Development of Coal Mine Methane (CMM) in CIL mining Leasehold Areas

R. K. Chopra
Director (T/ RD & T)
CMPDI, Ranchi
News Items

Sept 23: (The Hindu)
- India, which depends on imports to meet 80 per cent of its needs, imported 81.5 Mt crude oil during the April-August period, up 8.82 %
- The outgo for the imports was $60.2 billion …

Oct 27, 2013 (Business Standard)
- Coal import jumped 33 % in the quarter ended June 30, leading to a forex outgo of close to $1.9 billion, up 44 % against $1.3 billion in the year ago period.

Aug 21 (Reuters)
- Coal imports this fiscal year to March 2014 could hit a record 165 Mt from 137.56 Mt in 2012-13
Facts

- India Imports more than 1/3rd of its commercial Energy needs in form of Oil, Coal and Gas
- > 80% of Oil, 25% of Gas and 20% of Coal consumption is met through imports
- India’s per capita energy consumption is 1/2 the world’s average and 1/20th of US
- Energy consumption to grow 4 times in 20 yrs
The envisaged energy demand is to be met through:

- Safe, clean and convenient forms of energy
- In a technically efficient, economically viable and environmentally sustainable manner

All forms of energy both conventional and non-conventional are to be pursued to achieve this vision

India must seek to expand its energy resource base and look for new and emerging energy resources
Coal Mine Methane (CMM)

- Underground coal mines worldwide liberate an estimated 29 - 41 Billion cum of methane annually

- CMM/AMM development has taken a firm footing at international level

- Majority of projects making use of captured methane are in-
  - China
  - Australia
  - USA
  - Poland
  - Ukraine
  - Czech Republic
  - Germany
  - France
  - United Kingdom
Coal Mine Methane (CMM)

Greenhouse Gas Emission Reductions From Coal Mine Methane Projects: "Total" Estimate

- **Austria**
- **China**
- **Czech Republic**
- **France**
- **Germany**
- **Kazakhstan**
- **Mexico**
- **Finland**
- **Russia**
- **France**
- **South Africa**
- **Ukraine**
- **United Kingdom**
- **United States**

For the years 2005, 2010, and 2015.

Courtesy
Reduction of methane emissions is an international priority

Reduction contributes in mitigation of climate change

Methane capture and use add significant value to the mining operation

Harnessing & utilization of CMM is priority area in major coal producing countries- China, USA, Australia etc.

Several regulatory provisions and investor friendly fiscal initiatives have been introduced in these countries
Incentives Available in some Countries

- Chinese implemented Tax benefits for coal enterprises conducting CMM recovery and utilization. Preferential state policies on:
  - Resources tax
  - Value added tax (VAT)
  - Tariff tax
  - Income tax of enterprises

- USA tax policies are encouraging development of unconventional source of natural gas including CBM and CMM

- Ukraine implemented Green Tariff Law that provides a feed-in tariff for CMM up to 20 years

- Ukraine also adopted CMM law to legally clarify CMM and also issued CMM lease with coal lease to mine operators
Projected Demand of coal (2031-32) : 2000 MT

Stress to increase production from UG mines

To meet projected demand: Thrust on Deeper UG coal mining in future (Resulting in more methane emissions)

Harnessing and gainful utilization of CMM is a priority area for India at Govt. and coal industry level

MoC has made CMPDI Nodal Agency for the development of CMM in India

India CMM / CBM Clearinghouse functional at CMPDI since 2008 under the aegis of MoC and US EPA is promoting cause of development of CMM in India
CMM Development - Indian Perspective

CMM has a large variety of applications viz.

- Use as fuel in steel furnaces, kilns, and boilers
- Use in internal combustion (IC) engines or turbines for power generation
- Use as feedstock in the fertilizer industry
- Injection to natural gas pipelines
- As vehicle fuel (LNG or CNG)
Coal Mining in CIL areas is more than 200 years old.

CIL has large acreage of coal bearing areas and operates over 470 coal mines. Out of the 300 UG mines:

- 102 Nos. : Degree-II Gassy (methane emission 1 to 10 $m^3$/t)
- 18 Nos. : Degree-III Gassy (methane emission >10 $m^3$/t of coal mined)

CIL is putting major thrust to increase its production from deeper coal deposits through underground mining in near future to sustain huge energy requirement of the nation.

