Energy production from coal mine gas – environmentally friendly, innovative, efficient

Dipl. Engineer
Michael Kaminski
• Presenting Evonik Industries / Evonik Steag GmbH
• The Evonik coal mine gas locations in Germany
• The Evonik coal mine gas companies
• Presenting Minegas GmbH and Mingas-Power GmbH
• Presenting Evonik New Energies GmbH
• Services
• Results and corporate objectives
• Future prospects
## Business Areas of EVONIK Industries

### Chemicals
- Focus: special chemicals
- Global leader
- Market leader in more than 80% of chemical operations
- Market-oriented R & D and modern innovations management
- More than 100 production locations in around 30 countries

### Energy
- Focus: coal-fired power stations and renewable energies
- Technological leadership in the planning, construction and operation of coal-fired power stations
- Germany's fifth largest electricity generator
- Power stations abroad: Turkey, Columbia, Philippines
- Strong position in biomass and geothermal energy

### Real estate
- Focus: residential property
- One of Germany's largest housing associations
- More than 60,000 apartments
- Committed landlord with regional focus
- Quality supplier: vacancy rates and tenant fluctuation better than the industry average
Evonik Steag – the group's energy pillars

Evonik Steag

- operates
  - eight coal-fired power stations in Germany (five in Rhine and Ruhr area, three in Saarland),
  - and two industrial power stations
with three coal-fired power stations abroad (Turkey, Columbia, Philippines)

- builds and operates facilities for decentralised power supplies
- transports, treats and markets hard coal, coke and coal products
- operates coal mine gas, biomass and geothermal plants.
Evonik Steag – coal mine gas locations in Germany

North Rhine-Westphalia

- 26 locations, 100 modular combined heat & power plants (CHPP)
- Total output: $122 \text{ Mw}_\text{el}$
- Heat generation: approx. 100 GWh p.a.
- Market share in North Rhine-Westphalia: approx. 65 %

Saarland

- 5 locations, including one of the world's largest coal mine gas motive power units $42 \text{ Mw}_\text{el}$
- Total output: $55 \text{ Mw}_\text{el}$
- Energy generation: approx. 400 GWh p.a.
- Market share in Saarland: approx. 95 %

With total output of around $180 \text{ Mw}_\text{el}$ Evonik leads the market in Germany.
**Evonik Steag – subsidiaries**

**Minegas GmbH**

- **Founded:** 17 November 2000
- **Investment up to 2008:** approx. 75 million €
- **Facilities:** approx. 60 CHPPs
- **Output:** approx. 82 Mw\(_{el}\)
- **Avoidance of CH\(_4\) emissions:** approx. 2.5 million tonnes

**Shareholders:**

- **Evonik Grubengas-Holding NRW GmbH:** *74.8%
- **GreenGas:** 12.6%
- **Evonik Grubengas-Holding NRW GmbH:** 12.6%
Mingas-Power GmbH

- Founded: 20 June 2001
- Investment up to 2008: approx. 40 million €
- Facilities: approx. 40 CHPPs
- Output: approx. 50 Mw_{el}
- