



Methane to Markets

***A Public-Private Partnership to Advance
Recovery and Use of Methane as a Clean
Energy Source***

Rachel Goldstein, Landfill Methane Outreach Program, U.S. EPA

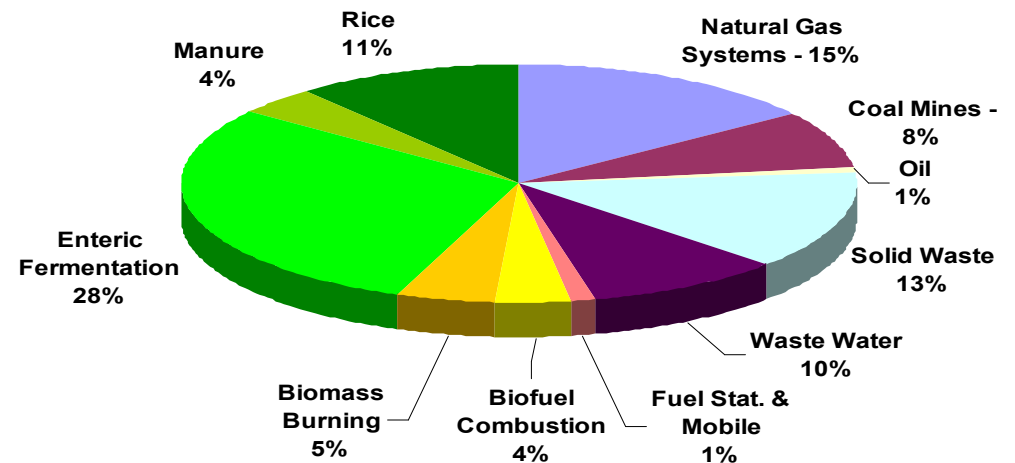
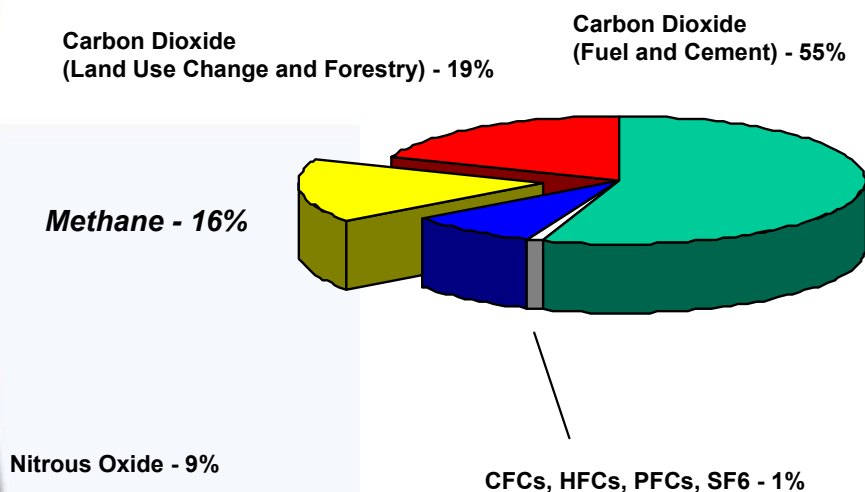
Overview

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Why focus on Methane?

- ✓ A potent GHG (100-year GWP of 23; atmospheric lifetime of ~12 years)
- ✓ The 2nd most important GHG accounting for ~18% of total climate forcing
- ✓ A primary constituent of natural gas and a valuable, clean-burning energy source

Global Greenhouse Gas (GHG) Emissions in 2000 = 40,702 MtCO₂e



Benefits of Methane Recovery and Use Projects

- Important local energy source
- Improved air quality and reduced odors
- Reduced greenhouse gas emissions
- Progress toward sustainable development goals
- Economic growth and energy security
- Reduced waste of a valuable fuel

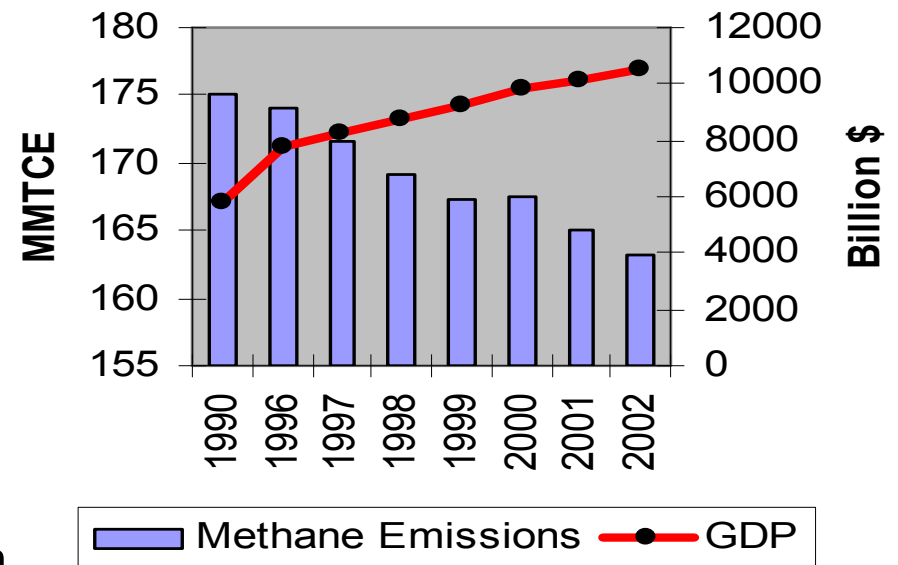
Barriers to Methane Recovery

- Lack of awareness of emission levels and value of lost fuel
- Lack of information on and training in new technologies and practices
- Traditional industry practices
- Regulatory and legal issues
- Limited methane markets and infrastructure
- Uncertain investment climate

EPA's Voluntary Programs Have Produced Measurable Results

- **Natural Gas STAR**
 - over 100 companies (65% of industry) in program
 - part of API's Climate VISION commitment
- **Coalbed Methane Outreach Program**
 - 90% of mine degasification CH₄ is used (up from 25% in 1993)
 - industry effort to demonstrate use for ventilation air methane
- **Landfill Methane Outreach Program**
 - Over 390 US landfill projects -- tripled since 1994
 - Strong corporate interest in use of landfill gas
- **AgSTAR**
 - strong state and Farm Bill support for methane digesters

Changes in US Methane Emissions and Economic Growth 1990 - 2002



Methane to Markets Partnership Overview

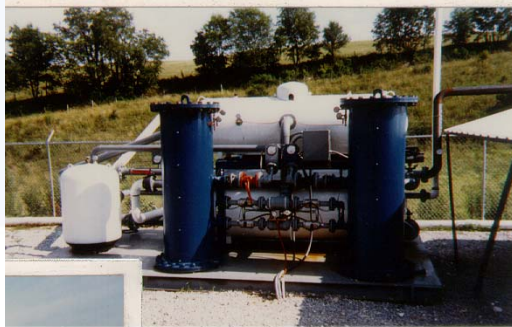
- Advances recovery and use of methane as a valuable clean energy source
- Encourages development of **cost-effective** methane recovery and use opportunities in
 - coal mines
 - landfills
 - oil and gas systems and
 - agriculture (manure waste management)
- Private companies, multilateral development banks and other relevant organizations participate by joining the **Project Network** – *over 220 organizations now participating*
- 17 Partner Countries

Argentina	Japan
Australia	Korea
Brazil	Mexico
Canada	Nigeria
Colombia	Russia
China	Ukraine
Ecuador	United Kingdom
India	United States
Italy	



Cost-Effective Projects Recover and Use Methane

Coal Mines



Oil and Gas Systems



Landfills



Livestock Waste

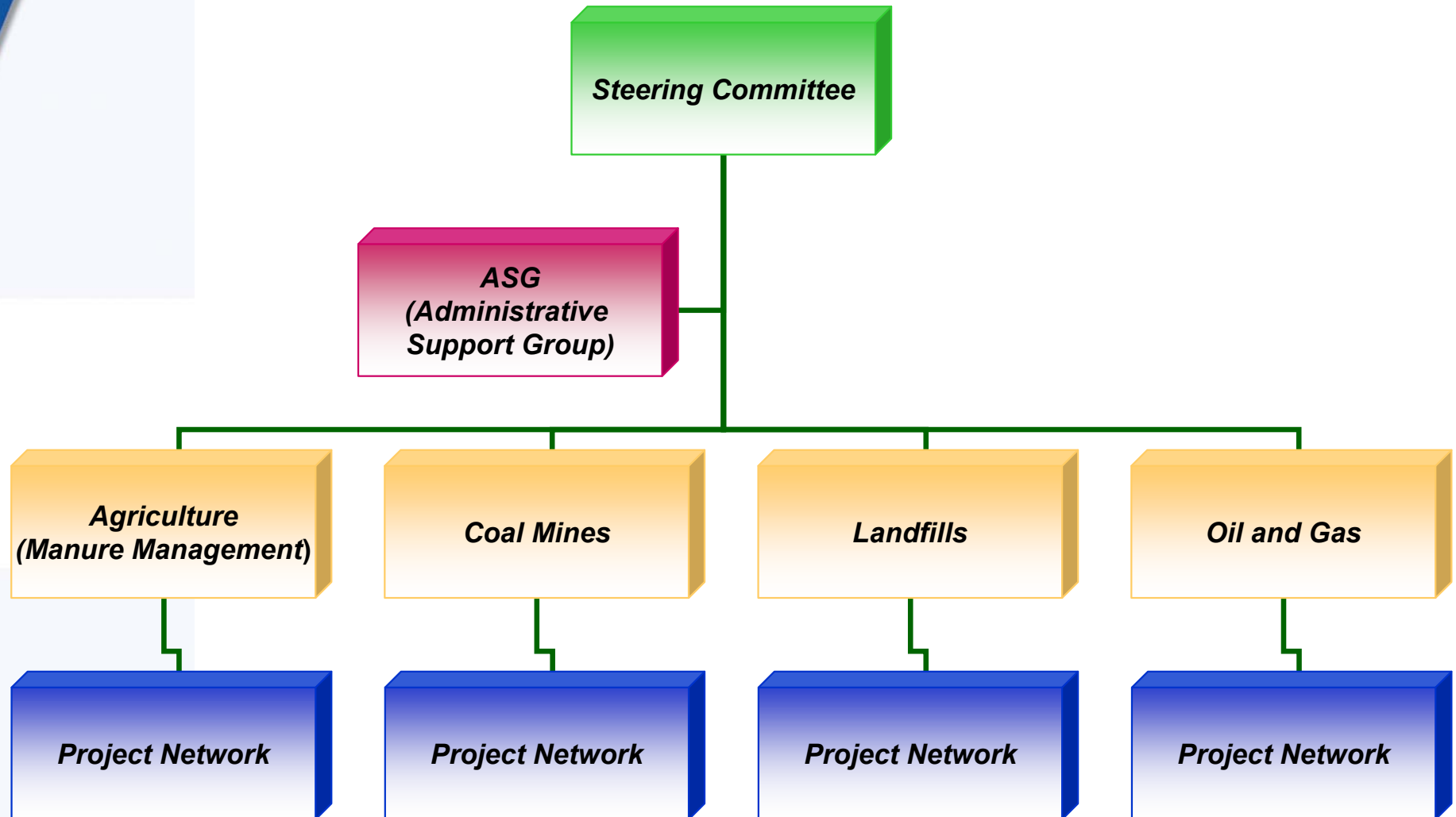
Purpose and Goals

- ***International Framework*** – to advance the recovery and use of methane as a valuable clean energy source
- ***Cost-effective and Near-term Focus*** – on facilitating methane recovery and use projects in developing countries and countries with economies in transition
- ***Private Sector Involvement*** – involve private companies, multilateral development banks and other relevant organizations in M2M implementation and activities through the ***Project Network***
- ***Developed countries assist developing countries and CEITs*** – to overcome in-country barriers to methane project development

Methane to Markets Activities

- Action oriented – focus on project development
- Participating countries and Project Network members work collaboratively to:
 - Identify cost-effective opportunities for capturing methane emissions for energy production
 - Identify and remove legal, regulatory, financial, and other barriers to project development
 - Develop sector-specific action plans and a process for evaluating their implementation
 - Conduct training, technical exchange, and demonstrations to support project development
- Developed countries commit to assist developing countries and countries in transition in undertaking the activities listed above

Partnership Organization



The Project Network

- Project network members are private firms, development banks, NGOs or other governmental and non-governmental entities with an interest in methane recovery and use projects
- Currently over 220 organizations including:
 - World Bank
 - UN Economic Commission for Europe
 - Consultants and Project Developers
- Private sector and broad stakeholder involvement is central to the success of the Partnership
 - Provide technical input and expertise
 - Participate in all activities and meetings
 - Identify and implement activities and projects
- Organizations can join on-line at www.methanetomarkets.org
- Project Network Members can submit project ideas on-line at <http://www.methanetomarkets.org/projects/submit-ideas.htm>

Climate Benefits of M2M

- By 2015 potential reductions of up to 50 MMTCE annually (~500 billion cubic feet (Bcf) of natural gas)
 - Equivalent to eliminating emissions from fifty 500 MW coal-fired power plants
 - Assumes significant global participation (65% of global CH₄ emissions – current partner base represents 57%)
 - Does not include US reduction opportunities
- Emissions reductions and energy generation can be measured and quantified
 - Partnership is currently focused on the number and quality of projects

U.S. Involvement in M2M

- U.S. EPA is coordinating efforts across the USG and staffs the Partnerships Administrative Support Group



- U.S. commitment
 - Pledge of \$53 million over five years
- Key activities to advance project development
 - Identify and assess project opportunities
 - Pre-feasibility and Feasibility studies
 - Support technology transfer and training
 - Workshops and Conferences
 - Study tours
 - Developing Reports / Databases / Clearinghouses
 - Address barriers to project development and increase access to information
 - Financial/market, regulatory, technical
 - Technology demonstration and deployment

M2M Accomplishments in 2005

- Partnership infrastructure established
 - Organization, website, outreach materials, etc...
- Subcommittees developed and began to implement action plans
 - Description of available technologies and best practices
 - Identification of key barriers and issues for project development
 - Identification of project finance opportunities and mechanisms
 - Discussion of country-specific needs, opportunities, and priorities
- Partners collaborated on key projects and activities

Priorities for 2006

- Implement and Expand Upon Sector Action Plans
 - Implement concrete activities in each sector and in each Partner country
 - Identifying near-term opportunities to develop projects for investment and implementation.

- Development of the Project and Technology Expo for 2007
 - Partners and PN members to support development of project pipelines

- Expanding the Project Network to include key organizations from the private sector and the investment community.

Upcoming M2M Meetings/Events

- **March 9, 2006 - Federation of Indian Chambers of Commerce and Industry - USEPA Landfill Gas to Energy Workshop Delhi, India**
- **28 April 2006 – Oil and Gas Subcommittee Meeting, Villahermosa, Mexico**
 - Co-located with technical workshop
- **23 May 2006 – Coal Subcommittee Meeting, Tuscaloosa, Alabama, U.S.**
 - Co-located with International Coal Mine Methane Symposium
- **Landfill Subcommittee Meeting – 12 May 2006, Cologne, Germany**
 - Co-located with Carbon Expo
- **Agriculture Subcommittee Meeting – TBD**
- **Steering Committee Meeting – 4th Quarter 2006**
 - Meeting of the Steering Committee only. Subcommittee co-chairs should also plan to attend to provide updates on their progress.
- **2nd half of 2007 (tentative) - Project and Technology Expo**
 - Co-located with Steering Committee and all subcommittee meetings

Current M2M Funding Opportunities

- [International Utility Efficiency Partnership \(IUEP\) 2006 Request for Proposals](#)
 - Deadline is April 20, 2006
 - Cost sharing required
 - Private companies are eligible

- [U.S. Agency for International Development \(USAID\) request for proposals under the Global Development Alliance \(GDA\)](#)
 - Ongoing
 - Cost sharing required
 - Private companies are eligible

- methanetomarkets.org/resources/general/index.htm



Methane to Markets

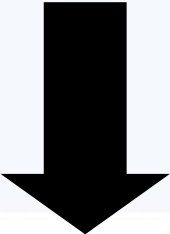
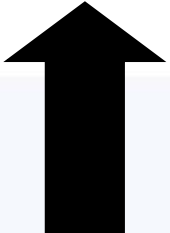
Accomplishments and Opportunities for the LFG Industry

Rachel Goldstein

U.S. Environmental Protection Agency

Landfill Methane Outreach Program

Global Landfill Methane Emissions Trends

- 
- Industrialized Nations Declining
 - Increased LFG regulation
 - Increased recycling of organics/paper
 - Increased LFG utilization (>1100 worldwide)
 - Developing Nations Sharply Increasing
 - Shift from open dumps to sanitary/engineered landfills
 - Increased MSW generation and disposal
 - Lack of LFG regulation and recycling
- 

Current Achievements & Near-Term Opportunities

- **Track Record of Operating Projects**, mainly in developed countries (~1100 worldwide)
- **New Projects in Developing Countries** (e.g., Nanjing, China; Monterrey, Mexico)
- **Near-Term Potential JI/CDM Projects** (e.g., Asia, Latin America)
- **Consolidation of small open dumps to regional disposal sites**
- **Emerging LFG technologies showing promise for developing countries**

