



COALBED METHANE EXTRA



A publication of the Coalbed Methane Outreach Program (CMOP)

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Technology

Successful Demonstration of Technology for Utilization of Ventilation Air Methane

Ventilation air methane (VAM) provides the largest single opportunity for abatement of greenhouse gas emissions from underground coal mining, but the low concentration of methane in the air stream (typically <1.0% by volume) makes this fuel difficult to use in conventional combustion technologies. Thermal and catalytic oxidation technologies, however, now offer viable alternatives to put this methane to use generating thermal energy for heat or power production. Both technologies have long been used for the treatment of volatile organic compound (VOC) emissions, and can operate with a wide range of airflow rates and with methane concentrations as low as 0.1%.

EPA's Coalbed Methane Outreach Program and the Australian Coal Association Research Program have independently studied the capture and use of VAM during the past few years. Two technologies

appear to present the best potential for commercial adaptation to VAM. One is MEGTEC's Vocsidizer™, which uses an in-bed regenerative thermal exchange principle. The other is a catalytic flow reversal reactor developed by Energy Diversification Research Laboratory/ Natural Resources Canada (CANMET). Both the Vocsidizer™ and the CANMET reactor combust the VAM at very high temperatures producing useable energy from a heat exchanger. The major difference is the use of a catalyst in the CANMET reactor to reduce the auto-ignition temperature. (Continued on Page 3)



Vocsidizer Installation—Appin Colliery, NSW
(Photo courtesy of BHP Billiton)

The staff of EPA's Coalbed Methane Outreach Program wishes to express our condolences and deepest sympathies to all of those affected by the terrible events of September 11, 2001, especially to our friends and colleagues at Cantor Fitzgerald/CO2e.com who were deeply affected. CO2e.com, Natsource, and Evolution Markets, firms located in and around the World Trade Center in New York City, were all impacted in some form. Their ability to move forward in the aftermath of the monumental disaster that struck New York that day is a true model of resilience and courage. All three firms have been and will continue to be instrumental in developing and promoting the markets for greenhouse gas emission reductions.

CHP Plants Provide Excellent Option for CMM Use

Worldwide there is considerable potential to use coal mine methane (CMM) from active and abandoned coal mines as a fuel source for combined heat and power (CHP). CHP, also known as cogeneration, refers to the production, from a common fuel source, of both electric (or mechanical) power and heat or cooling. By recovering heat that is typically discarded to the environment – up smoke stacks or cooling towers – CHP applications can achieve efficiencies of 80% and higher, significantly better than more common power-only applications that achieve efficiencies ranging from 25% to 50%. Coal mines have large energy requirements and can use the by-product waste heat from CHP to produce steam for heating mine buildings or generating additional electricity. Coal preparation plants can also act as a thermal host, using steam-produced electricity for indirect coal drying or using hot air for direct drying.

China's CHP program is perhaps the most developed in the world, and China supports CHP with both policy and market incentives. Similarly, the European Commission has adopted an aggressive strategy to double CHP capacity by 2010. A number of country-level incentives have set new production targets for CHP, provided financial assistance, and promoted small-scale CHP plants.

Throughout Europe, coal mine methane is establishing itself as an important source for green energy, particularly in cogeneration applications. The recently adopted German Renewable Energy Act, which includes CMM as a renewable resource, continues to have a positive impact on CMM development in Germany. Recently, an existing CMM CHP plant in

Lünen, Germany was enlarged. Lüntec and G.A.S. Energietechnik have signed an agreement to replace the present CHP plant with a similar but larger plant. A further intention of this expansion is to connect the modules with the heating facilities of Technologiezentrum Lünen, which has a year-round demand for heat.

Also in Germany, G.A.S. Energietechnik GmbH together with their partners, RAG Aktiengesellschaft, Essen, and LAMBDA Gesellschaft für Deponiegastechnik mbH, Wuppertal have recently founded the joint venture company called Minegas GmbH. The aim of Minegas GmbH is the development of CMM from abandoned coal mines in the Ruhr area for the generation of energy that will be used in the electricity and heat market. The company expects to build 50 MW of capacity using CMM-fueled gas engine-based CHP power plants.



