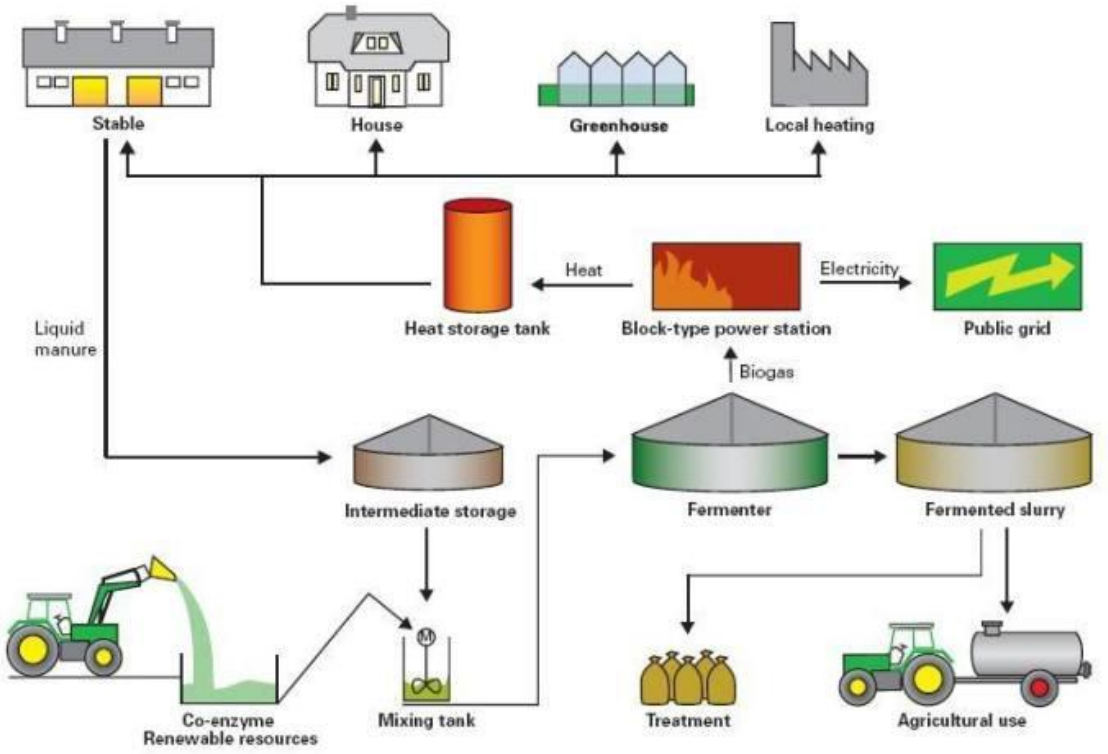
GREEN TRENDS FOR SUSTAINABLE LIVING IN AFFORDABLE HOUSING

BIOGAS

EMERGING TOPICS PAPER SERIES
WORKING PAPER #22



The Production and Utilization of Biogas

2015

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BIOGAS

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This document provides an overview on biogas. It is part of a series of profiles to introduce affordable housing practitioners to emerging trends in green, sustainable living. Contained below are a brief introduction to biogas, trends in the biogas market, potential financing sources for biogas projects, and case studies of innovative biogas implementations.

I. Introduction

Biogas is a product of decomposing organic matter that can be used as a heating fuel, or to generate electricity. Because it can be produced from sewage, municipal waste, manure, and other agricultural byproducts, biogas is considered a renewable fuel. Biogas thus holds potential as an affordable, renewable energy supply that can be used at a project or neighborhood level.

Biogas is typically 50–75% methane, 25–50% carbon dioxide, and might contain some traces of other compounds depending on the feedstock used in the process. The higher the concentration of methane, the better. If sufficiently purified—or *upgraded*—biogas can be distributed through the existing natural gas delivery systems, or compressed just like compressed natural gas (CNG) and used to fuel vehicles.

The process used to generate biogas is called *anaerobic digestion*. In this process, microorganisms break down biodegradable material in the absence of oxygen, and produce biogas.

Biogas is different from, but related to, biomass. Biomass, another alternative fuel source, is developed from organic materials (e.g. scrap lumber, forest debris, manure). Biomass can be a feedstock for biogas, or can be burned directly without anaerobic digestion. This distinction is important because some feedstocks, such as wastewater, can be converted to biogas but cannot be burned directly as biomass.

