Overcoming Barriers to Landfill Gas Energy Recovery

Announcing the International Best Practices Guide for Landfill Gas Energy Projects

Chris Godlove, US Environmental Protection Agency

16th Annual LMOP Conference

Baltimore, MD

Global Methane Initiative

Overview

- Global Methane Initiative (GMI) Overview
- Global Methane from MSW Sector
- LFG Recovery as Part of an Integrated Waste Management Solution
- Best Practices to Overcome Common LFG Recovery Barriers in GMI Partner Countries
- Tools and Resources Available

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What is Global Methane Initiative (GMI)?

GMI is a international multilateral partnership that aims to reduce methane emissions and to advance the abatement, recovery and use of methane as a clean energy source while:

- Enhancing economic growth
- Promoting energy security
- Improving local air quality and public health.

The Initiative reduces the informational, institutional, and other market barriers to project development in five sectors:

- Municipal Solid Waste (formerly the Landfills Sector)
- Coal Mines
- Oil and Gas Systems
- Agriculture
- Municipal Wastewater

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Global Methane Initiative: 41 Partner Governments

Argentina
Australia
Brazil
Bulgaria
Canada
Chile
China
Colombia
Dominican Rep.
Ecuador
Ethiopia
European Comm.
Finland
Georgia
Germany
Ghana
India
Indonesia
Italy
Japan
Jordan
Kazakhstan
Mexico
Mongolia
Nigeria
Norway
Pakistan
Peru
Philippines
Poland
Republic of Korea
Republic of Serbia
Russia
Sri Lanka
Thailand
Turkey
Ukraine
United Kingdom
United States
Vietnam

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Updated: June 2012

Global Methane Initiative Project Network

- Private companies, multilateral development banks and other relevant organizations participate by joining the ***Project Network –***
  - ***Over 1,200 organizations now participating***
  - ***Over 750 organizations interested in the MSW Sector***

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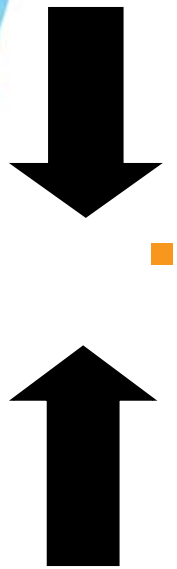
Global Landfill Methane Emissions Trends

- Global landfill methane projected to rise by 18.7% in the next decade
- Industrialized Nations Declining
  - Increased landfill gas (LFG) regulation
  - Increased recycling of organics/paper
- Developing Nations Sharply Increasing
  - Shift from open dumps to sanitary landfills
  - Increased MSW generation and disposal
  - Lack of LFG regulation and recycling
  - Increased consumerism and per capita waste generation rates



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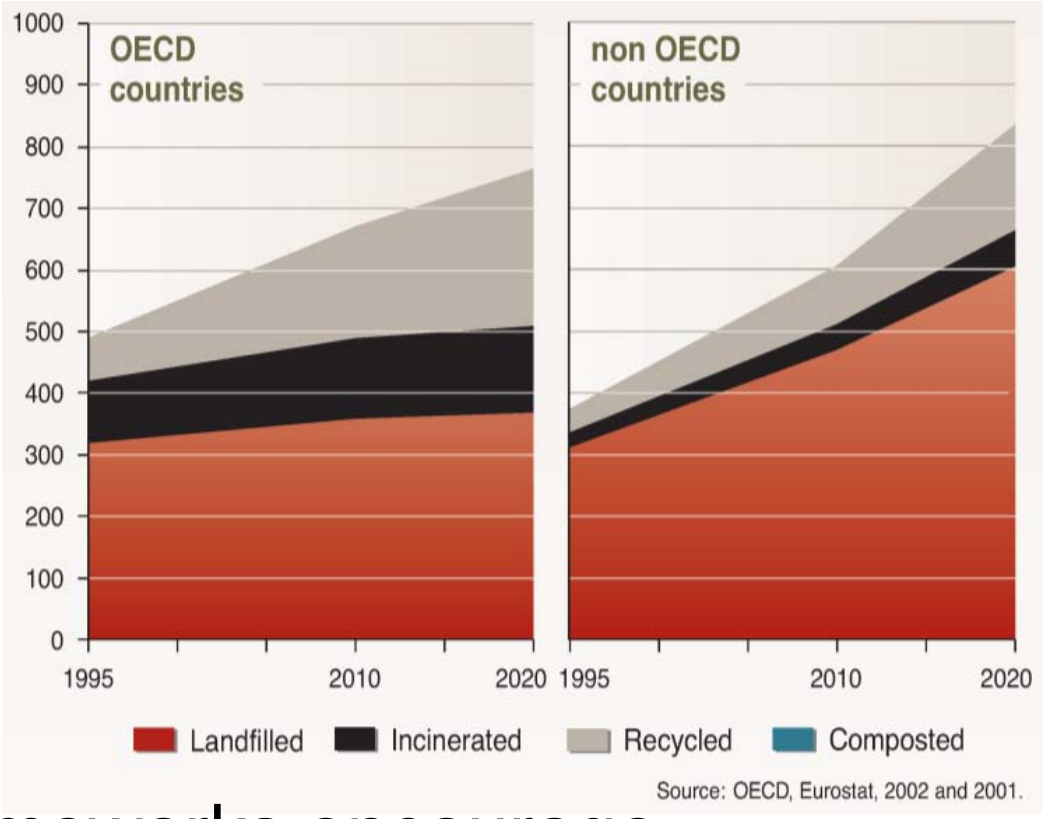
Waste Generation Rates in Developing Countries