CMM-Fueled CHP Plant, Lunen, Germany
 Photo courtesy of G.A.S. Energietechnik

In the United States, the environmental and economic opportunity that CHP represents has attracted the attention of energy and environmental policy makers at the highest levels. A coordinated initiative between EPA, DOE's Office of Energy

Efficiency and Renewable Energy, the district energy community, and a diverse group of industry stakeholders seeks to double U.S. CHP capacity from the 1998 level of 46 GW to 92 GW by 2010. Incentives to promote the use of CHP technologies are now being incorporated into many of the newly proposed energy bills. President Bush's recently released National Energy Plan prominently features CHP with four specific recommendations for encouraging its accelerated development.

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Federal legislation currently before the U.S. House and Senate calls for CHP projects through: 1) the removal of electric industry barriers to development and deployment of CHP plants, 2) investment tax incentives, and 3) the funding of research and development for new CHP technologies. Finally, U.S. EPA is announcing a new voluntary CHP Partnership this October to provide assistance and recognition to companies contributing to the achievement of this national objective.

For more information about CHP, contact Joe Bryson in EPA's Energy Supply & Industry Branch at (202) 564-9631 or bryson.joe@epa.gov



EPA Coalbed Methane Outreach Program Introduces New Website

On September 6, 2001, the Coalbed Methane Outreach Program launched its new website at <http://www.epa.gov/coalbed>. With a new look and many new features, EPA believes the website will better serve the coal mine methane community. Some of the interesting new features include an entire section devoted to the recovery and use of Ventilation Air Methane, a more detailed summary of coal mine methane emissions and recovery options, previous issues of Coalbed Methane Notes, Frequently Asked Questions, an on-line coal mine methane units converter, and links to other sites of interest.

You are encouraged to visit the new website and explore the many features, new and old.

Utilization of Ventilation Air Methane (*Continued from Page 1*)

Field tests have been or are being conducted for both technologies. CANMET's test-scale project at a mine in Nova Scotia showed that its technology could reliably combust VAM. Australian coal operator BHP Billiton, with the assistance of MEGTEC, is currently conducting an industrial demonstration-scale project at the Appin Colliery in New South Wales to adapt a Vocsidizer™ for use with a portion of its VAM.

The goal of the one-year project is to confirm the ability of the Vocsidizer™ to destroy methane in mine ventilation air and evaluate its stability at low methane concentrations. The BHP Billiton/MEGTEC project began in January 2001 by modifying a Vocsidizer™ unit with a capacity of 5,000 m³/hr (2,942 scf/min) of input VAM. Appin Colliery currently generates approximately 1,440,000 m³/hr (847,200 scf/min) of ventilation air exhaust. Methane concentrations at the Appin ventilation fan typically range from 0.3% to 0.8% by volume resulting in average methane emissions of 79,200 m³/hr (46,600 scf/min). Thermal energy is captured by circulating water through a heat exchanger embedded within the Vocsidizer.

Early results showed that the Vocsidizer unit demonstrated stable operation at methane concentrations below 0.3%. The heat exchanger unit produced an energy recovery efficiency of 85%, which was better than anticipated. This recovery efficiency, plus higher than expected methane concentration levels during the project, required upgrading the heat exchange circuit. The upgraded system was then successfully operated using normal levels of VAM. In addition, BHP Billiton has reported that operation of the test unit has had no detrimental effect on the mine's ventilation system or mine performance overall.

The results reported by BHP Billiton also indicate that the power required to operate fans circulating VAM to the Vocsidizer unit is a manageable parasitic load, even when full-scale utilization is implemented. BHP Billiton believes this additional operational cost can be offset through energy recovery, or if the Vocsidizer is used only for methane mitigation, through the accumulation of carbon credits.

