Growing Oregon's Biogas Industry:

A Review of Oregon's Biogas Potential and Benefits

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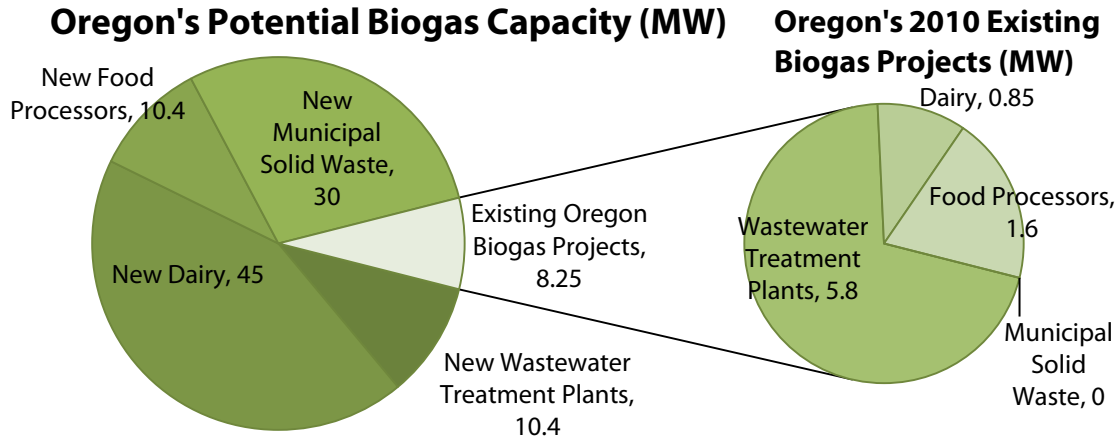
This paper resulted from a series of meetings of biogas project developers, regulatory agencies and environmental groups that raised the need to document the benefits, opportunities and barriers to developing a biogas industry in Oregon. The paper was funded by the Energy Trust of Oregon and written by Peter Weisberg of The Climate Trust and Thad Roth of the Energy Trust of Oregon with the technical support of the following individuals: Dominic Vaca and Dean Foor (ECOregon), Kevin Maas (Farm Power), Bill Eddie (OneEnergy), Shanna Brownstein (The Climate Trust), Bruce Cordon (Clean Water Services), Bill Edmonds and Chris Galati (NW Natural), Richard Cobbs (Revolution Energy Solutions), John Thorton (CleanFuture) and Margie Gardner (Bonneville Environmental Foundation).

Executive Summary

Biogas, a renewable substitute for natural gas, is generated by breaking down organic waste in an anaerobic digester. Oregon's dairies, wastewater treatment plants, municipal solid waste collectors and food processors have the feedstock and infrastructure to generate over 100 megawatts (MW) of biogas energy, but currently have only 8 MW installed. Dairy farms have the greatest potential to generate biogas energy, and wastewater treatments plants currently generate the most.



Realizing Oregon's biogas potential would

1. create at least 300 new, permanent full-time jobs and
2. reduce annual greenhouse gas emissions by 800,000 metric tons of carbon dioxide-equivalent—almost 5% of the reductions needed to meet Oregon's 2020 greenhouse gas emissions goals.

Biogas project developers struggle to finance construction and realize the opportunities described above. Federal and state programs provide payments or tax benefits to a project once it is operational, but there is little bridge financing for construction. Two Oregon policies would help biogas projects overcome this financial barrier:

1. *Production incentives* would raise the value of biogas energy and therefore increase the willingness of lenders to provide construction financing. These include
    a. *Renewable Avoided Cost Rates*: Oregon's Public Utility Commission can set the avoided cost rates for renewable resources such as biogas at prices that reflect the value of renewable resources.
    b. *Feed-in Tariff*: Legislation can require utilities to purchase biogas power at premium.
    c. *Enhancements to Oregon's Renewable Portfolio Standard*: 1) Specify a percentage of electricity that must be purchased from biogas projects and 2) credit thermal biogas energy under the renewable portfolio standard.
2. A *bridge loan program* to provide financing for project construction.

Introduction

Biogas plants create jobs and renewable energy while recycling nutrients and eliminating potent methane emissions. They are widespread in Europe, where higher energy prices and greater experience with the technology facilitate the lending of construction financing. Despite these multiple benefits and widespread adoption in other parts of the world, Oregon has only realized about 8% of its biogas potential.

