



Methane to Markets

Opportunities to Advance Landfill Methane Recovery Projects under the Methane to Markets Partnership

Presentation for:

Methane to Markets
Partnership Expo

Brian Guzzone
Landfill Technical Subcommittee

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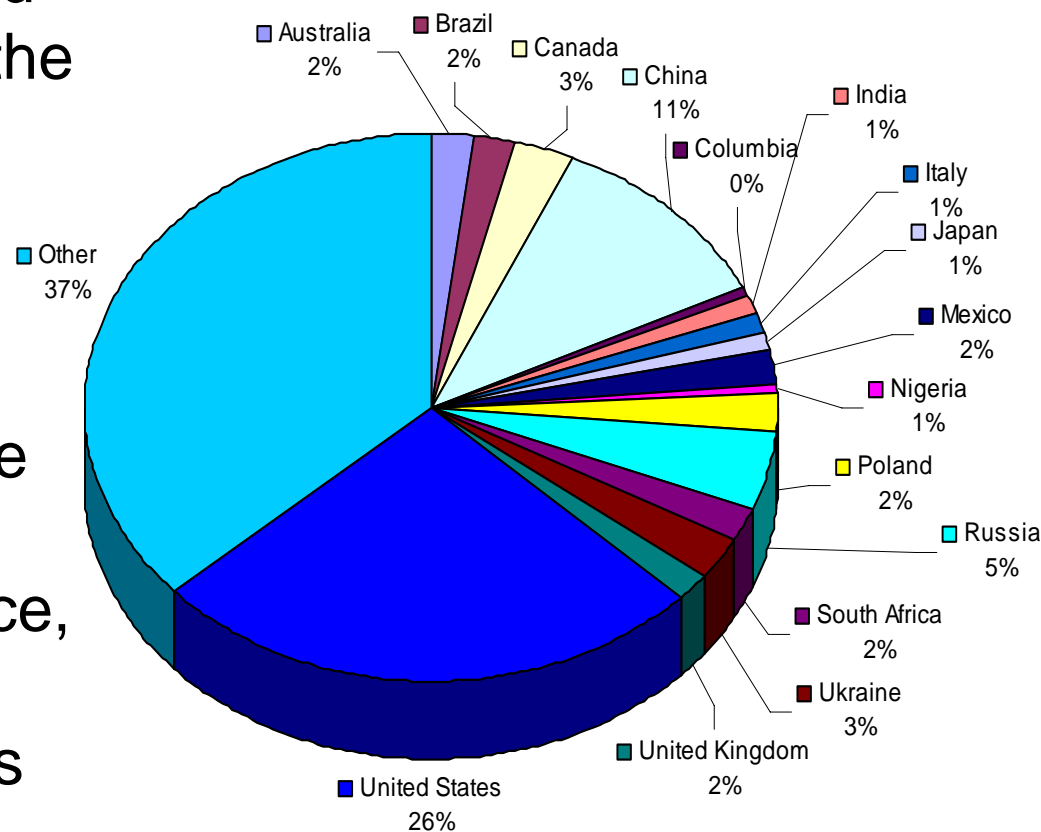
Overview

- Characterization of Landfill Methane and Landfill Biogas Recovery and Use Projects
- Identifying Project Opportunities
- Recent Landfill Subcommittee Accomplishments and Ongoing Activities
- Conclusions

Global Landfill Methane Emissions

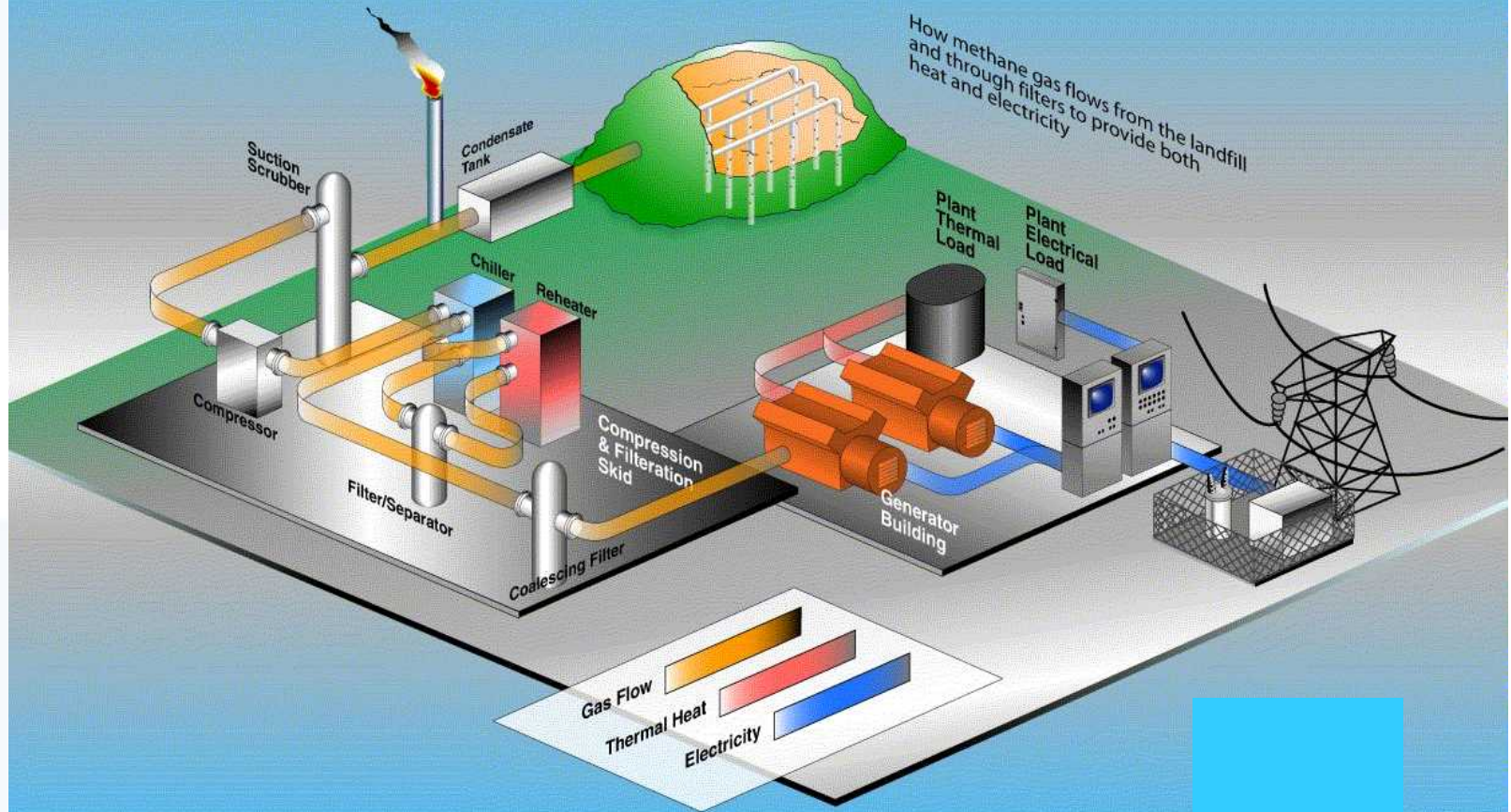
- Methane is produced and emitted during the anaerobic decomposition of organic material in landfills
- Globally, landfills are the 3rd largest anthropogenic source, accounting for 13 percent of emissions

Global Methane (CH₄) Emissions (MMTCO₂e) in 2000



Landfill Methane Recovery and Utilization



Landfill Gas to Energy



Advantages of Landfill Biogas Energy Recovery

- Combustion destroys methane and other organic compounds in LFB.
- Offsets use of nonrenewable resources (coal, oil, gas) reducing emissions of: SO₂, NO_x, PM, and CO₂
- LFB is a recognized renewable energy resource.
- LFB projects have over 90% on-line availability.
- Serves as the “baseload renewable” for many utilities.
- LFB is among the most cost competitive renewable resources available (US\$0.04 - 0.07/kW).
- LFB can act as a long-term price and volatility hedge against fossil fuels.

Landfill Methane and Biogas Project Trends

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- Emissions in industrialized nations
 - Increased LFG regulation
 - Increased recycling of organics/paper
 - Increased utilization (>1000)
 - Developing nations are growing landfill methane sources ...and represent new biogas project opportunities
 - Shift from open dumps to sanitary/engineered landfills
 - Increasing MSW generation and disposal
 - Lack of LFG regulation and formal recycling
 - *Developing world represents the largest (and mostly) untapped market for landfill biogas project development*
 - Yet challenges persist...and M2M is here to HELP
 - Technical hurdles including basic landfill management, landfill gas system O&M, and underperforming projects must be overcome
 - Contractual disputes (e.g., gas ownership) must be addressed.
 - Political and institutional capacity must be assessed.
 - Financing options (e.g., small landfills, no/limited carbon credits) must be analyzed
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Near-Term Landfill Biogas Opportunities

- **Track Record of Successful Landfill Biogas Energy Projects**, mainly in developed countries (~1100 worldwide)
- **Reliable Off-the-Shelf Commercialized Technologies Exist**
- **Many New Projects in Developing Countries** (e.g., Argentina, Brazil, China, Mexico)
- **CDM/JI Projects**
- **Consolidation of Small Open Dumps to Regional Sanitary Disposal Sites**

Landfill Subcommittee - Identifying Landfill Biogas Opportunities

- Subcommittee is undertaking comprehensive country studies to characterize landfills and identify project opportunities.
- Partnering with M2M countries to identify near-term project opportunities (technical assessments and pre-feasibility studies underway or planned)
- September 2007: launched M2M International Landfill Database



The screenshot shows the homepage of the International Solid Waste Database. At the top left is the EPA logo. The date 'April 21, 2004' is in the top right. A navigation menu includes 'About the Project', 'About The Data', 'Maps', 'Help', and 'Contact Us'. The main image is a photograph of a landfill with many birds flying overhead. Below the image, the text reads: 'International Solid Waste Database. The International Solid Waste Database was designed and developed by the U.S. Environmental Protection Agency (EPA) to address the lack of a centralized and comprehensive collection of data on solid waste generation and management practices in developing countries. Learn More >>>'. To the right of the text is a globe with flags. On the far right is a login form with fields for 'User Name:' and 'Password:', a 'Login' button, and links for 'New User?' and 'Request a Login Here'.

Status of M2M Landfill Gas Sector at the Expo and in the Field

- 48 landfills from nine Member Countries are represented
 - 30 Posters
 - 30 Handouts
- 29 of these landfill assessment reports completed
- Pre-feasibility studies with pump tests completed in 4 M2M countries
- Country-specific landfill gas models will be developed or revised for 3-4 countries in 07/08.
- Over 10 training and capacity building workshops completed and 4-6 additional are planned in 07/08

Landfill assessment reports and pre-feasibility studies submitted to the Expo by U.S. EPA

| Country | Landfills | Estimated Average Annual Potential Emission Reductions over a 15-year project life (MTCO ₂ E) |
|---------------|-----------|--|
| Argentina | 3 | 115,600 |
| China | 4 | 179,000 |
| Colombia | 4 | 1,688,400 |
| Ecuador | 5 | 692,900 |
| India | 3 | 191,200 |
| Mexico | 2 | 73,100 |
| Ukraine | 4 | 185,100 |
| Russia | 1 | 323,700 |
| TOTALS | 26 | 3,449,000 |

Landfill project opportunities submitted to the Expo by Argentina, China, and Mexico

| Country | Landfills | Estimated Average Annual Potential Emission Reductions over a 10-year project life (MTCO ₂ E) |
|---------------|-----------|--|
| Argentina | 3 | 86,300 |
| China | 7 | 20,600* |
| Mexico | 2 | 173,600 |
| TOTALS | 12 | 280,500 |