II. Sector Trends

Biogas is increasingly viewed as a viable energy source for sustainable economic development with high growth rates projected. Several benefits of biogas have led its increased use as an alternative fuel:

- **Increased Energy Security:** Biogas offsets non-renewable resources, such as coal, oil, and fossil fuel-derived natural gas. Producing biogas creates U.S. jobs and benefits local economies.
- **Reduced Emissions:** Biogas reduces emissions by preventing methane release in the atmosphere. Methane is 21 times more impactful than carbon dioxide as a greenhouse gas. Even though combustion of biogas releases carbon dioxide, it prevents methane from being released into the atmosphere.
- **Economics:** Biogas can divert significant portions of a municipality's waste stream, which decreases associated waste stream costs (e.g. sewerage, landfill). Biogas production and consumption also reduce energy costs. Finally, biogas producers might be able to create a new revenue stream by selling carbon credits.
- **Waste Reduction:** Producing biogas through anaerobic digestion reduces landfill waste and odors, produces nutrient-rich liquid fertilizer, and requires less land than aerobic composting.

II.A. National Incentives

There are a number of potential federal funding sources, including:

- AgSTAR is an EPA outreach program aimed at reducing methane emissions from livestock and generating renewable energy. In 2011, facilities participating in the AgSTAR program generated 541,000 MWh of energy, enough to power more than 45,000 homes.
- Info on other agricultural biogas trends here: www.nrdc.org/energy/renewables/biogas.asp

II.B. State Opportunities

The following are potential financing sources that may be available at the state level to make biogas more economically viable. Do the following exist in your state?

- Renewable energy demonstration grants
- Renewable energy production tax credits
- Renewable energy revolving loan funds

III.C. Other Factors

The following region- and project-specific factors make the case for biogas stronger.

- Access to organic feedstock for biogas production (e.g. food waste, manure).
- High energy costs
- Upcoming financing milestone and/or capital repair campaign
- Resident demand for energy security and/or sustainable lifestyle

III. Case Studies

Biogas technology is widely used in agricultural settings, and it beginning to be deployed in municipal settings as well. The following cases focus on municipal applications using different feedstocks.

III.A. Solid waste

Columbia Biogas Facility
Location: Portland, OR
Scale: Will generate sufficient electricity to power 3,000 homes
Website: www.columbiabiogas.com
Partners: Schaumann Biotic Consult, PacifiCorp

Financial Case
Cost: $55 million
Use of Biogas Generated: Original plan: combust biogas to produce 3–5 MW of electricity; New plan to refine biogas and sell to natural gas grid

The Columbia Biogas facility will produce biogas from 100% food waste supplied by local businesses. Although Columbia Biogas originally planned to use the biogas to fuel engines to generate 3–5 MW of electricity, it now plans to refine the biogas and sell it directly into the natural gas grid. It is likely that this decision was an economic one based on the prices of natural gas and electricity in the region—Oregon's electricity prices are roughly 20% lower than the national average, but its natural gas prices are even with the national average.

Columbia Biogas will process a broad range of food waste—usually sent to landfill—from multiple types of businesses including restaurants, grocery stores, and industrial food processors. The facility provides a needed recovery solution for difficult to

manage liquid waste including fats, oils, and greases. In addition to producing biogas, Columbia Biogas will produce natural fertilizer for use on local farms.

Key factors:

- **Proximity to feedstock:** Columbia Biogas will be located in an industrial zone in Northeast Portland, in close proximity to restaurants, grocery stores, and other businesses that will provide the food waste feedstock. Because Columbia Biogas is closer to these businesses than their landfill, they will realize cost savings by hauling their waste to Columbia Biogas instead of the landfill.
- **Stakeholder buy-in:** Columbia Biogas signed a Good Neighbor Agreement with the Cully Association of Neighbors in 2011. This agreement created a Neighborhood Advisory Committee that will formalize communications and complaint procedures, and environmental and livability standards that support long-term facility operations and sustainability within the neighborhood.

III.B. Wastewater treatment

Dos Rios Water Recycling Center
Location: San Antonio, TX
Scale: Population: 1.4 million
Partners: San Antonio Water System (SAWS), Amaresco
Website: www.saws.org/your_water/recycling/Biogas/

Financial Case
SAWS investment: $1 million
Revenue: $0.2 million/year
Payback: as few as 5 years
Use of Biogas Generated: Refine and sell into existing natural gas grid

In 2010, The San Antonio Water System (SAWS) opened a first-of-its-kind sewage-to-biogas facility at its Dos Rios Water Recycling Center. This facility generates and processes 1.5 million cubic feet of biogas every day, delivering 0.9 million cubic feet of natural gas into the natural gas grid. This generates $200,000 in natural gas royalties and keeps roughly 20,000 tons of carbon dioxide equivalent out of the atmosphere every year.

Key factors:

- Easy access to feedstock
- Public/private partnership

IV. Additional Resources

- Biogas Handbook: www.lemvigbiogas.com/BiogasHandbook.pdf
- American Biogas Council, Benefits of Biogas: www.americanbiogascouncil.org/biogas_biogasBenefits.asp
- US Dept. of Energy, Alternative Fuels Data Center: afdc.energy.gov/fuels/emerging_biogas.html

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