



Methane to Markets



Partnership Accomplishments **2004–2009**



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Data on project status and membership information (e.g., Partners, Project Network, subcommittee participation) are current as of 30 September 2009.

Introduction



Global warming is a serious environmental challenge that requires a global response. Greenhouse gas (GHG) emissions (including methane) that can be attributed to human activities have increased markedly since pre-industrial times. Globally, anthropogenic methane emissions are projected to increase by 23 percent to 7,904 million metric tons of carbon dioxide equivalent (MMT CO_2E) by 2020.¹ Countries around the world recognize that these changes pose a serious threat to the global environment.

Emissions of methane result from a variety of human activities (see Figure 1), which all together account for 14 percent of global GHG emissions and make methane the second most important GHG after carbon dioxide (CO_2).² Methane is also a hydrocarbon and the primary



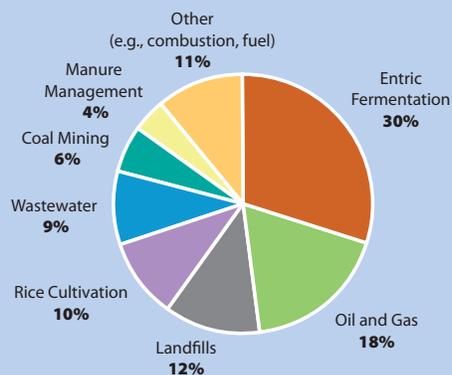
Charter Partners at the 2004 Ministerial Meeting.

component of natural gas, which can be used for energy. Methane accounts for approximately 18 percent of total radiative (i.e., climate) forcing, or about one-third of that of CO_2 and is 25 times as effective at trapping heat in the atmosphere as CO_2 .³ It also has a relatively short atmospheric lifetime of approximately 12 years, compared to about 200 years for CO_2 .⁴ These two characteristics make methane emission reductions particularly effective at mitigating global warming in the near term (see text box next page).

For many of the major emission sources, significant reductions are possible using currently available, cost-effective technologies. Many of the available reduction options involve the recovery and use of methane as a fuel for electricity generation, on-site uses, or off-site gas sales. These actions represent key opportunities for reducing emissions from animal waste management, coal mines, landfills, and natural gas and oil systems. Overall, the global potential for methane mitigation is significant,

Figure 1

Global Anthropogenic Methane Emission Sources, 2005



Total equals 6,407 MMT CO_2E

¹ U.S. Environmental Protection Agency (U.S. EPA), Global Anthropogenic Emissions of Non- CO_2 Greenhouse Gases: 1990–2020 (EPA Report 430-R-06-003), 2006a. <http://www.epa.gov/climatechange/economics/downloads/GlobalAnthroEmissionsReport.pdf>

² Idem.

³ Intergovernmental Panel on Climate Change (IPCC), Contribution of Working Group I to the Fourth Assessment Report, 2007. http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_Ch02.pdf

⁴ Idem.

Climate Benefits of Methane Reduction

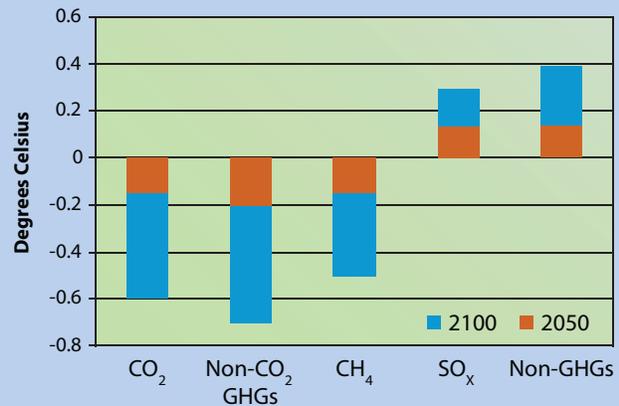
Reducing methane emissions can achieve significant near-term climate benefits. Studies indicate that a 50-percent reduction in methane and other non-CO₂ GHG emissions from a business-as-usual scenario can help reduce global temperature by 0.55°C over the next 50 years on the same scale as similar reductions in CO₂ emissions.⁵

In addition, methane contributes to the growing global background concentration of tropospheric ozone, another GHG and major air pollutant associated with premature mortality. Thus, reducing methane emissions decreases surface ozone everywhere, yielding additional climate benefits as well as improvements in local air quality.

Other co-benefits of methane recovery include availability of a local energy source (thereby strengthening energy security), improved water quality, and enhanced worker safety.

For more information, please visit the Methane to Markets Web site at: www.methanetomarkets.org.

Global Mean Temperature Effects of Emissions Reductions



it is estimated that by 2020 reductions of more than 1,800 MTCO₂E can be achieved with currently available technologies and management practices at a breakeven price of \$30/TCO₂E.⁶

Recognizing the important role of methane in global warming and the significant mitigation potential, 14 countries came together in 2004 to launch the Methane to Markets Partnership. The Partnership unites public and private interests to fight climate change by advancing the near-term recovery and use of methane as a clean energy source. By engaging partner governments, private companies, nongovernmental organizations (NGOs), researchers, and multilateral institutions, Methane to Markets brings together the technical and market expertise, financing, and technology necessary for methane capture and use project development around the world. Together,

Methane to Markets Partners are accelerating the deployment of methane emission-reducing technologies and practices around the world, stimulating economic growth and energy security in developing countries, and leading the fight against global warming.

Key Highlights

The Methane to Markets Partnership has grown tremendously in size, scope, and influence in its first 5 years. As a result, Methane to Markets is on its way to achieving methane emission reductions of 180 MMTCO₂E by 2015. Since 2004, the Partnership has:

- Expanded from 14 to 31 Partner countries, including the European Commission. Together, these Partners represent more than 60 percent of the world's estimated anthropogenic methane emissions.

⁵ Reilly et al. Multi-Gas Contributors to Global Climate Change: Climate Impacts and Mitigation Costs of Non-CO₂ Gases. Pew Center on Global Climate Change and Massachusetts Institute of Technology Joint Program on the Science and Policy of Global Change, 2003.

⁶ Methane mitigation potential was recently assessed by the ASG in "Global Methane Emissions and Mitigation Opportunities." Data was obtained from U.S. EPA's *Global Anthropogenic Emissions of Non-CO₂ Greenhouse Gases: 1990-2020* (EPA Report 430-R-06-003), www.epa.gov/climatechange/economics/international.html.



- Recruited more than 900 Project Network members from around the world, including some of the most well-respected financial institutions, consultants, manufacturers, project developers, and NGOs in the industry.
- Supported the development of more than 170 methane emission reduction projects in Methane to Markets Partner countries around the world. These projects are already delivering reductions of approximately 27 MMTCO₂E per year—and, when fully implemented, will yield more than 63 MMTCO₂E annually.
- Garnered financial support of \$84.3 million USD from Partner countries and leveraged \$359.7 million USD from private companies and financial institutions.
- Held more than 80 events and workshops in 23 countries, bringing together methane professionals from a broad range of technical disciplines, countries, and sectors. The Partnership has also provided training on methane-reducing technologies and practices for thousands of people. Last year alone, for example, more than 2,700 people attended Partnership events and trainings.
- Developed a wide array of tools and services that provide accurate and targeted information to the international methane community, helping to catalyze project development.
- Organized the first Partnership Expo in Beijing, China, in 2007. The Expo brought together more than 700 members of the international methane community and showcased more than 90 potential methane capture and use projects from around the world (see page 28). Because of the event's success, the Partnership is planning a second Partnership Expo to be held in India in March 2010.

These important accomplishments are the product of significant efforts over the past 5 years undertaken by developed and developing Partner governments along with organizations across the Project Network. In the sections that follow, this report will help outline what makes the Methane to Markets Partnership work, introduce the Partner governments, highlight some of the key accomplishments in the target sectors, and provide some insight as to where the Partnership is headed in the future.

The Methane to Markets Partnership, in conjunction with the Government of India and the Federation of Indian Chambers of Commerce and Industry (FICCI), will host a Partnership Expo at the Taj Palace Hotel in New Delhi, India on March 2-5, 2010. The Expo will feature a comprehensive technical and policy program, trade show, and an International Methane Capture Marketplace!

The Methane to Markets Partnership Expo is the premier international forum for promoting methane recovery and use project opportunities and technologies. Please join us at this world class event!

**Additional details can be found online at:
www.methanetomarkets.org/expo**



Government of India



Overview of the Partnership

Goals and Benefits of Methane to Markets

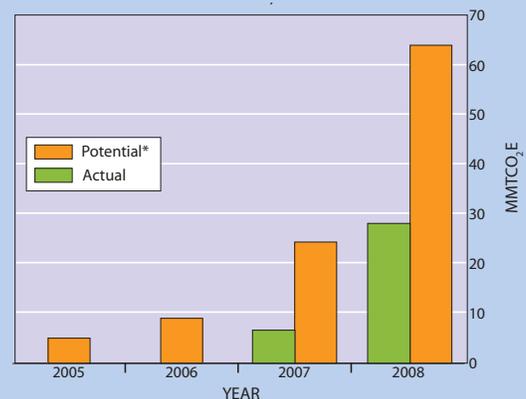
Methane is not only a potent and significant GHG but also the primary component of natural gas and a source of clean energy. Large mitigation opportunities are available around the world at low cost, but informational, institutional, market, and other barriers impede the development of methane emission reduction projects. Methane to Markets is an international public-private partnership, the goal of which is to address these barriers to reduce global methane emissions, enhance economic growth, promote energy security, and improve the environment. Other benefits include improving industrial worker safety, developing new clean energy sources, and improving local air and water quality.

Methane to Markets-supported projects are estimated to deliver annual emission reductions of more than 63 MMCTO₂E.

The Partnership is breaking down the barriers to methane reduction project development by disseminating information, building technical and institutional capacity, and raising awareness of project potentials among policymakers and financing organizations around the world. These efforts are already yielding significant results. For example, more than 170 Methane to Markets-supported projects could deliver estimated annual emission reductions of more than 63 MMCTO₂E when fully implemented (see Figure 2), and are already reducing emissions by more than 27 MMCTO₂E per year.

Figure 2

Annual Reduction of Methane Emissions from Partnership Supported Projects, 2005–2008



*Potential emission reductions include actual reductions from Partnership-supported projects now online.

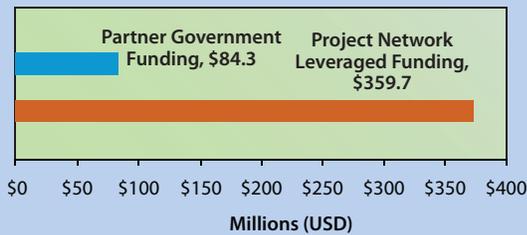
Using a highly successful public-private partnership model, Methane to Markets has been very effective at leveraging funds from Partner Country governments and the Project Network (see Figure 3). The majority of government funding has been used to develop a strong foundation for project development that has enabled large investments by multilateral institutions and the private sector. For example, a \$700,000 USD Partner government grant was awarded to the Thai Ministry of Agriculture to reduce methane emissions from swine farms. This grant is leveraging \$7 million USD from the World Bank (a Project Network member) to deploy large-scale anaerobic digesters throughout Thailand.

Leveraging the efforts of Partner countries—along with the expertise and investment of the Project Network—is critical to advancing



Figure 3

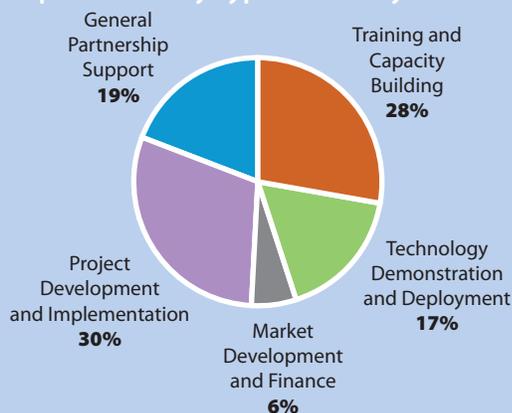
Government and Leveraged Funding for Partnership Activities



project development. These resources support various activities such as: conducting pre-feasibility and feasibility studies at potential project sites; addressing market, institutional, and other barriers to project development; and building capacity through technology transfer and training (see Figure 4).

Figure 4

Methane to Markets Partner Government Expenditures by Type of Activity



As a result of these efforts, the Partnership expects to achieve significant economic, environmental, and energy benefits. Assuming the Partnership's continued growth, Methane to Markets is on track to deliver estimated annual methane emission reductions of more than 180 MMTCO₂E by 2015, or the equivalent of:

- More than 760 billion cubic feet of natural gas.
- CO₂ emissions from nearly 420 million barrels of oil consumed.
- Annual emissions from 76 500-megawatt (MW) coal-fired power plants.

If achieved, these reductions could lead to stabilized or even declining levels of global atmospheric concentrations of methane.

History of Methane to Markets

The Partnership was launched in November 2004 at a Ministerial Meeting in Washington, D.C., when 14 national governments signed on as Partners. The new Partners made formal declarations to minimize methane emissions from key sources, stressing the importance of implementing methane capture and use projects in developing countries and countries with economies in transition. Initially, the Partnership focused on developing projects in three major areas—coal mines, landfills, and oil and gas systems—which made up more than a third of all global anthropogenic methane emission sources. In each of these sectors, cost-effective methane mitigation technologies and practices were currently available to capture and use the methane gas as a fuel for electricity generation, onsite energy needs, or offsite gas sales.

The Partnership has hosted more than 80 events and workshops in 23 countries.

Over the last 5 years, the Partnership has grown tremendously in both size and influence. The number of Partners has grown to 31, including the European Commission, and accounts for more than 60 percent of total global anthropogenic methane emissions. In addition, the Partnership added agricultural methane emissions from manure management operations as a sector in 2005. The Partnership has hosted more



than 80 events and workshops in 23 countries, trained thousands of people, and produced a suite of tools and resources to advance project development around the world.

A timeline of Partnership milestones can be found in Appendix A.

Organizational Structure

Methane to Markets brings together industry, NGOs, national governments, and other stakeholders to advance project development around the world. The Partnership is structured around the Steering Committee, the Administrative Support Group (ASG), four technical subcommittees, and the Project Network (see Figure 5). Together, these arms of the Partnership are working to overcome the sector-specific barriers impeding methane emission reductions project development (for more information on barriers, see pages 13-27).

