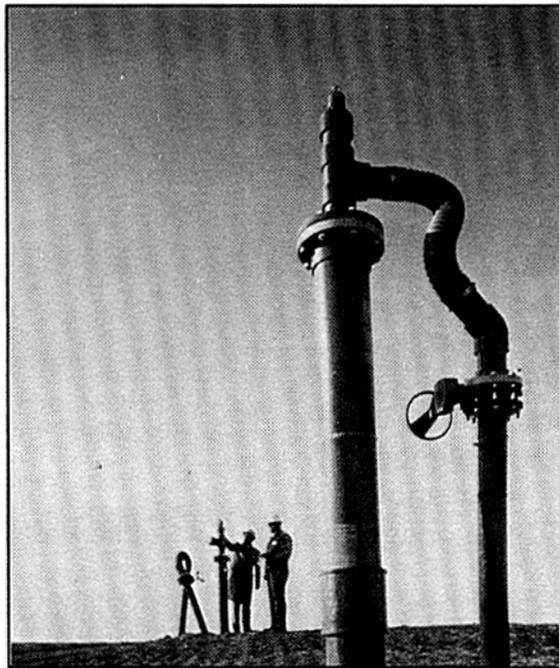


Landfill Methane and Clean Air Act Opportunities

Incentives from the Acid Rain Program



*Photo courtesy of New England Electric
System*

The environmental benefits of generating electricity from landfill methane now have an added, quantifiable value. Through an innovative system of tradeable emission allowances, Title IV of the Clean Air Act has increased the value of electricity generated from landfill methane.

Methane gas emissions from our country's growing landfill sites are a serious threat to greenhouse gas stabilization. Capturing methane from landfill sites for electrical generation serves both economic and environmental goals. Landfill methane is already a cost-effective energy resource in many areas of the country. The Clean Air Act incentives will further enhance the cost-effectiveness of landfill methane energy projects.

The Clean Air Act Incentives

The 1990 Clean Air Act Amendments call for a 10 million ton annual reduction in national SO₂ emissions from 1980 levels. This program creates a new tradeable commodity, the SO₂ emission allowance. Each allowance represents an authorization to emit one ton of SO₂ (i.e., a unit that emits 5,000 tons of SO₂ must hold at least 5,000 allowances that are usable that year). By avoiding the emission of SO₂ with landfill methane systems, utilities will both earn and save tradeable emission allowances. And these emission allowances have a real market value.

To promote pollution prevention, Title IV of the Clean Air Act includes two incentives for energy efficiency and renewable energy. These incentives are:

1. Avoided emissions
2. Conservation and Renewable Energy Reserve

Avoided emissions is perhaps the most lucrative of the incentives; each ton of SO₂ avoided through the generation of electricity from landfill methane saves one emission allowance. Allowances are saved at the utility's own rate of

emissions. The avoided emissions incentive is automatic; there are no application or verification requirements.



The Sonoma County, California landfill gas-to-energy facility. Photo courtesy of Landfill Energy Systems.

The Conservation and Renewable Energy Reserve is a special bonus pool of 300,000 allowances set aside to reward new initiatives in technologies such as landfill methane. For every 500 MWh of electricity generated through landfill methane systems, a utility earns one allowance from the Reserve.

For more information on these incentives, see *Energy Efficiency and Renewable Energy: Opportunities from Title IV of the Clean Air Act*.¹

1. US EPA, *Energy Efficiency and Renewable Energy: Opportunities from Title IV of the Clean Air Act*, Document no. EPA 430-R-94-001, February 1994. To obtain a copy, contact the Acid Rain Hotline at (202) 233-9620.

Valuing the Incentives

In general, the value of the Clean Air Act incentives will be the number of allowances earned or saved by the landfill methane installation multiplied by the market price of an SO₂ emission allowance. The hypothetical example below illustrates the potential savings from the Clean Air Act incentives.²

The market for tradeable emission allowances is continuing to evolve. A recent report issued by the Electric Power Research Institute (EPRI) indicates that prices could rise from \$250 per allowance in 1995 to \$480 per allowance in 2007.³ Price signals are also being provided by private trades and trading exchanges.

