



# COALBED METHANE EXTRA



A publication of the Coalbed Methane Outreach Program (CMOP)

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## Technology

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### CMM-Fueled Power Generation In The US: Prospects For The Future

*The United States is the world's leader in capturing and utilizing coal mine methane, putting to use 36 billion cubic feet (1 Bm<sup>3</sup>) of CMM in 2000 - - over 80% of the gas drained from US mines. Almost all of this gas enters the US natural gas system. Power generation, however, may hold the key to achieving even greater market penetration for CMM. While implemented in many countries around the world, CMM-fired power projects have yet to become an established market in the US. Recent events suggest this could be changing as power projects come on line, notably an 88-MW power plant in Virginia that utilizes a mixed CBM/CMM stream. This article explores the challenges faced by US CMM-fired power projects, the favorable market conditions in other countries that have led to successful project implementation, and the future prospects in the US for such projects, including those that use ventilation air methane and gas from abandoned mines.*

#### CONSOL Energy and Allegheny Energy 88-MW Plant Enters Commercial Service

On June 25, 2002, CONSOL Energy and Allegheny Energy placed the 88-MW Buchanan Generation Station into commercial service. The power plant, consisting of two 44 MW units, began generating electricity for sale into the grid on June 27, and is intended to meet peak demand in the Eastern Region of the US. Located in southwest Virginia near CONSOL's VP and Buchanan mines, the generators are General Electric LM6000 combustion turbines utilizing a mixed stream of coalbed methane and coal mine methane. Allegheny Energy, with a 50 percent interest in the project, operates the facility, and is selling power into the competitive wholesale market. For more information, please visit [www.consolenergy.com](http://www.consolenergy.com).



Consol Energy and Allegheny Energy's 88 MW Buchanan Generation Plant  
(photo courtesy of Consol Energy, Inc.)



**CMM-Fueled Power Generation In The US (Continued From Page 1)**

**Introduction**

Coal in gassy seams is mined in many countries around the world liberating large volumes of methane. Drainage, or degasification, systems are often used in conjunction with mine ventilation to recover the methane in advance of mining or after mining occurs producing high-quality or medium-quality gas that can be utilized in a variety of applications. The United States leads the world in both the recovery and use of coal mine methane (CMM). In 2000, the most recent year statistics are available, US coal mines recovered 45 Billion cubic feet (1.4 Bm<sup>3</sup>) of CMM using degasification systems while utilizing 36 billion cubic feet (1Bm<sup>3</sup>), or over 80%, of the recovered gas. The market penetration is the highest since 1990 when EPA began tracking recovery and use data.

Almost all of the 36 Bcf of CMM utilized in the US is put directly into the natural gas system. The remaining 9 Bcf of is vented to the atmosphere. This unutilized CMM is typically medium quality gas that can either be processed to meet pipeline quality standards or used directly in other applications. Electricity generation is one alternative use gaining interest among project developers. In fact, on June 25, 2002, CONSOL Energy and Allegheny Power Systems began operating an 88-MW power facility in southwestern that uses a mixed coalbed methane/ coal mine methane stream Virginia (see box on page 1). US project developers are also examining potential CMM-based power models in Europe, Asia, and Australia where mines have pursued power generation projects to a much greater extent (see Table 1).

Does the CONSOL/Allegheny project signal the start of a trend toward more CMM-based power projects, and are the current market conditions favorable for power and other types of projects to attain an even greater market penetration for CMM? To address these questions, this article examines the historic market conditions for CMM in the US, considers pertinent trends in other coal producing countries, and offers some insights on the future prospects for CMM-fired power production in the US.

**The US CMM Market & Power Generation Projects – A Historical Perspective**

Several factors, including a capitalized and well-established natural gas infrastructure and low power prices, have contributed to making pipeline injection the preferred CMM use option over electricity generation in the US.

- High quality gas. Much of the CMM produced in the US is high quality gas recovered before mining occurs, and it usually meets pipeline quality standards.
- Established natural gas infrastructure. CMM can be sold directly into developed natural gas markets using the established pipeline and distribution infrastructure with minimal or no processing. This has often resulted in lower investment thresholds than other utilization alternatives.
- Low electricity prices. Another factor is the low price of electricity in many US coal producing regions. When comparing the economic returns of power generation to other alternatives, the low electricity prices have resulted in power projects not being as attractive, regardless of whether the mine intended to use the power on-site to offset electricity purchases or sell the power to generate revenues.

