Recent Trends in Recovery and Use of Coal Mine Methane

by

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Acknowledgements

- Sponsors and organizers of this conference for their efforts
- United States Environmental Protection Agency for their support
- My colleagues at Raven Ridge Resources for their encouragement and boundless energy
Global Trends in CMM Emissions

- CMM emissions grew by 20% from 1990 to 2000
- But not all countries had increased emissions:
  - CMM emissions from Russia and Ukraine dropped nearly 50% during the 1990’s
  - Significant reductions occurred in the United States, Germany, South Africa, Kazakhstan, and the United Kingdom
- Notable increases were seen in China, Australia, and India
Trends in Global CMM Emissions

China, USA, Russia, Ukraine, Australia, Poland, Germany, India, South Africa, Kazakhstan, UK, Czech Republic

Years: 1990, 2000, 2010

Methane (Million M³)
Markets for CMM

- Six of the twelve largest emitters of CMM needed to import gas in 2001 to meet demand.
- Countries with largest expected increase in annual gas consumption in 2010 will be USA (125Bcm), China (35Bcm), Kazakhstan (31Bcm) and India (29Bcm).
- Opportunities to sell CMM in natural gas markets in China, USA, Australia, Germany, Poland, India, Kazakhstan are substantial.
India

- CMM is not being recovered and used
- New pipelines are being constructed by Gas Authority of India, Ltd.
- Central government is considering gas pricing reforms
- India is currently host to CMM recovery and use demonstration project funded by GEF, UNIDO and GOI.
China

- Several notable CMM projects are operating
- Market potential is being realized -- prices are becoming rationalized in some regions
- Policies at central, provincial and local levels are supportive of CMM development, ownership issues
- Technology is available and is being employed successfully by Chinese and foreign companies
- Investment in CMM projects arising from Chinese private sector is rare
Total volume liberated in the US was 4.9 Bcm in 2003

1.1 Bcm was recovered and used from underground mine drainage systems

- 94 percent of total was recovered from 7 mines
- 68 percent of total was recovered from 2 mines

April 2004 - First new active coal mine projects to go on line since 1997

Many new abandoned mine projects have become operative in the past few years

Recent conflicts over gas resource ownership and primacy reflect need for policy development
Australia

- Commercially advanced-- has largest CMM power project in the world
- VAM technology was demonstrated
- Australian government awarded funds to three CMM emission reduction projects, two are VAM related
- Limited markets may be the most significant barrier
Germany

- Laws and policy have been developed to promote CMM as a renewable/green energy source and a way of meeting the country’s commitment to GHG reduction.
- Energy conversion of CMM is supplying both the electricity and heat market—CHP.
- Gas to electricity projects at active and abandoned coal mines now greater than 120+MW.
Realizing full development potential of CMM depends on cumulative gains arising from five interrelated aspects of development:

- Market Development
- Economic Development
- Socioeconomic Development
- Technological Development
- Physical Development
U.S. CBM Production 1989-2003

Billion Cubic Meters

U.S. CBM Production
CBM Development in USA

**Categories of Potential**

- Physical Potential
- Technological Potential
- Socioeconomic Potential
- Economic Potential
- Market Potential

**Activities and Barriers**

**Market Potential**

- Market existed because of widespread natural gas pipelines, nearly concurrent deregulation, incentives, and guaranteed access to pipelines by producer.

**Technological Potential**

- Tax credits spurred R & D which was leveraged by oil & gas technologies; Major exploration & production companies using latest technologies.

**Socioeconomic Potential**

- Gas Research Institute took the lead with research & development and education.

**Economic Potential**

- Section 29 tax credits spurred development.

**Physical Potential**

- Achieved
CMM Development Potential

Categories of Potential

- Physical Potential: Achieved in few countries
- Technological Potential
- Socioeconomic Potential
- Economic Potential
- Market Potential

Actions That Can be Taken to Overcome Barriers

- Use of sound technologies and practices, economic incentives, and multi-lateral agreements
- Industry involvement in policy making, continued research, development, and demonstration of new technologies, and implementing those new technologies
- Increased education, policy initiatives, institutional reform, and changes in attitudes,
- Define gas property rights, create markets, increase financial transfers and credit, reduce number failed projects

Development Potential
Time

Achieved in most countries
Market Development

Achieved and stabilized for sustainable growth through:

- Use of sound technologies and practices,
- Economic incentives (tax incentives and rationalization of prices),
- Multi-lateral agreements (contracts and the rule-of-law allowing enforcement of agreements)
Economic Development

Actions that facilitate the fully achieving the potential gains of economic development are:

- Defining gas property rights,
- Creating markets,
- Increasing financial transfers and credit,
- Reducing number failed projects
Achieving, full realization of socioeconomic benefits is dependent on:

- Increased advanced education and technical skills training
- Policy initiatives supporting sustainable development,
- Institutional reform,
- Changes in attitudes toward resource development and environmental issues.
Technological Development

Advancement of technological potential is achieved through:

- Industry input and support of rational policy initiatives
- Ongoing research and development in supporting sciences and engineering applications,
- Invention and demonstration of new technologies,
- Commercialization and deployment of new technologies
Physical Development

- Physical development of CMM resources is dependent on synergism of the development components described previously.

- The upper bound is impacted by changes in the economy, advances in technology, changes in policy and political agendas.
## Relative Achievements of Profiled Countries

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<td>Bilateral or multi-lateral agreements</td>
<td>Define gas property rights; Create annex panel markets</td>
<td>Reduce risk and failure rates of projects</td>
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- **New technologies**: commonplace
- **Socio-Economic Potential**:
  - Change in attitudes
  - Educational and institutional reform
- **Technical Potential**:
  - Government initiatives (CMM/CBM, energy plan)
  - Continuously developing and demonstrating new technologies
  - Costs and benefits
- **Physical Potential**:
  - Increased use of new technologies
  - Widespread use of new technologies

- **Market Potential**:
  - Use & transfer technologies
  - Implement new technologies
- **Economic Potential**:
  - Utilize existing economic incentives
  - Create annex panel markets
  - Unsubsidized, freemarket
Conclusions and Predictions Through 2010

- Largest number of new CMM projects developed will be located in:
  - China
  - USA

- Most comprehensive use of CMM will be in:
  - Australia
  - Germany

- Technology transfer and outside investment will be needed to result in significant CMM development in:
  - India
  - Kazakhstan