- Due to the relatively high cost of sanitary landfills, municipalities make little progress toward transition from open dumps unless policy frameworks encourage a more ISWM-based solution



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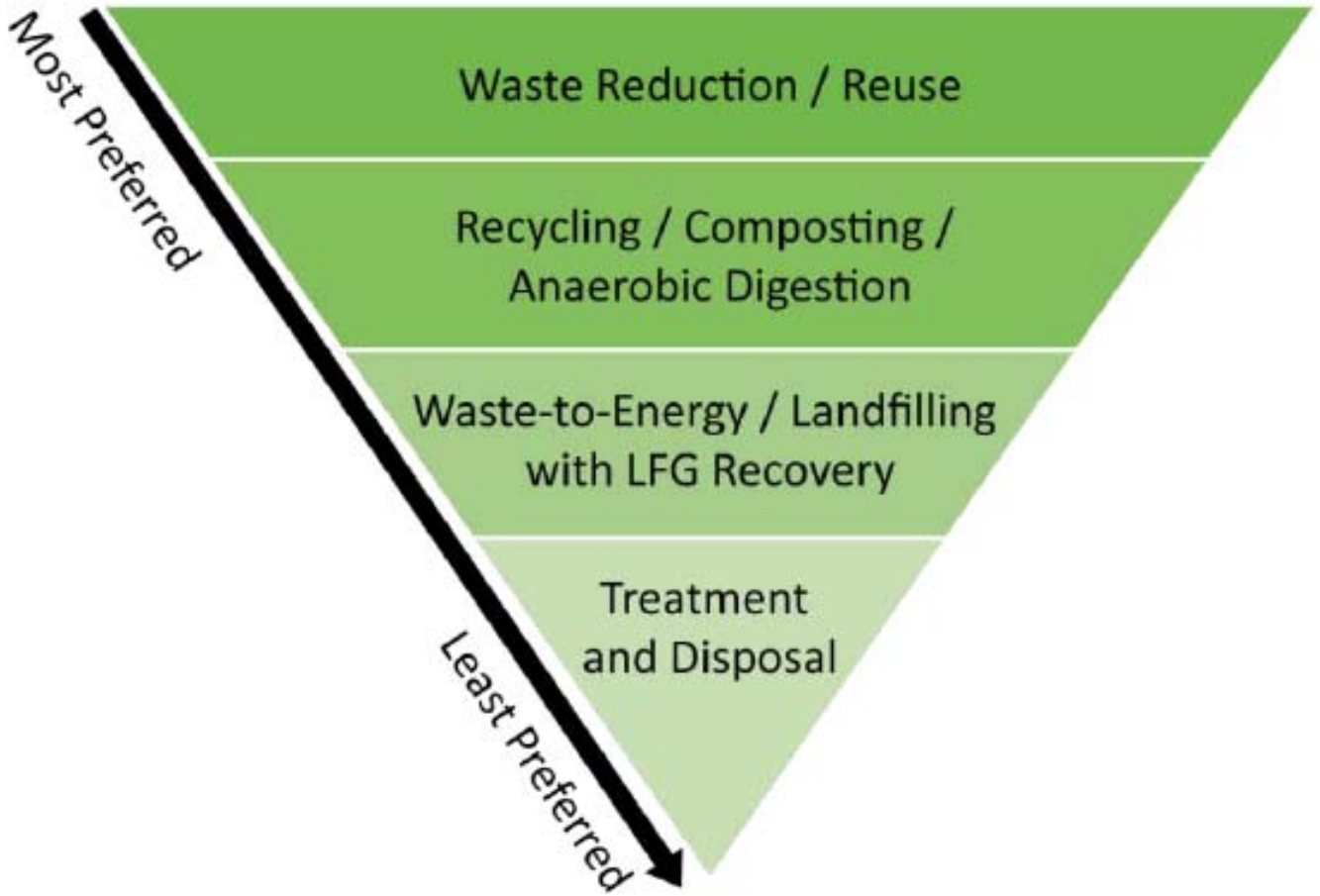
Components of Integrated Solid Waste Management (ISWM)



