



Methane International

The Methane to Markets Partnership Quarterly Update

What's Inside:

- Project Network Member Caterpillar to Provide Generator Sets for World's Largest CMM Gas Power Project
- Updates from the Methane to Markets Technical Subcommittee Meetings
- Canada Showcases Methane to Markets at Sustainable Development Meeting
- Methane to Markets Participates in Carbon Expo 2006
- PEMEX Hosts Emissions Reduction Workshop
- Welcome Germany!
- Coal Sector Snapshot: Advances in Ventilation Air Methane Technologies
- Methane in the News
- Upcoming Methane to Markets Conferences and Related Events

Project Network Member Caterpillar to Provide Generator Sets for World's Largest CMM Gas Power Project

*Chinese Project to Reduce GHG Emissions by 40
Million Metric Tons of Carbon Dioxide Equivalent*

On May 18, 2006, U.S.-based engine manufacturer Caterpillar, Inc., was awarded a \$58 million contract to supply all the power generation equipment for the world's largest power plant fueled by coal mine methane (CMM). Under this contract, Caterpillar will provide 60 gas generator sets—

manufactured in Lafayette, Indiana—to the Jincheng Anthracite Coal Group in Shanxi Province, China. The power plant will produce 120 megawatts of electricity from coalbed methane and CMM from the Sihe Mine, China, in addition to exhaust gas heat that will be recovered to produce usable hot water and steam for the mining operations.

This project demonstrates how multiple benefits from methane projects can accrue to both private and public sector entities in Partner countries. In addition, the environmental and economic benefits of this project are substantial. Once the project has been completed, an estimated 40 million metric tons of carbon dioxide equivalent emissions will be avoided over a 20-year period. This is equal to the annual emissions from nearly 7.3 million cars. In addition, the project will improve mine safety from methane reductions, and total power plant energy efficiency (electrical plus heat recovery) will approach 75 percent.

For more information, visit www.epa.gov/methanetomarkets/activities.htm#1.



Updates from the Methane to Markets Technical Subcommittee Meetings

Representatives from Partner Countries and Project Network members gathered at the biennial meetings of the technical subcommittees this past spring to undertake sector-specific activities that are vital to the Partnership. The Coal, Landfill, and Oil and Gas Technical Subcommittees met in the United States, Germany, and Mexico respectively and updated their Action Plans, discussed goals, and began planning for the Methane to Markets Partnership Expo.

Members of the Coal Technical Subcommittee accomplished the following:

- Developed specific Action Plan activities to support the Partnership Expo, including identifying project opportunities to showcase and determining guidance for collecting key project information.
- Agreed on steps for finalizing Global Overview of CMM Opportunities, which profiles 30 countries, and the web-based, global database of CMM projects containing detailed project-level information. Also agreed on steps to finalize a global database on CMM utilization and mitigation technologies.
- Identified opportunities to coordinate and share information with the Coal Mining Task Force of the Asia-Pacific Partnership.

Members of the Landfill Technical Subcommittee accomplished the following:

- Developed a draft agenda and critical planning steps and activities for the Partnership Expo, including outreach to municipal officials, identification of candidate landfill sites for project development, and guidance for collecting

key site information. Also identified a list of initial topic areas to include in a sector-specific discussion period at the Partnership Expo.

- Assigned a task force to finalize the format and functions of an international database of landfills and project opportunities.

Members of the Oil and Gas Technical Subcommittee accomplished the following:

- Agreed to develop a list of methane emissions reduction and capture projects by country; track them as potential, ongoing, or completed; and to input applicable project data into the ASG's project tracking database in preparation for the Partnership Expo.
- Added new Action Plan items, including a commitment to increase outreach and data collection, share information, and track projects. Also committed to integrate these activities into preparations for the Partnership Expo. Reviewed results of efforts to collect sector methane emissions reduction studies and materials.

For meeting minutes, presentations, and details of upcoming subcommittee meetings, please visit www.methanetomarkets.org and click on "Conferences & Events."

Canada Showcases Methane to Markets at Sustainable Development Meeting

Canada sponsored a Methane to Markets event as a part of the Partnership Fair at the United Nations Commission on Sustainable Development's 14th Session (CSD-14) in May in New York City. This is the first year of a 2-year implementation cycle during which the Commission is focusing on energy for sustainable development, industrial development, air pollution/atmosphere, and climate change—all topics with a clear relevance to methane recovery and its use as a clean energy source.