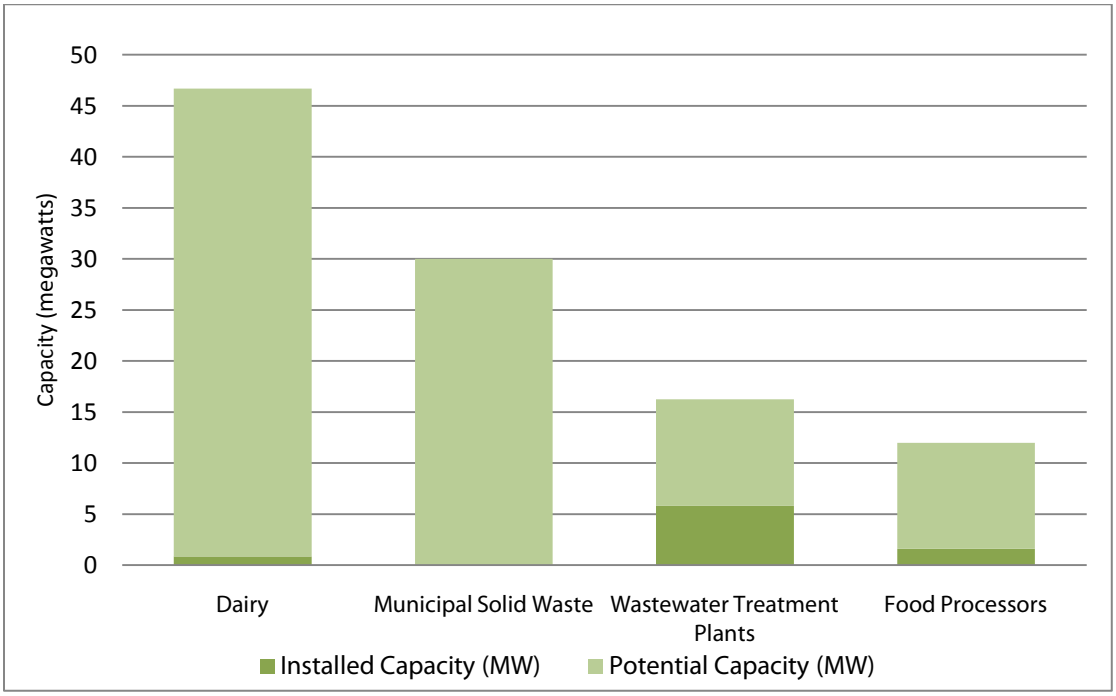


Figure 1. Oregon's Unrealized Biogas Potential. Oregon has the feedstock, industry and infrastructure to generate over 100 megawatts (MW) of biogas electricity, but currently has only 8 MW installed.[1]

With proper incentives and financing programs, Oregon could support a biogas industry 12 times its current size. As this paper demonstrates, realizing this potential would create at least 300 permanent fulltime jobs and reduce annual greenhouse gas emissions by 800,000 metric tons of carbon dioxide-equivalent emissions—almost 5% of the reductions it needs to meet its 2020 greenhouse gas emissions goals.

This paper describes state policies that will help realize this opportunity for rural economic growth and environmental stewardship. Section 1 will review the Oregon industries with the greatest potential to generate biogas. Section 2 will discuss the unique economic and environmental benefits of these plants. Section 3 recommends Oregon policies to accelerate their construction.

[1] Installed and potential capacity are estimated in megawatts because most biogas is currently converted into electricity. Other options are discussed in the "Beyond Electricity" sidebar.

What is biogas?

Bacteria make methane-rich gas when breaking down organic waste in oxygen-free environments such as landfills or wastewater lagoons. This natural process can be controlled at a biogas plant in an anaerobic digester, which fosters methane production and then captures the resulting gas, which is called biogas. Because it can be combusted to generate renewable energy, biogas is a renewable substitute for natural gas.

