Energizing the Electricity Market for Methane

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GMI Expo
Vancouver, March 2013
Contents

- Methane emissions and coal production
- Coal mine methane (CMM) and the electricity sector
- Selling to the grid
- Case studies:
  - Russia
  - Ukraine
  - Germany
- Policy recommendations for increased utilization of CMM for electricity
Methane Emissions and Coal Production
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(Source: Data from USEPA 2011 and IEA 2012).
Trends in CMM Emissions

(Source: Data from USEPA 2011).
In all IEA policy scenarios, electricity consumption is expected to significantly increase by 2035.

(Source: Data from IEA 2011).
Coal Mine Methane (CMM) and the Electricity Sector
Methane Emissions from Coal Mines

- Underground mines are a major source of methane emissions in all significant coal producing countries.
- Degasification systems present the easiest opportunity to utilize CMM, because of high methane concentrations.
- If captured, methane is commonly used for power generation, district heating, boiler fuel, or direct sales to the pipeline.
- Utilization of methane for power generation takes advantage of proven technologies and does not require pipeline-quality methane or compression.
Power and heat/power co-generation are most common CMM projects, according to Global Methane Initiative.

Utilization of methane on-site is common because coal mines have significant electricity loads; selling power to grid can increase demand, but many countries have barriers.

(Source: Methane to Markets Partnership, 2009)
Electricity Regulation and CMM

The structure of the electricity sector has a large impact on whether CMM projects can materialize, generate electricity out of excess methane, and sell it to the grid.

- Are electricity prices cost-reflective or subsidized?
- Is there easy access to the grid?
- Can electricity producers participate in the wholesale market?
- Do CMM projects have special tariffs or other support from the government?
- Is there institutional framework to support CMM projects?
Selling to the Grid
Power generation allows for utilization of medium-quality gas that is too poor for pipeline marketing.

Mines can generate electricity for on-site needs or sell it to utilities. Selling to utilities expands the potential demand, though it can add risk.

Power generation projects using CMM exist in mines in many countries, including China, Australia, the United Kingdom, Germany, United States, Czech Republic, and others.

According to GMI database on CMM projects,

- Germany, China, UK and Czech Republic are leaders in the number of projects generating power or combined heat and power.
- Germany is known to sell power generated from CMM methane.
Policies Encouraging CMM Power Generation

- Policies that favor CMM projects in general and increase the volume of methane extracted from coal seams will increase the share of CMM electricity on the market.

- Easy access to the market for CMM projects.

- Cost-reflective prices for electricity are beneficial for CMM projects wishing to sell to the grid—it is hard to compete against low-cost, subsidized electricity.

- Feed-in tariffs can help boost investment while market for CMM develops.

- Additional examples of supporting policies:
  - Tax incentives (eliminating production tax on CMM).
  - Clear methane ownership rules, preferably with transferrable ownership.
  - Strong implementation of safety requirements regarding degasification.
Case Studies
CMM in Russia

- Russian mines are some of the gassiest in the world (11.6 m³/t compared to 7 m³/t in the U.S.).
- If a mine has over 13 m³/t of methane, mine has to be degasified by Russian law.
- 25% of active mines have degasification systems.
- In 2010, 49 Mt CO₂-equivalent was released from coal mines in Russia, world’s third emitter after China and U.S.

(Source: Data from USEPA 2011 and IEA 2012).
CMM in Russia

- Around 30 mine explosions in the past 10 years.
- In recent years, enforcement of safety regulations has strengthened.
- Recent policy developments also favor CMM projects.
Russia: CMM-fueled Electricity

Currently, 4 CMM installations owned by SUEK-Kuzbass generate electricity in Russia with total capacity 4.4 MW:
- 3 at Kirova mine and 1 at Komsomolets mine.
- All electricity is used for mine needs (assessed at 20 MW each).

SUEK also developed Joint Implementation project.

But electricity prices have doubled over the past decade. Thus, CMM projects have become more attractive financially.

- SUEK mines generate electricity from CMM at 30%-50% below what it pays when purchasing electricity.
Russia: Possibilities for Selling to the Grid

- With larger-scale production, selling to the grid will become possible.

- Access to the grid for CMM-fueled electricity is by law equally available in Russia.
  - In SUEK’s case, the company owns a significant share of JSC Kuzbassenergo’s stock, which may facilitate grid sales.

- Mines do not pay production taxes on CMM extracted.

- Gazprom, Russia’s largest energy company, has been increasing its capacity to capture and utilize CBM/CMM, primarily in the Kuzbass region.
  - Currently, have a power installation in Taldinskoye reserve.
Russia: Challenges for CMM

- Biggest challenge: abundance of cheap natural gas to compete with. Gas-fired power plants make up 44% of installed electric capacity (cogeneration plants included).
  - But gas prices have been going up as well.
  - Liberalized electricity market can make CMM-fueled electricity marketable in the future.

Photo credit: PNNL.
CMM in Ukraine

► High energy prices in Ukraine make CMM projects attractive.

► Ukraine’s legislation in general supports CMM projects, but there is room for improvement.
  ■ Coal production licenses automatically authorize coal producers to extract and emit or utilize CMM, but no easy transfer of ownership.
  ■ Attempt at Green Tariff Law, but not specific for CMM
  ■ No production taxes on CMM gas, but there have been changes recently.

► 10 JI projects in Ukraine, most using CHP or new boilers.

► Zasyadko Mine: 12 CHP units with capacity 36 MW for electricity and 34 MW for heat; 12 more were planned to sell electricity to network.
CMM in Germany

- Germany is the leader in utilizing CMM as a percentage of total mine-related methane emissions, largely due to progressive legislation.
  - According to the so-called EEG (Erneubare Energie Gesetz, Renewable Energy Law), the supply of renewable power into the grid is guaranteed and the price is fixed for a period of 20 years.
  - CMM has the status of renewable energy source, and thus, CMM-based electricity is sold at subsidized prices.

(Source: Data from USEPA 2011 and IEA 2012).
Germany: Push for CMM

- The Ruhr area is particularly known for CMM-utilization projects.
- In 2000, Minegas GmbH was founded to develop CMM from abandoned coal mines in the Ruhr area for generation of electricity and heat to be sold to the market.
- Today, the company operates 59 CMM-fueled co-generation plants, with ranging capacity between 0.3 to 1.5 MW.
In one project, Stadtwerke Herne utilizes CMM captured from an abandoned coal mine located in Herne, Ruhr area in Germany.

3 cogeneration gas engines with a total capacity of 4.05 MW were adapted to utilize CMM.

The power produced is fed into the electricity grid and displaces conventionally produced power.

In addition, Germany has the highest electricity prices in Europe.
Policy Recommendations
Policy Recommendations

► Financial/legislative incentives can foster CMM projects:
  ■ Feed-in tariffs,
  ■ Obligations (minimum percent of renewable or clean energy),
  ■ Tax incentives.

► Liberalized electricity market with cost-reflective energy prices favor CMM projects and sale of CMM electricity to the grid.

► Clear rules regarding ownership rights to the methane.

► Education and information dissemination through CMM clearinghouses and information centers, technology transfer programs, and international cooperation.

► Institutional framework, such as designated CMM authorities and regulatory agencies to identify policy measures and technical barriers.
References


► Russian Federation. Decree No. 315 dated 15 April 2011. “On allowable norms for explosive gas content (methane) in mines, coal seams and developed space, going over which requires degasification.”


Thank you!