Diversity of Project Types

Electricity Generation

**Internal
Combustion
Engine**



**Gas
Turbine**



Emerging Technologies



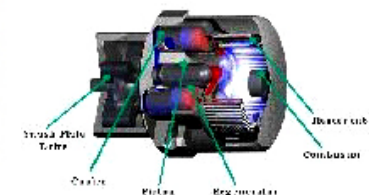
Microturbine



**Organic Rankine
Cycle Engine**



**Stirling "External
Combustion" Engine**



Diversity of Project Types

Direct Use of LFG

- Direct-use projects are growing
 - Boiler applications - replace natural gas, coal, fuel oil
 - Combined heat & power (CHP)
 - Direct thermal (dryers, kilns)
 - Natural gas pipeline injection
 - Medium and high-Btu
 - Greenhouse
 - Leachate evaporation
 - Vehicle fuel (LNG)
 - Artist studios
 - Hydroponics
 - Aquaculture (fish farming)

Greenhouse Burlington, NJ



Pottery Studio Sugar Grove, NC



LFG-fired Boiler Ft. Wayne, IN

Landfill Technical Subcommittee

- Co-Chairs
 - Argentina and Italy
- Current Landfill Subcommittee Membership
 - Argentina, Australia, Brazil, Colombia, Italy, India, Japan, Korea, Mexico, Russia, Ukraine, United Kingdom, United States
- Landfill Subcommittee Contacts-
 - 2 from Ministry of Urban Development, 1 from Central Electricity Authority

USG Accomplishments (2005)

- EPA and USAID are working in Mexico with the Border Environmental Cooperation Commission and the North American Development Bank, SEMARNAT, SEDESOL to advance LFGE projects.
 - Performing pre-feasibility studies at two landfill sites.
 - Reviewing barriers for landfill gas use and creating a guide on financing LFG capture and use.
- Implementation of a LFGE project in Fortaleza, Brazil
 - Project includes technical support, feasibility study, and social inclusion activity
- Conferences/Workshops
 - Sponsored LFG Training Workshop, Moscow, May 2005
 - Co-sponsored the World Bank Latin America LFG Project Expo, July 2005
- ISWA joined the Project Network
- Developed bibliography of tools and links to existing documents on LFG (now available on M2M website)



LMOP International Assistance Overview

Three Main Types of Project Support:

- **Training and technical support:** Assist with project identification, assessment, design, end-user identification, and development
- **Financing:** Work with international agencies and the private sector to identify financing
- **Outreach:** Work with project partners to communicate project benefits on local and national levels



Additional LMOP International Assistance

- USEPA LFG project development and training workshops have been conducted in South Korea, Poland, Mexico, Brazil, Ukraine, China, and Thailand
- LFG model training workshops
- Feasibility studies have been conducted in Brazil, Mexico, Philippines, Thailand (Kampangsean)
- Thailand LFG Assessment (w/World Bank)
- And now India

U.S.G. LFG Project Assessment and Training Tools

- International Landfill Database
- International LFG Model (generation and recovery)
- Feasibility Assessments
- Technical Training

International Landfill Database



April 21, 2004

[About the Project](#) | [About The Data](#) | [Maps](#) | [Help](#) | [Contact Us](#)



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 >>>](#)