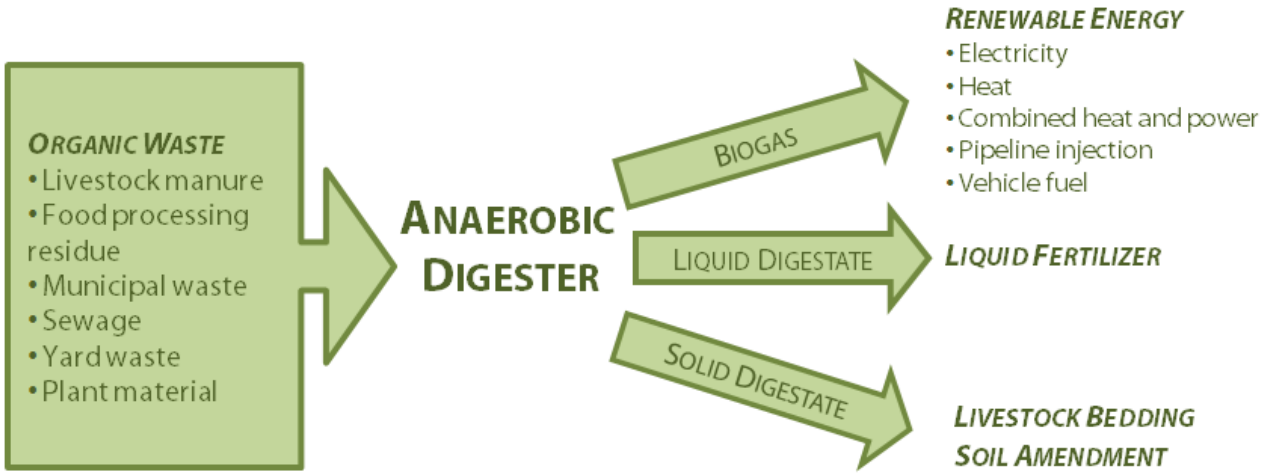


Figure 2. Overview of a biogas plant. Plants can combust biogas to generate electricity and/or heat, clean biogas and inject into a natural gas pipeline, or compress biogas to serve as a transportation fuel in compressed natural gas vehicles. Beyond energy, biogas plants also generate a digestate, which is frequently separated into solids and liquids. Liquids can be applied to land as a nutrient-rich fertilizer and solids can be used as fiber or bedding for livestock. As a result, the biogas industry includes companies that generate, utilize and dispose of organic waste.

BEYOND ELECTRICITY

While this paper measures biogas potential in electrical megawatts, there are many other options for generating energy from biogas. When making electricity, biogas plants can also generate usable heat with combined heat and power units. This heat can satisfy nearby thermal demands. Combined heat and power units capture and use up to 80% of the energy in biogas, compared with the less than 40% efficiency of stand-alone generators.

Projects can also inject gas into new or existing pipelines. New pipelines can be built from biogas plants to nearby industrial facilities. Projects located close to existing natural gas pipelines are also beginning to clean biogas and inject it into pipelines to substitute directly for natural gas. If cleaned biogas is injected into a pipeline and combusted at a combined cycle gas turbine power plant, efficiency increases up to 60%; if it is combusted in a high-efficiency furnace in residential homes, efficiency can be 95%.

The best use for biogas is determined by the specific circumstances of each individual project. Biogas policy incentives need to be designed with the flexibility to encourage all potential uses.

Section 1: Industries with Biogas Opportunity

Almost all of Oregon's industries that produce or process significant quantities of organic byproducts or waste have biogas potential. Dairies, municipal sewage treatment plants, food processors and municipal solid waste present the largest opportunities.[2] No comprehensive analysis has documented the volumes of biogas feedstocks available in Oregon. The energy potential described below is based on existing projects, projects that are presently being developed and feasibility studies.

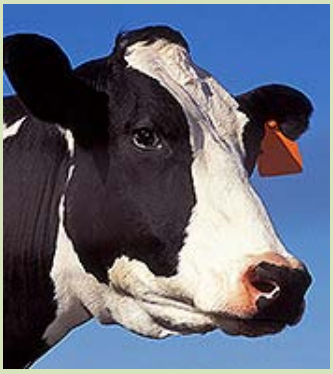
Dairy Farms

Oregon's dairies, with 140,000 cows on 150 farms, are the state's largest biogas opportunity. Because they centrally produce and manage large quantities of manure feedstock, dairy farms are excellent sites for biogas plants. Dairy manure has less energy than other undigested feedstocks so dairy projects often supplement manure with other feedstocks such as food residues or energy crops such as switchgrass to increase energy production. This approach, called co-digestion, can dramatically increase energy yield.

CASE STUDY:
LOCHMEAD FARMS BIOGAS PLANT
Junction City, Oregon

Revolution Energy Solutions, a Washington, D.C., company attracted to Oregon by the Business Energy Tax Credit, built a dairy biogas plant in 2010 at the 750-cow Lochmead Farms in Junction City, Oregon. The $2.2 million project began operation at the end of 2010 and is owned and operated by Revolution Energy Solutions.

- Renewable Energy Capacity: 240 KW. The small biogas plant produces enough electricity to power 300 homes per year.
- Jobs: Two new full-time positions were created as a result of the biogas plant; construction generated over 4,000 hours of work.
- Greenhouse Gas Reduction: The project reduces at least 3,500 metric tons of carbon dioxide-equivalent greenhouse gas emissions per year, the equivalent of removing nearly 700 cars from the road.
- Economic Impact: The project reduced the farm's water and energy use while producing solids that are used for livestock bedding and soil enhancement.



