Landfill Gas Energy Capitalizing on International Opportunities

Brian Guzzone

U.S. Environmental Protection Agency

Landfill Methane Outreach Program (LMOP)

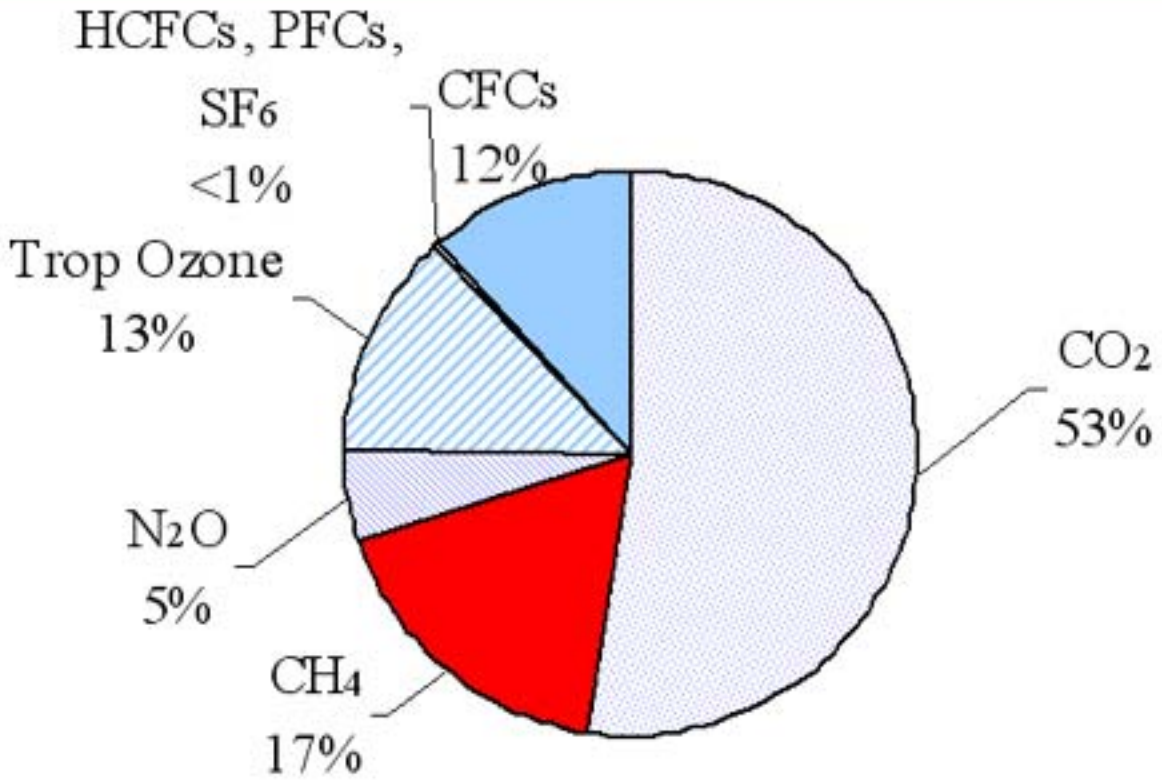
7th LMOP Conference & Project Expo

Washington, DC

Why Does EPA Care About LFG Internationally?

- Landfill methane is a potent heat-trapping gas and it's global!
- USA ratified UNFCCC (LMOP born)
- Landfills are one of the largest human-made sources of methane in the world (and rising!).
- Global emissions will increase as developing countries improve landfilling practices
- LFGE reduce global methane emissions and local air pollution, create jobs, revenues, cost savings, and opportunities for developed countries.

Greenhouse Gas Accounting



Source: IPCC, 2001

Contribution of Anthropogenic Emissions of All Greenhouse Gases to the Enhanced Greenhouse Effect Since Industrial Times (measured in Watts/m^2)

Landfill Methane Emissions Trends

- Industrialized Nations → Declining
  - Increased LFG regulation
  - Increased recycling of organics/paper
  - Increased LFG utilization (>1000 worldwide)
- Developing Nations → Sharply Increasing
  - Shift from open dumps to sanitary/engineered landfills
  - Increased MSW generation and disposal
  - Lack of LFG regulation and recycling

Key Barriers to LFG Use

- Lack of interest (e.g., national/local governments)
- Lack of financing
- Lack of regulation and enforcement
- Poor landfill operations and management
- Most disposal in small open dumps with limited LFG utilization potential
- Difficult to attract foreign investment - how to get paid?

Current Achievements & Near-Term Opportunities

- Track Record of Operating Projects, mainly in developed countries (1200 worldwide)
- New Projects in Developing Counties (e.g., Nanjing, China; Monterrey, Mexico)
- Near-Term Potential CDM Projects (e.g., China, Mexico, and Latin America)

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

Thailand LFG Monitoring

Landfill Methane: Key Countries and LMOP Assistance

LMOP Assistance Profile: *China*

- China represents the largest source of landfill CH4 emissions amongst developing countries (4,210 Gg CH4 in 2000)
- In 1997 and 1999, EPA and the UN conducted training workshops on LFG utilization
- 4 operational LFGE projects to date and dozens planned
- 2003 - 3rd EPA Methane Mitigation Conference - LMOP and SEPA partnership planned

LMOP Assistance Profile: *Thailand*

- Kasetsart University pilot LFG project at Kamphang Saen Landfill initially unsuccessful - low gas quality, high moisture problems (organics and leachate)
- 1996: LMOP technical support led to improved modeling, recommended condensate knockouts, and horizontal wells
  - Results - improved/consistent gas flow and quality, electricity project currently operational.
- 2003: LMOP and World Bank assess (model) LFG opportunities at over 50 landfills and dump sites
  - Thailand data will presented at a World Bank workshop in Bangkok, March '04

Additional LMOP International Assistance

- USEPA LFG project development and training workshops have been conducted in South Korea, Poland, Mexico, Thailand, Brazil, Ukraine, and China
- LFG model training workshop in Mexico (2-3 December)
- Additional feasibility studies have been conducted in Brazil, Mexico, and Philippines

Development of LMOP's International LFG Model

- Project purpose: to develop a model for estimating the amount of energy available from landfill gas which can be extracted from landfills in developing countries (e.g., Mexico and Thailand)

- Model is useful tool for finding target sites and matching available fuel volumes with potential end-users

LANDFILL DATA COLLECTION AND METHODOLOGY

- Landfill Data Needed
- Background Landfill Data Collection
- Site Selection
- Site Visits