The Steering Committee guides the work of the Partnership and is supported by the ASG, or secretariat, which is currently housed at the U.S. Environmental Protection Agency (U.S. EPA). The subcommittees—Agriculture, Coal Mines, Landfills, and Oil and Gas Systems—are responsible for guidance and assessment of sector-specific activities and engaging representatives of both Partner governments and the Project Network. Each subcommittee has also developed an action plan for coordinating and implementing these activities. The Project Network is an engaged community of industry, nonprofit organizations, financial institutions, and other expert stakeholders who actively participate in Methane to Markets meetings and activities as a means of building capacity, transferring technology, and promoting private investment.

Figure 5

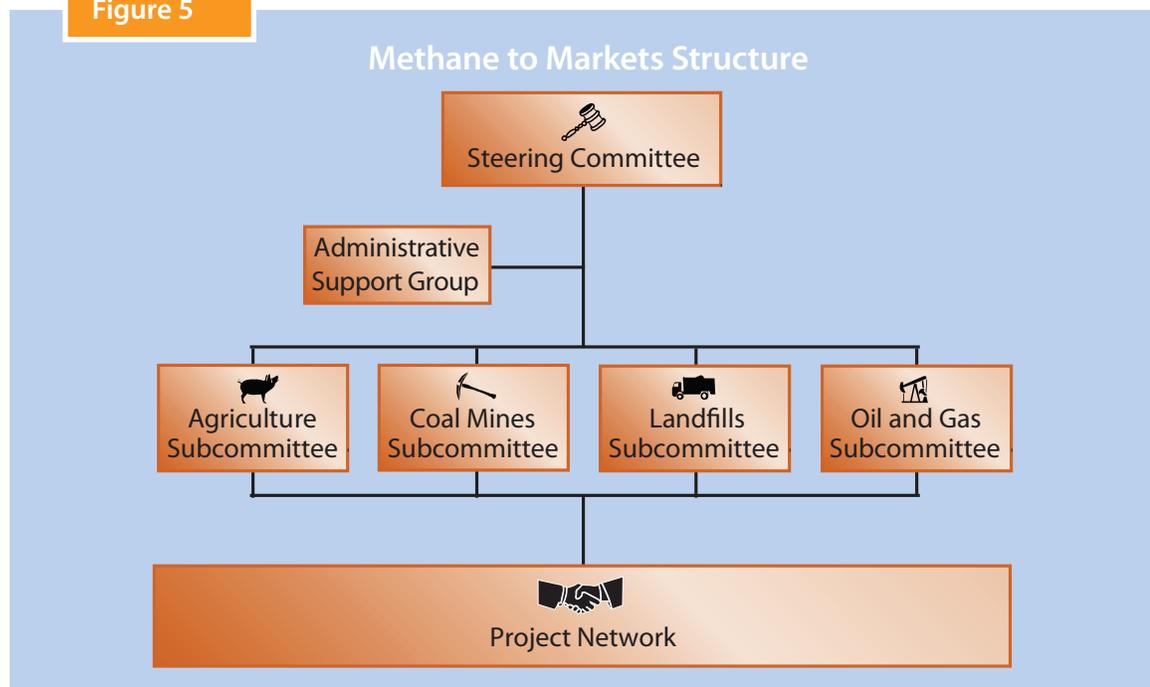




Figure 6



Introduction to Partners

Methane to Markets achieves its goals principally through commitment and action on the part of its Partners. The Partnership is a collaboration between developed countries, developing countries, and countries with economies in transition—together with strong participation from the private sector. Currently, 30 countries

and the European Commission (see Figure 6) have signed the Terms of Reference. A brief introduction to the Partners' activities in support of the Partnership can be found in Appendix B. Partners account for more than 60 percent of the global anthropogenic methane emissions from the four targeted sources, and nearly 65 percent of total global anthropogenic methane emissions.⁷

⁷ U.S. EPA, 2006a. This report is also the source for all Partners' global methane emissions rankings and percent total methane emissions from the targeted sectors.



International Energy Agency Publishes Methane Mitigation Papers

The International Energy Agency (IEA), a Methane to Markets Project Network member, is an intergovernmental organization that acts as energy policy advisor for governments and industry. Current work focuses on climate change policies, market reform, and energy technology collaboration. To support these efforts, IEA offers a broad program of energy research, data compilation, publications, and public dissemination of the latest energy policy analysis and recommendations on good practices.

In 2009, IEA released three reports outlining the importance of Methane to Markets' activities:



“Turning a Liability into an Asset: the Importance of Policy in Fostering Landfill Gas Use Worldwide.” This report identifies and examines global policies, measures, and incentives that appear to be stimulating LFG use. The report pulls from IEA’s Renewable Energy and Energy Efficiency Global Databases to identify and discuss policies.
www.iea.org/textbase/papers/2009/landfill.pdf



“Coal Mine Methane in China: A Budding Asset with Potential to Bloom.” This report identifies and examines policies, technologies, and practices in China for CMM recovery. The report also identifies a number of barriers to CMM recovery and utilization in China, including a lack of information and expertise at the local level about CMM power generation and ineffective subsidies for CMM electricity generation.
www.iea.org/textbase/papers/2009/china_cmm_report.pdf



“Methane Recovery and Use: The Importance of Policy.” This report highlights policies that have been used to advance methane projects in the oil and gas, landfill, coal mining, and agricultural sectors. The report also highlights the performance of methane recovery projects in the United Nations Framework Convention on Climate Change (UNFCCC) Clean Development Mechanism (CDM) and makes recommendations for greater international collaboration.⁸
www.iea.org/textbase/papers/2009/methane_brochure.pdf

Project Network

The Project Network plays a vital role in the financing, development, technology deployment, and operation of methane capture and use projects. The Methane to Markets Partnership established the Project Network to ensure that national governments pursuing methane emission reductions would be able to leverage the project development knowledge, experience, and resources of these critical stakeholders around the world.

More than 900 organizations participate in the Project Network.

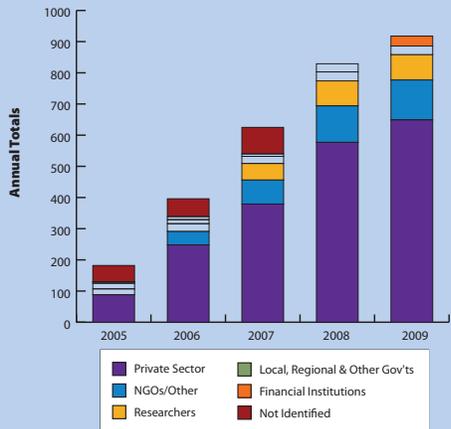
Today, more than 900 organizations participate in the Project Network from countries in Africa, Asia, Australia, Europe, North America, and South America. These diverse organizations (see Figure 7) identify and implement cost-effective methane recovery and use projects globally; address the informational, technical, and institutional barriers to project development; and contribute to capacity-building and technology transfer activities. At the same time, these organizations can increase profits, expand their businesses, distinguish themselves in the marketplace, and more successfully achieve their strategic goals—all while helping to address the critical issue of climate change.

⁸ The CDM is an arrangement under the Kyoto Protocol through which industrialized countries can invest in emission-reduction projects in developing countries as an alternative to more costly projects in their own countries.



Figure 7

Project Network Distribution and Annual Totals



Active participation by the Project Network is critical to the success of the Partnership, and facilitating Project Network member involvement is a top priority. Methane to Markets invites and encourages Project Network members to participate in as many of the Partnership-sponsored meetings, events, and activities as possible. Project Network members typically represent approximately 20 percent of the total participants at subcommittee meetings and sector-specific workshops worldwide.

Project Network member information, searchable by geographic area of interest and description of services, is available on the Methane to Markets Web site: www.methanetomarkets.org/project-network/pnmSearch.aspx.

Sector Overview and Key Accomplishments

Methane recovery and use project development faces a number of barriers such as lack of country-specific information, insufficient identification of suitable candidate sites/facilities, and lack of appropriate technology and technical knowledge (see Table 1).

The Methane to Markets subcommittees—Agriculture, Coal Mines, Landfills, and Oil and Gas—work to address these barriers by creating action plans to guide the implementation of subcommittee activities and projects. These action plans include:

- Overview of methane recovery and use opportunities.
- Descriptions of technologies and best practices.
- Key barriers/issues to project development.
- Possible cooperative activities to dismantle barriers to methane recovery and use.
- Discussion of country-specific needs, opportunities, and barriers.
- Strategies to engage Project Network members.

Table 1

Targeted Barriers to Project Development for Methane to Markets Subcommittees				
Targeted Barrier ⁹	Agriculture	Coal Mines	Landfills	Oil and Gas
Lack of financing and/or understanding of how to apply for funding or investment from multilateral organizations or other financial institutions	X	X	X	X
Insufficient in-country knowledge and/or experience developing methane recovery and use projects (i.e., national capacity)	X		X	
Lack of understanding about the legal, regulatory, economic, and policy frameworks in various countries (e.g., gas ownership rights, taxes, or incentives)	X	X		X
Lack of country-specific information on the current status of methane recovery and use activities (e.g., market assessments) as well as needs, opportunities, and priorities (e.g., sector profiles)	X	X	X	X
Insufficient identification of suitable candidate sites/facilities for potential methane recovery and use project assessment and development	X		X	
Lack of available/appropriate technology (e.g., best practices) and/or technical knowledge/expertise	X	X	X	X
Lack of demonstrated technical or economic feasibility of technologies and/or projects (e.g., feasibility studies, demonstration projects)		X	X	
Difficulty accessing existing documents, tools, and other resources characterizing methane recovery and use			X	

⁹ While additional barriers across all sectors might exist, these barriers were self-selected and prioritized by the subcommittees' members.



Many of the barriers—financing, policy/regulatory, and technical—are cross-cutting over many sectors, and the subcommittees work with Partners and Project Network members to facilitate discussions and propose solutions to help overcome these challenges. These activities are highlighted under “Accomplishments” for each subcommittee (starting on page 13).

In addition to addressing barriers, the subcommittees are committed to working collaboratively on action plan activities that help to develop and disseminate information about methane emission reduction opportunities. The subcommittees conduct these activities in a way that promotes cooperation among Partners, Project Network members, and other interested stakeholders. The subcommittees also continue to work to understand the needs and priorities of Partner countries.

The subcommittees regularly engage in meetings, workshops, and training seminars. To date, more than 80 Steering Committee, subcommittee, and/or task force meetings and sector-specific workshops or trainings have been held worldwide.¹⁰ Table 2 shows the distribution of events by sector and geographic region.

In addition to meetings and workshops, the subcommittees pursue ongoing information collection, outreach, and coordination tasks. Activities across all sectors include:

- **Country-Specific Strategy Development.** In response to the Steering Committee’s request for more directed, country-specific

plans in each sector, the subcommittees have recently undertaken the development of individual country strategies to promote in-country methane recovery and use. A secondary—but equally important—audience for these strategic plans is project developers, who might review the plans to determine where to focus development efforts. To encourage Methane to Markets Partners to develop these strategies, the subcommittees identified current methane-related activities in Partner countries and country-specific barriers to project development, and recommended and prioritized further activities to overcome barriers and promote projects. A significant point of discussion during recent subcommittee meetings has been how to expand and improve these strategies for each country.

- **Methane to Markets Sector Web Pages.** The subcommittees also maintain critical resources for all project-related information on the Methane to Markets Web site. Included are fact sheets (with translations available in Chinese, Italian, Russian, and Spanish), project opportunities in Methane to Markets countries (see text box on page 12), as well as case studies, analyses, and reports. The subcommittees also maintain lists of project ideas and ongoing projects and activities in each sector as a reference for developers, regulatory agencies, and other entities. Guidance documents for the development of country-specific strategies are posted to

Table 2

Distribution of Partnership Events by Sector and Geographic Region

Geographic Region	Agriculture	Coal Mines	Landfills	Oil and Gas	Steering Committee
Asia/Australia/Africa ¹¹	✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓✓✓	✓✓✓	✓
Europe	✓✓	✓✓✓✓✓	✓✓✓✓✓✓✓✓	✓✓✓✓✓✓	✓
North America	✓✓✓✓	✓✓✓	✓✓✓✓	✓✓✓✓✓✓	✓✓✓
South America	✓✓✓	✓	✓✓✓✓✓✓✓	✓✓✓✓	✓

¹⁰ During the first year of the Partnership, animal manure management issues were addressed by the Agriculture Task Force, which became a subcommittee in 2005.

¹¹ A joint meeting was held for coal mines, landfills, and oil and gas in India.



Overview of Online Tracking System

The project tracking database on the Methane to Markets Web site allows users to submit information for ongoing or proposed methane capture and use projects. For each project submitted, the database contains information such as a project description, anticipated benefits and outcomes, estimated annual GHG emission reductions, and primary contacts. The database is intended to connect a variety of stakeholders and to help promote the development of new projects. It currently contains information on more than 170 projects.

The screenshot shows the 'Projects' page on the Methane to Markets website. At the top, there is a navigation bar with links for 'Contact Us', 'About the Partnership', and 'About Methane'. Below this is a main navigation menu with options like 'How to Participate', 'Partner Countries', 'Project Network', 'Projects', 'Tools & Resources', and 'News & Events'. The 'Projects' section is highlighted. On the left, there is a 'Submit a Project' button and information about '2010 New Delhi Expo Projects' and '2007 Beijing Expo Projects'. The main content area features a 'Success Story' titled 'China's Sihe Mine: Proving the Power of Coal Mine Methane Projects'. Below this is a filter section with dropdown menus for 'Sector', 'Geographic Focus', 'Project Stage', and 'Select Expo Type', followed by a 'GO' button. At the bottom, there is a table listing projects with columns for 'Last Update Date', 'Project Name', 'Sector', 'Geographic Focus', and 'Project Stage'.

Last Update Date	Project Name	Sector	Geographic Focus	Project Stage
26/11/2007	2006 EPA M2M Grant: Small Scale Direct Utilization of Landfill Gas to Fulfill On-Site Energy Needs	Landfills	Argentina	Ongoing
14/08/2007	Salta Methane Recovery - Partner with Clean Air (20 year project lifetime)	Landfills	Argentina	Ongoing
26/11/2007	Jilin City Landfill Methane Assessment Report and Capacity Building	Landfills	China	Ongoing

assist Partner countries in crafting country action plans that are analogous in content and format.