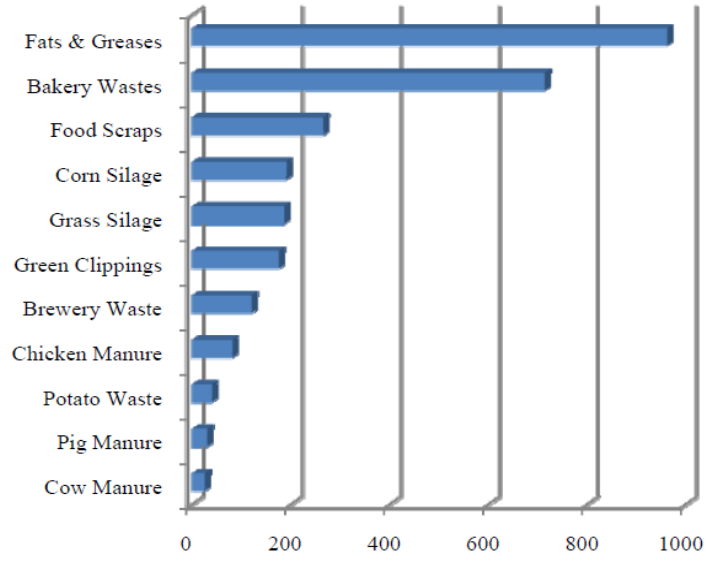
[2] Landfills generate biogas. They are not included in this paper, however, because landfills do not face the same barriers to project development. Oregon has already realized 18 MW of landfill capacity; less than 5 MW of additional capacity remains to be developed.

Biogas Potential for Oregon's Dairy Farms

- *Currently installed capacity: 0.85 MW.* There are four small dairy biogas plants currently operating in Oregon:
    1. Calgon Farms in Marion County
    2. Hooley Digester in Tillamook County
    3. Lochmead Farms (described in the case study) in Junction City
    4. Three Mile Canyon Dairy in Boardman, which is experimentally digesting 15% of its manure
- *Capacity in development: 7 MW.* Nine dairy biogas plants are in various stages of development around the state.
- *Total potential capacity: 46 MW.* A recent study found a 1,000 cow dairy that brings in significant quantities of additional higher-energy organic waste has the potential to generate 1 MW of renewable energy.[3] Presently there are approximately 45 dairies in Oregon with over 1,000 cows; with access to other feedstocks, these dairies could generate 45 MW of electricity in addition to the 0.85 MW already operating.

THE IMPORTANCE OF CO-DIGESTION

This chart illustrates the biogas production potential of different feedstocks. Wastewater treatment plants and dairies have access to large quantities of low-energy feedstocks. Profitable biogas plants often bring in higher-energy feedstocks such as food residues or fats, oils and greases to supplement their biogas production. This use of multiple feedstocks, called co-digestion, dramatically increases a plant's energy yield. By bringing in other organic wastes, biogas plants can serve as a waste management tool for the entire community, reducing the cost and environmental impact of waste disposal.



Source: Translated by Biogas Energy Inc. from Basisdaten Biogas Deutchland, Marz 2005: Fachagentur Nachwachsende Rohstoffe e.V.

[3] Essential Consulting Oregon. "Oregon Dairy Digester Feasibility Study Summary Report." January 25, 2010. Available online at www.energytrust.org/library/reports/100125_DairyBiogasSummaryReport.pdf.

Municipal Solid Waste

The organic waste contained in municipal solid waste–such as the food scraps or paper that households discard–can be separated and sent to a biogas plant rather than a landfill. These organics are high in energy. With increasing interest in diverting organic residues from landfills, demand for alternative waste disposal is growing.

Biogas Potential for Oregon's Municipal Solid Waste

- *Currently installed capacity: O MW.* There are no plants that capture energy from municipal solid waste.
- *Capacity in development: 5 MW.* Columbia Biogas, a proposed facility in Portland, plans to process 150,000 tons of municipal solid waste annually. The project recently completed permitting and will be operational in 2012 with an estimated 5 to 8 MW of capacity.
- *Potential capacity: 30 MW.* Evaluations done by state and regional organizations indicate that Oregon's commercial and residential sectors could produce enough organic residues to generate 25 to 30 MW.

Municipal Wastewater Treatment Plants

Wastewater treatment plants collect and treat residential and commercial wastewater. The sludge formed during treatment can be processed in an anaerobic digester. There are three ways to expand the biogas capacity of Oregon's wastewater treatment plants:

1. Plants that already use biogas to generate energy can expand production by adding fats, oils and greases, food residues, and other feedstocks to traditional wastewater that is already treated in an anaerobic digester.
2. Plants that digest sludge but flare the biogas rather than capture energy can install equipment to generate electricity and/or heat.
3. Plants that treat sludge through other processes can switch to anaerobic digestion.