Sharon Lee Smith, Director General, Climate Change International, Environment Canada, moderated the session. Brian McLean, Director of the U.S. EPA's Office of Atmospheric Programs, spoke about the Partnership in general. John "Jack" Gehring, Director of Caterpillar Inc.'s International Services Division, spoke about his experience with the Sihe Mine project in China (see article on page 1 for more information). Arden Berg, Alberta Energy and Utilities Board member, addressed Canada's experience in the gas sector; and Horacio Terraza, Coordinator of the World Bank Landfill Gas to Energy Project, provided an overview of the recent Landfill Project Expo in Latin America. More than 50 people attended the session.

For information on the CSD, please visit www.un.org/esa/sustdev/csd/policy.htm.

Methane to Markets Participates in Carbon Expo 2006

To promote the Methane to Markets Partnership, the Administrative Support Group made appearances at two prestigious conferences last month to recruit new Project Network members and ramp up outreach to the international methane community. In Cologne, Germany, Methane to Markets sent representatives to Carbon Expo 2006. The Expo attracted more than 2,000 participants from nearly 100 countries—including high-level government representatives from 25 developing countries and countries with economies in transition (EITs), invited by the World Bank. Participants convened to generate new business opportunities for GHG emissions reductions in both the private and public sectors. In fact, more than 200 GHG emissions reduction projects from

developing countries and EITs were presented, and several contracts for the purchase of emissions rights were initiated at the Expo.

Methane to Markets Partnership representatives introduced the Partnership to hundreds of attendees and recruited Project Network members from its new booth.



Brian Guzzone, U.S. EPA greets Francisco Ocampo, Argentina Landfill Subcommittee delegate. Also present is Kirsten Jaglo from the U.S. Department of State.

"We definitely achieved our goal of increased awareness of the Methane to Markets Partnership and greater participation in our Project Network," stated Erin Birgfeld, head of the Administrative Support Group. "With more than 22 new Project Network members registered on site, the Expo has been a tremendous success."

For more information on Carbon Expo, please visit www.carbonexpo.com.

PEMEX Hosts Emissions Reduction Workshop

Tour of PEMEX Facility Provides Close-up of Latest Technologies and Best Practices

Over the course of two days in April, participants at a Petróleos Mexicanos (PEMEX) facility in Villahermosa, Mexico, gathered to learn about proven, cost-effective ways to reduce methane emissions from oil and natural gas operations. The workshop featured presentations on the latest

technology for infrared leak detection and vapor recovery from storage tanks; best practices for compressors, processing, and pipeline maintenance; and other related issues from 15 international industry experts. Fernando Mogollon, from Ecuador's Ministry of the Environment, spoke about ongoing methane reduction projects in Ecuador. Participants also toured PEMEX's gas processing complex and viewed methane emissions reduction equipment installed at the facility.

The event was sponsored by PEMEX, the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), USAID, and the U.S. EPA's Natural GasSTAR Program in support of the Methane to Markets Partnership. The workshop attracted more than 80 oil and gas industry representatives from 10 different countries. Copies of the workshop presentations are available in Spanish and English at www.methanetomarkets.org (click on "Conferences and Events").

Welcome Germany!



Methane to Markets Welcomes Its Newest Partner Country

Germany became the

18th country to join the Methane to Markets Partnership in July. A welcome addition, Germany brings strong experience and knowledge of advanced waste management practices in landfills, gas pipeline rehabilitation programs in local gas distribution networks, and CMM-based power projects. This expertise will help the Partnership meet its shared goals of reducing global methane emissions while enhancing economic growth, promoting energy security, and improving the environment.

For more information on this and other new developments, please visit the "News" section of the Methane to Markets Web site at www.methanetomarkets.org/resources/news/index.htm.

Coal Sector Snapshot: Advances in Ventilation Air Methane Technologies

During normal underground mining operations, methane trapped in and around coal deposits is released, posing health and safety hazards to miners. To reduce these hazards, engineers use large-scale ventilation systems to draw large volumes of clean air into and through the mine to dilute and remove the methane. This diluted methane gas, referred to as ventilation air methane (VAM), is typically vented to the atmosphere.