- Methane to Markets Partnership Expos.** The subcommittees were instrumental in planning concurrent technical tracks for the first Partnership Expo held in Beijing, China (see page 28) and also played a key role in identifying potential methane capture and use opportunities to feature in the Expo's Project Showcase. Once again, the subcommittees are actively involved in planning for

the 2010 India Expo. The subcommittees will be responsible for providing updates on the project opportunities exhibited at the 2007 Expo, identifying new project opportunities to be showcased in 2010, and planning the sector-specific technical agenda for the upcoming Expo.

The following sections provided an overview of the sector-specific activities and accomplishments for each of the Methane to Markets technical subcommittees.



Agriculture

Methane to Markets' agriculture activities focus on methane emissions from livestock and food processing wastes, which currently account for 4 percent of the estimated global anthropogenic methane emissions. In 2005, the global total amount of methane from livestock manure was estimated to be slightly more than 230 MMTCO₂E.¹² The methane produced and emitted during the anaerobic decomposition of manure can be reduced, captured, and used as clean energy with the implementation of anaerobic digestion (AD) technology. There is much potential for methane recovery; in 2020, more than 10 percent of methane emissions will be profitable to recover with no price on carbon, and about 30 percent will be profitable to recover with a carbon price of just \$30/TCO₂E.¹³

In 2005, global methane emissions from livestock manure were estimated to be slightly more than 230 MMTCO₂E.

Accomplishments

The members of the Agriculture Subcommittee have been working to reduce the barriers to AD project development in their respective countries. They have organized numerous meetings and workshops to raise awareness about AD technologies and project financing; conducted resource assessments in order to characterize opportunities for AD deployment and identify potential project sites; supported the development of demonstration and full-scale AD projects; and employed other strategies to reduce the informational, institutional, and regulatory barriers to AD project development. Since its inception in 2005, the subcommittee has organized or hosted workshops or targeted meetings in Argentina, China, Colombia, India, Mexico, the Philippines, Republic of Korea, Thailand, the United Kingdom, and Vietnam. Highlights of the subcommittee's efforts include:

¹² U.S. EPA, 2006a.

¹³ U.S. EPA Global Mitigation of Non-CO₂ Greenhouse Gases (EPA Report 430-R-06-005), 2006b.



Agriculture Subcommittee Leadership



Jeremy Eppel, Department for Environment, Food and Rural Affairs, United Kingdom—Co-Chair



Jorge Hilbert, Instituto Nacional de Tecnología Agropecuaria, Argentina—Co-Chair

Agriculture Subcommittee Membership (22 Partners)

Argentina	Italy
Australia	Japan
Brazil	Mexico
Canada	Mongolia
Chile	Nigeria
China	Philippines
Colombia	Poland
Dominican Republic	Thailand
Ecuador	United Kingdom
Finland	United States
India	Vietnam

- Compiling country profiles and strategic plans for 13 Partner countries. The plans outline country-specific opportunities and challenges for AD deployment, including sector overviews, policy frameworks, financial incentives, and institutional and informational barriers. These plans can be found on the Methane to Markets Web site at: www.methanetomarkets.org/agriculture/index.aspx.
- Reviewing currently available AD systems and the types of waste that have the most energy production potential in order to provide clarity and support to farmers and developers around the world who are interested in AD projects.
- Evaluating leakage rates from AD systems to determine if an improved leakage rate could be developed for use in the CDM methodology. Greater certainty about gas production and flow increases the attractiveness of AD projects for carbon financiers.



Key Projects

- **Partnership With the World Bank to Improve Livestock Waste Management in Southeast Asia.** The World Bank (a Project Network member) has been supporting livestock waste management projects in Southeast Asia since 2004. The World Bank has provided \$21 million USD to develop affordable pollution control methods for livestock waste management in China, Thailand, and Vietnam, while Methane to Markets has provided technical assistance necessary to implement these projects. To date, 10 methane recovery projects are under construction, with approximately 20 more projects in planning stages.
- **Methane Reduction from Swine Farms in Thailand.** In 2008, Thailand began working with Methane to Markets to reduce methane from swine farms in three provinces located near Bangkok. With support from the World Bank's Global Environmental Facility (GEF), Methane to Markets, and Thailand's Department of Livestock Development and Energy Policy and Planning Office, 12 swine farms, raising nearly 200,000 pigs, are transitioning from open lagoons to biogas systems, which will generate electric power. Project engineers are expecting the project to reduce annual methane emissions by more than 90,000 MTCO₂E.
- **Expansion of Demonstration Programs in Mexico.** While much animal waste from large agricultural operations is managed in lagoons or storage units, or discharged directly into surface waters, projects to recover methane are emerging in Mexico. Over the past two years, SEMARNAT (Mexico's Environmental Protection Agency), has worked to develop a series of commercial-scale demonstration farms at various swine farms to raise awareness and technical capability within Mexico. As a result of these demonstrations, Methane to Markets is assisting SEMARNAT in implementing the next phase to advance the capability of the Mexican AD industry, including the development of national AD

technical standards, energy and environmental performance verification methodologies for Mexican AD systems, and an AD technology supplier certification program.

- **Transformation of Livestock, Distillery, and Winery Wastes in India.** India has initiated a program that includes a market assessment of AD opportunities, identification of commercially proven and affordable technologies, targeted technical demonstration, education and extension, and policies that promote the adoption of appropriate AD technologies. This process is being guided by the recent development of an India Agricultural Program Steering Committee, consisting of government, the private sector, and the research community. The purpose of this group is to develop a targeted implementation strategy to expand the use of methane to energy. The Energy and Resources Institute (TERI) in India organized a 2-day regional workshop in March 2009, which focused on the methane capture and use opportunities in the livestock and food processing industry sector, and convened the first India Agricultural Program Steering Committee meeting. In addition, Indian authorities are working with other Methane to Markets Partners to expand the program from the dairy sector to the distillery and winery sectors.



Floating dome anaerobic digestion of animal wastes in India.

- **Anaerobic Digesters in Rural China.** In China, the Ministry of Agriculture is working on a number of initiatives to expand



improved village-scale digesters and technical training in rural areas. A market assessment of methane recovery and use opportunities in the livestock and agro-industrial waste sector is also underway in southern China, with an expected demonstration component to follow. Similar efforts are also scheduled for other Partner Countries, including Vietnam, Philippines, Thailand, and the Republic of Korea.

- **Italian Cooperation for Biogas Recovery Plants in China.** A project aimed at assessing technical and economical feasibility of anaerobic digestion of animal manure for biogas production has been developed in China, with the support of the Italian Ministry for the Environment, Land and Sea. A feasibility study of an anaerobic digestion plant for cow manure and joint electric power production from the collected biogas was carried out at the Pinjipu Cattle Farm in the Ningxia province, including the assessment of potential emission reductions in order to submit the project as a CDM activity.
- **Animal Waste-to-Energy in Mongolia.** To help mitigate methane emissions, Mongolia is exploring options to install a “complete mix” AD system at the Makh Impex slaughterhouse and meat processing company. Methane to Markets supported a feasibility study, initiated in February 2009, to assess technical and financial requirements (e.g., mix, digester, and effluent tanks; gas collection equipment) for a facility capable of handling waste generated by approximately 30,000 animals. If the assessment demonstrates feasibility, the project would be funded with a combination of debt from Mongolian banks plus equity from project sponsors, including the National Association of Mongolian Agricultural Cooperatives, Makh Impex, and McKeown Development Co. Ltd.
- **Australia’s Research and Monitoring Efforts.** The Australian Methane to Markets Agriculture Program, established in 2007, aims to reduce GHG emissions from

Australia’s intensive livestock industry by mitigating emissions from manure management and livestock waste, replacing fossil fuels with renewable energy, and displacing synthetic fertilizer with recycled nutrients. Research topics include methane capture and use developments applicable to intensive livestock industries, assessment of Australian biogas flaring standards, and viability of producing and capturing methane from manure for conversion into energy. Other program activities include: characterizing methane potential and modeling AD of livestock wastes, monitoring biogas production from covered lagoons, validating manure production prediction models, and quantifying feedlot manure output data.

- **Expo Projects.** The agriculture sector featured 22 project opportunities from five countries at the 2007 Partnership Expo in Beijing, which could yield more than 106,000 MTCO₂E in estimated average annual GHG emission reductions, if fully implemented. The agriculture projects featured at the 2007 Expo can be viewed at: www.methanetomarkets.org/projects/index.aspx?expo=beijing.

Next Steps

The Agriculture Subcommittee will continue to promote AD development through the following activities:

- **Developing an International AD Protocol.** An international panel of experts, led by the Agriculture Subcommittee, has developed a protocol for evaluating the environmental performance of AD and providing a standardized method for comparison of AD technologies.
- **Considering Enteric Fermentation and Rice Cultivation.** The Agriculture Subcommittee and the ASG are considering options for inclusion of enteric fermentation and rice cultivation into the scope of the Partnership. These are the largest sources of agricultural methane emissions, but they do not offer energy generation opportunities.



Coal Mines

Methane gas that is trapped in coal seams and released during coal mining can be captured and used as a clean energy source, resulting in reduced GHG emissions, improved air quality, and enhanced mine worker safety. In 2005, global methane emissions from coal mines were estimated to be nearly 400 MMTCO₂E.¹⁴ The Coal Subcommittee works with Partners and Project Network members through Methane to Markets to share information, expertise, and technology to promote coal mine methane (CMM) project development. There is much potential for methane recovery; in 2020, about 15 percent of methane emissions will be profitable to recover with no price on carbon, and 80 percent will be profitable to recover with a carbon price of just \$30/TCO₂E.¹⁵

In 2005, global methane emissions from coal mines were estimated to be nearly 400 MMTCO₂E.

Accomplishments

The Coal Subcommittee has been working to reduce the barriers to CMM project development by engaging in capacity-building workshops, training, and study tours; conducting or supporting feasibility studies, assessments, and technology demonstrations; and developing informational tools and resources. Since the beginning of the Partnership, the subcommittee has organized or hosted workshops or targeted meetings in Argentina, Australia, China, India, Italy, Mexico, Mongolia, Poland, Russia, Switzerland, Ukraine, and the United States. Highlights of the subcommittee’s efforts include:

- **Country-Specific Strategic Plans.** To help identify Partners’ needs, opportunities, and priorities, country-specific strategic plans have been completed for seven Partners. These plans focus on activities to overcome

¹⁴ U.S. EPA, 2006a.

¹⁵ U.S. EPA, 2006b.

Coal Subcommittee Leadership

Current:

 A.K. Singh, Central Mine Planning and Design Institute Limited, India—Co-Chair

 Pamela Franklin, U.S. EPA Coalbed Methane Outreach Program—Co-Chair

 Huang Shengchu, China Coal Information Institute—Vice Chair

Previous:

 Subrata Chaudhuri, Central Mine Planning and Design Institute Limited, India—Co-Chair (2005–2007)

 Clark Talkington, U.S. EPA Coalbed Methane Outreach Program—Co-Chair (2004–2005)

Coal Subcommittee Membership (21 Partners)

Argentina	Mexico
Australia	Mongolia
Brazil	Nigeria
China	Pakistan
Colombia	Poland
European Commission	Republic of Korea
Germany	Russia
India	Ukraine
Italy	United Kingdom
Japan	United States
Kazakhstan	

the technical, financial, and regulatory barriers to CMM project development. These plans can be found on the Methane to Markets Web site at: www.methanetomarkets.org/coal-mines/index.aspx.

- **International CMM Projects Database.** To provide an overview of methane recovery and use opportunities, the subcommittee developed a Web-based database

containing information on more than 220 CMM recovery and utilization projects currently operating, in development, or planned around the world. Users can search on seven categories, update existing or add new project information, and export results to an Excel spreadsheet. The International CMM Projects Database can be found online at: www2.ergweb.com/cmm/index.aspx.

- **CMM Global Overview.** The subcommittee assembled a Global Overview that contains comprehensive country profiles summarizing the coal and CMM sectors of 32 coal-producing nations around the world. The overview, which includes summary tables and statistics, is updated periodically and is housed on the Methane to Markets Web site at: www.methanetomarkets.org/tools-resources/coal_overview.aspx.
- **Coal Mine Technology Database.** The Coal Mine Technology Database was developed by Australia's Department of Tourism, Industry, and Resources, on behalf of the Methane to Markets Partnership, in order to outline technological options for CMM project development. It includes basic information and case studies on several key types of technologies that are applicable to CMM recovery and utilization, and can be found on the Methane to Markets Web site at: www.methanetomarkets.org/documents/partners_australia_cmm_tech_database.pdf.
- **Technological and Economic Feasibility of CMM Projects.** The subcommittee members have also been responsible for numerous activities that help address the lack of demonstrated feasibility and technical knowledge, which might ultimately lead to commercial or operations projects. These activities include 10 full-scale feasibility studies at sites in China, India, Poland, and Ukraine, and pre-feasibility studies at coal mines in China and Nigeria.

- **Project Financing Possibilities.** Important project stakeholders are often unaware of the economic benefits and opportunities of CMM capture and utilization projects. Project finance and capacity-building training have taken place in China, Kazakhstan, Poland, Russia, and Ukraine to raise awareness of financing opportunities and project economics.

Key Projects

- **Jincheng Sihe Power Plant Project in China.** This project is the world's largest CMM power generation project, with a total installed capacity of 120 MW. Funding for the \$247-million USD project came from a number of sources, including the World Bank and Asian Development Bank (both Project Network members) and the Japan Bank for International Cooperation. The U.S. Trade and Development Agency (USTDA) also provided funding for the end-use design specification. Several Project Network members were also involved in the project, ranging from design (SCS Engineers) to end-use (Caterpillar provided 60 modular gas internal combustion engines). The project is currently reducing methane emissions by approximately 3 MMTCO₂E annually.
- **Huainan Mining Group Power Generation Project in China.** This methane recovery



Pumping station at a coal mine under study in China.



project at Pansan Mine in Anhui, China, became operational in 2005. Four 1.2-MW domestic gas engines were installed and began operating in August 2005, and two 1.8-MW Caterpillar gas engines came online in October 2007. Annual GHG emissions avoided per year are estimated to be approximately 67,000 MTCO₂E. The project was developed with support from the China Coal Information Institute, which houses the China Coalbed Methane Clearinghouse (www.coalinfo.net.cn/coalbed/coalbed.htm).