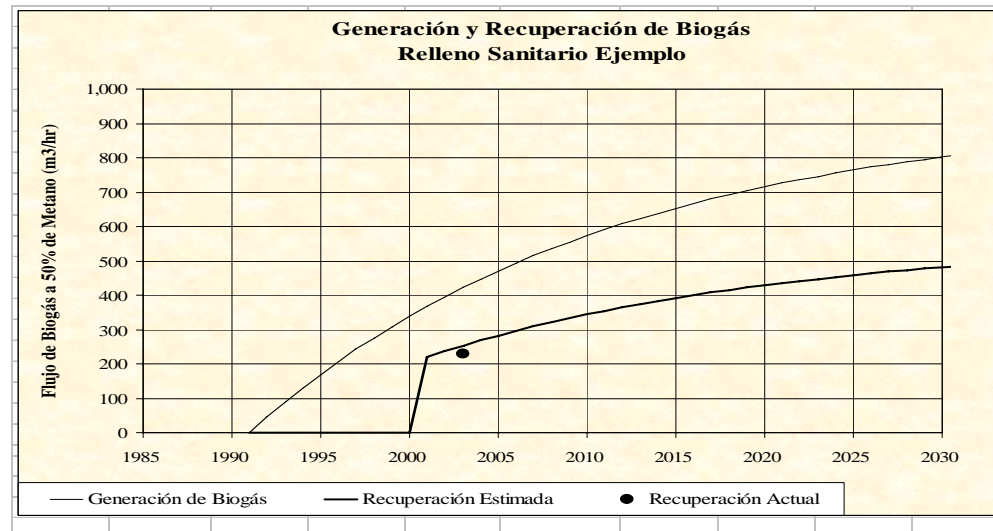
*Gas estimates only available for one of the 7 submissions

Case Study: Mexico Landfill Technical Subcommittee

- Beginning in 2005, USEPA, SEMARNAT, SEDESOL, NADBank, BECC, and USAID partnered to evaluate landfill gas uses at landfills along the US/Mexico border (signed agreement)
- Several sites were reviewed and two landfills were selected for further study:
 - Pre-feasibility studies performed at Ensenada and Nuevo Laredo
- Both studies will be used to attract investors to develop landfill biogas recovery projects.
- GOM formed M2M Mexico Landfill subcommittee to address country-specific issues and opportunities.
 - Interagency group meets frequently to discuss progress and milestones.

Landfill Subcommittee Technical Documents, Tools and Resources

- International Landfill Database
- International LFG Modeling (generation and recovery)
- Technical Assistance and Training
 - Pre-feasibility Studies (pump test)
- On-line Bibliography of LFG Project Resources



Technical Assistance: Evaluating Landfill Biogas Recovery Potential

- Off-site data collection
 - In-country Landfill subcommittee delegate works with landfills to complete Landfill subcommittee Profile Form
 - landfill physical, operational data, waste stream
 - institutional factors (power tariffs, waste pickers)
 - local contact information
- On-site data collection at top candidate landfills
 - Landfill Site Visit to Collect Information
 - Gas Analysis (passively venting gas, if available)
 - Leachate (depth, evidence of breakout)
 - Engineering (layout, capping, topography, surface water)
 - Management (phasing and placement of waste, recycling)
 - Gas Utilization (grid connection, local industry or gas users, costs associated with leachate treatment/disposal)

Technical Assistance: Evaluating Landfill Biogas Recovery Potential

- Model gas availability and energy potential
- Assessment reports prepared based on data collection activities (basic analysis)
- Conduct pre-feasibility studies and pump tests (limited/as needed) at top candidate landfills
 - Landfills selected based on criteria e.g., ability to support gas energy project, political willingness, institutional capacity
 - Pump test: drill up to 3 test wells (wells can be used in future full-scale gas extraction projects; developing country-specific model)
 - Test results can be used to adjust gas model estimates
 - Assess technical and economic analyses and considerations of project feasibility and options.

Conclusions

- Members of the M2M landfill technical sector have:
 - Technical expertise in multiple types of landfill biogas
 - Demonstrated landfill methane-specific Partnerships between M2M countries and the Project Network
 - Landfill data collection and site visits
 - Pre-feasibility studies and assessment reports
 - Country-specific modeling tools
 - Training
- M2M landfill technical sector is focused on creating opportunities for LFG capture and use

Contact Information

- Brian Guzzone
- USG Landfill subcommittee delegate
- Tel: +1.202.343.9248
- Email: guzzone.brian@epa.gov
- www.methanetomarkets.org