**Table 1. Selected CMM-Fueled Power Projects**

Country	CMM Source	Mine Name	Size (kW)	Technology
Australia	Active mines	Appin & Tower	94,000	Gas engines
China	Active mine	Jincheng	1,840	Gas engines
Germany	Active mine	Lunen	373	Turbine/cogeneration
Germany	Abandoned mines	Lunen & Mont Cenis	6,400	Turbines
Japan	Abandoned mine	Akibira	130	Micro turbines
Poland	Active mine	Krupinski	2,700	Gas engine
Poland	Active mine	Pniowek	7,100	Gas engines
Russia	Active mine	Chertinskaya	1,000	Gas engine
UK	Abandoned mine	Shirebrook	9,000	Gas engines
UK	Abandoned mine	Steetley	6,000	Gas engines
UK	Active mine	Hickleton Vent	5,400	Gas engines

## CMM-Fueled Power Generation In The US (Continued From Page 2)

- Smaller size for power projects. CMM power projects are sized according to the gas resource in place, estimated coal production, gas liberation rates, long term mining plans, location to transmission lines, financial resources, and power markets. With the exception of the CONSOL/ Allegheny project, many project developers have considered the optimal size to be in the 1-10 MW range for both technical and market reasons. It can, however, be difficult for projects of this size to compete with larger plants that have greater thermal efficiency and lower marginal costs.

### Why Have Power Projects Proven Viable Overseas?

Two key factors have supported the relative success of power projects overseas: the existence of barriers to enter the natural gas pipeline system and a positive environment for power project development.

Counter to the experience of CMM producers in the US, it is technically and economically difficult in many countries to develop high-quality gas pipeline injection projects. Reliable natural gas networks are limited in many countries and are often distant from mining areas, creating hurdles for marketing the gas. Additionally, the CBM/CMM industry in many countries has limited access to modern gas production and collection technologies, thus much of the CMM does not meet pipeline standards,

In contrast, the commercial climate for power projects is attractive in many coal producing countries. While each country exhibits a different set of conditions, several factors are positively influencing power project development: (1) growing demand for power; (2) demand for power in remote mining areas; (3) attractive power prices; (4) strong markets for thermal energy by-products of cogeneration plants; and (5) special incentives that apply to CMM.

In several of the countries listed in Table 1, these factors, either alone or in combination, have provided powerful incentives for power project development.

- Australia. The world's largest CMM power project benefits from a relatively high power cost, an abundance of medium-quality CMM, and a supportive federal government. Australia continues to promote CMM use with a series of grants that support the demonstration of innovative CMM recovery technologies such as gas engine-generators at the Bellambi Mine that will use CMM drained in advance of mining.

- Germany. Like several European countries, Germany offers strong markets for both the electric and thermal outputs of cogeneration plants that are fueled with CMM. In this positive climate, one new joint venture will develop 50 MW from gas engine-combined heat and power (CHP) plants using CMM from abandoned mines. Another joint venture will install up to 15 CHP plants that will use drained CMM from active mines such as the Lohberg/Osterfeld Mine. To spur installation of smaller units, the German government in 2000 passed a renewable energy law that sets a price of 7.7 Euro cents per kWh (~US\$0.075) for electricity generation installations (with an electrical capacity of under 500 kilowatts) that use gas from coal mines.
- United Kingdom. With the introduction of the Climate Change Levy in 2001 and its exemption for "clean" renewable energy resources like solar and wind, renewable sources of energy are beginning to gain more attention in the UK. This was recently bolstered by the announcement that power generated from CMM now joins those sources that are exempt from the Climate Change Levy (see article on page 6). Additionally, the British government is investing over US \$360 million in the next three years into renewable energy sources.

### Future Prospects for Power in the US

With 9 Bcf of drained gas from operating mines still being emitted to the atmosphere, there is plenty of opportunity for CMM-fired generation, and several factors should encourage additional project development.

- Gas supply. The remaining medium-quality CMM (usually gob gas) is the major uncommitted drained gas source. In some cases, it will likely be more economical to use this gas for electricity generation rather than the natural gas system due to the costs associated with processing the gas to meet pipeline specifications.
- More limited access to the natural gas grid for mines in the West. Drainage operations have begun in the western US, but access to the pipeline network is more limited than in the East. Power generation may be a viable option for more isolated areas.
- Increased demand for power in certain regions of the US. Continued growth in electricity demand, especially in the western US, is expected to increase the need for additional generating capacity.
- Better transmission access. The formation of regional transmission owners (RTOs) may improve efficiencies in transmission grid management by improving reliability and access and cutting transaction costs.