- **Ventilation Air Methane (VAM) Project in Australia.** The first commercial-scale demonstration of power generation from the dilute VAM at an active coal mine is operating at West Cliff Colliery in New South Wales, Australia. The project was commissioned in 2007 to generate 6 MW of electricity using thermal flow reverse reactor technology. The Australian government provided key funding and sponsorship for the project, and the technology was provided by Methane to Markets Project Network member MEGTEC Systems. The project is a prime example of collaborative technological innovation. Australia has three additional CMM power generation projects that could further reduce GHG emissions by 10 MMTCO₂E by 2012. Two projects use CMM from underground mining operations to generate onsite electricity. Gas collected at the Grasstree coal mine is delivered via pipeline to a power station, where it is distributed to combustion engines.
- **India CMM/CBM Clearinghouse.** Under Methane to Markets, a CMM/CBM information center, or clearinghouse, was launched in November 2008 in India, the world's third largest coal producer. The India CMM/CBM clearinghouse (www.cmmclearinghouse.cmpdi.co.in) receives financial support from Coal India Ltd, U.S. EPA, and USTDA, and it operates under the aegis of India's Ministry

of Coal. The clearinghouse is intended to promote CMM project development in India through technology transfer, data collection, and training. The opening ceremony was followed by a 2-day international workshop on development of CMM, CBM,



Degasification pumping station at a Ukrainian coal mine.

and VAM project opportunities in India.

- **Technical and Policy Capacity-Building in Ukraine.** The Ukrainian coal sector has benefitted from several capacity-building activities, which have focused on both technical and policy measures to improve the recovery and use of methane from the Donbass coal region. The U.S. Agency for International Development (USAID) funded a drilling and degasification program through which miners from local coal mines were trained on the use of horizontal coal seam drilling rigs, which allows better removal of CMM prior to mining. On the policy front, a series of workshops has been held, most recently a high-level roundtable in April of 2009, to raise awareness of CMM utilization and identify best policy and regulatory practices to create incentives and reduce barriers for CMM projects in Ukraine.
- **Pre-Feasibility Study in Mongolia.** Several activities designed to identify and

promote CMM recovery and use—including a pre-feasibility study of mine geology and assessment of methane resources—have recently been completed at the Nalaikh Coal Mine located near Ulaanbaatar, Mongolia. Additional efforts to remove policy barriers, develop capacity, and raise awareness of the socioenvironmental benefits of methane recovery and use were also undertaken. As a final step, a proposal on possible CMM recovery and use investment opportunities is being submitted to GEF.

- **VAM Mitigation Project in North America.** In April 2008, Project Network member Biothermica Technologies received authorization to implement a VAM oxidation project at Jim Walter Resources' Coal Mine #4 in the U.S. state of Alabama. Construction on this project—the first of its kind at an active underground coal mine in America—began in October 2008, and the VAMOX® system has been successfully oxidizing VAM since January 2009. Annual emission reductions are estimated at approximately 40,000 MTCO₂E.
- **Expo Projects.** The coal sector featured 20 potential projects from six countries at the 2007 Partnership Expo, which could yield nearly 6.7 MMTCO₂E in estimated average annual GHG emission reductions if fully implemented. The coal projects featured at the 2007 Expo can be viewed at: www.methanetomarkets.org/projects/index.aspx?expo=beijing.

Next Steps

The Coal Subcommittee will continue to promote CMM capture and use project implementation through the following activities:

- **Fostering On-the-Ground Project Development.** The members of the Coal Subcommittee will continue to focus on site-specific assessments and technology demonstrations that result in concrete emission reductions. These activities will be supported with capacity-building workshops and trainings in Partner Countries around the world.
- **Compiling a CMM Best Practices Guide.** With cooperation from the World Coal Institute and the United Nations Economic Commission for Europe (UNECE) Ad Hoc Group of Experts on CMM, a guidance document on CMM degasification “best practices” around the world is under development. This best practices guidance will provide a roadmap for CMM project developers and potential CMM project developers, as well as mines. The guide will be launched in conjunction with the 2010 Methane to Markets Partnership Expo. It will also be promoted through workshops and will be available on the Methane to Markets Web site.



Landfills

Landfills produce methane when organic matter in the landfill decays under anaerobic conditions. Landfill gas (LFG) is composed of about 50 percent methane, and, when captured, it can also be a source of clean energy. In 2005, global methane emissions from landfills were estimated to be nearly 750 MMTCO₂E.¹⁶ LFG can be used to generate electricity, used as a substitute for direct fossil fuel consumption, or refined and injected into the natural gas pipeline. Capturing and using LFG in these ways can yield substantial energy, economic, environmental, air quality, and public health benefits. There is much potential for methane recovery; in 2020, more than 10 percent of methane emissions will be profitable to recover with no price on carbon, and about 60 percent will be profitable to recover with a carbon price of just \$30/TCO₂E.¹⁷

In 2005, global methane emissions from landfills were estimated to be nearly 750 MMTCO₂E.

Accomplishments

The Landfill Subcommittee has been working to reduce the barriers to landfill gas energy project development, which include a lack of in-country technical expertise; insufficient identification of suitable candidate sites; a lack of demonstrated technical and economic feasibility of technologies and practices in local contexts; and other financial, informational, and institutional obstacles. The subcommittee has been involved in capacity-building workshops, training, and study tours; feasibility studies, assessments, and technology demonstrations; and the development of informational tools and resources. Overall, the subcommittee has held workshops or targeted meetings in Argentina, Brazil, China, Colombia, Ecuador, Germany, India, Italy, Kazakhstan, Mexico, Nigeria, Poland,

¹⁶ U.S. EPA, 2006a.
¹⁷ U.S. EPA, 2006b.

Landfill Subcommittee Leadership

- Current:**
-  Mario Lazzeri, D'Appolonia S.p.A., Italy—Co-Chair
 -  Gabriel Blanco, Ministry of Environment and Sustainable Development, Argentina—Co-Chair

- Previous:**
-  Roberto Urquizo, formerly with the Ministry of Environment, Ecuador—Vice-Chair (2006–2007)
 -  Dr. Atilio Savino, Ministry of Environment and Sustainable Development, Argentina—Co-Chair (2004–2007)

Landfill Subcommittee Membership (26 Partners)

Argentina	Japan
Australia	Kazakhstan
Brazil	Mexico
Bulgaria	Mongolia
Canada	Nigeria
Chile	Pakistan
China	Philippines
Colombia	Poland
Dominican Republic	Republic of Korea
Ecuador	Russia
Finland	Ukraine
India	United Kingdom
Italy	United States

Russia, Singapore, Ukraine, the United Kingdom, the United States, and Vietnam. Highlights of the subcommittee's efforts include:

- Country Profiles and Country-Specific Strategies.** To overcome the barrier of limited information on landfill and LFG management practices in each country, the subcommittee has collected and updated eight Partner country landfill profiles. These profiles contain an overview of the country solid waste and LFG sectors and outline the



country-specific opportunities and challenges to developing landfill methane recovery projects. These plans can be found on the Methane to Markets Web site at: www.methanetomarkets.org/landfills/index.aspx.

- **Country-Specific Landfill Gas Models.** Establishing reliable estimates of the amount of gas a landfill is expected to produce is an important element of the project development process. In order to improve those estimates in developing countries in which there are many potential project sites, the Landfill Subcommittee has assisted U.S. EPA in the development of country-specific landfill models for China, Ecuador, Mexico, and Central America. The models use country or regional level data to characterize climate, waste composition, and landfill operation, which all influence LFG generation. Additional models are being developed, with a Ukraine model expected to be completed in early 2010.
- **International Landfill Database.** The subcommittee launched the International Landfill Database, which stores information from more than 250 landfills around the world, to help address the need for country-specific information on landfills and LFG management. After unveiling the tool in October 2007, the subcommittee has focused on populating the tool with data. The database also includes information from CDM project design and project monitoring reports. When appropriate, the database links to existing information systems that may already be managed by a Partner Country.
- **Online Landfill Biogas Bibliography.** To help overcome the obstacle of difficult access to existing LFG documents, tools, and other resources, the subcommittee compiled and posted an online, searchable bibliography of landfill and LFG energy resources from around the world.

- **Preliminary Studies, Demonstrations, and Capacity-Building.** The Partnership has supported efforts for pre-feasibility studies and assessment reports in seven Partner Countries. Grant awards have also been made in 11 Partner Countries to develop landfill inventories, conduct pre-feasibility studies (some including pumping trials), and hold technology demonstrations. To help overcome insufficient in-country knowledge on developing LFG recovery and use projects, the Partnership has trained local landfill personnel in waste drilling, test well construction, and data gathering and basic landfill operations. The Partnership has also sponsored delegates from Mexico, Ecuador, and Colombia to visit a U.S. landfill to see an active gas collection system with energy recovery.

Key Projects

- **Gorai Landfill Project in India.** When the Gorai landfill in Mumbai began operating a flare in June 2009, it became the first landfill methane recovery project in India. USAID supported the preparation of a pre-feasibility study to assess the technical and economic viability of the project, which helps the project move into the development pipeline. Now the project has earned \$5.2 million USD for 26 carbon credits for captured gases, 70 percent of which are estimated to be methane. Landfill operators are now exploring gas utilization options, with the intention of moving to gas utilization in the near future.



Extraction well monitoring at the Uruli Devachi Landfill in Pune, India.



- **Olavarria Landfill in Argentina.** This landfill has an active flare-only project under CDM. The National University of the Central Province of Buenos Aires received a grant to demonstrate that landfill biogas can be beneficially used to fuel a pyrolysis furnace. The project will relocate a medical waste incinerator and autoclave to treat waste using 50 m³/hour of LFG. The medical waste incinerator will treat waste on site that was previously treated at four different medical facilities located in urban areas. Initially, the project will blend propane and LFG, but will operate fully on LFG once the gas collection system is expanded to incorporate a second cell scheduled to close at the end of 2009.



A landfill gas well in China.

- **Italian Cooperation for LFG Recovery in China.** With the support of the Italian Ministry for the Environment, Land and Sea, detailed studies evaluating the technical and financial feasibility of LFG recovery and use for energy production have been carried out in several Chinese provinces (Tianjin, Hebei, Hainan, Henan, Hunan, Heilongjiang, Ningxia, and Jiangsu). Gas recovery and power generation has been developed in some landfills, and final CDM project development agreement has been concluded for some projects.
- **Pre-Feasibility Studies in India.** Pre-feasibility studies were completed for evaluating LFG-to-energy (LFGE) potential at landfills in Pune, Ahmedabad, Mumbai, Hyderabad, and Delhi. These studies explored the economic viability of several project alternatives, including electricity generation, flare-only, and a pipeline to a nearby industry. All together, these sites have a combined emissions reduction potential of 300,000 MTCO₂E.
- **Infrared Heater Technology and Flare Installation in Ukraine.** Ukrainian landfills face operational challenges (e.g., lack of modern landfilling practices such as use of daily cover, proper compaction, and leachate and gas collection) that make large-scale LFGE projects difficult. The Renewable Energy Agency (REA), an NGO near Kiev, has embarked on a project that involves the relatively easy and inexpensive installation of an LFG-powered infrared heating system, which—if successful—could lead to additional similar projects across the country. Another REA project entails a feasibility study and subsequent collection system and flare installation at the Rivne Landfill. Annual emission reductions from both projects are expected to equal more than 14,000 MTCO₂E.
- **Pre-Feasibility/Evaluation Studies and Capacity-Building in Colombia.** In recent years, Colombia has undertaken several activities to advance LFG capture and use. Pre-feasibility and/or evaluation studies have been conducted at the Loma de Los Cocos, Dona Juana, El Navarro, El Tejar, La Pradera, and Villa Karina landfills, and there are studies underway at four more landfills. Additional Colombian efforts include several capacity-building workshops and site visits, as well as development of a landfill database in cooperation with the country's Superintendencia de Servicios Públicos.



- **LFG Extraction and Commercial Use in the Russian Federation.** An information center has been established in Russia to help identify clean energy technologies, particularly those that use alternative and renewable energy sources, with a focus on methane utilization. The objective of the Clean Energy Technology Information Center is to monitor the status and development of alternative energy sources, identify barriers (e.g., technical, economical, legal) hindering introduction and wide-scale deployment of clean energy technologies, and disseminate information to interested stakeholders.
- **Pre-Feasibility Studies in the Republic of Korea.** The Korean District Heating Corporation has conducted three pre-feasibility studies for evaluating LFG at Chuncheon, Gangneung, and Jinju landfills in the Republic of Korea. The studies recommended the installation of reciprocating engines ranging from 0.6 to 2 MW of electricity generating capacity at each of the three landfills. The studies also recommend that developers discuss green power premium pricing with the Korea Electric Power Company.
- **Expo Projects.** The landfill sector featured 47 potential projects from nine countries at the 2007 Partnership Expo, which could yield more than 4.6 MMTCO₂E in estimated average annual GHG emission reductions, if fully implemented. The landfill projects featured at the 2007 Expo can be viewed at: www.methanetomarkets.org/projects/index.aspx?expo=beijing.

Next Steps

The Landfill Subcommittee will continue to promote LFG capture and use through the following activities:

- **Collecting Data and Building Capacity.** In 2008, the Landfill Subcommittee Action Plan was reorganized to focus on two barriers: limited information and insufficient in-country knowledge. In the coming years, the subcommittee will continue addressing the sector's needs to collect data and build capacity for improved LFG extraction systems.
- **Expanding the International Landfill Database.** The subcommittee will collaborate with the International Solid Waste Association (ISWA) to collect data from ISWA member countries.



Oil and Gas

Methane emissions from oil and gas systems can be the result of normal operations, routine maintenance, and system disruptions. In 2005, global fugitive (leaked) and vented methane emissions from oil and gas systems were estimated at nearly 1,170 MMTCO₂E.¹⁸ There is much potential for methane recovery; in 2020, about 10 percent of methane emissions will be profitable to recover with no price on carbon, and 30 percent will be profitable to recover with a carbon price of just \$30/TCO₂E.¹⁹ In addition, reducing fugitive (leaked) and vented methane emissions can reduce product losses, enhance energy security, lower methane emissions, and increase revenues.

In 2005, global fugitive (leaked) and vented methane emissions from oil and gas systems were estimated at nearly 1,170 MMTCO₂E.

Accomplishments

The Oil and Gas Subcommittee has undertaken numerous activities to support the identification, reduction, and utilization of vented and fugitive methane emissions from oil and natural gas systems in Partner Countries. Through capacity-building workshops and trainings, measurement and feasibility studies, and the development of critical tools and resources, the subcommittee has worked to reduce the informational, institutional, and financial barriers to emission reduction technologies and practices. Overall, the subcommittee has organized or hosted workshops and targeted meetings in Argentina, Brazil, Canada, China, Colombia, Ecuador, India, Mexico, Poland, Russia, Ukraine, the United Kingdom, the United States, and Uruguay, as well as partnering with the World Bank Global Gas Flaring Reduction Initiative to host an on site flaring and venting reduction training

¹⁸ U.S. EPA, 2006a.

