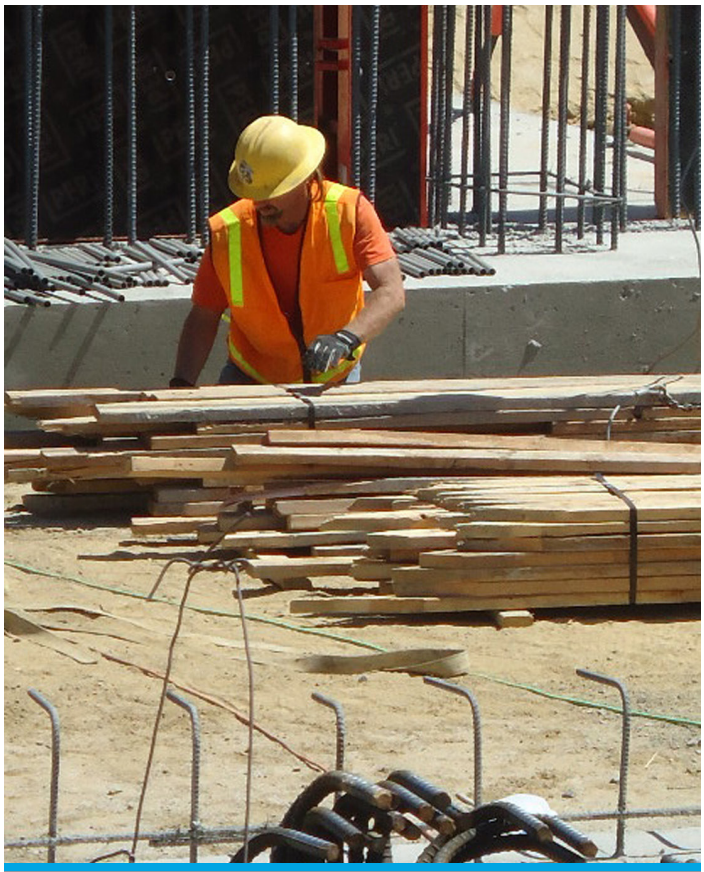
Using landfill gas to produce electricity also reduces greenhouse gas emissions indirectly, as it displaces fossil fuel-fired electricity generation. The indirect emission reductions total will be an estimated 311,000 tons of CO_2 per year for the two projects.

A ribbon cutting ceremony initiated commercial operation of BroadRock's Olinda plant in October 2012.

Photo courtesy of BroadRock Renewables, LLC

"It's hard to describe the excitement of being part of a truly state-of-the-art facility like this [Olinda]! There is nothing else like it, except our sister plant in Rhode Island...The systems specially designed here to eliminate emissions are beyond anything used before and set a new standard for the industry and the environment."

– Karl Darrington, Plant Manager at Olinda



The projects created immediate manufacturing and construction jobs, as well as permanent jobs associated with the operation and maintenance of the plants and equipment.

Photo courtesy of BroadRock Renewables, LLC

U.S. EPA LMOP Award 2012

The U.S. Environmental Protection Agency (EPA) presented BroadRock Renewables, DCO Energy, and Orange County, California, with a 2012 Landfill Methane Outreach Program (LMOP) Award, which "recognizes select Partners for excellence in innovation and creativity, success in promoting landfill gas (LFG) energy, and achieving both environmental and economic benefits." The Olinda project won the award because of its creative financing, including the ARRA grant from the U.S. Department of Energy and a Section 1603 grant from the U.S. Treasury; innovative emission controls, including a two-stage siloxane removal system and post-combustion selective catalytic reduction (SCR) process to control nitrous oxide; wastewater recycling; and positive economic impacts.[1]

[1] "EPA Recognizes Partners for Economic and Environmental Successes in Landfill Gas Energy (2012)," Landfill Methane Outreach Program, U.S. Environmental Protection Agency website.

The combined cycle electric generating plants each have four combustion turbine generator sets that are equipped with turbine inlet chilling, heat recovery steam generators, and post-combustion emissions control systems.

Photo courtesy of BroadRock Renewables, LLC

Value of Landfill Gas in Electric Generating Mix

Landfill-gas-to-electricity projects are an attractive addition to the nation's electricity generation mix.

- **Proven technology:** Landfill-gas-to-electricity plants utilize technologies, such as gas turbines and reciprocating engines, that have been in use for many decades. Because the technologies are proven, there is less uncertainty for facility owners, operators, and potential investors.
- **Baseload resource:** Many renewable energy technologies—including wind and solar—are intermittent in nature, which can make them more challenging to integrate into the grid. In contrast, a landfill gas-fired electricity generation facility can be operated continuously, just like a fossil fuel-fired plant.

"The facility benefits the environment and the economy. The electricity produced at the [Olinda] plant will power local homes and businesses. It's a win-win."[2]

– John M. W. Moorlach, Chair of Orange County Board of Supervisors

Landfill Gas Offers Potential for Electricity Generation and Other Uses

According to the U.S. Environmental Protection Agency (EPA), 594 landfill-gas-to-energy projects are operational in the United States. Approximately two-thirds of these projects generate electricity, with a total capacity of 1,813 MW. In the remaining one-third of the projects, landfill gas is used as a substitute for other forms of energy in a wide range of applications, such as industrial processes, boilers, and space and water heating.

EPA has identified 540 additional "candidate landfills" that have the potential to utilize landfill gas for energy production. It is estimated that these landfills have the potential to generate an additional 1,212 MW of electricity.[3]

[2] "Broadrock Renewables LLC Marks Inauguration of Landfill Gas-to-Energy Expansion Facilities at Olinda Alpha Landfill," BusinessWire, Oct. 19, 2012.

[3] "Energy Projects and Candidate Landfills," Landfill Methane Outreach Program, U.S. Environmental Protection Agency website.

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

manufacturing.energy.gov

DOE/EE-0898 • April 2013

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