



Russian Mine Practices

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- CMM Emissions in Russian coal industry
- Recent International CMM utilization projects
- Barriers for the development of CMM projects



Ventilation & Degasification



Ventilation

- Presently complex ventilation facilities are installed in mining workings of Russia's coal mines
- Mainly, a downstream ventilation method is used on coal mines:
 - Fresh air is supplied into mine's workings through a ventilation shaft, employing a reversible fan (e.g. VSD-3.3) with the estimated flow rate up to 20,000 m³/min.
 - The mine has an integrated ventilation system with a flank, divisional layout
- For the dead-end development workings ventilation local airing facilities like BME-6 and BME-8 are used
- Methane concentration in methane-air vent mixture should not exceed 1% and in the outgoing ventilation shaft it should be not more than 0.75%

Degasification



- Degasification of mining and satellite coal seams is performed via in-seam boreholes drilled from sustained workings
- Drilling work starts prior to longwall development and shortly before longwall mining:
 - Boreholes are linked to the main pipeline, where the vacuum is created by a surface vacuum pump station (VPS)
 - In VPS liquid-packed ring pumps of 50 and 150 m³/min nominal capacity are generally used
 - Currently application of dry rotary pumps of adjustable capacity from 35 to 120 m³/min was initiated
- Methane concentration in degas methane-air mixture should not be lower than 25%, meeting the safety requirements for coal mines operation and usually not exceed 75%

Degasification (2)



- Degasification of gob areas is done by means of surface wells drilled into the caving dome and their connection to a mobile surface degasification unit (MSDU/PPDU)
- The degasification process may be implemented by means of inclined boreholes drilling into coal seam's roof from a neighboring working
- On coal mining sections the isolated air/gas mixture discharge is applied to ensure safe gas environment
- Degasification of gob areas by means of isolated air/gas discharge beyond the mining section limits is performed by gas suction units, constructed on the basis of VMSG-7 fans (gas blowers), using pipeline of 800-1000 mm diameter
- Methane concentration in methane air mixture on the outlet point of VMSG-7 unit should not exceed 3%