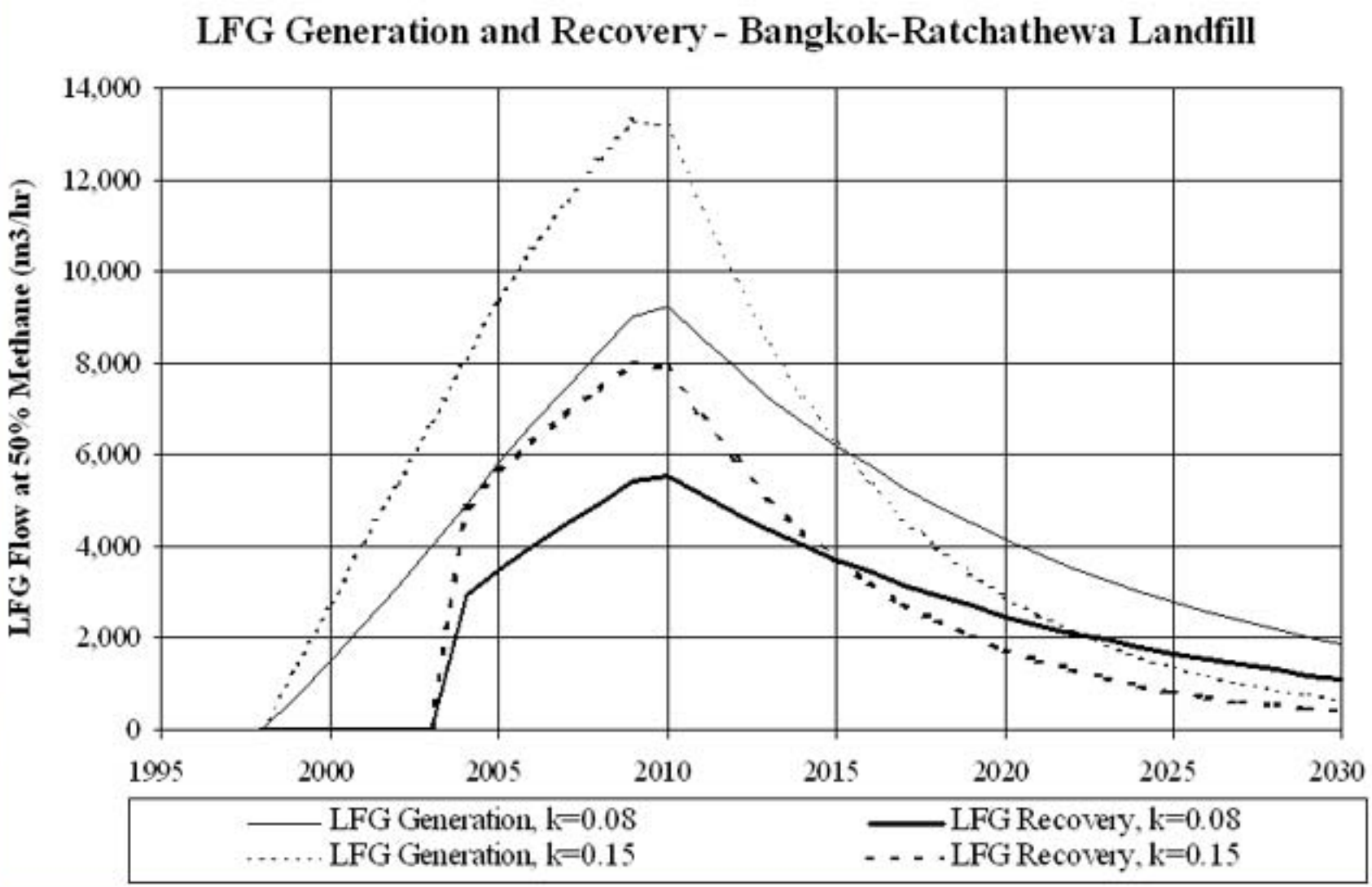
ADAPTING EPA MODEL TO INTERNATIONAL APPLICATIONS

- **Model Inputs**
  - **Mass of waste disposed each calendar year**; can use waste in place and years of operation
  - **"k"** – refuse decay rate (units = 1/year)
  - **"L_0"** – "ultimate" methane generation rate (units = m^3 methane per megagram [Mg] of waste)
- **Model output will be estimated landfill gas generation in m^3/minute and million m^3/yr**

THAILAND LFG MODEL

- **Similar approach as Mexico LFG model:**
  - **Developed a single Thailand Lo value for all sites based on waste composition data = 78 m3/Mg**
  - **Developed site specific k values using results of the Mexico model calibration work, and adjusting for precipitation (k = 0.065 to 0.08).**
  - **Developed a second set of higher k values for each site based on published work on LFG G & R in Thailand (k = 0.10 to 0.15)**
- **Estimated collection efficiencies of 60% for landfills and 50% for dump sites**

