



# COALBED METHANE EXTRA



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## Benefits of Gob Gas Flaring Gain Attention

Installing a controlled flaring system on gob wells could offer underground coal mine operators significant safety, environmental, and economic benefits, according to a U.S. Environmental Protection Agency (U.S. EPA) report.\* Specifically, gob well flares could:

- Improve the current level of gob wellhead safety in the U.S. by minimizing the potential for an unconfined deflagration (brought about by natural or man-made causes) occurring on the surface at well discharge locations;
- Provide uninterrupted records of gob well performance through flare monitoring systems;
- Substantially reduce atmospheric greenhouse gas (GHG) emissions; and
- Possibly attract the interest of companies seeking carbon reduction credits, thus providing the mine with an additional income source.

The efficacy and benefits of gob gas flaring already have been well demonstrated at a deep mine in central Queensland, Australia (see related article). Furthermore, although there are no uniform standards for equipping gob wellheads in the U.S., the practice is not prohibited and, in fact, is employed as a standard safety practice in many U.S. industries. For example, methane and other associated gases are routinely

flared when producing and processing oil and gas, and are continuously flared from some types of landfill collection systems. The petroleum industry flares for safety reasons during system upsets when high concentrations and volumes of gas are released in the vicinity of potential sources of ignition. In the landfill industry, where methane

contributes approximately 50 percent of the gas captured, flaring is conducted to address air quality concerns.

Currently, approximately 30 U.S. coal mining operations use degasification systems to reduce

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### CLARIFICATION

to article entitled  
*New Technologies Allow Productive Use of Methane  
in Mine Ventilation Air*  
June 1999 issue of *Coalbed Methane Extra*

U.S. EPA wishes to clarify some of the points made in the last issue of *Coalbed Methane Extra* relating to the experience and capability of the VOCSIDIZER, a thermal flow-reversal reactor manufactured by MEGTEC. First, the article said, "The system has been run on volatile organic compounds (VOCs) at more than 600 installations, but it has limited experience with methane and no field data are available at present." It should have stated, "Over 200 units use methane (in the form of very low concentrations of natural gas) to support combustion and maintain stability during periods when there is little or no VOC flow. In addition, the system does have successful, albeit limited, experience with coal mine methane. British Coal conducted tests on a VOCSIDIZER unit using ventilation air from one of its mines.

Unfortunately, data from these tests are unavailable."

Second, the article stated, "During modeling, . . . the VOCSIDIZER did less well, becoming unstable at about 0.35 percent, contrary to MEGTEC's observations." It should have stated, "MEGTEC has observed bed stability at methane concentrations generally around 0.1 percent and has supplied actual field data which showed a unit exhibiting stable operation with a 0.08 percent methane concentration. This result is consistent with MEGTEC's simulation modeling but contrary to the modeling performed during the U.S. EPA study. U.S. EPA acknowledges that computer simulations are no substitute for actual field observations."



## Gob Gas Flaring

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methane emissions into their mine ventilation systems. All of these mines use vertical gob wells. In many cases, however, mine operators simply discharge methane recovered from gob wells directly to the atmosphere rather than capturing and using or flaring it. This practice wastes a potential resource, and it poses environmental concerns because methane is 21 times more potent a greenhouse gas than carbon dioxide.

U.S. EPA commissioned a conceptual design of a single gob well flare to constructively engage labor, industry, and regulatory entities in considering the safety, technical, and cost aspects of constructing and operating flares at active gob wells. The conceptual design is an active controlled flare system with

the following characteristics and redundant safety features (as derived from applicable guidelines, industry handbooks, and American Petroleum Institute (API) Recommended Practices).

- **Active Flare:** A mechanical blower/exhauster maintains a positive gas pressure through the flare system and serves as the prime gas mover.
- **Open Unassisted Flare:** An open, unassisted flare burns gas at the tip of an elevated stack at combustion efficiencies of 98 percent with continuous burning pilot.
- **Flare Safety Features:** Potential sources of ignition are isolated with appropriate flame arresters. The design incorporates all of the API-recommended flare protection alterna-

tives (fluidic seals, liquid seal) and proposes a continuous monitoring and control system with the capability of activating a system of fail-safe valves.

- **Flare Diameter and Height:** An 8-inch diameter stack with a 20-foot overall height combusts gas flows up to 2 million cubic feet daily (mmcf).

The estimated costs of this type of flare include: installed capital cost of \$85,000, and annual operating costs of \$17,000 over an assumed twelve-year operating life. Economic analysis indicates that flaring daily methane flows of greater than 200 thousand standard cubic feet (200 mcf) (5,700 cubic meters) is economically viable at a carbon value of \$5.00 per metric tonne (t) (\$4.54 per standard ton).