## CMM-Fueled Power Generation In The US (Continued From Page 3)

- Continued research and development. Engine manufacturers continue research and development into more efficient and cost-effective engines. In some cases, the engines are able to utilize very low methane concentrations through employment of catalysts and concentrators. Several manufacturers are targeting the CMM market, and hope to deploy demonstration scale projects in the near future.

<http://www.epa.gov/coalbed/vam/index.htm>).

The flow reversal reactors generate thermal energy by oxidizing the ventilation air at very high temperatures. The thermal energy can then be used in steam or gas turbines to generate electricity. The generating capacity using VAM is substantial. In the US, with VAM emissions of 90 Bcf (2.5 Bm<sup>3</sup>), the total technical potential exceeds 500 MW.

## Additional Sources of CMM for Power Projects Conclusions

Drained gas from active mines is not the only prospective source for CMM-fueled electricity generation. Power projects can also use methane drained from abandoned mines and ventilation air methane.

### Abandoned Mine Methane

Abandoned mines are an excellent source of fuel for power projects. In most cases, abandoned mines produce medium quality gas that requires treatment before being injected into the gas pipeline system. This abandoned mine methane (AMM), however, can often be used directly in gas-fired engines without any pre-treatment. In addition, AMM developers are typically not required to integrate the project with the operations of a working mine; therefore, the power project can be sited at the optimal location and run according to the project developer's needs rather than the mine's needs. With the exception of the CONSOL/Allegheny project, all US CMM power projects to date have been associated with abandoned mines. One such project is Northwest Fuels Development's operations in Cadiz, Ohio ([www.northwestfuel.com](http://www.northwestfuel.com)).

### Ventilation Air Methane

The greatest opportunity to increase power generation from CMM may be through the use of ventilation air methane (VAM). VAM is the dilute methane stream in the mine ventilation air, typically less than 1% of volume. Though low in concentration, it accounts for about two-thirds of all methane liberated from underground mining operations in the US. VAM has already been used as combustion air in the internal combustion engines at the Appin Colliery in Australia, but recent advances in flow reversal reactor technology and other technologies now make large-scale use of this methane resource a potentially viable option (for more information see October 2001 *Coalbed Methane Extra* <http://www.epa.gov/coalbed/clibrary/extra/10-01.pdf> or visit

While historically, factors have favored pipeline injection over CMM-fired power projects in the US, CONSOL and Allegheny Power have demonstrated the viability of CMM-fired power projects. Continued research and development, an increasing demand for electricity, and a ready supply of medium-quality CMM make power a feasible alternative for drained gas, especially the remaining volumes that are still being vented to the atmosphere. In addition, abandoned mine projects and, especially, ventilation air methane are also excellent sources of fuel for electricity generation. If this methane can be recovered and put to use, the benefits are significant including utilization of an otherwise wasted energy resource and mitigation of a greenhouse gas.

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## International Developments

### UK Coal Emissions Trading Bid Successful

An auction for entry into the UK's Department for Environment, Food, & Rural Affairs (DEFRA) emissions trading scheme took place on March 11-12, 2002. Direct participants are required to make absolute reductions against their emission levels in 1998-2000 in exchange for an incentive payment from the government. The maximum incentive payment that any one company could receive is £43 million.

According to DEFRA, the auction was completed successfully after nine rounds and closed at a price of £53.37 per tonne of CO<sub>2</sub> equivalent (CO<sub>2</sub>e). The set price is what the UK Government will pay per tonne of emissions reduction delivered by the 34 direct participants. Actual trading began on April 2<sup>nd</sup>, when participating organizations were able to trade allowances to meet their target at minimum cost.

One of the successful auction participants was UK Coal Plc., which set an overall target of emissions reductions of 400,000 tonnes of CO<sub>2</sub>e over five years or about 10% of the total UK target.

UK Coal plans to meet this goal through CMM recovery projects at one or more of its 13 collieries in the Midlands, Yorkshire and the North East areas of the United Kingdom. UK Coal had already volunteered to increase methane utilization at its collieries by 135% from its 1998 level by 2005. This voluntary action will remove the equivalent of 350,000 tonnes of carbon dioxide per annum, taking their total annual utilization to over 600,000 tonnes. The company hopes that the proceeds from this recent UK emissions trading scheme will fund additional methane generation units at several collieries which in turn, will assist in helping the Company to meet its emission reduction targets.