¹⁹ U.S. EPA, 2006b.



Oil and Gas Subcommittee Leadership

Current:



Michael Layer, Natural Resources Canada—Vice-Chair



Javier Bocanegra Reyes, Petróleos Mexicanos, Mexico—Co-Chair



Dr. Kaplan Basniev, Russian Academy of Natural Sciences—Co-Chair

Previous:



Carlos de la Parra, Mexico—Co-Chair (2004–2005)



Alexander Gritsenko, Russia—Co-Chair (2004–2005)

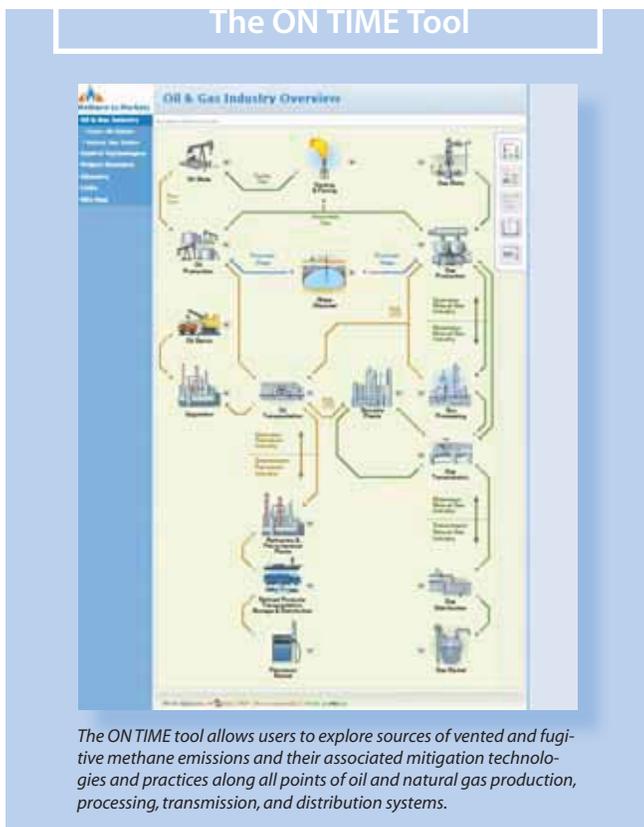
Oil and Gas Subcommittee Membership (21 Partners)

Argentina	Japan
Australia	Mexico
Brazil	Nigeria
Canada	Pakistan
Chile	Poland
Colombia	Republic of Korea
Ecuador	Russia
European Commission	Ukraine
Georgia	United Kingdom
India	United States
Italy	

workshop. Highlights of the subcommittee's efforts include:

- **Country Profiles and Country-Specific Strategies.** Seven Oil and Gas Partners have completed country profiles. These profiles characterize structure of the oil and natural gas sectors and outline key opportunities and challenges in reducing vented and fugitive emissions. These plans can be found on the Methane to Markets Web site at: www.methanetomarkets.org/oil-gas/index.aspx.

- Project Identification Tool Development.** The Oil and Gas Subcommittee recently launched ON TIME—an online tool that displays a series of interactive flow diagrams, showing fugitive and vented methane emission sources and respective reduction technologies and practices at each node of the oil and gas industry. The tool also contains links to related Web sites for more information on sector-specific methane emission reduction information. The government of Canada sponsored the initial development of this application, and U.S. EPA contributed time and resources to facilitate subsequent refinements and provides ongoing maintenance (see figure below).



- Natural Gas STAR International.** In 2006, in support of the Methane to Markets Partnership, U.S. EPA expanded its Natural Gas STAR Program to include international

operations, significantly increasing opportunities to reduce methane emissions from the oil and natural gas sector. The Partnership started with seven charter partners (ConocoPhillips, Canada Ltd, Devon Energy Corporation, Enbridge Inc., ExxonMobil Corporation, Marathon Oil Corporation, Occidental Oil and Gas Corporation, and TransCanada), who were soon joined by: the Oil and Natural Gas Company of India Ltd. (ONGC), a state-owned company; Comgas, a natural gas distribution company in São Paulo, Brazil; and Poland's GAZ-SYSTEM, a state-owned transmission entity. Gas STAR International partners work with U.S. EPA to identify, analyze, promote, and track methane emission reduction projects from their worldwide operations.

Key Projects

- Methane Emission Reduction Program and Equipment Upgrades in Mexico.** Since 2006, USAID and U.S. EPA have supported several projects with Petroleos Mexicanos (PEMEX), the Mexican national oil company. Activities focus on three areas: 1) identifying and developing methane emission reduction projects, 2) developing PEMEX capabilities to continue identifying and implementing these projects, and 3) developing detailed PEMEX-specific methane emission reduction project economic analyses. Work has included measurement campaigns in six different facilities (e.g., gas processing, compressor stations, pipelines) to quantify methane emissions and define emission reduction opportunities and to work closely with PEMEX plant staff by providing on-the-job training. These efforts have achieved emission savings of approximately 30,000 MT_{CO₂E} to date through directed inspection and maintenance and replacement of wet seals on compressors. PEMEX has additional compressor seal replacement projects underway, totaling approximately 70,000 MT-_{CO₂E}. PEMEX has identified approximately

400,000 MTCO₂E of additional savings in four facilities measured and analyzed in detail, and more cost-effective emission reductions are expected in 2009.



A PEMEX engineer takes a measurement of newly installed dry gas seals at facility in Mexico City, Mexico.

- **Outreach and Capacity-Building in India.**

India's ONGC has put forth significant effort to build a strong methane emission reduction program by raising awareness, providing training, and building internal capacity. In December 2007, ONGC, in cooperation with U.S. EPA, hosted a series of technology transfer workshops at four different ONGC operations to increase awareness of cost-effective emission reduction opportunities. As a follow-up to the workshops, ONGC collaborated with U.S. EPA to develop seven pre-feasibility studies, which led to onsite measurement studies at four locations. The measurement study sites were chosen based on expected methane emissions and potential mitigation opportunities and were representative of ONGC's varied operations. The measurement study results and methane recovery project recommendations (e.g., routing vents to vapor recovery units, performing directed inspection and maintenance) were presented to the ONGC Board of Directors in September 2008. It is estimated that these projects could save 381 million cubic feet of methane, equating to more than 154,000 MTCO₂E.

- **Multi-Pronged Approach in Ukraine.**

Reducing methane emissions in Ukraine's natural gas sector includes several areas of focus: expanding and documenting methane reductions in the Cherkasytransgaz gas transmission system in close collaboration with Cherkasytransgaz, replicating the success of Cherkasytransgaz in reducing methane leaks through training and other programs in conjunction with Ukrtransgaz affiliates in other regions, preparing pre-feasibility studies on methane monitoring and mitigation in the natural gas system, and developing national regulations and incentive programs to reduce methane emissions from the gas transmission system in coordination with the national government and Ukrtransgaz. Through its efforts, Cherkasytransgaz has reduced methane emissions by more than 1 million cubic meters and set a goal of reducing methane emissions by a total of 3.7 million cubic meters by 2010.

- **Opportunities in Oil Production and Natural Gas Facilities in China.**

Environment Canada and the United States have been working with the China National Petroleum Corporation (CNPC) to identify methane emission reduction opportunities at CNPC facilities and provide related training and technology transfer to CNPC experts. Measurement programs were conducted in 2007 and 2008 at selected crude oil production and gas processing and distribution facilities operated by CNPC subsidiaries to evaluate the feasibility of reducing GHG emissions through measures aimed at controlling methane emissions and improving energy efficiencies. Specific emission-control opportunities were identified, and preliminary cost-benefit analyses were performed to evaluate the cost-effectiveness of these opportunities. Over the long term, emphasis will shift toward CNPC establishing internal leadership and implementing a sustainable methane emission reduction program.

- Accelerating Project Development in Central and Eastern Europe.** In addition to activities in Ukraine, the Partnership is also actively engaging Poland and Russia to identify and implement emission reductions projects. The first Methane to Markets conference on methane mitigation in the natural gas and oil sectors was held with Russia's Gazprom and VNIIGAZ (Gazprom's research institute) in October 2008. This event involved training and information exchange for oil and gas personnel in the Gazprom system and in other companies. The conference also involved a 1-day site visit to a Russian compressor station to demonstrate several state-of-the-art methane leak detection and measurement technologies. To support project development in Poland, an analysis has been prepared for GAZ-SYSTEM on potential methodologies to aid in assessing system-wide methane emissions from gas transmission pipelines. Similar efforts to those with GAZ-SYSTEM are also underway with oil and gas companies in Argentina and Colombia.
- Emission Reduction in Italy.** Eni, an integrated energy company and Project Network member, has demonstrated its commitment to Methane to Markets by undertaking a Carbon Management Strategy that combines operation and management activities with technological research strategies. Eni's projects and initiatives include: fugitive emission monitoring and leak repair in its gas transmission systems; pipe conditioning/ replacement in the gas distribution network; and protocol development to quantify and advance further emission reductions. Eni also provides information exchange with its industry colleagues at Methane to Markets events, and shares knowledge with its employees and customers.
- Expo Projects.** At the 2007 Partnership Expo in Beijing, the oil and gas sector highlighted two projects—one on large-scale emission reductions projects in Mexico and another on leak detection and repair in Ukraine—that would yield estimated average annual GHG emission reductions of 30,224 MTCO₂E,

if fully implemented. The oil and gas projects featured at the 2007 Expo can be viewed at: www.methanetomarkets.org/projects/index.aspx?expo=beijing.



Utilizing infrared cameras to detect leaks at a natural gas facility in Mexico.

Next Steps

The Oil and Gas Subcommittee will continue to promote methane emission reduction through the following activities:

- Continuing Education and Outreach.** Strategic activities continue to be defined with the clear goal of working with Partner countries to identify and implement methane emission reduction project opportunities. A key element of these activities is the ongoing education and outreach to the international communities on the economic benefits of reducing methane emissions from oil and natural gas systems. Outreach will occur through technical and marketing materials and onsite and online workshops, as well as by providing tools (e.g., ON TIME) and up-to-date technical documents on the Methane to Markets Web site.
- Conducting Technical Feasibility Studies.** The subcommittee will also be sponsoring studies to evaluate the technical feasibility of reducing emissions at many facilities worldwide. Activity benefits will include increased profits, improved efficiency, reduced GHG emissions, and increased energy security.



2007 Partnership Expo

Results From the 2007 Expo

In October 2007, the Methane to Markets Partnership convened the world's largest gathering of methane professionals, in Beijing, China. Together with China's host, the National Development and Reform Commission (NDRC), U.S. EPA co-hosted this 3-day event, which brought together investment, project development, and government professionals to network and collaborate on advancing new methane capture and use projects. In all, the Expo attracted more than 700 attendees from 34 countries and more than 20 corporate sponsors from a cross-section of industries and trades. These sponsors included turbine and equipment manufacturers, alternative energy companies, investment banks, project developers, and consulting firms.

The 2007 Partnership Expo attracted more than 700 attendees from 34 countries.

The Expo featured concurrent technical tracks for the agriculture, coal mines, landfill, and oil and gas systems sectors. For each track,



Plenary session at 2007 Partnership Expo in Beijing, China.

breakout sessions gave attendees the opportunity to review and discuss case studies of methane projects, technological advances, financing, and country-specific policy and regulatory barriers and solutions. The Methane to Markets Steering Committee and subcommittees also met during the Expo to discuss the implementation of sector-specific subcommittee Action Plans and other Partnership business.

One of the most significant aspects of the Partnership Expo was the Project Showcase, at which project developers and other parties highlighted potential projects in need of funding and/or technical assistance to move forward. Ninety-one potential



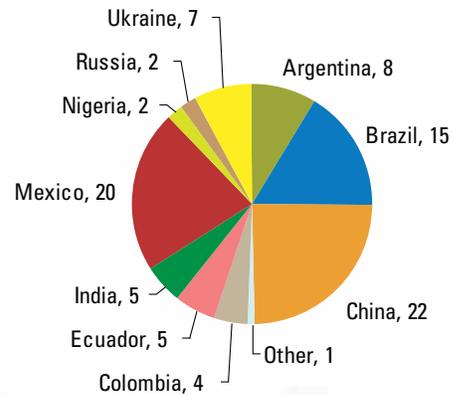


methane capture and use projects from 11 countries across all four Methane to Markets sectors were showcased (see Figure 7). If fully implemented, these 91 projects are estimated to yield annual methane emission reductions of 11.5 MMTCO₂E by 2015.

Updates on Projects Showcased at the 2007 Expo

Following the Expo, several featured projects indicated they received additional inquiries from project developers and/or financiers. Since 2007, the ASG has continued to follow up with the project contacts to learn the current project status and/or anticipated next steps. As of 30 September 2009, the ASG has received updates on more than a third of the 91 Expo projects (see Table 3). Additional information on these Expo-featured projects can be found in Appendix C and also on the Methane to Markets Web site at: www.methanetomarkets.org/projects/index.aspx?expo=beijing.

Projects Showcased at the 2007 Expo, by Country



Posters displayed in the Expo Project Showcase.

Table 3

Current Project Status and Next Steps			
	Agriculture	Coal Mines	Landfills
Additional Inquiries	✓	✓	✓✓✓✓
Selecting Investor(s)/Negotiating	✓	✓	✓✓
Continued Assessment (e.g., pre-feasibility/feasibility studies, engineering plans)		✓✓✓✓	✓✓✓✓✓✓
Demonstration Stage	✓✓	✓✓	
Under Development (i.e., implementation)	✓	✓✓✓	✓✓
Construction Completed (i.e., operating)		✓	✓✓✓✓
Planned Expansion*		✓	✓

*At construction completed/operating sites.

Looking Forward

Over the past 5 years, the Partner governments and Project Network members of the Methane to Markets Partnership have made tremendous progress in accelerating the development of methane emission reductions projects around the world. The Partnership has demonstrated that countries along all stages of development and the private sector can join together to reduce GHG emissions, stimulate economic growth, develop new sources of energy, and improve local environmental quality; however, the work of the Partnership has only just begun. The science of climate change is revealing ever more clearly the critical importance of reducing methane emissions in order to mitigate climate impacts, especially in the near term. There are many more barriers to overcome, many more projects to develop, and many more stakeholders to engage. The Partnership is looking forward to tackling those challenges in the years to come, and in the near term will focus on:



India Gate in New Delhi.

