Opportunities and Barriers for CMM Development: A Perspective from Developing Countries and Transition Economies (Part II)

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Overview:

- CBM Resources and CMM Emissions in Russian Coal Industry
- Technical, Economic and Institutional barriers for CMM Recovery and Utilization Development
- CMM Emissions Reduction Projects Development Potential in Russia
Hard Coal and Methane Deposits of Russia

Donetsk coal basin
Recoverable Coal Reserves - 108 mmt
Coalbed Methane Reserves - 1.2 x 10^12 m³
Coalbed methane utilization
Some of the methane is used in the boilers

Pechorsky coal basin
Recoverable Coal Reserves - 61 mmt
Coalbed Methane Reserves - 1.9 x 10^12 m³
Coalbed methane utilization
Boiler stations - 4
Coal drying unit - 1
Unit for heating of ventilation air - 1

Taimyrsky coal basin
Recoverable Coal Reserves - 185 mmt
Coalbed Methane Reserves - 37.7 x 10^12 m³

Tungusky coal basin
Recoverable Coal Reserves - 1967 mmt

Juzno-Jakutsky coal basin
Recoverable Coal Reserves - 39.5 mmt

Sakhalinsky coal basin
Recoverable Coal Reserves - 15.9 mmt

Primorsky coal basin
Recoverable Coal Reserves - 10.9 mmt
CMM Emissions in Russia

Graph showing the trend of CMM Volume ('000 m³/year) and Coal Output (MMtonne) from 1998 to 2002. The graph indicates an increase in both CMM Volume and Coal Output over the years.
Technical barriers

• The low number of mines employing degasification
• Lack of effective modern drilling equipment for surface and horizontal boreholes
• Variability of methane concentration in methane-air mixture and the lack of equipment to maintain the assigned methane content
• Currently employed drainage systems are designed to meet mining demands - to secure mining sections’ degasification, their layout and technical parameters, but don’t consider options for coalbed methane utilization
Economic barriers

• Absence of economic incentives and legal foundation (such as tax credit for coalbed methane recovery in USA in 1982)
• Ample natural gas reserves
Institutional barriers

- Disengagement and uncoordinated action undertaken by Russian institutions in the matter of coalbed methane recovery and use
- Potential property issues
- Poor knowledge about how coalbed methane can enhance mine profitability
- In near past, Russia’s inefficient use of energy because of energy resource abundance
Factors Encouraging CMM Recovery and Utilization

• The advent of free market conditions
• Greater economic independence stimulate mines’ managers to make their mines more profitable
• Preliminary degassing is required to increase coal production
• Pechora Coal Basin lacks the network of gas lines connecting the region with basic gas fields
• Fines are paid in Russia for pollutant emissions, which may be lowered by utilizing coalbed methane
Market Facts

Power consumption:

Electric = 21,343 MkWh @0.58 RUR/kWh

Thermal = 31,113 Tcal @266 RUR/Gcal

NG consumption = 3,010 Mm³ @720 RUR/1,000 m³

Exchange rate:

$1 = 28.5 RUR
Local Initiatives to Encourage CBM/CMM Projects

• Tax credits for:
  – Scientific research, experimental and design work related to CBM resources exploration (Law № 44-O3, Apr. 19, 2001)
  – Companies actively investing in Kemerovo region (Law № 105-O3, Nov. 19, 2001)
  – Companies receiving investments as a capital inputs in Kemerovo region (Law effectives on Jan.1, 2002)

• The overall impact of these laws for CBM/CMM projects might be a reduction of income taxes from 24 to 13.5 percent
Komsomolets Mine Case Study

• The mine is among the prospective mines in Kuzbass, mining a high quality coking coal
• The mine is located in central-western part of Kuzbass and incorporated within a stock company SUEK
• Mine’s coal field amounts to 15.5 square km
• Coal production was initiated in 1933
CMM Removing Technologies

• Three techniques for keeping unexplosive CH4 concentration in the workings:
  - Ventilation
  - Bleeder discharge with ventilation at active workings
  - Degasification of coal seams and gob areas

• The mine released 47.90 million cubic meters of methane (32,554 tonne) in 2003
Overall Annual Coalmine Methane Emissions