DEFRA also received an application for entry into the Emissions Trading Scheme from an abandoned CMM project, but currently, methane from abandoned underground coal mines is not an eligible emissions source.

Details of the UK Government emissions trading scheme can be found at: <http://www.defra.gov.uk/environment/climatechange/trading/index.htm>

### Ugletmetan Coal and Methane Center Announces Grand Opening

The International Coal & Methane Center: Ugletmetan was recently established in Kemerovo, Russia and was formally dedicated in June 2002. It was previously known as the Russian Coalbed Methane Center, which operated informally under the auspices of the Russian Coal Institute, Siberian Branch. Ugletmetan retains the same experienced staff and base of knowledge, but is now an autonomous, formally registered not-for-profit organization.

Ugletmetan is dedicated to promoting coal mine methane and coalbed methane recovery and utilization in Russia and other countries of the Former Soviet Union. The firm provides a wide variety of services to mining companies, investors and public organizations interested in developing the resource. These services include resource assessment, laboratory analyses, feasibility studies, economic evaluations, technical translation, and logistical arrangements. Ugletmetan has in-depth knowledge of technical and institutional issues related to coal mine and coalbed methane in Russia, and can help guide investors through the steps required for project development.

Ugletmetan is managed by Oleg Tailakov, the Executive Director, Tamara Panchisheva, the Assistant Director, and Gennady Polevshikov, a Senior Mining Engineer. An accountant/economist, and four staff engineers serve to round out the team's capabilities. Those interested in learning more about Ugletmetan may contact them at [mail@ugletmetan.ru](mailto:mail@ugletmetan.ru) or visit their website at [www.ugletmetan.ru](http://www.ugletmetan.ru).



Oleg Tailakov tours a CMM drainage station at a gassy coal mine in Vorkuta, Russia



## CMM Projects Exempt from UK Climate Change Levy

Power projects using abandoned mine methane in the UK will now be exempt from the UK Government's Climate Change Levy (CCL). The CCL, a tax on the business use of energy introduced in April 2001, encourages business to improve energy efficiency and reduce emissions of greenhouse gases. In addition to the existing exemption for renewable forms of energy, the Government is exempting two further sources of energy generation from the CCL in view of their environmental benefits. The exemptions will cover: 1) electricity from combined heat and power (CHP) plants sold via licensed electricity suppliers, and 2) electricity from coal mine methane from abandoned coal mines sold via licensed electricity suppliers.

This exemption, which is also subject to state aids approval, will take effect shortly and be reviewed during 2004-05 in the light of further information on the environmental benefits of CMM.

Details of the exemption are available at: [www.hm-treasury.gov.uk/budget/bud\\_bud02/budget\\_report/bud\\_bud02\\_repchap2.cfm](http://www.hm-treasury.gov.uk/budget/bud_bud02/budget_report/bud_bud02_repchap2.cfm)

## CONSOL Energy Wins EPA's Annual Climate Protection Award

In March 2002, CONSOL Energy, Inc. became the first coal mining company to receive EPA's Annual Climate Protection Award. At a special EPA Awards dinner on March 25, J. Brett Harvey, CEO, accepted the award on behalf of CONSOL. This year CONSOL was one of only 7 corporate EPA Climate Protection Award winners. With these awards, EPA honors the extraordinary accomplishments of companies, associations or individuals that have made contributions to protecting the Earth's climate. Since 1998, 68 individuals, companies, and organizations from 12 countries have earned the Climate Protection Award.

CONSOL Energy was one of the first coal companies to extract methane from its mines to improve mine safety,

and is a global industry leader in recovering and using coal mine methane and coalbed methane. The company has an average daily gas production of 130 million cubic feet, most of which is sold commercially. In 2000, CONSOL's recovery operations resulted in avoided emissions of 9.2 million tons carbon dioxide equivalent (MMTCO<sub>2e</sub>). This was two-thirds of the U.S. coal industry's avoided emissions in 2002, and was almost four times more than CONSOL's 1990 avoided emissions.

## CMM Web Sites Provide a Wealth of Information

Several government organizations and industry associations worldwide have CMM and/or CBM web sites that provide helpful information on legislation, projects and current happenings.