Assessment of CMM Emissions

CMM Emissions Estimate

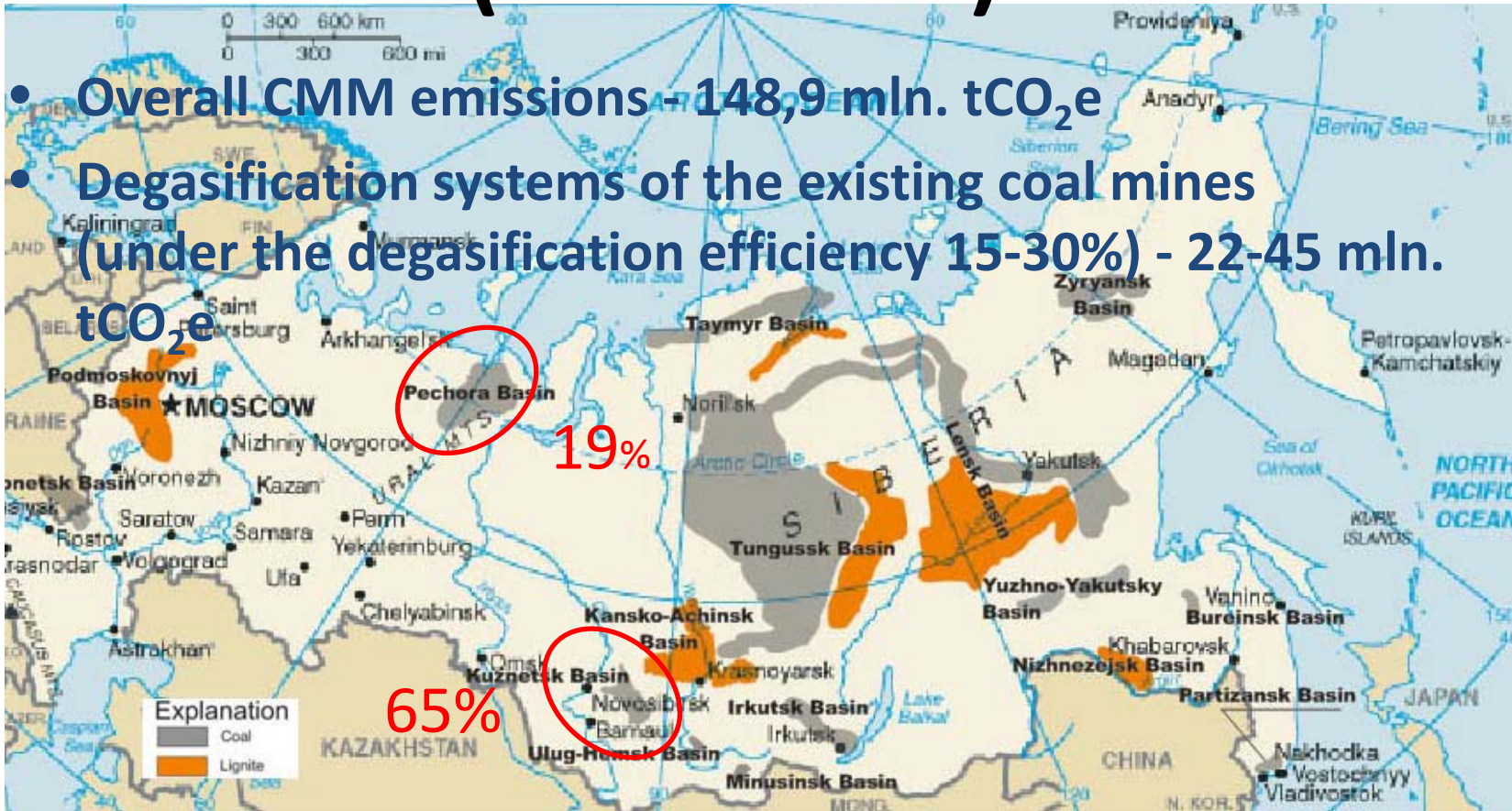


- Assessment of CMM emissions based on the 2006 IPCC methodology
- Mines report absolute methane emissions to the Rosstat (Federal Statistics Agency)
- Absolute methane emissions are used for the preparing RF National Reports on GHG emissions
- Sources:
 - Underground mining (amount of recovered and utilized methane is considered)
 - Surface mining
 - Post mining

CMM Emissions in Russia (2008-2012)



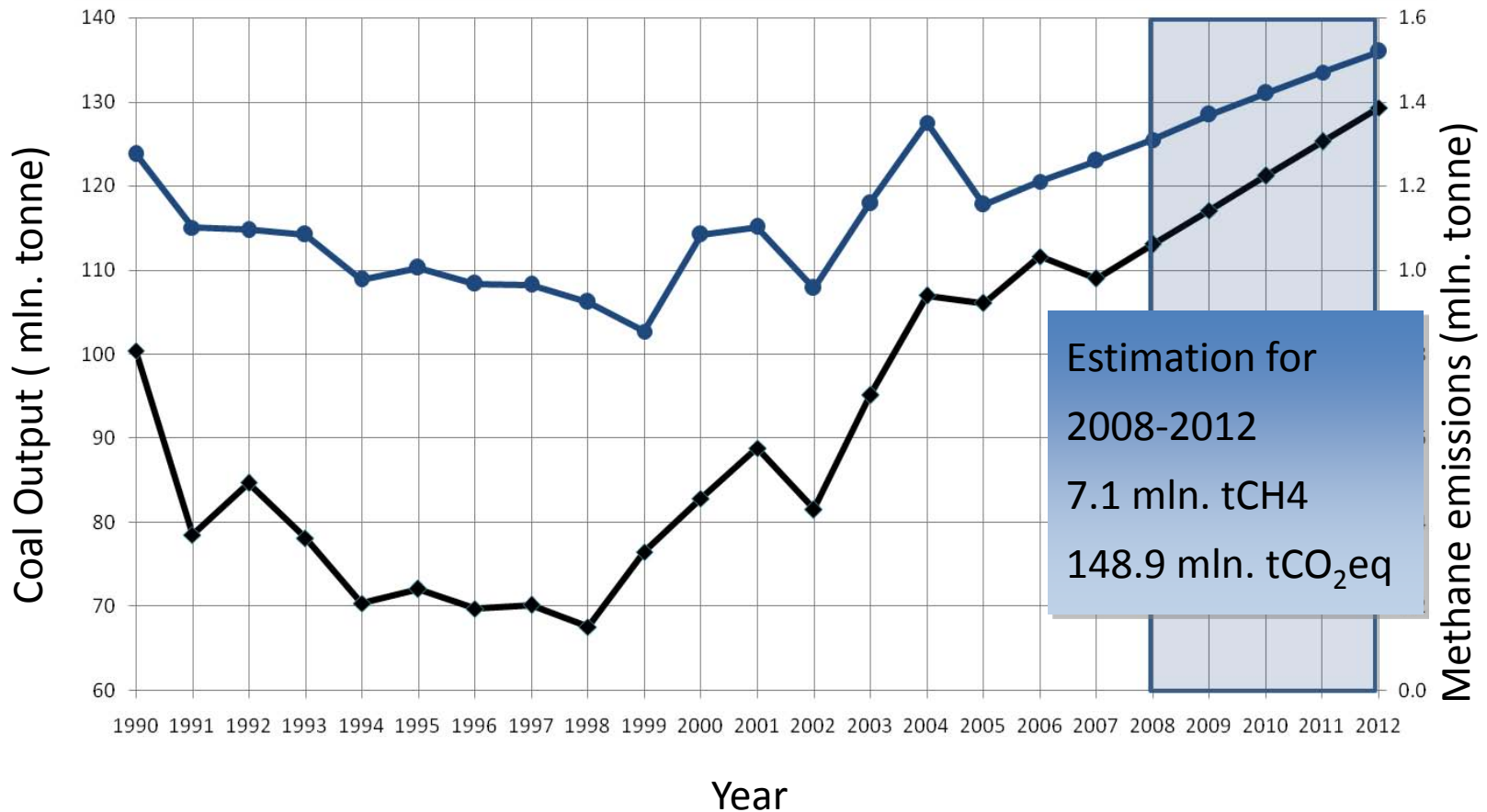
- Overall CMM emissions - 148,9 mln. tCO₂e
- Degasification systems of the existing coal mines (under the degasification efficiency 15-30%) - 22-45 mln. tCO₂e