- Ventilation System: 17.18 million m³ of CH₄ (11,662 tonne) or 11,662 tCH₄ x 25 = 291,550 tCO₂-eq
- Gob Bleeder System: 9.04 million m³ of CH₄ (6,148 tonne) or 6,148 tCH₄ x 25 = 153,700 tCO₂-eq
- Degasification System: 21.68 million m³ of CH₄ (14,744 tonne) or 14,744 tCH₄ x 25 = 368,600 tCO₂-eq
Technologies

- Methane combustion in the boilers for heating the ventilation shafts in the winter time
- Running vacuum pump methane buster for coal seams degasification purposes
- Producing electricity by internal combustion engines, e.g. Caterpillar
- Flow-reversal reactors for oxidizing dilute methane in ventilation air and produce useable energy from a heat exchanger
- Using compressed coalmine methane to fuel vehicles
## Analysis

<table>
<thead>
<tr>
<th>Technology</th>
<th>Boiler</th>
<th>Generator (2 units x 1 MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated project cost ($'000’000)</td>
<td>0.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Estimated reductions (tCO2-eq/year)</td>
<td>100,475</td>
<td>100,475</td>
</tr>
<tr>
<td>Implementation time (months)</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Cost Effectiveness ($/tCO2-eq)</td>
<td>1</td>
<td>3.2</td>
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</tbody>
</table>
# Emission Reduction Data

<table>
<thead>
<tr>
<th>Parameters</th>
<th>2003</th>
<th>2005 (baseline)</th>
<th>2005 (project implementation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Methane Emission (tones/year)</td>
<td>32,554</td>
<td>21,830</td>
<td>21,830</td>
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<tr>
<td>Methane Emission from Ventilation &amp; Bleeder Systems (tones/year)</td>
<td>17,811</td>
<td>17,811</td>
<td>17,811</td>
</tr>
<tr>
<td>Methane Emission from Ventilation &amp; Bleeder Systems (%)</td>
<td>54.7</td>
<td>81.6</td>
<td>81.6</td>
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<tr>
<td>Methane Emission from Dagasification System (tones/year)</td>
<td>14,743</td>
<td>4,019</td>
<td>0</td>
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<tr>
<td>Methane Emission from Dagasification System (%)</td>
<td>45.3</td>
<td>18.4</td>
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<tr>
<td>Utilized Methane (tones/year)</td>
<td>0</td>
<td>0</td>
<td>4,019</td>
</tr>
<tr>
<td>Utilized Methane (% from overall methane emission)</td>
<td>0</td>
<td>0</td>
<td>18.4</td>
</tr>
</tbody>
</table>
Strategy

• To facilitate methane recovery and utilization projects successfully, Russian and foreign stakeholders could enter into consortium agreements with coal mining entities.

• Making a joint venture on recovery and utilization of coal mine methane, as a coal mining by-product, the investor escapes the necessity for licensing a methane recovery procedure.

• Get licenses on CBM resources recovery to start independent project.
UNDP/GEF Project

- **Title:** Russian Federation – Removing Barriers to Coal Mine Methane Recovery and Utilization started
- **Beginning:** 15 October 2003
- **End:** October 2007
- **The primary area of focus:** Kuzbass, further replication potential in other coal producing areas in Russia
- **Goal:** To mitigate greenhouse gas emissions by removing barriers to the implementation and financing of CMM utilization projects in Russia
- **Main idea:** To strengthen the institutional and financial framework in order to promote CMM projects and facilitate the implementation of selected demonstration projects
- **Vehicle:** To support the establishment of a specialized service Coal Mine Methane Recovery and Utilization Company
- **Budget:** $8.3 million
Successful Outcome

• For company:
  – Making profit (potential for >$100 Million revenues)
  – Enterprise development, sustainable job base

• For region:
  – New jobs (potential for > 1,100 Jobs )
  – Ecological benefits (reducing CH$_4$, sulfur, particulate, carbon, and NO$_X$)
  – Mine safety from lower methane levels
Conclusions

• CMM emissions is rapidly growing in Russia since 2000
• Main barriers for the CMM projects development are low number of mines employing degasification and poor knowledge about how coalbed methane can enhance mine profitability
• The CMM emission reduction project might cost 1-3 $/tCO2-eq versus 8-15 $/tCO2-eq in Europe
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Thank you!