- **Continuing the Partnership's Charter.** At the most recent Steering Committee meeting, the members decided to extend the current Partnership Terms of Reference until a revised and enhanced Terms of Reference can be drafted. The Partners are considering strengthening and expanding commitments to country-specific action plans, improving monitoring and reporting mechanisms, adding new sectors, and exploring linkages with the UNFCCC, among other issues. It is expected that the revised version will be signed at a Ministerial level event to take place in Mexico in 2010.
- **Organizing the 2010 Partnership Expo.** The first Partnership Expo proved to be an effective means of matching project development opportunities with relevant skills and resources, and Partners and Project Network members alike look forward to sharing experiences and insight at the second Expo. The 2010 Expo, which is co-organized with the Government of India and the Federation of Indian Chambers of Commerce and Industry (FICCI), promises to be the premier international forum promoting methane recovery and use project opportunities. In addition to the Methane Project Showcase, a collection of potential methane capture and use projects seeking development, the 4-day event will feature high-level plenary sessions, policy and technical tracks, site visits, and a full Partnership meeting. Approximately 1,000 participants are expected to attend the Expo, which will take place at the Taj Palace Hotel in New Delhi, India, on March 2–5, 2010.
- **Responding to the Year 6 Charge to Subcommittees.** The Partnership will also work diligently to respond to the Year 6 Charge, which will be given to the subcommittees by the Steering Committee at the India Expo. The Charge is likely to include continuing the development of country-specific action plans, continuing to improve Partnership communications and outreach, and delivering new tools and resources to accelerate project development in Partner countries around the world.

Appendix A: Partnership Milestones

2004

- ▶ The United States announces the intent to begin an international effort to reduce global methane emissions and advance clean energy solutions.
- ▶ The Methane to Markets Partnership is launched at a ministerial meeting in Washington, D.C., USA. Fourteen national governments sign on as Partners: Argentina, Australia, Brazil, China, Colombia, India, Italy, Japan, Mexico, Nigeria, Russia, Ukraine, the United Kingdom, and the United States.

2005

- ▶ Canada, Ecuador, and South Korea join Methane to Markets, expanding the Partnership to 17 Partners.
- ▶ Project Network members total 200.
- ▶ Second Methane to Markets Meeting held in Buenos Aires, Argentina.
- ▶ Events and workshops held in seven countries.

2006

- ▶ Germany and Poland join Methane to Markets, expanding the Partnership to 19 Partners.
- ▶ Project Network members total 500.
- ▶ Events and workshop held in nine countries.

2007

- ▶ The European Union and Vietnam join Methane to Markets, expanding the Partnership to 21 Partners.
- ▶ Project Network members total 600.
- ▶ Methane to Markets Partnership Expo: A Forum for Projects, Technology, Financing, and Policy held in Beijing, China.
- ▶ Events and workshop held in 10 countries.

2008

- ▶ Finland, Kazakhstan, Mongolia, Pakistan, the Philippines, and Thailand join Methane to Markets, expanding the Partnership to 27 Partners.
- ▶ Project Network members total 800.
- ▶ Events and workshops held in 14 countries.

2009

- ▶ Bulgaria, Chile, Dominican Republic, and Georgia join Methane to Markets, expanding the Partnership to 31 Partners.
- ▶ Project Network members total 900.
- ▶ Partnership-wide Technology Transfer Workshops held in Monterrey, Mexico.
- ▶ Events and workshops held in 13 countries.



Appendix B: Methane to Markets Partners

Committee Membership Legend



ARGENTINA



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 15th (95.11 MMTCO₂E)

From the Targeted Sectors: 24 percent (24.2 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include numerous AD projects as well as LFG capture and use projects. More than 10 AD projects have been initiated in Argentina in recent years, and Argentina is in the process of developing its own Methane to Markets Program with the participation of several government secretaries, universities, and research institutions such as Instituto Nacional de Tecnología Agropecuaria (INTA) and Instituto Nacional de Tecnología Industrial. During 2009, an aggressive extension plan was implemented with national workshops and conferences held at principal agricultural farm shows. Two resource assessment studies that prioritize methane reduction opportunities in various regions of the country have been completed. A nationwide, technical network has been created, along with a Web site, to help raise awareness within the public and private sectors. A cooperative program with Germany has also been established, and Argentina is

working with experts from Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH on biogas implementation.

The entry into force of the Kyoto Protocol has prompted the development of new initiatives related to capturing LFG, based on the incentives given by selling certified emission reductions. Landfills that have installed LFG capturing systems during the past 3 years and have registered their activities under CDM burn the LFG in closed flares to assure the destruction of methane. Two LFGE projects use the energy for onsite consumption: Norte III for electricity generation, and Olavarría as fuel for a pyrolytic furnace. As of March 2009, there were 10 CDM LFG projects approved by Argentina, and eight of them are already registered at UNFCCC. There are approximately 15 additional LFG project sites, some with the potential of advancing as LFGE projects, that are looking for financing. The Partnership is also engaged in ongoing communications and outreach with oil and gas companies operating in Argentina, and desktop studies of methane emission potential at oil and gas facilities have been completed.

Eight potential projects from Argentina were highlighted at the 2007 Beijing Expo, including two agricultural sites and six landfills. Argentina hosted the November 2005 Steering Committee and all technical subcommittee meetings, the May 2007 Agriculture Subcommittee meeting and accompanying AD workshop, the June 2008 Landfill Subcommittee meeting, an October 2008 landfill operations training course, a November 2008 oil and gas technology transfer workshop and technology demonstration, and an April 2009 landfill operations training courses. Argentina serves as co-chair of the Agriculture and Landfill Subcommittees.



AUSTRALIA



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 10th (128.85 MMTCO₂E)

From the Targeted Sectors: 31 percent (40 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include Australian government programs and policies that support the capture and use of fugitive methane emissions. Under the GHG Abatement Program (GGAP), the Australian government provided grants that have supported four CMM projects aimed at facilitating substantial and cost-effective emission reductions. This includes the world's first commercial-scale project converting mine VAM from an operating coal mine to electricity. In October 2006, Australia hosted the Coal Subcommittee meeting and an accompanying CMM workshop.

The Australian government has formed partnerships with industry to improve energy efficiency under the "Greenhouse Challenge Plus." Under the "Renewable Energy Target" scheme, the Australian government will increase the contribution of renewable energy to Australia's electricity supply mix, including using energy generated from LFG sources. The scheme has been expanded to accommodate existing coal waste gas electricity recovery. The Australian government and industry research organizations have invested approximately \$2 million in the Australian Methane to Markets in Agriculture Program, which undertakes the research and development of methane capture and use technology in the Australian intensive livestock industries. Australia will implement an emission trading scheme in July 2011, known as the Carbon Pollution Reduction Scheme (CPRS), which will cover all six Kyoto gases, including

methane, and large emitters in most sectors (more than 25,000 MTCO₂E a year). The CPRS will encompass about 75 percent of Australian emissions. Large emitters will need to surrender permits for each MTCO₂E they emit. The agriculture sector will not be included in the scheme from its commencement but will be considered for inclusion from 2015.

BRAZIL



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 4th (389.07 MMTCO₂E)

From the Targeted Sectors: 8 percent (30.13 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include AD and LFG-fired power plants across the country. Current AD projects and research in Brazil are focused on swine and poultry manure, with more than a dozen anaerobic digesters in operation on swine farms in Southern Brazil. Brazil completed and distributed a country-specific biogas model to the Landfill Subcommittee, and as of 2008 there was more than 160 MW of electricity generating capacity proposed in 20 LFG energy project designs submitted in Brazil.

In addition to outreach to governmental institutions and industry, Brazil is working to promote an environmental management system that accounts for methane emission reduction opportunities and successes from the oil and gas sector. Fifteen potential projects from Brazil were highlighted at the 2007 Beijing Expo, including four agricultural sites and 11 landfills. Brazil hosted a September 2008 landfill operations training course.



BULGARIA



Partner Since: 2009

Global Methane Emissions Ranking: 61st (10.31 MMTCO₂E)

From the Targeted Sectors: 43 percent (4.44 MMTCO₂E) of total methane emissions

Committee Membership:



Landfills are Bulgaria's primary source of methane emissions. Organized municipal solid waste (MSW) collection is provided to 90 percent of the country's population, serving approximately 7 million people and accounting for more than 3 trillion kilograms of wastes annually. According to the Ministry of Environment and Water (MoEW), implementing methane capture projects at the 10 largest landfills in Bulgaria could recover 72 million cubic meters of methane, resulting in emission reductions of more than a million MTCO₂E.

includes national and provincial policy developments that affect landfill biogas, has identified more than 20 sites with a total electricity generating capacity from LFG of approximately 65 MW. Several Canadian provinces and municipalities are providing incentives for renewable energy, which includes LFG projects. So far, two LFGE projects have been built under this incentive program.

Environment Canada was instrumental in the development of ON TIME, an online tool that identifies cost-effective methane reduction technologies and practices along most points in oil and gas systems. Canada has secured additional funding from government and industry to advance the development of continuous oil and gas monitoring equipment/models. Canada hosted a January 2007 energy management workshop and the September 2009 Oil and Gas Subcommittee meeting. Canada serves as vice-chair of the Oil and Gas Subcommittee.

CANADA



Partner Since: 2005

Global Methane Emissions Ranking: 12th (102.0 MMTCO₂E)

From the Targeted Sectors: 63 percent (68.24 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include identifying and implementing cost-effective methane emission reduction practices and supporting technology transfer workshops. Canada currently operates 16 AD systems utilizing farm and food industry waste, and an additional 16 digesters are under construction in Ontario. All current systems are equipped with generators and use heat or electricity on site. Canada's landfill emission inventory, which

CHILE



Partner Since: 2009

Global Methane Emissions Ranking: 50th (14.79 MMTCO₂E)

From the Targeted Sectors: 25 percent (3.66 MMTCO₂E) of total methane emissions

Committee Membership:



Some Chilean facilities have AD systems to capture and use methane, and government has supported the development of an AD demonstration project with hopes to replicate it throughout Chile. Chile's interest in landfill biogas is focused in the area of town gas and pipeline distribution, although most of the landfills are privately owned, and 12 landfills have gas flaring projects.



CHINA



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 1st (853.26 MMTCO₂E)

From the Targeted Sectors: 22 percent (209.9 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include several CMM utilization projects, including the world's largest CMM-fueled power plant, as well as LFG recovery and agriculture projects. The Chinese Ministry of Agriculture seeks to expand improved village-scale digesters and technical training in rural areas. Since 2003, the Chinese central government has invested about \$2.8 billion for rural biogas development only, including household digesters and medium-to large-scale biogas plants. By the end of 2008, more than 30 million household digesters have been used and about 20,000 plants have been established. The World Bank has provided funding to develop affordable pollution control methods for livestock waste management, including demonstration projects in Guangzhou and Shanghai.

Since 2004, the CMM industry has advanced in China, with several dozen projects currently operating, including the world's largest CMM power generation project at the Sihe Mine in Jincheng. Additional CMM-related activities include demonstration projects, feasibility studies, capacity-building, and training workshops. To support landfill activities, China's Ministry of Construction completed a survey of Chinese landfill sites to identify suitable opportunities for project evaluation. By the end of 2008, 28 LFG utilization projects had been completed and commissioned throughout mainland China. In the oil and gas sector, China continues to support identification and analysis of methane emission reduction opportunities at all three major Chinese oil and gas companies.

China hosted the first Methane to Markets Partnership Expo in Beijing in October 2007, and 21 potential projects from China were highlighted there, including six coal mine projects, two biogas projects, and 11 landfill projects. China also hosted a December 2005 Methane to Markets regional coal workshop, a September 2007 biogas workshop, the October–November 2007 Steering Committee meeting and technical subcommittee meetings, March and April 2008 LFGE workshops, an April 2008 oil and gas workshop, October 2008 and May 2009 biogas workshops, and the September 2009 Agriculture Subcommittee meeting. China serves as vice-chair of the Coal Subcommittee.

COLOMBIA



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 21st (62.35 MMTCO₂E)

From the Targeted Sectors: 22 percent (14.7 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include investigating livestock waste management practices and potential technologies for fermentation and energy generation, and conducting a study to address the safety, security, and integrity of Colombia's hydrocarbon pipeline system. A country resources assessment is underway in the agriculture sector, and funding for a pre-feasibility study for a slaughterhouse facility and processing plant has been secured.

U.S. EPA has supported Colombia with four LFG assessment reports, and there are plans to complete two additional studies. Two Colombian landfills—Doña Juana and La Pradera—are CDM-registered LFG management and LFGE projects, respectively. Four potential projects from Colombia were highlighted at the 2007 Beijing Expo, all from



the landfill sector. Colombia hosted an October 2005 Methane to Markets oil and gas workshop, a March 2008 LFG opportunities workshop, and an April 2009 landfill operations and LFG workshop.

DOMINICAN REPUBLIC



Partner Since: 2009

Global Methane Emissions Ranking: Unavailable at time of publication

of publication

From the Targeted Sectors: Unavailable at time of publication

Committee Membership:



The Dominican Republic has opportunities for methane capture and use projects in the areas of agriculture and landfills. From an agricultural perspective, the country has significant methane emission reduction potential from its agro-industrial waste, such as sugar and fruit processing, as well as manure waste management (i.e., swine and dairy operations). In the landfill sector, the Dominican Republic welcomes opportunities for establishing standards and constructing engineered landfills with methane collection systems.

ECUADOR



Partner Since: 2005

Global Methane Emissions Ranking: 49th (15.46 MMTCO₂E)

From the Targeted Sectors: 13 percent (2.0 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include two pre-feasibility studies at the Las Iguanas and Pichacay landfills and three additional

landfill assessment reports. In the oil and gas sector, Ecuador conducted a workshop and is meeting with private oil companies to promote Methane to Markets. Ecuador continues to work with key oil and gas companies to identify (e.g., desktop studies) and implement methane emission reduction projects. Five potential projects from Ecuador were highlighted at the 2007 Beijing Expo, all from the landfill sector. Ecuador hosted the November 2006 Landfill Subcommittee meeting, an August 2007 Methane to Markets landfill workshop, and a July 2008 LFG opportunities workshop.

