



Coal Mines

Methane gas released from coal mining activities can be captured and used as a clean energy source, resulting in reduced GHG emissions, improved air quality, and enhanced mine safety. In 2005, global methane emissions from coal mines were estimated to be nearly 400 MMTCO₂E. The United States is a leader in the recovery of CMM and continues to work with international partners through Methane to Markets to share information, expertise, and technology to promote CMM project development. In this reporting year, the U.S. government has supported these initiatives with more than \$1.7 million in funding. Major activities from this sector are summarized below.

Supporting Technology Demonstration Projects in China and Mexico

To facilitate and encourage the adoption of the latest technologies in the global marketplace, EPA is supporting demonstration projects to showcase available, cost-effective CMM technologies. In China, EPA is supporting a demonstration project featuring the use of engine technologies capable of producing power from low-quality methane. In Mexico, EPA is funding a demonstration project designed to convert CMM to liquefied natural gas (LNG).

Building Capacity and Overcoming Informational Barriers in China and India

One significant barrier to developing effective CMM recovery and use projects is the lack of information on coal mines, common mining practices, and coal mine project opportunities.

To help project developers overcome this barrier, the United States is supporting several initiatives that will help to develop the on-the-ground awareness and technical expertise necessary for successful short-term and long-term project development.

For example, in 2007, EPA continued to support the work of the Coal Mine/Coalbed Methane (CBM) Clearinghouse in China. This clearinghouse provides project developers and investors with easily accessible in-country technical and regulatory expertise on CMM project development. To date, the clearinghouse has provided its services to a variety of international organizations, including the International Energy Agency, ADB, Asian Pacific Economic Cooperation, and the United Nations Development Program.

To further increase awareness and expertise at the provincial level, EPA is backing the CMM Recovery and Utilization Initiative in the Guizhou Province in China. With more than 2,000 coal mines producing a combined 100 million tons of coal each year, the potential for CMM recovery and utilization as a clean energy source in Guizhou is substantial, yet for most mines this source is not exploited because of information, communication, and other market barriers. Work in Guizhou is aimed at helping stakeholders overcome these barriers and connect viable CMM project sites with the international project development community. Specifically, the initiative will provide international project developers with free, focused, and current information regarding project development opportunities at 45 coal mines in Guizhou.

EPA, USTDA, and the Government of India have recently established a CBM and CMM Clearinghouse in India, the world's third largest producer of coal. The clearinghouse is similar to the national clearinghouse in China and is managed by India's Ministry of Coal and the Ministry of Petroleum and Natural Gas. EPA organized one introductory workshop and USTDA organized a kickoff event to inaugurate this work. India's coal production is predicted to dramatically increase in the near future; CMM emissions are expected to increase unless methane recovery and utilization projects are implemented.

Improving Mine Safety and Policy Incentives in Ukraine

In Ukraine, USAID and the U.S. Department of Labor have provided in-depth, onsite training to coal miners at a mine in the Donbass coal region on the use of a U.S. horizontal coal seam drilling rig to remove methane from coal seams more effectively. This advanced technology and best practice will help reduce in-mine methane concentrations, improving mine safety and encouraging the recovery and utilization of high-quality methane gas as a clean energy source.

EPA is also promoting methane utilization at coal mines in Ukraine. EPA funded three technical workshops there; in addition, EPA and a Ukrainian NGO are investigating and raising awareness of the best policy and regulatory practices to help create incentives and reduce barriers for CMM project development. After an initial exploratory phase, a roundtable is planned for key government stakeholders to share initial policy recommendations.

Overcoming Financial Barriers in Russia and Eastern Europe

The United States supported the United Nations Economic Commission for Europe's (UNECE's) work in Russia and Eastern Europe to minimize financial barriers to CMM projects.