Biogas Potential for Oregon's Wastewater Treatment Plants

- *Currently installed capacity: 5.8 MW.* With nine biogas plants, the wastewater treatment sector is the largest producer of biogas energy in the Oregon. These plants generate enough electricity to serve 4,652 households.
- *Capacity in development:* 2 MW. Two existing facilities already generating biogas electricity are looking to expand production by co-digesting additional feedstocks. These two projects are currently designing facilities to process fats, oils and greases in addition to traditional wastewater. Adding these hard-to-manage wastes is expected to double electricity generation at each site.
- *Total potential capacity: 16.25 MW.* Wastewater treatment plants generally must treat at least one million gallons per day before they are large enough for anaerobic digestion. There are 50 plants that meet this minimum size requirement, including

the nine that currently produce energy and 19 others that have anaerobic digestion but do not currently produce energy. If all these facilities produced energy, capacity would be increased to approximately 11.5 MW. Adding fats, oils and greases to municipal wastewater can increase energy production by 50%. If all the plants large enough to produce energy augmented their energy production with new feedstocks, capacity would be increased to 16.25 MW.

Food Processors

Food processing is the third largest industry in Oregon. It generates significant quantities of energy-rich food residue. Food processors can either build a digester at the processing facility or transport their processing residues to existing digesters at a dairy or wastewater treatment plant for co-digestion.

Biogas Potential for Oregon's Food Processors

- *Currently installed capacity: 1.6 MW.* Stahlbush Island Farms in Corvallis, Oregon (described in the case study below) has North America's first biogas plant that operates solely on food processing residues.
- *Capacity in development: 0 MW.* No other plants are planned.
- *Total potential capacity: 12 MW.* The energy potential of food processing is the least understood of the sectors included in this paper. Energy Trust of Oregon recently completed a survey of food processors' waste streams in the Portland region. The study identified over 100,000 tons per year of waste that might be available to a biogas plant with milk, fruit and vegetable processors representing the largest opportunity. Sites that generate more than 50,000 tons of waste per year present the largest opportunities.

CASE STUDY:

STAHLBUSH ISLAND FARMS BIOGAS PLANT

Corvallis, Oregon

Stahlbush Island Farms, a national leader in sustainable agriculture and food production, installed the first biogas plant in North America to generate electricity from its fruit and vegetable byproduct. The $10 million project is owned and operated by Stahlbush Island Farms.

- Renewable Energy Capacity: 1.6 MW. The power plant will provide enough electricity to power 1,100 homes, nearly twice the electricity the farm and food processing plant uses in a year.
- Jobs: The project created four new full-time positions. The plant employs six additional people during the four-to-six month harvest season.

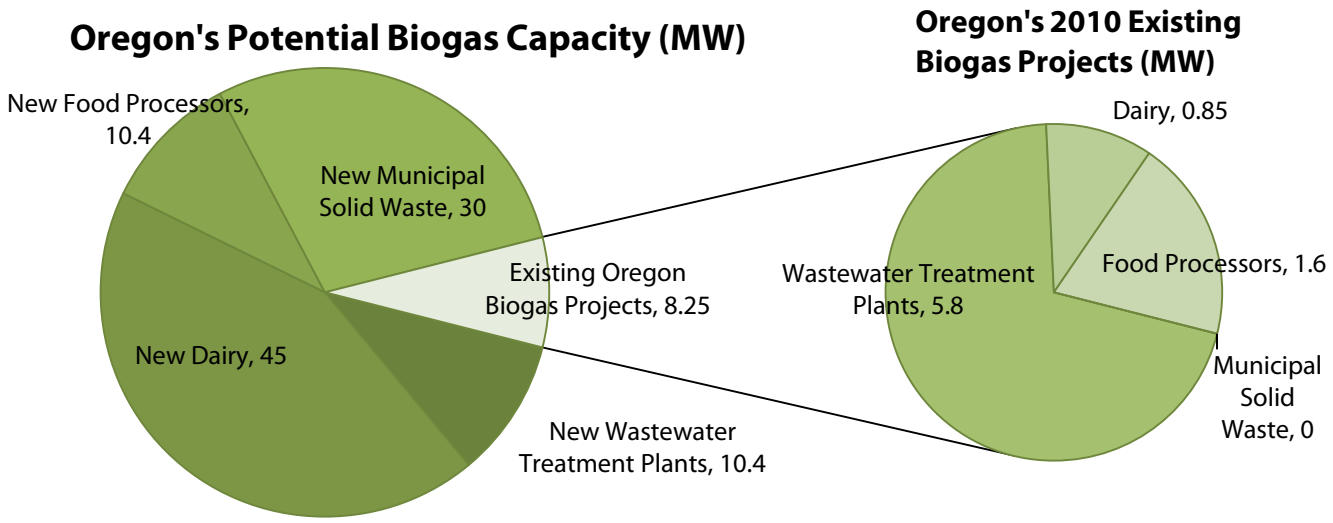


Figure 4. Summary of Oregon's current and potential biogas capacity.

Section 2: Benefits of Biogas Projects in Oregon

Realizing Oregon's biogas potential could create at least 300 permanent Oregon jobs and protect many more while minimizing the environmental impact of organic waste disposal by reducing odors, pathogens and greenhouse gas emissions.