- In the U.S., the U.S. Environmental Protection Agency Coalbed Methane Outreach Program ([www.epa.gov/coalbed](http://www.epa.gov/coalbed)). The Coalbed Methane Association of Alabama ([www.coalbed.com](http://www.coalbed.com)) have long-established sites that include information on US and international projects.
- The UK's Association of Coal Mine Methane Operators (ACMMO) represents 16 companies involved with the extraction and use of methane from abandoned coal mines to generate electricity ([www.acmmo.org](http://www.acmmo.org)). The UK Department of Trade & Industry Cleaner Coal Technology Programme (<http://www.dti.gov.uk/cct/index.htm>) has published a number of excellent documents on CMM recovery technologies and market opportunities.
- Germany's Interessenverband Grubengas, the German CMM association, features a web site at [www.grubengas.de](http://www.grubengas.de).
- For information on activities in the Far East, the China Coalbed Methane Clearinghouse ([www.coalinfo.net.cn/](http://www.coalinfo.net.cn/)) and the Japan Coal Energy Center or JCOAL ([www.jcoal.or.jp](http://www.jcoal.or.jp)) have very informative sites in English.
- In Eastern Europe and the CIS, check the following: Partnership for Energy & Environmental Reform in Ukraine has several important documents available for downloading on its website (<http://www.peer.org.ua>). Uglemetan, the International Coal & Methane Research Center in the Kuzbass Basin of Russia initiated a website on August 1, 2002 <http://www.uglemetan.ru> in Russian and English. For information on Poland, the Central Mining Institute's web address is <http://www.gig.katowice.pl>. The Methane Center of Kazakhstan is also developing a website. In the interim, please contact Mr. Serguei Stoupak at [kazmethane@azimut.kz](mailto:kazmethane@azimut.kz)



# Upcoming Events

## 1st International Kazakhstan Coal Methane Conference and Workshop, Almaty, Kazakhstan Fall 2002

Kazakhstan project opportunities are to be presented at the Conference as well as international experience in design and implementation of coal methane projects. For more information, contact Mr. Serguei Stoupak at [kazmethane@azimut.kz](mailto:kazmethane@azimut.kz) or at 3272.503232.

## Fifth European Coal Conference Mons-Frameries Belgium September 17-19, 2002

The conference will focus on the geology of coal deposits, with special attention to environmental issues. Recovery and use of coalbed methane and coal mine methane, abandonment and natural gas storage will be among the conference themes. For more information please visit the conference web site at <http://ibelgique.iffance.com/Geoindex/eurocoal/ecc5.htm> or contact Michiel Dusar, Geological Survey of Belgium at Jenner str. 13, B-1000 Brussels, Belgium  
tel ++32 26270410 ; fax ++32 26477359; e-mail [michiel.dusar@pophost.eunet.be](mailto:michiel.dusar@pophost.eunet.be)

## Pittsburgh Coal Conference Pittsburgh, Pennsylvania, USA September 23-27, 2002

One session will be devoted specifically to production of coalbed methane while several other related sessions are scheduled for the conference. Email [pcc@engrng.pitt.edu](mailto:pcc@engrng.pitt.edu) or visit <http://www.engr.pitt.edu/pcc> for more information.

## Emissions Marketing Association Fall 2002 Conference and International Meeting Toronto, Ontario, Canada

## September 29 - October 1, 2002

The EMA will be holding its Fall 2002 meeting at the Hilton Toronto. Please visit the EMA website at [www.emissions.org](http://www.emissions.org) for more information.

## Sixth International Conference on Greenhouse Gas Control Technologies Kyoto, Japan October 1-4, 2002

The aim of the conference is to provide a forum for the discussion of the latest advances in the field of greenhouse gas control technologies, including those for non-CO<sub>2</sub> gases. For more information, please visit [www.rite.or.jp/English/E-home-frame.html](http://www.rite.or.jp/English/E-home-frame.html) or [www.ieagreen.org.uk](http://www.ieagreen.org.uk).

## 4<sup>th</sup> Unconventional Gas and Coalbed Methane Conference October 23-25, 2002

Calgary, Alberta, Canada  
Sponsored by the Canadian Coalbed Methane Forum and Petroleum Technology Alliance Canada, the conference focuses on CBM and unconventional gas characterization, exploration, and production in Canada and the US. For more details, see <http://www.ptac.org/techgasf.html>.

## Third International CBM/CMM Conference

### Beijing, China November 12-14, 2002

Sponsored by the China State Administration of Coal Mine Safety Supervision, the China National Coal Association, China United Coalbed Methane Corp., and US EPA, the conference will present the opportunity to learn about CBM/CMM projects in China and opportunities for future investment. For more information, contact Ms. Liu Xin of the China Coalbed Methane Clearinghouse at [cbmc@public.bta.net.cn](mailto:cbmc@public.bta.net.cn) or Ms. Sally Hill of Raven Ridge Resources at [shill@ravenridge.com](mailto:shill@ravenridge.com) or visit the

Symposium website at <http://www.coalinfo.net.cn/coalbed/meeting/2002/m2002.htm>.