Providing Technical Assistance to the World's Largest CMM Project

The United States has been instrumental in helping to implement the world's largest power generation project fueled with CMM. Located at the Sihe Mine in Shanxi Province, China, the Jincheng Anthracite Mining Group operates a 120 MW power generation project that uses Caterpillar engines. The project also recovers heat to produce hot water and steam (i.e., combined heat and power) for mining operations. The electricity generated serves an estimated 90,000 households in addition to local commercial and industrial facilities. Over the project's 20-year lifetime, it is anticipated that 40 MMTCO₂E emissions will be avoided.

The total project investment of \$235 million has been financed by Japan Bank for International Cooperation, ADB, the Jincheng municipal government, and the World Bank Prototype Carbon Fund. USTDA provided a \$500,000 technical assistance grant to develop specifications for the power generation equipment. Additionally, EPA provided training for a Chinese delegation from the Jincheng Anthracite Mining Group on advanced U.S. methane degasification technologies.



Construction of the world's largest CMM-generated power project (120 MW capacity) at Sihe Mine, Jincheng, Shanxi Province, China.

Technical and financial experts conducted missions to identify potential project opportunities in Russia and Kazakhstan. They provided support to develop bankable documents, which project proponents can use to apply for financial support

Supporting Pre-Feasibility and Feasibility Studies in Partner Countries

Pre-feasibility and feasibility studies are key steps in project development. Pre-feasibility studies help developers determine whether a project has the potential to succeed financially and technically. This information is necessary to raise needed capital and generate interest to move the project forward to the next stage of development: the feasibility study. The feasibility study provides developers with more detailed analysis on costs, challenges, and expected results based on project parameters. Undertaking either type of study can be challenging and expensive.

The United States has funded several pre-feasibility and feasibility studies for projects in the coal sector to help advance project development in China, India, and Nigeria. These studies provide important information that accelerate project implementation at the study sites. For example, in 2007:

- In China, EPA launched initiatives to work with Chinese coal mines by conducting three full-scale feasibility studies at the Liuzhuang mine in Anhui Province, a group of six mines in the Songzao coal basin in Chongqing, and a group of six mines in the Hebi region of Henan Province. The studies will assess the technical and economic viability of implementing methane recovery and utilization projects. The results will be summarized along with project implementation recommendations in three comprehensive final reports. These projects could yield significant benefits. For example, the Hebi project plans to utilize CMM to power 22 internal combustion engines, each capable of generating 500 kW of electricity, and could deliver up to 250,000 MTCO₂E in emission reductions annually.
- Also in China, EPA has funded a feasibility study for an innovative technology that mitigates dilute

methane from coal mine ventilation shafts at the Tiefa Mine in Liaoning Province.

- In India, EPA funded a study quantifying the dilute methane emissions from underground coal mine ventilation shafts (known as ventilation air methane or VAM) from the Moonidih Mine in Jharia, Jharkland, and the Chinakuri Mine in Ranigani, West Bengal.
- In Nigeria, EPA supported a pre-feasibility study at the Okpara Mine. Mining here is expected to recommence in 2010 after several years of inactivity, with the mine producing up to 400,000 tons of coal annually. Project developers are planning to capture and use drained mine methane to generate 1.24 MW of electric power, which will then be sold to the mine.

EPA provided technical support to help develop preliminary analyses and profiles of 20 project opportunities for CMM projects in China, India, Mexico, Nigeria, Russia, and Ukraine. These project opportunities were showcased at the 2007 Methane to Markets Partnership Expo in Beijing.



Pumping station at a mine under study in China. The station extracts methane from the underground coal seam in advance of and during mining.

and complete project-specific business plans to attract investor interest. These efforts culminated in a road show to showcase a preliminary investment study about the opportunity to develop a CMM recovery and utilization project at the Krasnogorskaya Mine in Russia to six interested investors in London. Also as part of this effort, UNECE developed a business plan

template in Russian and English and conducted three finance-focused workshops in Russia and Switzerland as well as technical workshops in Poland and Ukraine. Lessons learned from this initiative were disseminated at several meetings of the UNECE Ad Hoc Group of Experts on Coal Mine Methane and at the 2007 Methane to Markets Partnership Expo in Beijing.