Example

In 1994, a utility installs 7 MW of capacity from landfill methane sites. The utility will enter the Acid Rain Program in the year 2000, and thus is eligible to earn Reserve allowances until 2000. Assuming a typical capacity factor of 0.85, the value of the Reserve allowances is calculated as follows:

$$7 \text{ MW} \times 8,760 \text{ hours/yr} \times 0.85 = 52,122 \text{ MWh/yr}$$

$$52,122 \text{ MWh/yr} \div 500 \text{ MWh/allowance} = 104 \text{ allow./yr}$$

$$\$250/\text{allowance} \times 104 \text{ allowances/yr} = \$26,000/\text{yr}$$

Thus, for the six years from 1994 through 1999, the utility could earn \$156,000 from the Reserve alone. However, landfill methane will continue to add value in the year 2000 and beyond through the avoided emissions incentive. And the benefits from avoided emissions will be even greater than those from the Reserve.

Assuming the utility's marginal rate of SO₂ emissions is 1.2 lbs/mmBtu (the emission limit for the Acid Rain Program) and a typical heat rate of 10,000 Btu/kWh, the value of avoided emissions in the year 2000 is:

$$1.2 \text{ lbs/mmBtu} \times 10,000 \text{ Btu/kWh} \times \text{mmBtu}/1,000,000 \text{ Btu} = 0.012 \text{ lbs/kWh}$$

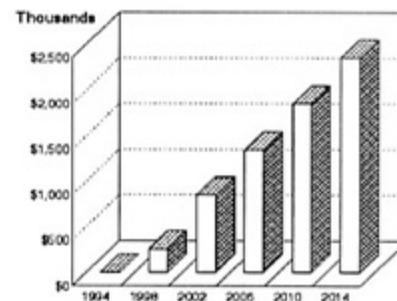
$$52,122,000 \text{ kWh} \times 0.012 \text{ lbs/kWh} \times 1 \text{ ton}/2000 \text{ lbs} = 313 \text{ tons} = 313 \text{ allowances}$$

$$313 \text{ allowances} \times \$340/\text{allowance} = \$106,420$$

Assuming a 20 year project life and a 6% discount factor, the net present value of the Clean Air Act incentives for this landfill methane project is \$980,000.

Since landfill methane is a local resource, transmission losses are reduced and thus further improve the project's cost-effectiveness.

Cumulative Value of the SO₂ Incentives



2. For a more detailed explanation of the calculations in this example, contact the Acid Rain Hotline at (202) 233-9620 and ask for the *Landfill Methane Example*.

3. EPRI, *Integrated Analysis of Fuel, Technology and Emission Allowance Markets: Electric Utility Responses to the Clean Air Act Amendments of 1990*, Report no. TR-102510, August 1993, p. 1-20.

	1995	2000	2003	2007
Price (\$/ton)	\$250	\$340	\$400	\$480

Utility Allies: Tapping the Potential of Landfill Methane

By purchasing electricity generated from landfill gas, utilities gain a clean, renewable energy source, produce valuable reductions in local air pollutants and greenhouse gases, and build a more diverse and local resource base. To mobilize the use of landfill gas as an energy resource, EPA has created the Landfill Methane Outreach Program.

To become a Utility Ally in this program, a utility agrees to take advantage of the best opportunities for obtaining power from landfill gas. In turn, EPA recognizes and publicizes the utility's efforts and can assist in the evaluation and development of projects. The result is a win for the utility and its customers, and a win for the environment and the economy.

EPA estimates that over 700 landfills across the US could install economically viable landfill gas energy recovery systems, yet only about 115 facilities are in place. The EPA Landfill Methane Outreach Program is working to overcome the informational, regulatory, and other barriers that prevent these otherwise economical projects from going forward.

For more information on how your utility can become a Utility Ally, please contact EPA's Landfill Methane Program at (202) 233-9042.



Complying Cost-Effectively

Landfill methane resources can be cost-effective components to an integrated compliance strategy by:

- ◆ Complementing or offsetting the use of other compliance strategies such as fuel-switching;
- ◆ Delaying or eliminating the need for expensive alternative strategies such as scrubbing;
- ◆ Helping to avoid the noncompliance penalty of \$2,000 per ton of SO₂; and
- ◆ Increasing revenues through the sale of extra allowances.

