



Potential Benefits Gained By Landfill Owners/Operators From Landfill Gas Energy

Economic

Revenue shares from the sale of landfill gas (LFG) or electricity produced

- Typical revenue for electricity = \$0.05/kWh to \$0.05/kWh
- Typical revenue for gas = \$2.00/mmBtu to \$4.00/mmBtu
- REPI¹ payments (municipal owners only) = 1.5 cents per kWh
- Royalty payments for gas extraction (private developer only) vary

Offset the cost of a LFG collection/control system

- Typical capital costs (1 million ton landfill) = \$600,000 - \$750,000
- Typical O&M costs (1 million ton landfill) = \$40,000 - \$50,000/yr

Market potential

- LFG = \$2.00/mmBtu (avg.) vs. natural gas = \$5.00/mmBtu vs. propane = \$8.00/mmBtu (avg.)

Other potential sources of revenue

- Emissions reductions trading
- Green power/pricing programs

¹ Renewable Energy Production Incentive

Environmental

- Improved local air quality
- Lower greenhouse gas emissions
- Emissions offsets from fossil fuels
- Subsurface gas migration control

Community Image

- Progressive, innovative resource use
- Responsible community planning
- Safer landfill with reduced odors
- Job creation through project development
- Improved economic development near the landfill

Energy

- Reliable, local fuel source
- Less need for use of polluting fossil fuels

One Million Tons of Waste Yields Considerable Benefits

- 1 million tons of waste in place would typically generate about 300 cubic feet per minute (cfm) of LFG, which could then generate approximately 7 million kilowatt hours (kWh) per year.
- 7 million kWh is enough energy to power 700 homes for a year.
- In terms of reducing greenhouse gas emissions, generating 7 million kWh/yr by using LFG has the same environmental benefit of removing the emissions equivalent of more than 8,000 cars from the road for one year.
- Similarly, this use of LFG has the same environmental impact as planting more than 11,000 acres of trees.

Follow the
Steps to:

Landfill Gas Energy Project Development

- 1 Estimate LFG Recovery Potential and Perform Initial Assessment or Feasibility Study
- 2 Evaluate Project Economics
- 3 Establish Project Structure
- 4 Draft Development Contract
- 5 Assess Financing Options
- 6 Negotiate Energy Sales Contract
- 7 Secure Permits and Approvals
- 8 Contract for Engineering, Procurement & Construction, and Operation & Maintenance Services
- 9 Install Project and Start Up Commercial Operation

Work with LMOP through each step of Landfill Gas Energy Project Development

- Determine who your LMOP representative is
- Join LMOP's partner program
- Work with your LMOP representative at each phase of project development
- Helpful LMOP tools are located at www.epa.gov/lmop

1 Estimate LFG Recovery Potential and Perform Initial Assessment or Feasibility Study

Desired Landfill Characteristics*

- Landfill contains municipal solid waste (MSW)
 - Landfill has at least 1 million tons of MSW in place
 - Landfill is at least 30 feet deep
 - Site receives greater than 25 inches of rainfall annually
- * A number of energy projects, however, have been developed at smaller and arid landfills.

- Helpful LMOP Tools
- LandGEM or EPLUS software
 - Project Development Handbook

2 Evaluate Project Economics

Identify End Users/Sales

- On-site use (gas and electric)
- Nearby direct gas use (sale to industrial end users, such as boilers, kilns)
- Electricity use
- High-Btu upgrade (sales to nearby customers or gas utility)
- Specialty use (greenhouse, vehicle fuel)

- Helpful LMOP Tools
- Project Development Handbook
 - EPLUS software

3 Establish Project Structure

Identify Who Will Develop/Manage the Project

- Option 1: Develop/manage the project internally
- Option 2: Team with a project developer
- Option 3: Team with a partner (equipment supplier, energy end user, community)

Find a Partner

- Issue a Request for Proposals (RFP)
- Acquire expressions of interest
- Solicit developers
- Negotiate with vendors

- Helpful LMOP Tools
- Industry partner list for reference, advice, and distribution of RFPs
 - Identifying Partners for Landfill Gas Projects: Preparing Requests for Proposals (RFPs)

6 Negotiate Energy Sales Contract

- Prepare draft offer contract
- Determine utility or end user need for power or gas demand
- Develop project design and pricing
- Prepare and present bid package
- Review contract terms and conditions
- Sign contract

5 Assess Financing Options

- Private equity financing
- Project financing
- Municipal bonds
- Direct municipal funds
- Grants
- Federal, state, and local incentives
- REPI – Renewable Energy Production Incentive

- Helpful LMOP Tools
- Funding Landfill Gas Projects: A Guide to Federal, State, and Foundation Resources
 - Financing Landfill Gas Projects Fact Sheet

4 Draft Development Contract

- Determine gas rights
- Determine rights for potential emission reductions
- Determine partner responsibilities, i.e.:
 - design
 - installation
 - operation and maintenance

- Helpful LMOP Tool
- Project Development Handbook

7 Secure Permits and Approvals

Regulations

- Solid waste permit
- Air permit
- Local permitting issues
- Right-of-ways and easements

Procedures

- Contact and meet regulatory authorities to determine requirements
- Educate about benefits of project and seek approval from landfill neighbors, local officials, and local environmental and public interest groups
- Assemble information, perform calculations and designs
- Submit complete permit applications to regulatory agencies
- Amend permit application (as needed)

- Helpful LMOP Tools
- State Primers
 - Community Outreach Primer

8 Contract for Engineering, Procurement & Construction (EPC) and Operation & Maintenance (O&M) Services

- Owner/developer solicits bids from EPC/O&M contractors
- Owner/developer selects EPC/O&M contractor
- Owner/developer negotiates contracts
- EPC/O&M contractor conducts engineering design, site preparation, plant construction
- EPC contractor/developer conducts start-up testing

9 Install Project and Start Up Commercial Operation

- Ribbon cutting
- Public tours
- Press releases

- Helpful LMOP Tools
- Marketing and Promotion Primer
 - Community Outreach Brochure

Ready to get started?

Contact LMOP to help you take the first step: 1-888-782-7937, www.epa.gov/lmop