Economic Development

Creating Rural Jobs

Given the ongoing need to manage feedstocks, biogas plants create more permanent jobs than other renewables. Smaller projects with the capacity to generate around 1 MW of electricity create approximately three permanent full-time jobs.[4] According to this figure, developing Oregon's biogas potential would create 300 permanent jobs, many at rural food processors and dairy farms. The jobs associated with digester construction, manufacturing and transportation are not included. A German study, however, calculated the overall job creation associated with biogas development: the 1,750 German biogas plants built between 2004 and 2010 created 21,660 jobs, with an average of 12.4 new jobs associated with each plant.[5]

Developing Oregon's biogas potential would create at least 300 new, permanent jobs

[4] This number is based on an estimate by Essential Consulting Oregon, a consulting company that specializes in biomass-to-energy projects.
[5] Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety. Renewable Energy Employment Effects: Impact of the Expansion of Renewable Energy on the German Labor Market.

Protecting Jobs by Diversifying Revenues, Decreasing Operating Expenses, and Increasing Energy Independence

Biogas projects sell energy, fertilizer and livestock bedding. These new revenue streams, which can often be guaranteed through long-term contracts such as power purchase agreements, can provide stable returns to dairies or food processors whose main business depends upon volatile commodity markets. This diversification decreases risks, protecting Oregon industries and jobs.

Biogas plants can also reduce operating costs. Industries that generate waste may have previously paid tipping fees to dispose of waste that is now fuel for the biogas plant; biogas plant tipping fees are typically lower or nonexistent. Additionally, the digestate from a biogas plant can be used as bedding for livestock. At a 1,500-cow dairy, this bedding can cost as much as $200,000 per year. Installing a digester can eliminate or significantly reduce this cost. This digestate is also a valuable soil amendment that is of increasing interest to manufacturers of commercial and residential compost.

"Companies in energy-intensive businesses recognize that energy is a strategic resource, not a commodity."

Northwest Food Processors Association

Biogas plants also make Oregon's food processing and dairy industries more competitive suppliers. Large retailers are increasingly selecting suppliers based in part on their sustainable practices. Wal-Mart, for example, has pledged to reduce 20 million metric tons of carbon dioxide emissions from its supply chain by 2015. Biogas plants help Wal-Mart and others meet these goals while increasing the attractiveness of Oregon suppliers.

Finally, dairy farms, waste water treatment plants and food processors all demand energy. Producing it independently in a biogas plant allows these facilities to reduce or eliminate energy purchases at volatile prices and instead fix their long-term energy prices. Hedging energy prices in this way creates long-term financial certainty. Unlike many other renewable resources, the energy generated is reliable, non-intermittent and can therefore serve as distributed baseload power.

Environmental Stewardship

Greenhouse Gas Emission Reductions

Biogas reduces significantly more greenhouse gas emissions than other renewable energy projects of similar sizes. Unlike solar or wind, biogas plants often prevent potent methane greenhouse gases from being released to the atmosphere. Many feedstocks digested by biogas projects normally decompose in an oxygen-free environment: dairy manure is flushed into lagoons or municipal solid waste is sent to landfills. When these organic wastes decompose without oxygen they release methane to the atmosphere. Methane is a potent greenhouse gas; its ability to warm the planet is more than 20 times that of an equivalent mass of carbon dioxide. Biogas plants capture and combust this methane, destroying it

before it is released to the atmosphere. This environmental benefit can be monetized and sold as carbon credits, serving as another revenue stream to biogas plants over their lifetime.

These methane reductions are significant. For example, a 1 MW biogas plant on a 1,000-cow dairy farm will annually avoid 5,000 tons of carbon dioxide-equivalent methane emissions. In addition, biogas plants replace fossil fuel energy with renewable energy. The 1 MW biogas plant annually generates enough renewable energy to reduce power plant emissions by 3,000 metric tons of carbon dioxide. Given this dual emissions benefit, a 1 MW plant reduces a total of 8,000 metric tons of carbon dioxide-equivalent greenhouse gas emissions.

Realizing opportunities to avoid methane emissions is essential to Oregon's goal to reduce greenhouse emissions 10% below 1990 levels by 2020. Developing Oregon's biogas potential could annually reduce 800,000 tons of carbon dioxide equivalent emissions, about 5% of the reductions Oregon needs to meet its 2020 goal.