VAM emissions are a significant source of fugitive methane emissions yet are challenging to capture and use productively. Coal mines from around the world are responsible for emitting more than 500 billion cubic feet of VAM emissions annually, which in greenhouse gas terms, equates to nearly 237 million metric tons of CO₂ equivalent. The concentration of the methane in VAM is very low—typically less than 1 percent by volume. Such low concentrations of methane present a significant obstacle to using VAM cost-effectively. Because the methane is so dilute, VAM cannot be

"Since reducing VAM emissions is a totally new business area, not just for MEGTEC but for all, the Methane to Markets Partnership provides an important forum in understanding what is happening with this emerging market place... Methane to Markets can address barriers, simplify administrative routines, and provide an overview of market conditions, opportunities, and available technologies."

—Richard Mattus
MEGTEC

combusted with conventional technologies, such as reciprocating engines and boilers, which are typically used to burn methane recovered from other sources, such as landfills and waste water treatment plants.

As concern and awareness about methane's contribution to climate change have increased, so has interest in finding ways to oxidize VAM and use the resulting thermal energy to produce heat, generate electricity, or serve as a direct fuel. Thanks to emerging technologies, a substantial portion of VAM can be used cost-effectively at the mine.

An Overview of VAM Technologies

Currently, several exciting technologies hold promise—or are fulfilling that promise—for productive use of VAM at the mine.

A thermal flow-reversal reactor employs the principle of regenerative heat exchange between mine ventilation air and two beds of heat exchange medium. During the initial operating cycle, ventilation air at ambient temperature flows through the first of the two heat exchange beds, where it is heated to the combustion temperature of the methane. The hot gases from the combustion of the methane pass through the second bed, heating it to the combustion temperature of methane. When the second bed becomes hot enough and the first bed has been cooled by the inflowing ventilation air, the system automatically reverses the direction of flow. Ventilation air then enters the second bed, is heated to combustion temperature, and reheats the first bed. Temperature at the system core between the two beds reaches over 1,832° F (1,000° C). An additional benefit of flow-reversal reactors is that the excess heat from the system's core can

be recovered to generate electricity or for other useful purposes.

MEGTEC Systems has developed a commercially available thermal flow-reversal reactor technology, known as the Vocsidizer, for eliminating VAM emissions. MEGTEC has sold more than 700 Vocsidizer units globally; the technology is being deployed in the United States for the first time at an installation in West Virginia with CONSOL

U.S. Mine Safety and VAM Emissions

The United States maintains some of the strictest mine safety standards in the world. A key objective for CONSOL's VAM demonstration project is to design and demonstrate a safe and effective interface between the thermal flow-reversal reactor and the mine ventilation system that does not compromise mine safety. This project will also play a key role in determining the costs, feasibility, and effectiveness of applying this technology in the United States and globally.

Energy Inc. At an abandoned coal mine, the Vocsidizer will utilize about 30,000 cubic feet per minute (about 50,000 m³/h) of mine gases to simulate VAM containing various concentrations of methane. The CONSOL-MEGTEC project is partly funded by the U.S. Department of Energy through the National Energy Technology Center and by the U.S. EPA.

BHP Billiton is installing the world's first commercial VAM oxidation project using MEGTEC technology, which is expected to come on line in late 2006. Located in Australia at West Cliff Colliery, this project will handle 250,000 cubic meters per hour of ventilation air and use a waste

Australian VAM Project Receives GHG Award

In 2005, the Australian Coal Association Research Program (ACARP) recognized Australian company BHP Billiton for its VAM recovery and utilization project at Illawarra Coal's Appin Colliery. This small-scale installation used MEGTEC's Vocsidizer technology to handle 3,500 cubic feet per minute of ventilation air for 12 months. The project demonstrated that the system could operate continuously while handling variations in the concentration of VAM. The energy recovered from the VAM was used to fuel an on-site boiler. The project won "Best ACARP-Supported Greenhouse Gas Project."

heat steam turbine to generate a net of 5 megawatts of electricity for use on site. Project developers hope that this demonstration will show it is possible to use VAM efficiently and further stimulate the market for large-scale projects.

A *catalytic flow-reversal reactor* oxidizes mine ventilation air at lower methane concentrations and/or temperatures than a thermal flow-reversal reactor does. The catalyst reduces the combustion temperature of methane by several hundred degrees Celsius, so it operates in ranges of 662° F (350° C) to 1,472° F (800° C). At these lower temperatures, catalytic flow-reversal reactors do not generate NO_x, reduce the need for costly engineering and fabrication materials, and allow for easier control of the reactor as VAM concentrations fluctuate.