The extent to which the Clean Air Act incentives affect the financial outlook of landfill methane systems will depend upon each utility's own circumstances. Utilities that currently emit high levels of SO₂ can benefit significantly from the incentives. However, even utilities already in compliance can benefit from the revenues generated from extra allowances.

Benefiting the Environment

Emissions from fossil fuel generation harm waters and forests, endanger animal species, accelerate the decay of buildings and monuments, and impair public health. In many sensitive lakes and streams acidification has completely eradicated fish species.

Research has pointed to the increased health risks from particulate matter, which includes sulfates and other pollutants emitted during the combustion of fossil fuels. A recent study by Harvard University's School of Public Health linked these emissions to higher mortality rates and lung dysfunction in children and other sensitive populations.⁴



Emissions from fossil-fuel sources have damaged many forests.

Electricity generated from landfill methane helps combat not only acid rain, but other environmental harms as well, including global climate change. Landfill methane systems avoid emissions of SO₂, toxics, and particulates, as well as the production of ash and scrubber sludge.

Electricity generated from landfill methane will also help minimize emissions affecting

global climate change. Not only does this resource offset emissions from fossil fuel energy generation, but it also prevents the escape of methane gas, a greenhouse gas that is over 20 times more potent than carbon dioxide. Every 10,000 kilowatt hours of electricity generated from landfill methane is equivalent to:⁵



Planting 23,680 Trees per Year, or



Eliminating 360 Barrels of Crude Oil

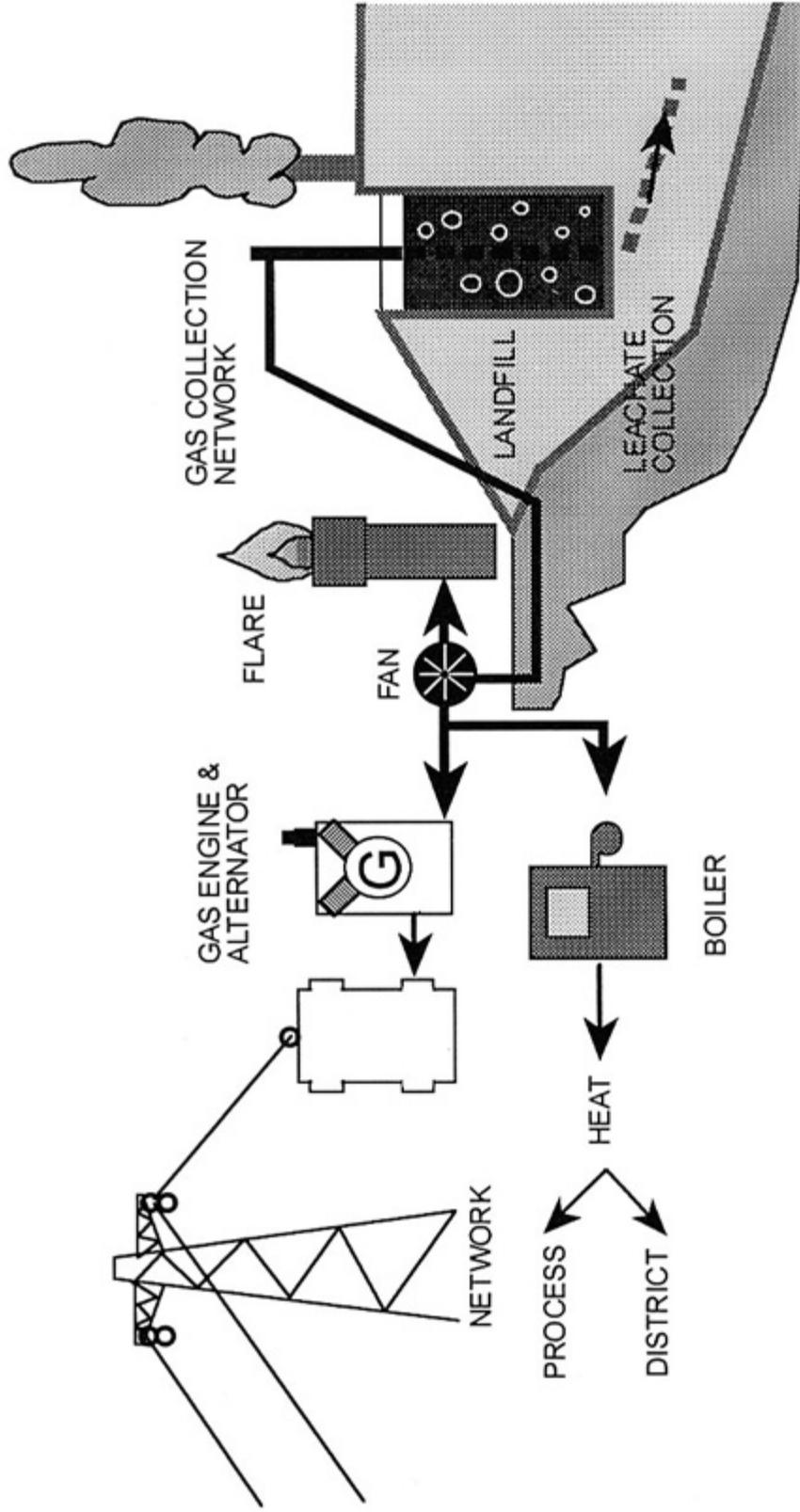
Landfill methane systems can be cost-effective solutions for simultaneously eliminating multiple pollutants. Rather than installing costly controls for each pollutant, landfill methane technology can be a solution for many pollutants. Landfill methane systems also provide insurance against the risk of future environmental regulations, including regulations on greenhouse gas emissions.