Under this scenario, degasification of target coal seams is essential.
Coal seams at shallower depths: Mostly mined out/ being mined

Virgin coal seams lying at depth: Yet to be mined (& are prime target for UG coal production in future)

Recovery of methane from virgin coal seams (some of which are de-stressed) below the worked out seams require comprehensive approach for safe and economic operation

Due to occurrence of high rank coal, Damodar Valley Coalfield is the focus area of CMPDI for identification of prospective CMM areas
Coalfields in Damodar Valley
Coal seam profile with special reference to Damodar Valley Coalfields:

- Coalfields are having varied spatial extent
- Multi seam occurrence with cumulative thickness in some coal fields exceeding over 100m
- Occurrence of gassy seams with methane emissions $>10$ m$^3$/t in many mines
- Virgin areas accounts for 94% of the total gas content
Development of CMM within CIL mining leasehold areas

- Target area for CMM development: Virgin coal seams lying below the active mining/worked out/goaved/abandoned areas

- The CMM extraction from such areas are technically challenging and poses safety concern

- With the advancement of harnessing and utilization technology of CMM, concerted efforts were made by CMPDI for CMM development in CIL mines since late 90s
Potential areas for implementation:

- Raniganj Coalfield
- Jharia Coalfield
- East & West Bokaro Coalfields
- South Karanpura Coalfield
# CMM Development: Indian Perspective

<table>
<thead>
<tr>
<th>Coalfield</th>
<th>Area (Sq. Km)</th>
<th>No of coal seams</th>
<th>Cumulative Thickness (m)</th>
<th>Gas content (m³/t)</th>
<th>VRo%</th>
<th>Prog. CBM resource (BCM)</th>
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</thead>
<tbody>
<tr>
<td>Raniganj</td>
<td>1550</td>
<td>10</td>
<td>30-40</td>
<td>5-7</td>
<td>0.6-1.2</td>
<td>40</td>
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<tr>
<td>Jharia</td>
<td>450</td>
<td>18</td>
<td>&gt;100</td>
<td>7-26</td>
<td>0.86-1.3</td>
<td>50</td>
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<tr>
<td>E Bokaro</td>
<td>237</td>
<td>22</td>
<td>&gt;100</td>
<td>10-22</td>
<td>0.8-1.69</td>
<td>30</td>
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<tr>
<td>W Bokaro</td>
<td>207</td>
<td>13</td>
<td>&gt;40</td>
<td>6-10</td>
<td>0.8-1.25</td>
<td>10</td>
</tr>
<tr>
<td>S Karanpura</td>
<td>194</td>
<td>42</td>
<td>&gt;100</td>
<td>5-10</td>
<td>0.6-0.9</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>150</strong></td>
<td></td>
<td></td>
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</tbody>
</table>
Standard Coal Column in Damodar Valley Coalfields

SCHEMATIC LOG SECTION OF DIFFERENT COALFIELDS
CMPDI perceived a demonstration project for harnessing and gainful utilization of CMM from mining areas and successfully implemented in the Moonidih mine of BCCL under the GOI, GEF & UNDP funding - proving the efficacy of this technology in Indian geo-mining condition.

This project gave confidence for such replication at other suitable places.

Encouraged by the result CMPDI took lead and identified 5 more areas within CIL leasehold for CMM development.
Global Tender was floated for identification of suitable service providers for commercial development of CMM in 5 blocks.

Certain issues pertaining to ownership and operationalization of CMM cropped which are under active deliberation between MoC & MoPNG.

As per understanding reached between MoC and MoP&NG, CIL may be given the right of CBM exploitation in their leaseholds.