The estimated discounted cost to flare (based on cost per tonne of carbon mitigated) varies over a range of gas flows from \$0.57/t of carbon for daily gob well production of 300 mcf, up to \$1.70/t for 100 mcf. Translated into gas values, this cost is between \$0.06 and \$0.19 per mcf, respectively.

Since 1995, U.S. EPA has shared this design with mine safety officials and has addressed their comments and concerns regarding the safety aspects of flaring. With such issues resolved, gob well flares similar to that proposed by U.S. EPA offer mine operators a safe and cost-effective means of controlling a significant source of greenhouse gas emissions.

\* *Conceptual Design for a Coal Mine Gob Well Flare, EPA 430-R-99-012, August 1999.*

## Visit the New CMOP Web Site!

The Coalbed Methane Outreach Program's (CMOP) World Wide Web site has been redesigned and upgraded. The site has a new look, and its content has been substantially increased. The new content includes expanded Program Overview pages that provide: (1) descriptions of coal mine methane (CMM) development projects underway in the U.S., (2) a mission statement and description of the program's outreach objectives, and (3) a new program fact sheet (brochure). The Web site contains revamped Companies/Experts pages and a new suite of pages addressing CMM activities abroad. As before, there

are notices of upcoming events of interest to the CMM community, CMOP documents and the quarterly *Coalbed Methane Extra* for viewing and downloading, and CMOP staff contact information.

Please visit the new site at <http://www.epa.gov/coalbed> (note that our URL has not changed). CMOP welcomes your comments on the utility of the site and its content.

Also, if you want your firm to be included in the Companies/Experts pages, the Web site provides a registration form. Simply fill out the form and submit it to CMOP via mail, e-mail, or fax.



## Methane Flaring Down Under

At the Central Colliery in Queensland, Australia, gob gas flaring is reducing greenhouse gas emissions while the mine evaluates the potential for productively using drained methane. Like gassy seams at U.S. underground mines, the German Creek seam at the Central Colliery requires methane drainage for safety reasons. Previously, the Central Colliery simply vented the drained methane to the atmosphere. To reduce these emissions, Capricorn Coal Development Joint Venture (Capricorn) commissioned a gob well flare similar to that designed by U.S. EPA. Upon receipt of Australian mine safety authority clearance, Capricorn constructed the flare, which has operated since December of 1998. The flare combusts methane from a number of vertical gob wells and is rated for 102,000 cubic meters (3.6 million standard cubic feet) per day of gob gas. Presently this flare combusts an average 90 percent methane-and-air mixture (by volume), and it is reducing carbon emissions by more than 10,000 metric tons (9,078 tons) per year. The flare is 20 meters tall (65.6 feet). It implements a flame arrester below

the flare tip for flare flash-back protection, as contrasted with the liquid seal proposed in the U.S. EPA concept design. It is continuously monitored, and there are fail-safe controls that bypass the flare during low gob gas flows and alarm if high static pressures are monitored upstream of the flare. As of the date of this article, the flare has operated successfully as designed.

Gob gas methane concentrations may increase as mining the German Creek coal seam proceeds to greater depths. In addition to draining gob gas, the mine also will employ in-seam methane drainage. The combined flows may provide a more predictable flow of higher-quality gas, thereby allowing Capricorn to implement productive gas use techniques. Until that time, however, the gob well flare will provide the mine with a safe means of reducing its greenhouse gas emissions.

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*(Source: "Capricorn Coal Meets Greenhouse Gas Challenge", "in site" publication by Shell Coal, 1999)*

## Coalbed Methane Energy Savings Performance Contract for Federal Facilities

The Department of Energy's Federal Energy Management Program (FEMP) is preparing a solicitation for a "Technology-specific Super Energy Savings Performance Contract" (ESPC) that emphasizes the use of alternative methane sources – such as coalbed methane, landfill gas, and sewage

treatment gas – to reduce energy costs at federal facilities. Under this nationwide performance contract, private contractors would assume all the capital costs of alternative methane projects and guarantee their federal customers a

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## Upcoming Events

**World Mining Environment Congress**  
**Moscow, The Russian Federation**  
**September 7 - 11, 1999**

The National Mining Research Center, Skochinsky Institute of Mining, is organizing this third in a series of Mining Environment Congresses. The First and Second Congresses were held in New Delhi, India in 1995 and in Katowice, Poland in 1997, respectively. The third congress is intended to provide a forum for discussing ecologically sound technologies for mineral extraction, state-of-the-art environmental monitoring systems for mining regions, and legal, social, and ecological problems associated with ecological disaster prevention. For more information, or to register, contact Mr. A. N. Novikov by phone at 011-7-095-5548155, by fax at 011-7-095-5545247, or by e-mail at [igd@igd.ru](mailto:igd@igd.ru).

