International Experience with Policies to Support AMM Projects

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Why is AMM Policy Important?

- Abandoned mines are a significant source of methane emissions
- AMM policy is often overlooked, but appears critical to project success
- Proper legal and regulatory framework and defined ownership rights can facilitate AMM utilization
- Incentives or tax policies can promote AMM utilization
Coal Production and AMM Emissions: Baseline and Policy Scenarios

- AMM increases faster than underground coal production
- AMM emissions grow even if coal production declines

Source: Model for Calculating Coal Methane (MC2M) emissions
Policy Support and Inventories

- With limited incentives to reduce AMM emissions, AMM emissions may not be tracked carefully.
- Ironically, lack of tracking can also lead to less interest in addressing AMM.

<table>
<thead>
<tr>
<th>Country</th>
<th>AMM emissions coefficient, kg CH4/Mt coal</th>
<th>Average mine depth in 2010, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>28</td>
<td>500</td>
</tr>
<tr>
<td>Germany</td>
<td>11</td>
<td>1150</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>25</td>
<td>850</td>
</tr>
<tr>
<td>United States</td>
<td>46</td>
<td>373</td>
</tr>
<tr>
<td>China</td>
<td>3</td>
<td>456</td>
</tr>
<tr>
<td>Ukraine</td>
<td>0.4</td>
<td>730</td>
</tr>
</tbody>
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AMM coefficient is a ratio of reported AMM emissions in 2010 to cumulative underground coal production in 1961-2010.
Case Studies

- Many countries have operational AMM projects
- Germany, the United Kingdom, Australia, and the United States can provide valuable lessons for other countries
- AMM utilization rates in these countries are from 29% to 99%
Operational AMM Projects Around the World

- Power Generation, 39
- Combined Heat and Power (CHP), 13
- Pipeline Injection, 27
- Boiler Fuel, 1
- Industrial Use, 2
- Coal Drying, 1
- Other, 2

# AMM Case Studies: Key Findings

<table>
<thead>
<tr>
<th>Country</th>
<th>AMM utiliz. rate</th>
<th>Royalties</th>
<th>Key Policies</th>
</tr>
</thead>
</table>
| Germany | 99%             | 10%       | • Clear gas rights and licensing process  
|         |                 |           | • Feed-in tariffs/market premium for AMM |
| UK      | 58%             | Taxes instead | • Clear rights and licensing procedures  
|         |                 |           | • Fairly high taxes  
|         |                 |           | • AMM exempted from climate change levy |
| Australia | 31%             | 10%       | • AMM is not defined as a resource  
|         |                 |           | • Flaring is prohibited |
| US      | 29%             | 12.5%     | • Royalty relief (some states)  
|         |                 |           | • AMM in Renewable Portfolio Standards (some states)  
|         |                 |           | • Carbon offsets |

Based on draft PNNL paper on AMM policies, scheduled for release later this year
Case Study: Australia

- No national legislative framework regarding AMM ownership and licensing
- AMM is not defined as a resource in national and state regulatory framework
- No incentives for AMM production
- AMM projects only in New South Wales*
- Royalty rate is 10% of petroleum gross value at the wellhead (NSW)

Case Study: Germany

- Rights to CMM are provided to coal companies
- Feed-in-tariff (and later market premium incentives) for AMM
- Germany has the largest number of active AMM projects
- Active AMM projects utilized up to 99% of AMM

![Graph showing AMM power generators and AMM emissions from 2001 to 2015]
Case Study: United Kingdom

- Government owns the methane associated with coal
- Oil and Gas Authority auctions rights to methane recovery
- Tax benefits for AMM utilization (Climate Levy)
- Active AMM projects in the UK utilize about 58% of total methane emissions from abandoned mines
- No more active underground mines after December 2015
Case Study: United States

- Federal lands: government issues coal leases without AMM rights
- Private lands: the coal owner has the AMM rights
- No federal incentives to promote AMM utilization
- Several states define AMM as a renewable energy source, creating financial incentive
Key AMM Policy Actions for Success

- Enact clear procedures for obtaining AMM ownership rights
- Allow for transfer of methane rights from the mine to the gas developer
- Consider including AMM as a renewable energy resource
- Set royalties at a low level to encourage investments
- Offer reduced taxes or other incentives to support AMM projects