EUROPEAN COMMISSION (EC)



Partner Since: 2007

Global Methane Emissions Ranking: 4th (448.49 MMTCO₂E)²⁰

From the Targeted Sectors: 56 percent (252 MMTCO₂E) of total methane emissions

Committee Membership:



Six EC member countries—Bulgaria, Finland, Germany, Italy, Poland, and the United Kingdom—are already members of the Partnership. The EC focuses its activities within the Partnership on working to reduce methane emissions from the coal sector and the oil and gas sector. The EC is currently supporting one CMM project that covers three Partner countries (Ukraine, Kazakhstan, and Russia), and another analysis study in China has been finalized.

FINLAND



Partner Since: 2008

Global Methane Emissions Ranking: 72nd (5.21 MMTCO₂E)

From the Targeted Sectors: 60 percent (3.17 MMTCO₂E) of total methane emissions

²⁰ If all EC member countries were considered together as one entity.



Committee Membership:



In the agriculture sector, private farms represent the fastest growing source for additional methane capture and utilization. The Finnish government promotes methane recovery and use by farmers by providing grants of up to 40 percent of the total cost of the methane projects. The largest landfill in the Nordic countries—Ämmässuo in Espoo, near Helsinki—has been recovering biogas since 1996 using an array of 220 gas wells. In addition, there are a total of 33 landfills throughout the country that already have biogas recovery installations.

GEORGIA



Partner Since: 2009

Global Methane Emissions Ranking: 78th (3.53 MMTCO₂E)

From the Targeted Sectors: 50 percent (1.78 MMTCO₂E) of total methane emissions

Committee Membership:



Georgia has ample opportunities for methane capture and reuse projects in the coal sector, particularly in the Tkibuli-Shaori Coal Basin and the Vale Coal Field. Georgia also has project development opportunities within oil and gas systems and will contribute its experience in the future.

GERMANY



Partner Since: 2006

Global Methane Emissions Ranking: 20th (68.53 MMTCO₂E)

From the Targeted Sectors: 65 percent (44.8 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include CMM-based power projects, a mature anaerobic digester program, and optimization of gas transmission systems. Germany has had much success with the adoption of AD, in part because of strong promotion by its government and other organizations. Nearly 5,000 AD plants are in operation in Germany, a majority of which use agricultural waste. An increasing number of licenses have been granted for CMM/CBM projects in Germany, and there is a trend of shifting capacity from active to abandoned mines because of the diminishing number of active mines. Germany has a very advanced landfill sector: all major landfills have gas collection systems installed and the majority of landfills use the energy in combined heat and power (CHP) applications. Germany hosted the May 2006 and May 2007 Landfill Subcommittee meetings.

INDIA



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 2nd (547.69 MMTCO₂E)

From the Targeted Sectors: 11 percent (84.6 MMTCO₂E) of total methane emissions

Committee Membership:



India is undertaking activities in all four sectors. Four million household AD systems utilize biogas produced from cattle manure, and there are approximately 2,000 large-scale biogas systems in operation at large farms. India is currently exploring opportunities for AD technologies and further reductions from the food processing sector.

In 2008, India established a CMM/CBM clearinghouse to promote the CMM/CBM industry in India, to be the public face of CMM/CBM in India, and to serve as the initial point of contact for foreign and domestic project developers and investors. An international workshop entitled



“Development of CBM/CMM in India: An Opportunity Area” was also organized to coincide with the opening ceremony of the clearinghouse. A CBM/CMM recovery and utilization demonstration project was successfully implemented at the Bharat Coking Coal Ltd. Moonidih mine in June 2007. CBM is being recovered from two wells and is continuously generating 500 kilowatts of electricity, which is being supplied to the Filter Plant of the Moonidih Project. So far, 6.5 lac units of electricity have been generated. At the Sudamdih mine, in-seam gas drainage and utilization will be demonstrated by December 2009. Slimhole drilling for generation of CBM-related data has commenced in the Singrauli and Korba Coal Fields. These two opencast mine projects were initially showcased at the 2007 Partnership Expo held in China.

Within the landfill sector, pre-feasibility studies exploring the economic viability of LFG have been completed for five landfills. The first LFG project in Mumbai went online in 2009. Since joining the Methane to Markets Partnership and Natural Gas STAR International, ONGC of India has collaborated with U.S. EPA on four technology transfer workshops throughout India, seven pre-feasibility studies to identify significant emissions sources, and four field measurement campaigns.

Five potential projects from India were highlighted at the 2007 Beijing Expo: one from the agriculture sector, two from the coal sector, and two from the landfill sector. India hosted: a March 2006 landfill workshop; a February 2007 coal, landfill, and oil and gas workshop; and a March 2009 agriculture regional workshop. India will host the second Methane to Markets Partnership Expo in New Delhi in March 2010. India serves as co-chair of the Coal Subcommittee.

ITALY



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 35th (34.57 MMTCO₂E)

From the Targeted Sectors: 39 percent (17.3 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include LFG capture and/or use projects involving simple electric energy recovery and cogeneration applications; feasibility studies concerning CMM and CBM; biogas recovery; and livestock gas projects, and support of hybrid technologies combining renewables, biogas, and methane natural gas to supply electricity. Multiple AD projects are ongoing through private initiatives in Italy.

Italy is currently evaluating the potential for VAM recovery, abandoned mine methane (AMM), and pre-mine drainage at the Miniera Monte Sinni Coal Mining Concession. The Italian Ministry for the Environment, Land and Sea has funded technical assistance to carry out 10 landfill assessment and pre-feasibility studies in China. Eni, an Italian energy company and Project Network member, has demonstrated its commitment to Methane to Markets by undertaking various pilot studies and field activities to reduce methane emissions from its oil and gas operations.

Italy hosted a November 2006 landfill workshop, the December 2006 Steering Committee, the April 2008 Coal Subcommittee meeting, and the May 2008 Oil and Gas Subcommittee meeting. Italy serves as co-chair of the Landfill Subcommittee.



JAPAN



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 45th (20.89 MMTCO₂E)

From the Targeted Sectors: 22 percent (5.7 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include evaluating CBM resources and exploration using S wave, a low-concentration gas utilization system, and using abandoned CMM for power generation. Japan's New Energy and Industrial Technology Development Organization (NEDO) provided travel support for participants from China, India, Mexico, Nigeria, and Russia to attend CMM workshops and Coal Subcommittee meetings, as well as the 2007 Partnership Expo. The domestic waste situation in Japan largely involves incinerators, but several private companies are active in the landfill sector, primarily through investment portfolios that include LFG projects. Japan is also focused on landfill project development in several parts of the world, including the Asia Pacific, Africa, and Latin America/Caribbean regions.

In January 2009, Japan launched the Greenhouse gases Observing SATellite (GOSAT), the world's first satellite to measure the concentrations of carbon dioxide and methane from space. With primary applications for the oil and gas sector, GOSAT observation data will ultimately provide valuable information for identifying and mitigating methane emissions from all sectors.

KAZAKHSTAN



Partner Since: 2008

Global Methane Emissions Ranking: 42nd (26.88 MMTCO₂E)

From the Targeted Sectors: 61 percent (16.21 MMTCO₂E) of total methane emissions

Committee Membership:



Kazakhstan has ample opportunities for methane capture and reuse projects, primarily in the coal mining and landfill sectors. General methane reserves in the Karaganda region amount to approximately 500 billion cubic meters (bcm) and reserves in the Ekibastuz region approach 75 bcm, making these regions some of the world's largest CMM sources. In Kazakhstan, the experience in collecting and utilizing landfill methane is still emerging, but preliminary research was implemented in 2005 by the Karaganda Ecology Museum, which also has a functioning biogas center. Kazakhstan hosted a September 2009 landfill biogas seminar.

MEXICO



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 6th (184.82 MMTCO₂E)

From the Targeted Sectors: 61 percent (114.3 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include creating a national program for capturing and using methane from AD of animal waste, a coal mine degasification program, landfill gas and flaring projects, and several methane emission reduction projects in gas transmission and storage systems. Approximately 450 AD systems currently exist in Mexico, of which 350 are operating and 100 are generating heat or electricity. A series of commercial-scale demonstration projects are underway to further raise awareness and technical capability, and Mexico is developing engineering specifications for AD systems.

In the coal sector, several actions have been instituted in Mexico, including new regulations regarding CMM recovery and use and



development of a technical coal mine database. There is also a demonstration project for CMM to liquefied natural gas (LNG) in the Sabinas coal basin. LFG feasibility studies have been conducted for four landfills. PEMEX continues with efforts to identify and implement cost-effective methane emission reduction projects at its subsidiaries and is currently working on a GHG emission inventory and detailed marginal methane abatement curves.

In 2006, Mexico's SEMARNAT established a program similar to Methane to Markets as a means to implement projects to capture methane from agricultural and industrial processes and practices, and use that captured methane as a renewable clean energy source. The Mexican government embraced those efforts and adopted the National Strategy on Climate Change (NSCC) in 2007, which identifies specific mitigation measures, research objectives for mitigation targets, and national capacity-building requirements for adapting to climate change. Twenty potential projects from Mexico were highlighted at the 2007 Beijing Expo, including three from the agriculture sector, 12 from the coal sector, four from the landfill sector, and one from the oil and gas sector.

Mexico hosted the April 2006 Oil and Gas Subcommittee meeting and workshop, the April 2008 Agriculture Subcommittee meeting and workshop, a December 2008 landfill operations workshop, the January 2009 Steering Committee and subcommittee meetings, and a March 2009 LFG modeling workshop. Mexico serves as co-chair of the Oil and Gas Subcommittee.

MONGOLIA



Partner Since: 2008

Global Methane Emissions Ranking: 68th (7.52 MMTCO₂E)

From the Targeted Sectors: 5 percent (0.39 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include a National Action Programme on Climate Change, which will include cost-effective methane recovery technologies as a clean energy source. Mongolia is pursuing funding for a "complete mix" AD system for animal wastes as well as conducting a pre-feasibility study and evaluation of costs/benefits for CMM recovery and utilization at the Nalaikh Mine. The study includes a detailed analysis of mine geology and a survey on the socioenvironmental benefits of a CMM project. Mongolia hosted a September 2008 CMM workshop.

NIGERIA



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 9th (150.54 MMTCO₂E)

From the Targeted Sectors: 38 percent (58.9 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include studies of LFG energy projects and electricity generation utilizing CMM. To help assess CMM potential, Nigeria has performed pre-feasibility studies at the Onyeama and Owukpa mines in the Enugu coal field. The Nigerian government is also working to improve coal mining operations and CMM recovery and use through joint ventures with private companies from Poland and South Africa. ISWA has completed an inventory of Nigerian landfills, and the data were added to the Methane to Markets International Landfill Database. Two potential CMM projects from Nigeria were highlighted at the 2007 Beijing Expo.



PAKISTAN



Partner Since: 2008

Global Methane Emissions Ranking: 13th (97.76 MMTCO₂E)

From the Targeted Sectors: 16 percent (15.4 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities in Pakistan include efforts by the country's Alternative Energy Development Board, which fosters sustainable development and use of alternative/renewable energy through initiation of policies and projects and enhancing technical skills in the alternative energy fields.

PHILIPPINES



Partner Since: 2008

Global Methane Emissions Ranking: 32nd (41.15 MMTCO₂E)

From the Targeted Sectors: 18 percent (7.3 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include promoting agricultural biogas systems and LFG assessment and extraction from sanitary landfills and dump sites. Numerous AD projects are currently operating in the Philippines, including 10 projects that are CDM-registered. The most promising industries for future AD projects include swine farming, slaughterhouses, alcohol distilleries, coconut processing, and pineapple processing. At present, the only engineered landfill in the Philippines is working with an Italian company to develop a biogas recovery project, but studies estimate the energy potential from all the country's landfills (if modernized) could approach 50 MW. The Philippines hosted an October 2009 agriculture workshop.

POLAND



Partner Since: 2007

Global Methane Emissions Ranking: 29th (46.40 MMTCO₂E)

From the Targeted Sectors: 75 percent (34.81 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include working on a methane-to-LNG project, developing CMM recovery and utilization projects, LFGE projects, and identifying and implementing oil and natural gas sector methane emission reduction projects. Although awareness of methane production from the agriculture sector is low, there is great emission reduction potential in Poland, and many companies offer technologies that could be applied to animal manure management.

Of 31 operating coal mines, 21 have methane drainage installations, and 14 of these already utilize methane in small-scale units for electricity generation, heat generation, or CHP generation. Ongoing activities include the assessment of VAM resources at Polish mines and a demonstration project for converting CMM to LNG. Poland's state-owned transmission and distribution company, GAZ-SYSTEM, has joined and is working in collaboration with Natural Gas STAR International to assess improvements in emission factors and evaluate methane mitigation opportunities.

Poland hosted a February 2008 CMM workshop, a November 2008 LFGE workshop, and the first-ever Methane to Markets side event at the UNFCCC Conference of the Parties (COP-14) in Poznan in December 2008.

REPUBLIC OF KOREA



Partner Since: 2005

Global Methane Emissions Ranking: 37th (33.40 MMTCO₂E)



From the Targeted Sectors: 47 percent (16.0 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include the assessment of source potential for methane capture from agricultural waste and LFG projects. The Korean District Heating Corporation has completed three pre-feasibility studies for LFG recovery and use.

RUSSIA



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 5th (314.46 MMTCO₂E)

From the Targeted Sectors: 74 percent (238.9 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include CMM recovery and utilization projects, an inventory of LFG recovery opportunities, and the identification and implementation of methane emission reduction projects in the oil and natural gas sectors. Russia is the focus of a UNECE project promoting CMM project financing, which includes site visits and scoping missions.

As part of this project, UNECE conducted a June 2008 workshop to address financial barriers, and a Russian mine participated in a "road show" with potential CMM project investors. As part of its landfill sector efforts, Russia has established a Clean Energy Technology Information Center to advance introduction and large-scale deployment of technologies that will reduce GHG emissions and facilitate diversification of its energy mix. The Russian Academy of Sciences has been working to identify methane emission reduction opportunities from the oil and gas sector. In October

2008, Gazprom and the Russian government collaborated with U.S. EPA on the first Methane to Markets oil and gas technology transfer workshop in Russia.

Two potential projects from Russia were highlighted at the 2007 Beijing Expo, one from the coal sector and one from the landfill sector. Russia hosted May/June 2005 and May 2007 landfill workshops as well as a September 2005 Oil and Gas Subcommittee meeting and workshop. Russia is co-chair of the Oil and Gas Subcommittee.