**North American Coalbed Methane Forum**  
**Morgantown, West Virginia, USA**  
**October 26 - 27, 1999**

The North American Coalbed Methane Forum will hold its next biannual meeting on October 27, 1999 at the Lakeview Conference Center in Morgantown, West Virginia. A reception on the evening of

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## Upcoming Events (cont.)

October 26th will precede the meeting. For additional information on conference content and schedule, contact Kashy Aminian, Coordinator, by phone at (304) 293-7682.

### **International Technical Conference on Coal Utilization and Fuel Systems Clearwater, Florida, USA March 6 - 9, 2000**

Sponsored by the American Society of Mechanical Engineers, Coal Technology Association, and U.S. Department of Energy in cooperation with the Federal Energy Technology Center, this conference will address the emerging state of the art in coal utilization for power generation. It will include sessions on global climate change issues, electric power industry deregulation impacts on clean coal technologies, and coalbed methane resources and sequestration. The conference sponsors have issued a call for papers. For more information, contact Barbara Sakkestad by mail at 104 Edith Drive, Rockville, Maryland, USA 20850; by phone at (301) 294-6080; by fax at (301) 294-7480; or by e-mail at [barbarasak@aol.com](mailto:barbarasak@aol.com). The conference Web site is [www.coaltechnologies.com](http://www.coaltechnologies.com).

### **International Symposium on Environmental Issues and Waste Management in Energy and Mineral Production Calgary, Alberta, Canada May 30 - June 2, 2000**

This sixth in a series of conferences will address methods and technologies for assessing, minimizing, and preventing environmental problems associated with mineral and energy production. The conference will provide an opportunity to learn about leading-edge technologies, to meet professionals from various industries around the world, and to increase understanding of current and future waste management practices and emerging environmental issues. Environmental issues associated with underground mining will be among the topics addressed. To obtain more information on the conference or to submit abstracts for papers (due by September 30, 1999), contact Dr. Raj K. Singhal by mail at P.O. Box 68002, Crowfoot Postal Outlet, 28 Crowfoot Terrace, Calgary, Alberta, Canada T3G 1Y0; by fax at (403) 241-9460; or by e-mail at [singhal@telusplanet.net](mailto:singhal@telusplanet.net).

### **Second International Methane Mitigation Conference Akademgorodok (Science City) Novosibirsk, Russia June 18 - 23, 2000**

This conference, co-sponsored by the Russian Academy of Sciences and the U.S. Environmental Protection Agency, aims to develop a stronger understanding of the specific measures that can lead to the most pragmatic and cost-effective methane emission reductions. Information exchanged will include science and policy implications of various industry-specific methane control measures, costs and benefits (economic and environmental) of adopting methane controls, national and regional emission reduction strategies, and other methane mitigation topics. The coal mining, natural gas, ruminant livestock, and solid waste landfill industries will contribute. In addition, there will be field trips to local industry sites. The conference sponsors have issued a call for papers. For more information, contact Karl Schultz by mail at U.S. Environmental Protection Agency, 401 M Street, SW, Mail Code 6202J, Washington, DC, USA, 20460; by phone at (202) 564-9468; by fax at (202) 565-2077; or by e-mail at [schultz.karl@epa.gov](mailto:schultz.karl@epa.gov).



## New CMOP Publications

### Conceptual Design for a Coal Mine Gob Well Flare (8/99)

Technical and economic circumstances can impede productively using recovered gob gas. In these cases, flaring the emitted gas could satisfy both safety and environmental objectives. This report proposes an active, controlled system of flaring, similar to that used in other industries. It presents a conceptual design for a flare system for a single actively extracted longwall gob well. The flare is designed to be suitable for igniting methane-air mixtures extracted from coal mine gob wells with particular concern to eliminating the possibility of a confined deflagration and/or detonation through the flare system and/or gob well and mine.

Also included with this report is a copy of a journal article entitled "Gob Well Flaring: Design and Impact". Currently, more than 30 U.S. coal mining operations use degasification systems to reduce methane releases into their mine ventilation systems. All of these mines use vertical gob wells. Because of vertical gob well gas production characteristics (vari-

able gas quality and quantity), difficulties in coordinating commercial gas recovery with underground mine degasification requirements, and the economics of commercializing gob gas, coal mine operators commonly vent gas from gob wells to the atmosphere. This practice raises safety and global environmental concerns, and wastes a potential resource.

This article, which is expected to be published in the September 1999 edition of *CBM Review* magazine (Palladian Publications, Ltd., UK), describes a safe and controlled system of gob well flaring that would provide substantial global environmental benefits. It outlines a conceptual design for a gob well flare that incorporates safety features and operating practices based on petroleum industry standards. It summarizes the safety benefits, the global environmental benefits, and the potential financial benefits to mine operators of applying this system in the U.S. In conclusion, it discusses an actual application of gob well flaring at a mining operation in Australia.

