Scope of Methane Emissions from Abandoned Mines and Their Impact on the Environment

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Capture and Use of Abandon Mine Methane and Mine Reclamation and Revitalization of Post Mining Areas
Cracow, Poland
26 February 2020
Growing emphasis on addressing CMM emissions

CMM emissions = 9% of global CH$_4$ emissions

CMM accounts for notable share of coal-related Life Cycle GHG emissions

- IEA: 7% of lifecycle emissions$^1$
- US Dept. of Energy NETL: Large share of indirect emissions which account for 13% of life cycle emissions$^2$

Source: World Energy Outlook 2019

1: World Energy Outlook 2019
2: U.S. DOE NETL, Modeling the life cycle impacts of US coal mining at a regional level, Pittsburgh Coal Conference
AMM resources and pathways

- Coal reserves are being mined at a faster pace
- Closure of coal mines, and therefore Abandoned Mine Methane (AMM) emissions, will continue
- AMM share of global CMM emissions\(^1\)
  - 2010 = 17%
  - 2050 = up to 24%
- PNNL projects AMM emissions\(^2\)
  - 75 Bm\(^3\)/yr 2050
  - >150 Bm\(^3\)/yr by 2100

1: UNECE AM Best Practice Guidance
2: Kholod, et. al; Pacific Northwest National Laboratories, "Global CMM and AMM Emissions: Implications of Mining Depth and Future "Coal Production"

Source: UNECE AM Best Practice Guidance, 2020 & INERIS, 2019
Top AMM producing countries

Source: GMI, U.S. EPA

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of projects</th>
<th>Emissions avoided (Mt CO₂e)</th>
<th>Main AMM use</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Unknown</td>
<td>Believed to be small</td>
<td>Unknown</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>10</td>
<td>0.36</td>
<td>Power generation</td>
</tr>
<tr>
<td>France</td>
<td>5</td>
<td>10.60</td>
<td>Industrial</td>
</tr>
<tr>
<td>Germany</td>
<td>40</td>
<td>5.71</td>
<td>Power generation</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>20</td>
<td>0.64</td>
<td>Power generation</td>
</tr>
<tr>
<td>United States</td>
<td>20</td>
<td>2.70</td>
<td>Pipeline sales</td>
</tr>
</tbody>
</table>
AMM recovery best in years immediately following mine closure

Source: U.S. EPA CMOP
Global AMM Development

Legend
- Countries with established AMM projects
- Countries with strong AMM recovery potentials
Potential barriers for AMM development

- Lack of resources
- Technological barriers
- Clear definition of gas ownership
- Presence of enabling regulatory framework
- Lack of fiscal incentives
Acknowledgements

- U.S. EPA and the Global Methane Initiative
- UN Economic Commission for Europe Group of Experts on CMM
- Contributors and editors of the UNECE *Best Practice Guidance on Effective Methane Recovery and Use from Abandoned Coal Mines*
- Phil Kong, ARI
Thank You!

Presentation supported by U.S. EPA under the auspices of GMI

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