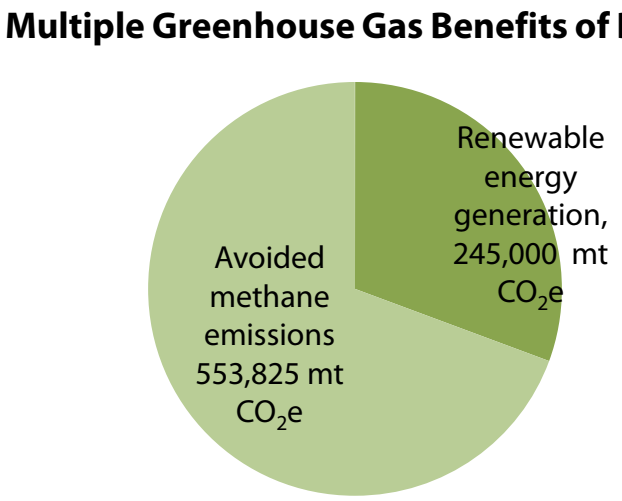


Figure 5. Annual greenhouse gas emission reductions from developing Oregon's biogas capacity. Developing Oregon's biogas potential would reduce 800,000 metric tons of carbon dioxide-equivalent emissions. Seventy percent of these reductions come from treating organic material that otherwise would have released methane to the atmosphere while decomposing in landfills or lagoons. This climate benefit is unique to biogas projects. Thirty percent of these reductions come from replacing fossil fuel energy with renewable biogas energy.

Reduced Odors and Increased Water Quality

Because anaerobic digestion is an enclosed, controlled process, it reduces the odors associated with organic waste. The stabilized digestate that leaves the biogas plant no longer produces offensive odor. As sprawl brings residential homes closer to dairies and food processors throughout the Northwest, odor control ensures agriculture remains a part of the Northwest's landscapes and local communities.

Additionally, when manures and other undigested organic wastes are excessively or carelessly applied as fertilizers, runoff can cause salmonella, E. coli and other dangerous pathogens to contaminate local watersheds. Biogas projects eliminate these pathogens, preventing water pollution. To maintain consistent methane production, biogas plants in the Northwest are commonly heated to 100°F. Research from Oregon State University demonstrates that this eliminates 95-98% of common pathogens.[6]

Section 3: Policies to Accelerate Biogas Project Development

Biogas project developers currently struggle to finance projects and realize the opportunities described above. While federal and state programs provide payments or tax benefits to a project once it is operational, there is little bridge financing for construction because lenders doubt the stability of the credits and incentives and have little understanding of the risks associated with biogas technologies. Banks are unwilling to use equipment as collateral because biogas plants are difficult to move and/or sell. The financial crisis has further reduced lenders willingness to finance construction. This lack of bridge financing requires projects to raise excessive equity, which constrains project development.

The biogas industry is in "mature infancy- the technology is ready but the energy policy is not."

Chris Voell
US Environmental Protection Agency

Two major Oregon policies can help biogas projects overcome this financial barrier: new and modified production incentives and a state-supported bridge loan program.

Production Incentives

There are three types of production incentives that would benefit the development of a biogas industry in Oregon: updating the avoided cost rates to reflect renewable power prices, creating a feed-in tariff for biogas power, and/or targeting biogas in Oregon's Renewable Portfolio Standard.

Renewable Avoided Cost Rates

Recently the Federal Energy Regulatory Commission ruled that states could establish avoided cost rates for qualifying facilities based on the utilities' cost for renewable generation instead of the lowest-cost fossil fuel alternative. The Oregon Public Utility Commission should investigate the opportunity to set avoided cost rates for renewable resources (such as biogas plants) at prices that reflect the cost of renewables.

[6] Oregon State University. Pathogen Reduction in Anaerobic Digestion of Manure. November 15, 2010. Available online at http://www.extension.org/pages/Pathogen_Reduction_in_Anaerobic_Digestion_of_Manure.

Feed-in-Tariff

Feed-in tariffs, which can be created by state legislation, obligate utilities to purchase renewable power at a premium rate. Oregon's legislature has used this incentive before: House Bill 3039 created a pilot "volumetric incentive rate" in July 2009 for solar projects. Because energy sales are the largest source of revenue for biogas projects, the rate at which power is purchased has the single greatest impact on a project's ability to service debt and provide investment returns. Essential Consulting Oregon analyzed the return on investment of twelve potential Oregon dairy biogas plants; at a long-term premium rate of $0.12/kWh, all projects provided a return on investment in less than 10 years. If power was instead purchased at the currently guaranteed "avoided cost" rates, the return on investment increases to 20 years. Because smaller projects often face larger financial barriers, some feed-in tariffs are tiered to enable smaller projects to sell their electricity at higher prices. Biogas projects smaller than 1 MW could receive a higher electricity price than 1 to 2 MW projects.