During the final months of the project, the unit is being operated on a continuous basis with higher levels of ventilation flow through the unit. The aim is to bring the project closer to commercial-scale development. During this time, BHP Billiton and MEG-

TEC are assessing heat exchanger efficiencies at operating levels closer to those associated with a system designed for steam and power generation.

VAM can also be used as a substitute for ambient air in internal combustion engines, gas turbines, or other combustion units. However, projects of this type usually require only a fraction of the VAM available. Until recently, the Appin-Tower Power Project used approximately 10% of the VAM from the Appin Colliery as combustion air in their internal combustion engines; however, this use was recently discontinued due to changes in Appin's ventilation system.

BHP Billiton and MEGTEC plan to present the results of the project at a seminar on capture and use of fugitive methane emissions from coal mining organized by the New South Wales Sustainable Energy Development Authority to be held on October 23 in Sydney, Australia. CBM Extra will continue to provide updates on this project and the seminar.

For more information about the project, contact Richard Danell of BHP Billiton at Richard.E.Danell@BHPBilliton.com, or Kenneth Zak of MEGTEC at kzak@megtec.com



CMM Projects in the Greenhouse Gas Emissions Reduction Market

Methane reduction and use projects, especially those at coal mining operations, have a window of opportunity in today's greenhouse gas market. Whatever form international or domestic policies on greenhouse gas (GHG) emissions take, they appear likely to include the opportunity for project-based emissions offsets and trading. Trading is already taking place and, to date, various parties have completed transactions totaling tens of millions of tonnes of CO₂ equivalent reductions throughout the world.

Many corporations have found that early involvement in the emerging emission trading market presents a valuable opportunity. Prices for GHG emission reductions today remain significantly lower than forecasted prices, due in part to buyer recognition of the risks associated with potential accreditation. According to Elizabeth Arner, Vice President of Transactions at CO2e.com, LLC, these risks are related to the uncertainties surrounding:

- implementation of international treaties or domestic programs;
- recognition of emission-generating project types;
- recognition of monitoring and verification protocols;
- flexibility of trading; and
- recognition of early credit.

Buyers can mitigate these risks through shared project liability with the seller, creating a diverse portfolio of project-based emissions purchases and investments, and by contract structures.

Coal mine methane projects are emerging as viable and credible project opportunities that will allow buyers to invest in diversified supply options. Arner notes that sellers in today's market should offer project-based investment and transaction

opportunities that meet at least a minimum set of requirements, including: (a) Real – meaning that the project results in reductions of GHG emissions or permanent sequestration of greenhouse gases; (b) Surplus – reductions must be voluntarily produced and not required by regulation; (c) Quantifiable – the seller must ensure that measurement of the GHG reductions is done with proven and reliable measurement protocols or techniques; (d) Verifiable – buyers require an independent third-party verification of the reductions; and (e) Ownership – proven and indisputable title to the reductions.

Greenhouse gas transactions currently include simple spot purchases and sales, structured options transactions, and project investment with adequate rates of return that include delivery of emissions reductions. Transactions are not standardized and terms are set by mutual agreement between the buyer and seller, but in adherence with evolving business practices guided by developments in international protocols. Independent and impartial brokers can provide a beneficial role in these negotiations by ensuring that both parties' interests are represented and that the resulting contracts reflect evolving market trends.

For more information visit the websites of greenhouse gas brokerage and consulting firms: CO2e.com www.CO2e.com; Evolution Markets LLC, www.evomarkets.com; Environmental Financial Products, www.envifi.com; Natsource, www.natsource.com; Trexler & Associates, www.climateservices.com; Ecorescurities www.ecorescurities.com; Emission Credits International www.ecarbontrade.com; The Carbon Trader www.thecarbontrader.com.