#### Note:

Paper copies of these reports are available free of charge by calling 1-888-STAR-YES. You can also find them in the "Document Download" pages on our World Wide Web site at <http://www.epa.gov/coalbed>.

## DOE Demonstration Projects Illustrate Potential Benefits of CMM Cofiring

A recently released U.S. Department of Energy report\* provides more evidence of the environmental benefits that could accrue from cofiring coal mine methane (CMM) in coal-fired utility boilers. That study reported notable NO<sub>x</sub> and SO<sub>2</sub> emissions reductions when natural gas is cofired with coal in a sequenced "reburning" boiler configuration.

The DOE report states, "Reburning is applicable to all types of coal-fired boilers, including the major types of firing systems used in electric power generation and industrial steam production."

Because CMM can substitute for natural gas in gas-fired boilers, this demonstration clearly indicates the benefits that could result when CMM is used as a reburn fuel, whether reburning is used alone or in combination with low NO<sub>x</sub> burners. Specifically, substantial NO<sub>x</sub> emission reductions can be achieved, with the added benefit of significant SO<sub>2</sub> and particulate emission reductions. To be economically attractive, however, CMM must be available at a cost that is at least competitive with other reburn fuels (coal, oil, natural gas), taking into account both capital and operating costs. It is possible that the economics of reburning with CMM may be improved if such applications were to result in

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## DOE Projects

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emissions reduction credits that could be traded or sold. Such credits could accrue not only from the reductions achieved in NO<sub>x</sub> and SO<sub>2</sub> emissions, but also from the destruction of CMM, a potent greenhouse gas.

*\*Reburning Technologies for the Control of Nitrogen Oxides Emissions from Coal-Fired Boilers, Clean Coal Technology Technical Report Number 14, U.S. Department of Energy, Federal Energy Technology Center, available for downloading from <http://www.fetc.doe.gov>. At the site, click on "Publications", then "Other Publications and Reports", then "Topical Reports", and finally on the report title.*

## Performance Contract

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fixed amount of energy savings and/or performance throughout the project's life. The private contractors would then be repaid directly from those cost savings. Projects under this ESPC could employ a variety of energy conservation measures as long as the savings attributable to alternative methane sources accounts for thirty-three percent of the total cost of hardware and services supplied. For more information, please contact Curtis V. Nakaishi ([curtis.nakaishi@fetc.doe.gov](mailto:curtis.nakaishi@fetc.doe.gov)) at the Department of Energy's Federal Energy Technology Center.

## EIA Data Reveal Hopeful Outlook

The U.S. Energy Information Administration (EIA) has reported that, based on data voluntarily submitted under Section 1605(b) of the Energy Policy Act of 1992,\* 156 U.S. companies and organizations reported 1,229 greenhouse gas emission reduction projects during 1997. Those projects achieved combined emission reductions and carbon sequestration equivalent to 166 million tons of carbon dioxide. That reduction equates with about 2.5 percent of total 1997 U.S. emissions. Since 1994 when the voluntary reporting began, the number of participating organizations has increased 44 percent, while the number of projects and emissions reductions achieved have doubled.

Companies in the coal mining sector report increasing numbers of emission reduction projects in the period 1994 through 1997. In 1997, MCNIC Oil and Gas, who own the gas rights to several CONSOL mines in Virginia, reported the largest coal mine methane reduction project. The combined methane recovered from those mines totaled 228,000 metric tons,

accounting for 93 percent of all the methane reductions reported for the energy production and consumption category for the year.

*Furthermore, preliminary data released by the EIA on 1998 carbon emissions indicate that achieving reductions in atmospheric carbon emissions may not conflict with economic growth.\*\* The EIA data point to a 1998 carbon emissions increase in the energy sector of only 0.4 percent, while the economy grew 3.9 percent in that year. Similarly, from 1990 through 1998 the economy grew 23 percent while energy related carbon emissions increased by approximately 10 percent. These data indicate that carbon emissions need not necessarily grow at a rate equal to that of the economy, and they supply evidence that a robust economy may not be inconsistent with efforts to reduce atmospheric emissions of carbon.*

*\* See 1997 summary report "Voluntary Reporting of Greenhouse Gases 1997", report #DOE/EIA-0608(97), which can be viewed and downloaded from the EIA Web site at <http://www.eia.doe.gov/oiaf/1605/vr98rpt/front.html>.*

*\*\* See "Emissions of Carbon from Energy Sources in the United States - 1998 Flash Estimate", which can be viewed and downloaded from the EIA Web site at <http://www.eia.doe.gov/env/ghg.html>.*

### CMOP

#### Contact Information

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