Pechora: coal reserves 61 mmt & CMM resources $1.4 \times 10^{12} \text{ m}^3$
Kuzbass: 548 mmt & $13.1 \times 10^{12} \text{ m}^3$



Coal Output and CMM Emissions in RF





CMM Utilization

Recent International CMM Projects in Russia



- UNDP/GEF Project «Russian Federation – Removing Barriers to Coal Mine Methane Recovery and Utilization» (2003-2010)
- JI project on the mines of SUEK (2008-2012)
- CoMeth (2009-2012) – EU Seventh Framework Program
- VAM at Russian Coal Mines (2011-2014)

CMM Use in Boiler Station



Boiler & Valves Set



- UNDP/GEF project
- Capacity 0.7 MW_{th}
- Two replaceable nozzles for different CH₄ concentration:
 - 60-90%
 - 25-45%

Gas Burner



Control System



Heat Exchanger



Power Generation



Generator



Vacuum pumps



Transformer



- JI SUEK project
- Capacity:
0.9 Mw_e, 1.1 MW_{th}
CH₄ concentration > 35 %

Utilization of the Low and High Concentrated Methane





Assembly of Equipment



CGGU 161901 for methane air mixture (with methane of high concentration) supply

CGGU 162401 for methane air mixture (with methane of low concentration) supply

Generator

VAM at Russian Coal Mines

(US EPA Project)



- The project aims at improving the measurement of ventilation air methane (VAM) emissions in Kuzbass
- This would lead to the use of VAM as a potential clean fuel for energy production
- Outputs of the project:
 - Technology transfer and catalyzing technology deployment
 - Technical reports
 - Pre-feasibility studies
 - Databases of methane emissions or potential sites for projects
 - Other tools that facilitate projects or provide access to information
 - Capacity development
 - Conference / Workshop
 - Improved VAM emissions estimates

Existing Legislation on the Coal Seams Degasification



- Degasification of coal seams is regulated by a guiding document «Methodological recommendations on coal mines degasification» (2006) containing:
 - Basic recommendations for technological processes of methane emission sources degasification
 - Description of the coal mines' degas systems, organization of degas works, technical recommendations for safe process of degasification and use of degas gas
- In 2007 Rostekhnadzor of Kemerovo region issued the order introducing the threshold on gas content value corresponding to 9 m³/t, according which coal seams degasification is recommended to be obligatory



Main Barriers for CMM Recovery and Use



Technological Barriers

- Coal has low permeability and it makes difficult preliminary degasification
- Russian coal companies endure lack of drilling equipment, especially for directional drilling
- Some attempts of directional drilling were not successful for the lack of qualified personnel able to efficiently operate such equipment
- Coal mining in Russia is undertaken under complicated climate conditions and it requires additional technologies for water separation from methane air and/or heating supply pipe lines



Economic Barriers

- Low costs of thermal and electric power in Russia brings to longer payback terms for CMM utilization projects compared with projects in Europe, USA and Australia
- The payback term of such projects under current state of market for thermal and electric power for boilers is equal to 3-4 years, for electric power stations – 5-7 years
- For projects of ventilation methane utilization the payback period is over 10 years



Legal Barriers

- The legal and regulative base in the field of CMM use is not developed sufficiently in Russia
- Currently in Russia only temporary guidance for operation of facilities supplied by degas methane exists which impedes the work of project institutions and experts' work of state control agencies



Conclusions

- Russian coal mines emit annually 1-2 bln. m³ CH₄
- Four recent international CMM projects
- There are technological, economic and legal barriers
- Necessary documentation for approval a project by mine safety inspection is available



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