CONSOL and Allegheny Energy to Construct CBM-Fueled Power Plant

CONSOL Energy Inc. and Allegheny Energy Inc. propose to form a joint venture company to construct and operate an 88 MW electric generating facility. Under the terms of the joint venture, each company will own a 50% interest in two General Electric simple cycle natural gas combustion turbines. An Allegheny Energy unit will operate the facility in Buchanan County, Va. on land controlled by CONSOL Energy. Output from the facility will be sold into the competitive marketplace. The plant is estimated to cost \$50 million and will be fueled by coalbed methane produced by CONSOL Energy's CNX Gas operations. CONSOL Energy officials are pleased that the company's first power generation partnership is with its largest coal customer. Permitting for the facility is under way. CONSOL expects to execute a final agreement by September 30 and the companies hope to have the new plant in operation by the end of June 2002.

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Legislative Update

The National Energy Security Act (S. 389) and the Energy and Tax Incentive Policy (S. 596)

Two bills have been introduced in the U.S. Senate that would extend or expand tax credits for CMM/CBM development. The first, S. 389, would extend the existing Section 29 Tax Credit. The second, S. 596, would create a specific tax credit for coal mine methane. Following is an overview of the two bills.

S. 389: National Energy Security Act of 2001

Senate Bill 389, Section 903 was formally introduced on February 27, 2001 by Senator Murkowski. It is currently in Senate Committee, and would expand the number of fuels (including CMM) covered by the Section 29 Credit and also extend the expiration date of the credit to December 31, 2012. That credit, although not specifically geared toward CMM/CBM development, played a significant role in encouraging CMM/CBM recovery in the United States. Enacted in 1980, Section 29 provided "a credit for qualified fuels sold by a tax payer to an unrelated person during the tax year." The purpose of the credit was to "encourage domestic production from deposits that are unusually difficult and expensive to develop." Currently, the credit only applies to CMM/CBM wells that were in existence by December 31, 1992, and payments on this production will end December 31, 2002. The bill proposes to phase-out the credit gradually over a five-year period.

S. 596: Energy Security and Tax Incentive Policy Act of 2001

Senate Bill 596, formally introduced on March 22, 2001 by Senator Bingaman and also currently in Senate committee, would create an entirely

new credit for "gas captured from active coal mines and used as gas." This bill is intended to provide further incentive for the development of clean coal technologies and other efficient energy resources. Section 45K states: "For purposes of section 38, the coal mine methane gas capture credit of any taxpayer for any taxable year is \$1.21 for 1,000,000 Btu of coal mine methane gas captured by the taxpayer and utilized as a fuel source or sold by or on behalf of the taxpayer to an unrelated person during such taxable year."

According to Elizabeth McClanahan, attorney at PennStuart in Abingdon, Virginia, this tax credit differs from that in Section 29 in several ways. First, this proposed credit is not as date restrictive as that in Section 29. Second, it is specifically geared toward coal mine methane. Third, the gas does not have to be sold to be eligible for the credit; if the taxpayer uses the CBM as a fuel source, they would also be eligible for the credit. These modifications answer many of the criticisms of the narrowly tailored Section 29 Tax Credit.

To view the bills' text, please visit the Library of Congress web site at <http://thomas.loc.gov>.

EPA Releases Workshop Summary

EPA sponsored a workshop in Tuscaloosa, Alabama in conjunction with the International Coalbed Methane Symposium at the University of Alabama this past May. Approximately 50 people attended from numerous countries to identify barriers constraining development of coal mine methane (CMM) and coalbed methane (CBM) resources in developing countries and countries with economies in transition (EITs, e.g., former Soviet republics).

CBM/CMM experts presented country-specific case studies for Ukraine, Kazakhstan, and Russia. In addition, Megtec Systems, a multinational corporation, presented the perspective of a company attempting to deploy technical equipment in several countries. Workshop participants identified many barriers focusing on cultural, political, financial, technological, market, and legal/regulatory issues. While these barriers present clear obstacles to successful development, participants noted that many of the barriers can be overcome and, in some cases, are currently being addressed.

EPA is attempting to build on the discussions at the workshop and would welcome input on the most effective way to continue the dialogue. A summary of the workshop proceedings is available on the Coalbed Methane Outreach Program website at www.epa.gov/coalbed on the "What's New" page.