Potential parameters for an Oregon Biomass Feed-In Tariff are listed below:

- Rate: $0.12-$0.15/kWh
- Term: 15 years
- Projects that qualify:
    - Less than 2 MW capacity
    - New projects in Oregon

Beyond raising a project's profitability, feed-in tariffs also eliminate the volatility of energy prices for project developers and lenders. Feed-in tariffs can set a time period over which utilities must pay the premium rate for biogas power. In other programs, contracts are guaranteed for 15 years or longer. The long-term guarantee of these contracts reduces the risk associated with lending, helping projects raise debt and equity for construction.

CASE STUDY OF VERMONT'S COW POWER PROGRAM: From Voluntary to Regulatory Feed-in Tariff

In 2003, the Central Vermont Public Service Utility recognized that its $0.045/kWh power price could not justify the costs of building biogas plants, despite the state's significant dairy potential. At this time, Vermont had one digester built in 1982. The utility launched a voluntary feed-in tariff program called Cow Power. Under Cow Power, the utility's customers could voluntarily pay an extra $0.04/kWh for biogas electricity, which would be passed on to any new dairy digester projects built in the state.

This voluntary feed-in tariff incentivized the construction of six new dairy digesters. Recognizing the success of the program, the state of Vermont created a regulatory feed-in tariff in 2009 called the Standard Offer for Vermont's Sustainably Price Energy Development Program. This feed-in tariff requires all Vermont utilities to pay $0.135/kWh for agricultural biogas power for a 20 year period. The current tariff has recently been increased to $0.141/kWh. Since the announcement of this regulatory feed-in tariff, two additional digester projects have been constructed and four new projects are planned.

Enhance Oregon's Renewable Portfolio Standard

Oregon's Renewable Portfolio Standard requires utilities to purchase a percentage of their power from renewable sources. Biogas projects that generate electricity are qualified renewable resources under the law. The additional value this adds to the price for biogas electricity, however, is insufficient to drive new project development. Adding the following provisions to Oregon's Renewable Portfolio Standard would incentivize new biogas projects:

1. *Create a "Carve Out" for Biogas*- Renewable Portfolio Standards can specify or "carve out" a targeted renewable resource from which electricity must be purchased. Oregon, for example, requires utilities to acquire 20 MW of solar projects by 2020. North Carolina has a carve out specifically for biogas, requiring investor owned utilities to purchase 0.2% of their electricity from swine manure biogas projects by 2021. A carve out for biogas serves a similar function to a feed-in-tariff by raising the value of a biogas project's electricity. Unlike a feed-in tariff, policy makers determine the minimum quantity of biogas to be built and then the electricity price is set by the market.
2. *Credit Thermal Biogas Energy under the Renewable Portfolio Standard*- Biogas projects that inject gas into the pipeline or combust it to meet thermal needs do not benefit from the incentive provided by the Renewable Portfolio Standard because they do not generate electricity. Such projects could be granted credits similar to Renewable Energy Certificates based on the electricity-equivalent of the heat they generate. Utilities could purchase these credits to comply with Oregon's Renewable Portfolio Standard. [7] This added flexibility ensures biogas is not simply turned into electricity to receive electricity-centered incentives but instead is used in the most efficient manner for each project's specific site.

Bridge Loan Program

Beyond guaranteeing long-term revenue, bridge loans for construction financing are needed. Oregon's Business Energy Tax Credit and State Energy Loan Program provide financing after the project reaches commercial operation; financing construction, however, remains a major obstacle.

In concept, this bridge loan program would require projects to raise a certain amount of equity and prove project viability before providing a loan. Biogas developers recommend projects raise 30% of the capital cost of a project in equity before the program considers loaning construction financing. Once this threshold is crossed, projects could apply for up to 15% of the capital costs of the project from the program. This money can either be lent at a

[7] Projects that compress biogas for use as a transportation fuel can be credited under the Oregon Low Carbon Fuel Standard, and therefore do not need this additional incentive.

low-interest rate or given as a grant, depending upon its source. Because biogas projects require specialized expertise, projects could be reviewed by an expert team assembled at Energy Trust, Oregon Department of Energy, The Climate Trust and/or another agency. This expert review could create a clearinghouse for biogas and other renewable energy projects to be shopped to interested lenders. The remaining construction would be financed by debt, which would be easier to obtain due to this bridge loan program.

Energy Trust of Oregon is currently testing this concept through a small-scale pilot effort where their typical above-market cost project incentive paid at project completion will be disbursed to selected projects prior to completion in the form of a construction loan. Although the magnitude of the loans won't be enough to cover their full project construction loan needs, Energy Trust theorizes that its early involvement can be leveraged by the project to smooth the process of pulling in other financing sources.

Conclusion

Biogas technology is ready for widespread implementation but additional state support is needed to realize its economic and environmental value. This paper provides policymakers with options to accelerate Oregon's biogas development. These general suggestions must be further refined by stakeholders across the state. The right policies will create rural jobs, advance energy independence and reduce potent methane emissions. The time is right to realize the potential of Oregon's biogas resources.