## Society for Mining, Metallurgy and Exploration Cincinnati, Ohio United States February 24-26, 2003

The Society for Mining, Metallurgy, and Exploration has issued a call for papers for its 2003 annual meeting. There are a number of sessions devoted to coal mining including Underground Coal Mine Ventilation. For more information, go to [www.smenet.org](http://www.smenet.org)

## 2003 International Coalbed Methane Symposium Tuscaloosa, Alabama, USA, May 5-9, 2003

The University of Alabama has issued a first call for papers and expressions of interest for next Symposium. The Call for Abstracts has been extended to September 30, 2002. The symposium provides the opportunity for examination and exchange of technologies concerning coalbed methane. For more information, please contact Nova Hodo at [nhodo@ccs.ua.edu](mailto:nhodo@ccs.ua.edu).

## Fall 2002 North American Coalbed Methane Forum Morgantown, West Virginia October 29-30, 2002

The Fall 2002 Session of the North American Coalbed Methane Forum at the Lakeview Resort in Morgantown will begin with reception on October 29. For more information, contact Kashy Aminian at (304) 293-7682, x 3406 or [kaminian@wvu.edu](mailto:kaminian@wvu.edu).



## New Publications

**Catalog of Coal Mine Methane Project Finance Sources.** Published by EPA in February 2002, this report describes six types of finance sources for coal mine methane projects: private, federal, state, multilateral and other international, and greenhouse gas emissions brokers. The report is available in electronic form from [www.epa.gov/coalbed/clibrary](http://www.epa.gov/coalbed/clibrary) or in hardcopy by calling 1-888-STAR-YES (782-7937).

**Proceedings from the SMI Coal Mine Methane and Coalbed Methane Conference, London, England, March 18-19, 2002.** To purchase proceedings from this conference in hardcopy, compact disk, or audio form, visit the SMI website at [www.smi-online.co.uk](http://www.smi-online.co.uk) for details.

**Proceedings from the SRI 3<sup>rd</sup> Annual Coalbed Methane and Coal Mine Methane Conference, Denver, Colorado, March 25-26, 2002.** A compact disk containing all power point presentations, many papers, and biographies on the speakers at the conference is available for \$199.95 (hardcopies are no longer available). To order the compact disk, send an e-mail to Heidi Aigler at [haigler@srinstitute.com](mailto:haigler@srinstitute.com), including credit card information, name, and shipping address.

**Natural Resource Report 95, Reconnaissance of the Coal-bed Methane Resources in Pennsylvania** by the Pennsylvania Geological Survey. To purchase, contact the Pennsylvania State Bookstore, Commonwealth Keystone Building, 400 North Street, Harrisburg, PA 17120-0053, telephone (717)787-5109.

**Open-File Report 00-01, Pennsylvania Coal-Bed Methane Wells.** Data from exploratory and producing CBM wells in the state from 1938 to 2000. To obtain the report, contact the Pennsylvania Geological Survey, Open-File Sales, 3240 Schoolhouse Road Middletown, PA 17057-3534 or contact Toni Markowski at (717)702-2038 or e-mail [amarkowski@state.pa.us](mailto:amarkowski@state.pa.us).

**Draft Environmental Assessment, Demonstration of an Integrated Power Generation System for Coal Mine Waste Methane Utilization.** US DOE/EA-1416. The report is available at <http://www.netl.doe.gov/publications/others/nepa/Northwest%20EA%20Draft%20Rev10%20app.PDF>

**Proceedings of China-UK Workshop: Exploitation of Methane from Abandoned Mines – Resources, Technologies and Commercialisation.** Proceedings from a workshop on exploiting opportunities for methane recovery at abandoned mines in China, May 21, 2002 in Beijing China. Available from the China Coal Information Institute [cbmc@public.bta.net.cn](mailto:cbmc@public.bta.net.cn).

### Papers for the Australian Coal Seam & Mine Methane Conference

Published from conference held June 25-26, 2002 discussing the viability, economics, and investment opportunities for CMM in Australia. Copies available for purchase at IBC Conferences (Informa Australia Pty Ltd) online ordering system: <http://www.ibcoz.com.au/cod/display1.asp?pid=AUCP02R21&category=EEL&company=AUC&team>

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