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China Symposium to Showcase CMM Investment Opportunities

The 2001 International CMM/CBM Investment and Technology Symposium/Expo, to be held November 6-8 in Shanghai at the Holiday Inn Pudong Shanghai, will feature presentations and discussions on specific CMM project opportunities in gassy coal mining areas of China. The Symposium is the culmination of a 2½-year effort by EPA and the State Administration of Coal Mine Safety Supervision of China to identify and market the best opportunities for CMM development in China. This joint project has identified eight coal mining areas (Jincheng, Huainan, Huaibei, Panjiang, Pingdingshan, Fushun, Yangquan, and Jiaozuo) that are especially favorable in terms of CMM/CBM resource and market potential.

EPA, the China State Administration of Coal Mine Safety Supervision, and the China National Coal Association are co-sponsoring the Symposium, organized by the China Coalbed Methane Clearinghouse. The event is timely in that the Asian Development Bank recently agreed to allocate substantial funding for CMM/CBM projects in China (see related

article at right), and opportunities for project development have never been better.

In addition to presentations on investment opportunities, international experts on methane drainage and use technologies, greenhouse gas emissions markets, and resource characterization will present papers. The Symposium is an important event for energy project developers, investors, lenders, and technology providers. Shanghai is the trade and financial capital of China.

The registration deadline for the event is October 15, 2001. Please visit www.ravenridge.com/china.htm for additional details about the Symposium and on-line registration. Persons wishing to contact the conference organizers directly may contact Mr. Huang Shengchu at the China Coalbed Methane Clearinghouse, cbmc@public.bta.net.cn or Ms. Sally Hill at Raven Ridge Resources Incorporated, shill@ravenridge.com. Inquiries may also be directed to Karl Schultz by phone at (202) 564-9468; by fax at (202) 565-2077; or by e-mail at schultz.karl@epa.gov.

ADB to Allocate Financing for China CMM Projects

The Asian Development Bank (ADB) recently announced plans to allocate significant financing for coal mine methane projects in China. ADB has already funded a feasibility study on the Yangquan CBM project, the results of which indicated that a 50 MW CMM-fueled power generation project at the Yangquan mining area (Shanxi Province) would be prima facie technologically and economically feasible.

Representatives of ADB and other parties present at ADB's CBM project meeting in Beijing on June 8, 2001 agreed that the Yangquan Coal Group could apply for financial assistance from ADB for this project. The Yangquan Coal Group is also considering developing a methanol project that would use CMM as a feedstock, and an underground coal mine methane drainage project.

ADB will provide financial assistance for a feasibility study on proposed CBM projects at the Jincheng Mining Area, also in Shanxi Province. Jincheng Mining Group's current proposal envisions a 120 MW CBM-fueled power project, as well as a project aimed at increasing recovery of CBM at the Panzhuang mine. ADB has also indicated its willingness to sponsor a feasibility study for a CBM surface development project at the Fushun Mining area in Liaoning Province.

ADB is a multilateral development finance institution that engages in mostly public sector lending for development purposes in its developing member countries. For more information on ADB's coal mine methane activities in China, contact Mr. Edu Hassing, ADB Senior Project Officer, at ehassing@adb.org.

New Publications

Proceedings from the following conferences are available:

- SRI 2nd Annual Coalbed and Coal Mine Methane Conference, March 27 and 28, 2001, Denver, Colorado; and Eastern Version, July 19 and 20, 2001, Annapolis, Maryland. To order call 1-888-666-8514.
- Conference on International Investment Opportunities in Coalbed and Coal Mine Methane, March 28th to 29th 2001, London. To order visit www.smi-online.co.uk/conference
- 2001 International Coalbed Methane Conference, May 14-18, 2001, University of Alabama, Tuscaloosa, Alabama. To order call 1-(205) 348-9966.
- Publications on investment opportunities in coal mine methane projects in four different mining areas of China, prepared by the China Coalbed Methane Clearinghouse, are now available. For each of the four mining areas – Jincheng, Huainan, Huaibei, and Panjiang – the Clearinghouse has prepared both full-length (12-16 page) reports and a four-page overview. The four-page overviews may be downloaded in PDF format from www.ravenridge.com/KeyTopics.htm. To order hardcopies of the full-length reports, please contact Karl Schultz (schultz.karl@epa.gov) and specify the name of the mining area(s) desired.