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Regulations Driving ISWM Approaches in GMI Countries

- Indonesia Waste Law
  - Requires closure of open dumps and transition to sanitary landfills
- Brazil National Solid Waste Policy
  - Prohibits disposal of wastes unless all other alternatives have been exhausted
  - *'Logística Reversa'*
  - Transition to regional sanitary landfills
- Eastern Europe
  - EU Waste Directive on Landfills
    - Bans landfilling of organic wastes
    - Requires LFG projects at landfills
  - Bulgaria Waste Law establishes a solid waste disposal hierarchy consistent with ISWM

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Role of LFG Energy in ISWM in Developing Countries

- Environmental
  - Reduce methane from MSW sector by destroying methane and other organic compounds in LFG
  - Offset use of nonrenewable resources
- Economic
  - Generate revenue for landfills
  - Reduce fuel costs for end user
  - Create jobs and local economic development
- Social
  - Improve landfill operations, human health, and safety

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Role of Guide to Promote LFG Recovery in Developing Countries

Guide presents best practices to overcome common barriers to LFG recovery, including:

1. Flawed solid waste disposal site design and operation
2. Poorly designed and operated LFG collection and control systems
3. Difficulties estimating LFG volumes available to the project
4. Selecting appropriate energy recovery technologies
5. Financing the project

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Improve Conditions of SWD site to Enhance LFG Collection

- Design
  - Install proper liner and cover systems
  - Maximize leachate collection and removal
  - Design slopes no greater than 3:1
- Operations
  - Implement a fill sequence plan
  - Compact waste
  - Apply daily cover

Design and Operate LFG GCCS to Maximize LFG Recovery Rates

- Design
  - Well configuration (horizontal vs. vertical)
  - Well Density
  - Size and placement of header pipes
- Operations
  - Implement a routine maintenance plan on wells, blowers and flare

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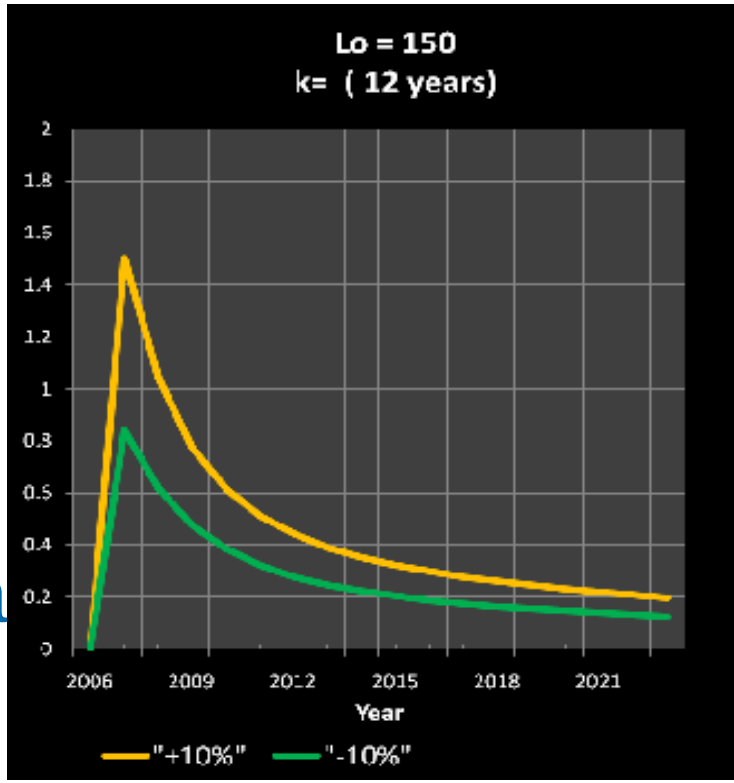
Reduce the Uncertainty of Estimated LFG Generation Rates

