Technical And Economic Potential For Use Of Coal Mine And Abandoned Mine Methane

G.A.S. Energietechnologie GmbH
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Utilisation of CMM /AMM

Boilers, secondary fuels, gas-to-pipeline

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Introduction of speaker

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Qualification: graduate engineer
Coal Mine Gas Classification

CBM
Coal Bed Methane

VCBM
Virgin Coal Bed Methane
- High/moderate risk
- Wells & Fracs
- Oil & Gas Industry

CMM
Coal Mine Methane
- Low risk
- Pre-Post-drainage
- Mining Industry

AMM
Abandoned Mine Methane
- Moderate risk
- Shafts/wells
- Mining/other Industries

VAM
Ventilation Air Methane
- Developing technology
- High risk
- Shafts
- Mining Industries
**Worldwide potential of - Coal Mine Gas**

Total 2010 MW$_{el}$ Power Potential

![Pie chart showing the power potential distribution between CMM, VAM, and AMM]
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Utilization of CMM / AMM

Decentralized CHP
Medium to low BTU gas
(25 – 30 % CH₄)

Gas-to-pipeline
(High BTU gas > 80 % CH₄)

Boilers
Heat
Electricity
Secondary fuels
MeOH
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Boilers

Use of coal mine gas for heating

• District heating (Poland, Eastern Europe)
• Internal use within the mining operations (heating/cooling of ventilation air, showers, etc)
• Electricity production via steam process
Secondary fuels

Use of coal mine gas to produce

• methanol
• urea (fertilizer)
• synthesis gas

→ high scales necessary
→ currently not adopted as an common utilization option
Gas to pipeline

- High-grade CBM/CMM (> 96 % CH₄) direct connected to pipelines
- Sub-quality gas (80 – 96 % CH₄) has to be prepared by:
  - drying
  - nitrogen and carbon dioxide rejection
  - desulphurization
  - filtration
  before it will be used in pipelines
- feasible economics in relation to the actual natural gas price
Example

Nitrogen Rejection Plant (NRU) Colorado, West Texas built through DDC D'Amico Development in early 90s.
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**CHP Technology Solution**

**Centralized approach:**

**Advantages:**
- large engine modules → lower specific invest
- centralized O & M

**Disadvantages:**
- no flexibility → difficult capacity adjustments
- high investment in fixed assets
  (buildings, pipeline system)
**CHP Technology Solution**

**Decentralized approach:**

**Advantage:**

- easy adjustment of the plant capacity due to availability of coal mine gas.
- easy change of locations
- possibility of lease financing
- minimization of ➢ investment risks,
  ➢ space requirements,
  ➢ duration of project execution (< 6 Months)
CHP Technology Solution

Decentralized approach:

Disadvantage:

- higher specific costs
- decentralized O&M
Operational experiences

Out of 25 MW installed for CMM

- CMM with a methane content down to 25 % CH\textsubscript{4} can be used
- Oversaturated gas due to utilization of watering pumps
- Dust (coal, rock, calcium anhydrite) → higher ware of the equipment
  - shorter equipment life
  - high costly maintenance efforts
→ gas treatment necessary

- availabilities up to 95 % are achieved
Operational experiences

Out of 85 MW installed for AMM

- availabilities of up to 98 % are achieved.
- decline of CH$_4$ concentrations and increase of sucking pressures over the time
- air ingress and climbing water levels might occur
- higher risk of gas availability
  → portfolio of mobile equipment
- dust; sulfur and water might be a problem on certain locations → higher wear of the equipment
  → gas treatment necessary
Examples of Mobil Coal Mine Gas CHP for AMM

- project: Kurl 3
- location: Lünen, Germany
- fuel: coal mine gas
- commissioning: 2002
- el. performance: 4.074 kW_{el}
- th. performance: - kW_{th}
- energy for: appr. 10,000 households/a
- emission reductions of: approx. 130,000 t/a CO_{2}-equivalents
Examples of Mobile Coal Mine Gas
CHP Plants for CMM

<table>
<thead>
<tr>
<th>project</th>
<th>Haus Aden</th>
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</thead>
<tbody>
<tr>
<td>location</td>
<td>Bochum, Germany</td>
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<tr>
<td>fuel</td>
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<tr>
<td>commissioning</td>
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<td>16.296 kW_{el}</td>
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<tr>
<td>emission reductions of</td>
<td>approx. 520.000 t/a CO_{2}-equivalents</td>
</tr>
</tbody>
</table>
Economical Aspects

- ownership of the CMM/AMM resource has to be clear
- electricity prices below 4 $ct. /kWh do not support feasible projects.
- CO₂ credits are a possibility to enhance the economic of projects
Economical Aspects

Governmental support is important

- supported designated nation authority (DNA approval, CO$_2$ credit)
- preferred access to the grid
- higher electricity prices for electricity to CMM/AMM resources
- easy and fast approvals of projects
- no royalties on CMM / AMM
- dedication to save work environment
Conclusion

• electricity from CMM/AMM is the most efficient utilization option for low BTU gas

• CMM/AMM is different from natural gas → sophisticated gas treatment

• governmental support is needed

• CO₂ credit might be the tool to avoid and utilize methane emissions from coal mining activities and even enhance the safety of coalmines
Thank you for your interest!

If you have any further question, please do not hesitate to contact me:

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