Upcoming Events

Fall 2001 North American Coalbed Methane Forum Morgantown, West Virginia October 30-31, 2001

The Fall 2001 Session of the North American Coalbed Methane Forum at the Lakeview Resort in Morgantown will begin with a reception on October 30. The program for the October 31 session includes presentations on energy pricing, a CBM legal update, sequestration of carbon dioxide, and summaries of CBM activity in several states. The pre-registration deadline is October 22. Registration fees are \$90 for pre-registration and \$120 after October 22. In addition, the Gas Technology Institute will be offering a one-day short course entitled "Fundamentals of Coalbed Methane Reservoir Engineering" on October 30. For more information, contact Kashy Aminian at (304) 293-7682, x 3406.

2001 International CMM/CBM Investment Symposium Shanghai, China November 6-8, 2001

This symposium, co-sponsored by the China State Administration of Coal Mine Safety Supervision and EPA, is a culmination of a 2 ½- year effort to identify and market the best opportunities for CMM development in China. Topics to be discussed include: 1) investment opportunity at eight coal mining companies with the best market potential, 2) exploration and development technology, and 3) financing, policy and regulatory issues.

For more information, see the article on Page 6 of this *Extra* and visit the Symposium website at www.ravenridge.com/china.htm

Fraunhofer Institute for Environmental, Safety, and Energy Technology Oberhausen, Germany November 7-8, 2001

The conference will focus on coal mine methane extraction and use, looking at it from a geological, environmental and safety-technologic aspects. The conference is targeted to an international audience with representatives from many countries.

For more information, visit www.umsicht.fhg.de or contact Ms. Alina Mroz, Osterfelder Str. 3, D-46047 Oberhausen, Germany 49 (0208) 85-98-259, alina.mroz@umsicht.fraunhofer.de

AICHe Spring National Meeting New Orleans, LA United States March 10-14, 2002

There will be four symposia on Gas Conversion & Utilization at the Spring 2002 National Meeting of the American Institute of Chemical Engineers. The symposia address Synthesis Gas Generation, Gas Conversion to Liquid Fuels, Gas Conversion to Chemicals, and Coal Bed Methane/Gas Upgrading/CO₂ Sequestration.

The Coal Bed Methane/Gas Upgrading/CO₂ Sequestration symposium will deal with coalbed methane resources, production, production enhancements, product upgrading, and utilization technologies, polymeric membranes, and hybrid gas separation technologies, and sequestration of CO₂ from natural gas operations.

For more information, visit the AICHe website: www.aiche.org/conferences/Spring

AAPG Annual Convention Houston, TX United States March 10-13, 2002

Houston, Texas, will host the 2002 American Association of Petroleum Geologists Annual Convention. The convention will be held at the George R. Brown Convention Center in downtown Houston. A technical program consisting of oral, poster, and Interactive E-Poster sessions is planned along with quality field trips and short courses. Session themes include New Frontiers in Coal and Coalbed Methane.

For more information, visit the AAPG website at www.aapg.org/meetings/annual2002.

North American / 9th U.S. Mine Ventilation Symposium Kingston, Ontario Canada June 8-12, 2002

The Department of Mining Engineering, Queen's University, is organizing the next U.S. Mine Ventilation Symposium, to be held at the campus of Queen's University in Kingston, Ontario. Papers will be presented on a variety of topics including ventilation planning, methane control, and explosions and outbursts.

For more information, visit the Symposium website at: <http://mine.queensu.ca/ventilation>, Or contact: Euler De Souza at (613) 533-2199