CANMET, a Canadian laboratory and Project Network Member, developed a catalytic flow-reversal reactor called CH4MIN. CANMET has recently conducted a large laboratory-scale test of its technology, using an air flow of 1,600 cubic meters per hour. The technology performed well over concentrations of 0.1 to 1 percent methane. The test was conducted on a simulated VAM stream composed of air and natural gas. CANMET also tested a very small catalyst sample on real coal mine VAM for a period of 4 months, and the catalyst did not lose any of its reactivity. CANMET is currently seeking a partner to manufacture a full-scale system and test it on actual VAM.

Another exciting technology under development is the lean-fueled turbine with catalytic combustor, or *catalytic combustion gas turbine*. This technology uses a catalytic combustor to oxidize the dilute methane. This catalyst allows the methane to ignite at concentrations as low as 1 percent and at a lower, more easily achieved temperature. A latent heat storage system is incorporated into the catalytic combustion gas turbine to even out variations in VAM concentration.

Researchers from Australia and China are planning to build the first pilot-scale demonstration of a catalytic combustion gas turbine, named VAMCAT (Ventilation Air Methane Catalytic Turbine). The Commonwealth Scientific Industrial Research Organization (CSIRO) and the Australian Greenhouse Office—together with China's Shanghai Jiaotong University and Huainan Coal Mining Group—will construct a prototype demonstration unit with a power output of 10 to 30 kilowatts at a Chinese mine. Researchers will use the resulting operational performance data and experience to design a second-generation turbine with an output of at least 1 megawatt. For more information on this pilot, please visit www.csiro.au/csiro/content/standard/ps1k0,,.html.

Brief technical descriptions of these and other technologies—along with vendor contact information—are available at the EPA's Coal Methane Outreach Program's Web site: www.epa.gov/cmop/vam/overview.html.¹

The Methane to Markets Partnership: Building Momentum and Surmounting Barriers

Despite the growing number of viable technologies, some barriers remain to using VAM cost-effectively. For example, if the ownership of methane from the mine is ambiguous or if regulatory authorities do not understand and accept VAM-related technologies, projects are difficult to launch. Lack of understanding and reliable data about issues such as safety, reliability, and economics among other stakeholders (e.g., financiers, regulators, mine owners/operators) also contribute to these challenges.

However, the Methane to Markets Partnership is positioned to take a leadership role in reducing these barriers. For example, the Partnership can help by better informing local coal mine operators and other key stakeholders about these evolving technologies through workshops, seminars, and participation in the CMM conferences. As additional VAM mitigation demonstration projects are implemented, the Partnership can assist by disseminating project results and opportunities among industry, project developers, mine operations, and others to ensure broad adoption of these emissions reduction opportunities and management practices.

Finally, because nearly 65 percent of VAM emissions occur in Methane to Markets Partner countries (with China accounting for more than one-third of the releases and the United States and Ukraine ranking second and third, respectively), the Partnership can use its networking power to communicate project and financing opportunities.²

VAM projects may be even more attractive in those countries where projects can qualify for the Clean Development Mechanism or as Joint Implementation projects and be eligible for carbon credits financing.

For updates on the Methane to Market Partnership's efforts on coal mine-related issues, including upcoming conferences and workshops, please visit www.methanetomarkets.org/coalmines/index.htm.

Notes:

1. Inclusion of a technology description in this article or on the Web site does not imply U.S. Environmental Protection Agency endorsement.
2. *An Analysis of Emissions and Market Potential to Optimize Ventilation Air Methane Mitigation.*
www.coalinfo.net.cn/coalbed/meeting/2203/papers/coal-mining/CM058.pdf

Methane in the News

Do you have news to share? This new section of *Methane International* features press releases and news stories from the international methane community. Please e-mail your contributions to asg@methanetomarkets.org.

Oakville Hydro Corporation, a Canadian energy company, recently announced that it would build a facility to generate 2 megawatts of electricity from landfill gas in Halton, Canada. For more information, please visit www.oakvillehydro.com/pdf/create_green_energy_from_waste.pdf.

CSIRO Exploration & Mining is introducing a new technology called VAMCAT (Ventilation Air Methane Catalytic Turbine) to reduce methane emissions from underground coal mines through exhaust ventilation air. For more information, please visit www.ferret.com.au/articles/8b/0c043d8b.asp.

QuestAir Technologies, Inc., a Canadian developer and supplier of proprietary gas purification systems, recently announced demonstration activities and significant sales of its landfill gas recovery systems. For more information, please visit www.questairinc.com/investor_relations/news_releases.htm.