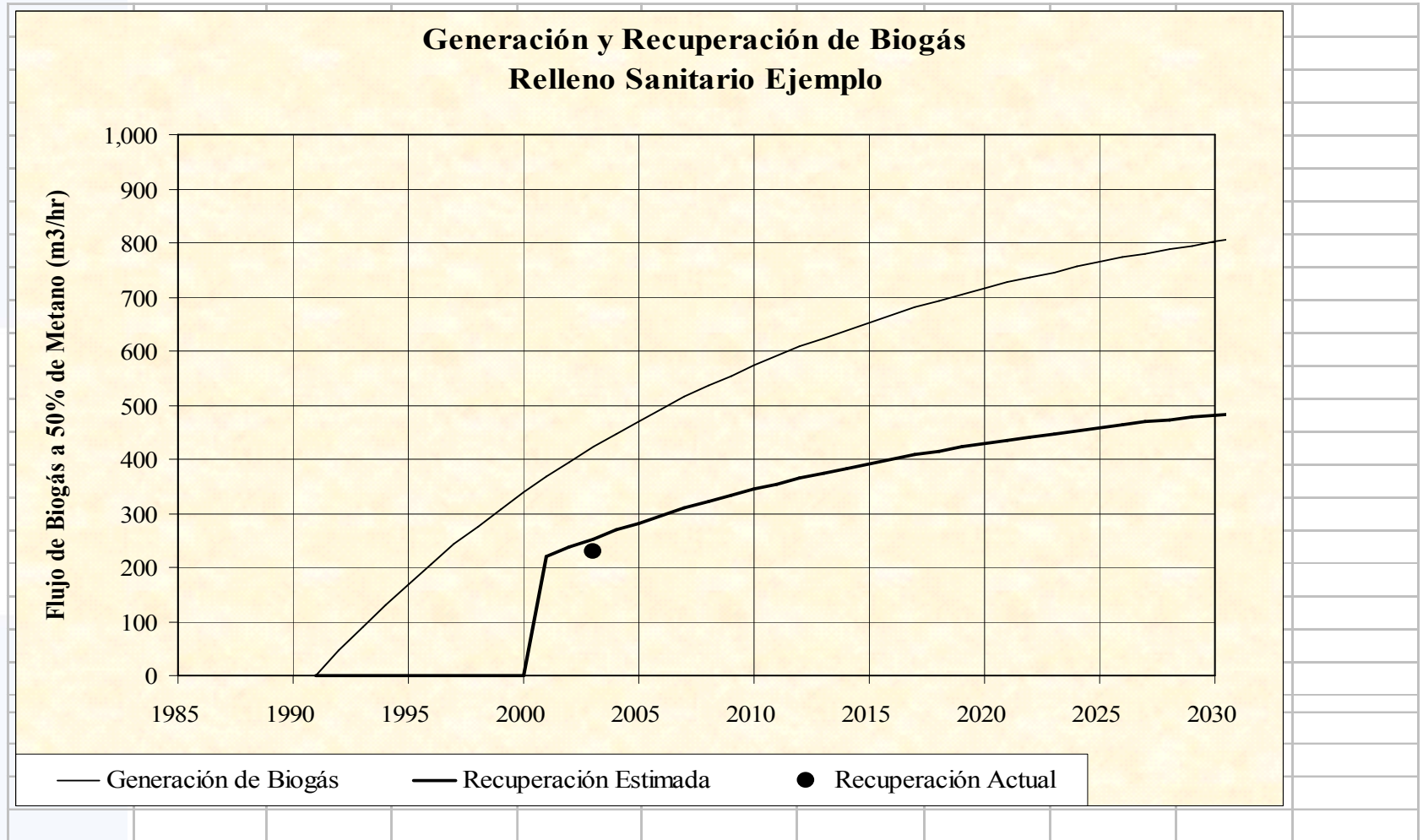
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Tailored LFG Model



USG Next Steps and Plans for 2006

- Identify landfills in Partner countries and support approximately 10-15 pre-feasibility studies
 - Projects to be characterized for showing at the 2007 Project Expo
- Finalize and launch international landfill database in early 2007
 - Database will be available on-line to make potential project opportunities readily available to investors
- Workshops on Landfill Gas Energy in India (March 9), Brazil, and Mexico (TBD)
- U.S. and Australia are collaborating to develop a screening template to help members characterize and select candidate landfills for further development
 - Available early 2006

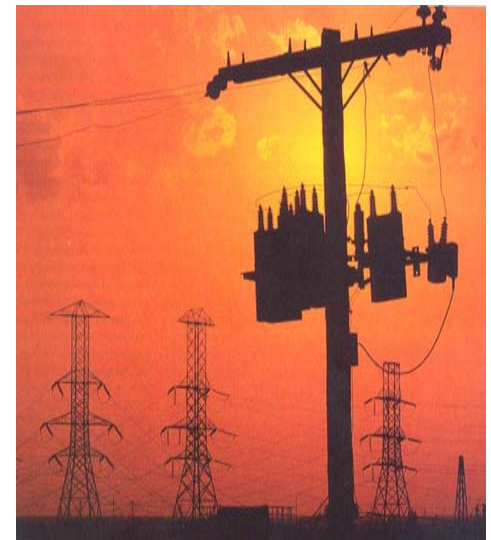
Possible Candidate Landfills

- Delhi- 4 dump sites, 3 of which look promising for landfill gas to energy
- Mumbai- 4 dump sites, some pre-feasibility work at one landfill
- Bangalore- 2 existing dump sites; the first sanitary landfill in India
- Chennai- 2 dump sites that may have high amounts of waste

For More Information...

www.methanetomarkets.org

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For More Information

- www.methanetomarkets.org
- www.epa.gov/lmop
- www.epa.gov/cmop
- www.epa.gov/agstar
- www.epa.gov/gasstar