Tenders to be re-floated once guidelines for commercial development are issued and these blocks given green signal by MoP&G.
Commercial Development of CMM: An Opportunity Area

Blocks on offer:
Jharia
1. Moonidih
2. Pootkee-Bulliary
3. Mohuda Sub-basin

East Bokaro
4. Asnapani-Jarangdih Shaft
5. North Kathara Phase I-III & Uchitdih
Combined Working Plan: Moonidih
Geological X-Section : Moonidih Block-
Combined Working Plan: Pootkee-Bulliary
## Technical details: CMM Blocks

<table>
<thead>
<tr>
<th>Name of CMM Block</th>
<th>Area (Sq. Km)</th>
<th>Total Coal Thick (m)</th>
<th>Rank of Coal</th>
<th>Estimated Coal resource (Mt)</th>
<th>Estimated CBM in-Place (BCM)</th>
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<tbody>
<tr>
<td>Moonidih</td>
<td>13</td>
<td>70-90</td>
<td>Low to Med Volatile Bituminous</td>
<td>1077</td>
<td>7.8</td>
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<tr>
<td>Pootkee-Bulliary</td>
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<td>40-70</td>
<td>Low to Med Volatile Bituminous</td>
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<td>7.0</td>
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<tr>
<td>Mohuda Sub-basin</td>
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<td>3-7</td>
<td>High Volatile Bituminous ‘A’</td>
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<td>0.41</td>
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<td>Asnapani-Jarangdih Shaft</td>
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<td>100-130</td>
<td>High Volatile Bituminous ‘A’</td>
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<td>6.2</td>
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<tr>
<td>North Kathara Phase-I &amp; III and Uchitdih</td>
<td>5.6</td>
<td>30-130</td>
<td>High Volatile Bituminous ‘A’ To Medium Volatile</td>
<td>835</td>
<td>8.4</td>
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</table>
Challenges in Commercial Development

I. Administrative

II. Technological

III. Safety/ Environment/ Economic
Administrative Challenges

- Settling clearance issues related to development of CMM by the Govt.
- Announcement of policies on:
  - Issues related to simultaneous allotment of blocks for Coal mining and CBM development
  - Going by the MoU between MoC and MoP&NG, the CIL to be given the right of CBM exploitation in their working mines
- Land acquisition
- Site specific problem
- Getting clearances: Single window system for Statutory Clearances viz: PEL, environmental clearance, PML etc. may be introduced
Technological Challenges

- Small size of UG mines; av. production from 250 mines < 0.2 Mty; occurrence of age old water filled goaves/ mine working coupled with complex geological conditions

- Drilling for methane drainage upto lower virgin seams to pass through worked out/ goaved of upper seams

- A very close coordination of the CMM operator with the mine operators will be needed to deal with this problem

- Sharing of Calendar programme and data between mine and CMM operator is required

- For safe operations and management, it is imperative that CMM extraction take due consideration of on-going operational condition of the mine and no way can jeopardize the safety concerns

- Reliance on international collaboration/ experts
Extraction of CMM from the working mine areas particularly underground requires issues of safety for men & mine of mines to be duly addressed.

The drilling of holes, associated activities must be carried out in a harmonious way under one ownership to avoid mine accidents/inundation of mine.

Connection of water-logged worked out coal seams with active working is to be guarded against.

- Activity like hydro fracturing etc. requires, full understanding of its implication on coal mining.
- Harnessing of CMM in association with coal mining will reduce methane venting in the atmosphere which is otherwise being vented out.
- CMM development will reduce energy import bill and warrants fiscal incentives.
Conclusion

- Need to develop additional energy resources from CBM, CMM, UCG, Shale Gas, etc. to meet the energy demand
- Administrative, technological & economical challenges being faced by the industry needs to be addressed by Govt. / operators
- All issue of CMM development should be expeditiously settled by the concerned Ministries In line with the international practices
- Fiscal incentives/ bonuses should be given to investors in order to encourage development of non-conventional hydrocarbon resource
- Exploration/ exploitation of methane and coal should be kept under one operator to ensure strict supervision, co-ordination, safety and administrative control of both the operation in the same project
- **CIL/ CMPDI is geared up for harnessing and utilization of CMM after getting the decision of the Govt on the issue**
Development of CMM within CIL mining leasehold areas: Perspective

Hydro Frac Unit

Sucker- Rod Pump in operation

Flare of Methane at Moonidih

2 X 250 KW Gas Based Generator
Thank you for patient listening