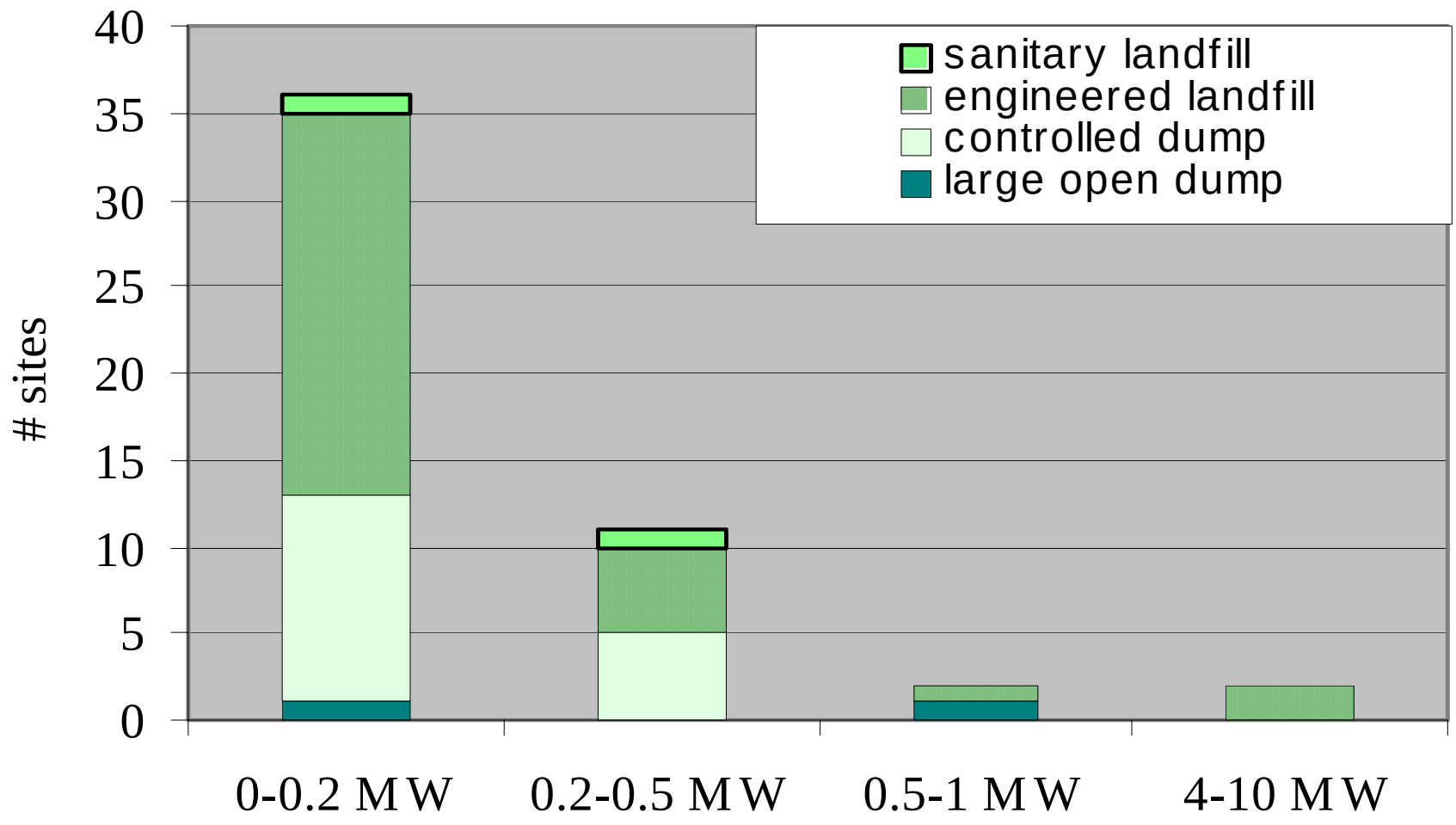
THAILAND LFG PROJECTIONS



Ranking of Potential LFG Projects for Thailand

Rank	Site Name	Site Type	Capacity (MW)	Duration (Years)	Years Project Operates
1	Kampangsean	Engineered	10	15	2004-2018
2	Ratchathewa	Engineered	4	16	2004-2019
3	Nonthanburi	Open Dump	0.5	23	2004-2026
			0.7	10	2013-2022
4	Nakorn Ratchasima	Engineered	0.5	12	2004-2015
5	Nakorn Pathom	Engineered	0.4	23	2004-2026
6	Pathum Thani	Engineered	0.4	10	2004-2013
7	Hat Yai	Controlled Dump	0.4	16	2004-2019
8	Phitsanulok	Engineered	0.2	35	2004-2038
			0.5	14	2013-2026
9	Kampang Phet	Controlled Dump	0.2	40	2004-2043
			0.3	31	2012-2042
10	Songkhla	Controlled Dump	0.2	50	2004-2053
		TOTAL	~18		

LFG Potential in Provincial Capitals



Many LFG Training & Conference Opportunities

- Mar ’04, ISWA Sanitary Landfill Conference, Buenos Aires *(LMOP presenting)*
- Mar ’04, SWANA LFG Symposium, San Antonio
- April ’04, LFG 3-day Training and CDM Potential in China, Beijing
- June ’04, SWANA Landfill Symposium, Monterey, USA
- Oct ’04, ISWA Landfill Gas Training, Rome
- Nov ’04, Intercontinental Landfill Symposium, Tokyo, Japan

For More Information

- www.epa.gov/lmop
- Brian Guzzone
  - guzzone.brian@epa.gov
  - +1.202.343.9248