- Verify model inputs
  - Annual disposal rates
  - Conduct sanity checks
- Present estimates as a range instead of absolute values



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Reduce the Uncertainty of Estimated LFG Collection Rates

- Select an appropriate model
  - IPCC
  - GMI Country and Regional Models
- Understand how common site operating practices or site conditions affect the collection efficiency

http://www.epa.gov/lmop/international/tools.html

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Select Appropriate Energy Recovery Technologies

Technology	Pro	Con
Direct Use •Boilers •Thermal •Leachate evaporation	•Cost-effective •Limited treatment •Accommodates wide range of flowrates (11 to 8,500 m^3/hr) •Utilize maximum amount of LFG	•Energy user must be in close proximity •Seasonal or periodic use may limit utilization and revenue
Electricity •IC engine •Gas turbine •Micro turbine •Cogeneration	•Modular design allows for adding/removing equipment over time •Turbines and microturbines have lower air emissions than IC engines •Cogeneration can increase efficiency	•Marginal economics in countries with low electricity rates •Higher treatment and maintenance costs.
High BTU •Pipeline injection •Alternative vehicle fuel (CNG/LNG)	•Allows for sale into local utility pipelines •Replaces diesel in vehicles with a locally produced fuel	•Most extensive and highest costs for LFG treatment. •Increased O&M on wellfield to reduce O_2 and N intrusion

Select Appropriate Energy Recovery Technologies

- Pair appropriate level of treatment with selected technology
  - Direct Use > Basic condensate removal
  - Electricity > Advanced Primary treatment essential; secondary treatment (siloxane and sulfur) is site-dependent
  - High BTU > Primary and secondary treatment, in addition to gas processing for CO_2 removal

Identify Appropriate Financing

- Evaluate Policy Drivers
- Understand Revenue Streams and Risks
- Explore local financial mechanisms
  - Tax incentives
  - Public-private partnerships
  - Loan guarantees
  - Multi and Bi-lateral Banking: http://www.waipa.org/inv_organizations.htm

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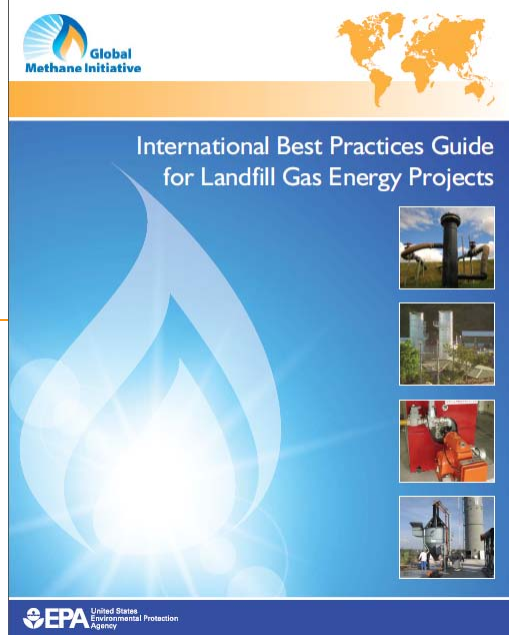
Format of Guide:



- Seven chapter Guide covering:
  - Basic concepts of ISWM
  - Site design and O&M
  - Design and O&M of gas collection systems
  - LFG energy technologies
  - Market drivers for LFG energy
  - LFG modeling
  - Project economics and financing
- Case studies on successful LFG recovery projects
- Access the guide on-line at: **http://globalmethane.org/tools-resources/tools.aspx#ibpg**

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Methane Expo 2013

- **12-15 March, 2013**
- **Vancouver, Canada**
- **Online Registration Available**
- **Exhibit and Supporter Opportunities Still Available**

For More Information

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