To view current news articles related to Methane to Markets, please visit the Methane to Markets Web site "News" section at www.methanetomarkets.org/resources/news/index.htm.

Upcoming Methane to Markets Conferences and Related Events

Visit www.methanetomarkets.org for the most up-to-date information on Partnership conferences and events.

Methane to Markets Meetings

4–5 October 2006

Coal Mine Methane Technical Workshop
Brisbane, Australia

Co-sponsored by the Asia-Pacific Partnership on Clean Development and Climate, this workshop will bring developers, equipment suppliers, mine operators, and policy makers together to examine opportunities to capture and use VAM and drainage gases.

www.methanetomarkets.org

6 October 2006

Coal Subcommittee Meeting
Brisbane, Australia
www.methanetomarkets.org

15 December 2006

Steering Committee Meeting
Rome, Italy
www.methanetomarkets.org

Details coming soon!

Other Related Meetings

Agriculture Meetings

13–15 September 2006

ORBIT 2006
Weimar, Germany
www.orbit2006.de/cms/

18–20 September 2006

Third International Conference on Biomass for Energy
Kiev, Ukraine
www.biomass.kiev.ua/conf2006/index.php?lang=en

13–15 November 2006

11th European Biosolids and Biowastes Conference, Workshop and Exhibition
Wakefield, United Kingdom
www.aqua-enviro.net/calendar_detail.asp?id=31

Coal Meetings

20–22 September 2006

UNECE Workshop on Geomechanical and Geodynamic Aspects of High Efficiency Extraction of Coalmine and Coalbed Methane
St Petersburg, Russia
www.unece.org/ie/se/docs/w_stpe_cmm.html

17–20 October 2006

15th International Coal Preparation Congress and Exhibition: Designing for the Environment
Beijing, China
www.ncics.org.cn

24–26 October 2006

Symposium on Western Fuels: 20th International Conference on Lignite, Brown, and Subbituminous Coals
Denver, Colorado, USA
www.undeerc.org/wfs

5–8 November 2006

American Association of Petroleum Geologists International Conference and Exhibition
Perth, Australia
www.aapg.org/perth/index.cfm

5–7 December 2006

International Oil and Gas Conference and Exhibition
Beijing, China

www.spe.org/spe/jsp/meeting/0,2460,1104_15354327557,00.html

Landfill Meetings

18–20 September 2006

Third International Conference on Biomass for Energy
Kiev, Ukraine

The Methane to Markets Partnership will be holding a one-day landfill methane workshop at this event.
www.biomass.kiev.ua/conf2006/index.php?lang=en

19–21 September 2006

Waste 2006
Stratford-upon-Avon, UK
www.waste2006.com

19–21 September 2006

Solid Waste Association of North America 44th Annual WASTECON
Charlotte, North Carolina, USA
www.swana.org/sections/wastecon

18–20 October 2006

Fourth Asia-Pacific Landfill Symposium (APLAS IV)
Shanghai, China
www.aplas.cn/index_e.htm

1–5 October 2006

International Solid Waste Association Annual Congress 2006
Copenhagen, Denmark
www.iswa2006.org

Oil and Gas Systems Meetings

6–8 September 2006

Renewable Resources and Biorefineries Conference
York, United Kingdom
www.rrbconference.net

23–25 October 2006

13th Annual Natural Gas STAR Workshop
Houston, Texas
www.epa.gov/gasstar/workshops/imp_workshops.htm

General Meetings

23–25 October 2006

Second International Conference on JI Projects in Ukraine—“Climate Change and Business”
Kiev, Ukraine
www.biomass.kiev.ua/JIconf2006/index.php?lang=en

24–27 October 2006

Great Wall World Renewable Energy Forum
Beijing, China
www.gwref.org/eng/main.asp

26–27 October 2006

Carbon Asia
Beijing, China
www.carbonexpoasia.com

28 November–1 December 2006

Pollutec 2006: 22nd International Exhibition of Environmental Equipment, Technologies, and Services
Lyons, France
www.pollutec.com

2–3 August 2006

Southwest Renewable Energy Conference
Flagstaff, Arizona
www.swrec.org/index.html

For more information about *Methane International* or the Methane to Markets Partnership, please visit www.methanetomarkets.org or contact the Administrative Support Group at asg@methanetomarkets.org.



Methane to Markets