The real, quantifiable value of the Clean Air Act incentives can maximize a utility's overall cost-effectiveness in serving its customers and protecting the environment.

4. Dockery, Douglas W., et al., *An Association between Air Pollution and Mortality in Six US Cities*, The New England Journal of Medicine, vol. 329, no. 24, December 9, 1993, p. 1753-9.

5. Based on the 1990 average CO₂ emission rate for US utility generation.

Landfill Methane Recovery Process



Landfill gas is generated naturally through the bacterial decomposition of organic matter deposited in a sanitary landfill. Gas collection systems pull the gas from a series of wells to a central processing facility. Landfill gas is typically a medium Btu gas that has a number of energy applications. The most prevalent use is production of electricity for sale to the local utility. The gas may also be employed directly for use as boiler fuel and industrial process heat or converted for use as compressed natural gas for vehicle fuel.

Utility Profile: Detroit Edison Company

As the landfill gas recovery industry evolved in the 1980s, Detroit Edison became active in developing Michigan's first landfill gas-fired combustion turbine generating station. The 6.6-megawatt facility has safely and reliably operated at more than 85 percent capacity since achieving commercial operation in 1988.

Sited on a landfill owned by the City of Riverview, 20 miles south of Detroit, the small power production facility uses enough methane gas to generate electricity for about 6,000 homes. More than 100 gas wells on the 150-acre site collect about 4.3-million cubic feet of landfill gas daily to generate the power, which is sold to Detroit Edison.

While the project's 225,000 megawatt-hours of electricity is a small portion of Detroit Edison's overall power production, the environmental significance is impressive. By capturing more than 8 million cubic feet of landfill gas, this project has prevented more than 1,200 tons of sulfur dioxide emissions which would have been produced by fossil-fueled power generation. Each day the project directly destroys more than 2 million cubic feet of methane, a potent greenhouse gas.



Riverview, Michigan landfill gas-to-energy facility

Detroit Edison's involvement with 120-acre Sonoma Central landfill in California is relatively new. Through a subsidiary, landfill gas is collected, cleaned, compressed and delivered as fuel to a plant producing 3.2 megawatts. Sonoma County, owner of the facility, has been selling the electricity since May 1993. The facility uses about 1,200 cubic feet per minute of landfill gas to produce its power.

The Riverview and Sonoma facilities are licensed to operate well into the 21st century. Their success has prompted Detroit Edison to pursue similar ventures in Florida, Illinois, Texas, Ohio, and elsewhere in Michigan.

For More Information

Write to:

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Acid Rain Division (6204J)
Energy Efficiency and Renewable Energy
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401 M Street, SW
Washington, DC 20460

If you have further questions or would like to receive any other publications, please call the Acid Rain Hotline at **(202) 233-9620**. An Energy Efficiency and Renewable Energy staff member will return your call within 24 hours.