THAILAND



Partner Since: 2008

Global Methane Emissions Ranking: 16th (91.62 MMTCO₂E)

From the Targeted Sectors: 12 percent (11.6 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include involvement with the Livestock Waste Management in East Asia Project to develop capacity and policies to deploy pollution reduction technologies appropriate for swine waste management using anaerobic digesters as the primary treatment. The World Bank has provided funding to develop affordable pollution control methods for livestock waste management in Thailand.

UKRAINE



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 8th (153.41 MMTCO₂E)

From the Targeted Sectors: 85 percent (133 MMTCO₂E) of total methane emissions

Committee Membership:





Current methane mitigation activities include working to increase CMM recovery and use; studying LFG recovery projects; and detecting, measuring, and repairing leaks in gas transmission systems. In the coal sector, USAID is providing support for an in-mine drilling project at the Belozerskaya Mine. Ukrainian policies promoting CMM development include the Green Tariff Law of 2008, which allows CMM power to sell at twice the average wholesale price and provides guaranteed access to the grid, and a CBM law (under development) that will require mines to adopt CMM capture and utilization technologies.

Ukraine has several landfill projects underway, including installing an LFG-powered infrared heating system at the Khmelnytskyi Landfill and a feasibility study at the Rivne Landfill. Within the oil and gas sector, Cherkasytransgaz continues its efforts to implement leak inspection and repair activities to reduce methane emissions, including measuring and tracking its results. Ukrtransgaz has launched a project to explore options for large-scale, system-wide methane mitigation measures.

Eight potential projects from Ukraine were highlighted at the 2007 Beijing Expo, including four from the coal sector, three from the landfill sector, and one from the oil and gas sector. Ukraine hosted a September 2006 LFG workshop, a June 2008 oil and gas methane mitigation technology transfer seminar, and an April 2009 CMM roundtable.

UNITED KINGDOM (UK)



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 30th (46.23 MMTCO₂E)

From the Targeted Sectors: 56 percent (25.69 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include CMM and LFG utilization schemes, regulation of methane emissions under law, and several methane recovery systems using animal manures. The UK actively supports the development of AD, as the use of AD advances many of the key government policy objectives: generating renewable energy, reducing GHG emissions, and managing water pollution from agriculture. Financial support is available for AD research through several UK grant programs and the UK government is also providing £10 million in funding for projects that demonstrate the different benefits of AD. Working with stakeholders from a wide variety of sectors, the UK government is developing an AD implementation plan to realize the ambitious aims set out in “Anaerobic Digestion – Shared Goals,” published in February 2009. The majority of UK CMM emissions are the subject of exploitation licenses and, in many cases, already linked to generating plants. The UK government provides technical capacity building to facilitate CMM project development in Russia and China.

The UK has a well-developed LFG utilization industry, encouraged by financial instruments (e.g., Renewable Obligation Certificates) and a strong regulatory framework to minimize local impacts while achieving significant methane gas emission reductions. The 11 largest sites each have between 8-MW and 20-MW installed power generation and represent almost a quarter of the total installed capacity. In the oil and gas sector, the UK is working with offshore facilities to encourage installation of vapor recovery systems (already in place for all onshore facilities), and exploring infrared techniques for analysis of vented gas from terminals.

The UK hosted the June 2005 Landfill Subcommittee meeting, a December 2006 Agriculture Subcommittee meeting and workshop, and an April 2007 Oil and Gas Subcommittee meeting. The UK serves as co-chair of the Agriculture Subcommittee.

UNITED STATES (U.S.)



Partner Since: 2004 (Charter)

Global Methane Emissions Ranking: 3rd (521.02 MMTCO₂E)

From the Targeted Sectors: 68 percent (352.7 MMTCO₂E) of total methane emissions

Committee Membership:



U.S. industries, along with state and local governments, collaborate with U.S. EPA to implement several voluntary programs that promote opportunities for reducing methane emissions. These programs are designed to overcome a wide range of informational, technical, and institutional barriers to reducing methane emissions, while creating profitable activities for the coal, natural gas, petroleum, landfill, and agricultural industries. Under its domestic programs, U.S. entities have: reported methane emission reductions of 63 MMTCE, valued at more than \$4.2 billion USD from the oil and gas sector; utilized nearly 90 percent of coal mine degasification methane; tripled the number of LFG projects to more than 445 facilities; and doubled the number of biogas recovery systems to more than 180 projects generating about 300 million kWh per year.

U.S. government efforts in support of the Partnership are led by U.S. EPA and involve the collective effort of the Departments of State, Agriculture, and Energy, as well as the Agency for International Development and the Trade and Development Agency. The United States has pledged up to \$53 million USD over a 5-year period to facilitate the development and implementation of methane projects in developing countries and countries with economies in transition. Specifically, U.S. Methane to Markets activities include: hosting the Partnership Administrative Support Group; organizing Partnership Expos; maintaining the Partnership

Web Site; and funding subcommittee meetings, grant solicitations, technology and transfer, training workshops, and the development of technical documents and tools. A full description of U.S. activities in support of the Partnership can be found in the four U.S. Government Partnership Annual Reports, which are located on the U.S. Methane to Markets Web site: www.epa.gov/methanetomarkets.

The United States hosted the first Methane to Markets Ministerial meeting in November 2004, as well as a June 2005 private sector workshop, the May 2006 Coal Subcommittee meeting, a September 2006 oil and gas workshop, the September 2009 Steering Committee meeting, and the September 2009 Landfill Subcommittee meeting. The United States serves as chair of the Steering Committee and co-chair of the Coal Subcommittee.

VIETNAM



Partner Since: 2007

Global Methane Emissions Ranking: 19th (68.59 MMTCO₂E)

From the Targeted Sectors: 10 percent (7.2 MMTCO₂E) of total methane emissions

Committee Membership:



Current methane mitigation activities include employing methane-reducing technologies and practices for livestock waste management and conducting a National Clean Development Mechanism Study, which set forth a strategy for the country to participate in the global market for GHG reductions. There are 100,000 biogas systems currently operating in Vietnam, mostly as household and small-scale systems. The World Bank is also providing funding to develop affordable pollution control methods for livestock waste management in Vietnam.

Appendix C: Status of 2007 Expo Projects



Up-to-date status of all 2007 Expo projects can be found on the Methane to Markets Web site at: www.methanetomarkets.org/projects/index.aspx?expo=beijing.

Subcommittee and Partner Country	Name of Project	Current Activity	Status
Agriculture			
Argentina	Marcos Juarez Experimental Field	This site is presently installing two demonstrative digestors, each with 11-cubic-meter capacity sealed bag type with an outlet reservoir of 6 cubic meters. Pending outcomes from this initial demonstration stage, INTA will proceed to build a complete plant.	Demonstration
	Rafaela Dairy Operation	This site is presently installing two demonstrative digestors, each with 11-cubic-meter capacity sealed bag type with an outlet reservoir of 6 cubic meters. Pending outcomes from this initial demonstration stage, INTA will proceed to build a complete plant.	Demonstration
Brazil	Mato Grasso Swine Operations	This project is under development by LOGICarbon, financed by the project owner (although several private companies also expressed financing interest).	Under development (i.e., implementation)
	Sao Paulo Dairy Operation	This slaughterhouse project is in the process of selecting an external investor.	Selecting investor(s)/ negotiating
India	Uria Biosystem Dairy Waste-to-Energy	Following the Expo, the project received solicitations for more information, but no funding opportunities have materialized.	Additional inquiry following Expo
Coal			
China	Hebi CMM Power Generation Project	Five CMM power plants were constructed in No. 3, No. 4, No. 6, No. 8, and No. 10 coal mines with 14 sets of generating units installed. Future plans involve constructing two more CMM power plants in the new ventilation shafts in No. 4 and No. 8 coal mines.	Construction completed/ operating Planned expansion
	Jixi CMM Power Generation Project	13 power generation stations will be constructed between 2009 to 2010, with the installed capacity of 75,700 kilowatts (kW) and annual electricity output of 288 million kWh.	Under development (i.e., implementation)
	Pingdingshan No. 4 VAM to Energy Project	The project has been approved by Pingdingshan Coal Co. Ltd., and specific implementation has been arranged.	Under development (i.e., implementation)
	Pingdingshan No. 8 CMM Drainage and Utilization Project	A trial power plant is currently operating, and suitable investors are being sought.	Demonstration

Subcommittee and Partner Country	Name of Project	Current Activity	Status
Coal			
China	Shigang Coal Mine CMM Purification/ Liquefaction and Utilization Project	An experimental device has been put into operation. The mine plans to construct an LNG plant with production capacity of 2,000 tons. The feasibility report and preliminary design have been completed, and engineering construction is in progress.	Demonstration
	Shihao Coal Mine VAM Recovery and Utilization Project	Preliminary intention of cooperation has been reached between AES and Songzao C&E CO. LTD. Further negotiation is in process.	Selecting investor(s)/ negotiating
	Songzao Coal Mine CMM Purification and Utilization Project	An agreement between China Gas and Songzao C&E CO. LTD has been reached to co-invest the project, which has entered the implementation stage.	Under development (i.e., implementation)
India	Korba Coalfield CMM Project Opportunity	Slimhole drilling for generation of CBM-related data likely to commence in November 2009, which is anticipated to be completed by February 2010. Report based on data generated to be prepared by May 2010.	Continued assessment (e.g., pre-feasibility/ feasibility studies, engineering plans)
	Singrauli Coalfield CMM Project Opportunity	Slimhole drilling for generation of CBM-related data commenced, which is likely to be completed by November 2009. Report based on data generated to be prepared by March 2010.	Continued assessment (e.g., pre-feasibility/ feasibility studies, engineering plans)
Mexico	Mimosa Mines Methane Project	Businesses are discussing how to implement the project, and contact between the organizations was facilitated by the Expo (information is business sensitive).	Additional inquiry following Expo
Nigeria	Okpara Mine Power Generation Project Opportunity	"The pre-feasibility study funded by U.S. EPA was to screen Owkupa, Onyeama, and Okpara coal mines. Unfortunately, at the start of the project we could not include Okpara because of safety issues at the mine. However, we screened Owkupa and Onyeama coal mines and conducted pre-feasibility study on Owkupa coal mine. The final report is being reviewed by U.S. EPA, and it should be out before the next Expo in India."—Dr. Bunmi Ogunsola	Continued assessment (e.g., pre-feasibility/ feasibility studies, engineering plans)
Landfills			
Argentina	Bahia Blanca Landfill	This project is currently stalled. Initial contacts indicated there was interest in this project, but some new players have impeded action.	Additional inquiry following Expo
	Bower Landfill	The landfill has prepared tended documents, which have been approved at the provincial level. Bidding was completed in December 2008.	Continued assessment (e.g., pre-feasibility/ feasibility studies, engineering plans)



Subcommittee and Partner Country	Name of Project	Current Activity	Status
Landfills			
Argentina	Rio Cuarto Landfill	A pre-feasibility study has been completed, and the developers are looking for private investment (i.e., currently in discussion with a Canadian company).	Continued assessment (e.g., pre-feasibility/feasibility studies, engineering plans)
	San Javier Landfill	The landfill signed an Emissions Reduction Purchase Agreement (ERPA) with World Bank, a feasibility study has been conducted, and engineering for an LFG recovery plant is complete.	Continued assessment (e.g., pre-feasibility/feasibility studies, engineering plans)
	San Nicholas Landfill	Project contacts are currently talking with private investors, and a letter of intent has been signed.	Selecting investor(s)/negotiating
Brazil	Multiple sites	Following the Expo, investors made inquiries to the Brazilian landfills and MGM International on the investment potential of some of the landfill sites.	Additional inquiry following Expo
China	Gaoantun Landfill	The landfill manager reported they signed an ERPA agreement with ASJA (an Italian company) for purchase of credits only (no investment or technical assistance). A second engine was installed in 2009. The site now has LFG electric generating capacity of 1 MW. Another 1.5 MW of generating capacity is planned for the future.	Construction completed/operating Planned expansion
	Gaoyan	Several companies have inquired about developing an LFG project, but none have moved ahead because of the fact that the landfill will likely close within a few years (ahead of the initial planned closure date of 2032).	Additional inquiry following Expo
	Haikou Landfill	Camda Generator Work Co., Ltd. signed a contract with the Haikou Environmental Sanitation Bureau for an LFG-to-generator project. Two 500-kW installations have been completed, and another three 1,000 kW of capacity are under construction.	Construction completed/operating
	Jilin City Landfill	A number of Chinese companies have contacted the landfill regarding LFG projects and purchase of certified emission reductions (CERs), but no agreements have been reached.	Additional inquiry following Expo
	Longquan Mountain Landfill	An LFG-to-generator project is anticipated with three 957-kW installations planned in the first phase. A project developer has been selected, and construction will begin in the near future.	Under development (i.e., implementation)
Colombia	La Pradera Landfill	The landfill has installed an LFG collection system and flare. The project was registered with the UNFCCC CDM Executive Board in February 2009, the first registered landfill project in Colombia. Green Gas International, a Project Network member, is the project developer.	Construction completed/operating

Subcommittee and Partner Country	Name of Project	Current Activity	Status
Landfills			
Colombia	Dona Juana Landfill	The landfill has installed collection system and flare, and the project was registered with the UNFCCC CDM Executive Board in September 2009. This project has the largest emission reduction potential in Colombia, the second largest in Latin America, and ranked in the top four landfill sites globally. Proactiva, Veolia, Gas Natural SDL, and Biogas Dona Juana all developed the project. The project is considering electricity generation and potentially looking at using some of the LFG at the nearby brick plant.	Construction completed/operating
	Los Cocos	The landfill has completed a project idea note for the UNFCCC CDM process.	Continued assessment (e.g., pre-feasibility/feasibility studies, engineering plans)
Ecuador	Las Iguanas	Based on interest generated at the Expo, this landfill was awarded a 2008 U.S. EPA grant to support an LMOP pre-feasibility study.	Continued assessment (e.g., pre-feasibility/feasibility studies, engineering plans)
India	Deonar Landfill in Mumbai	The landfill is before the Standing Committee of the Corporators for approval. Contracts for the project are being negotiated.	Selecting investor(s)/negotiating
Ukraine	Chernivtsi	Pump tests were conducted in 2008. To date, no further development activities have occurred.	Continued assessment (e.g., pre-feasibility/feasibility studies, engineering plans)
	Lviv	An LFG project is being developed by a company called C6 Capital, which is putting in place 150 gas wells.	Under development (i.e., implementation)
	Mariupol	LFGE site design plans were concluded in late 2009, and validation will be completed.	Continued assessment (e.g., pre-feasibility/feasibility studies, engineering plans)

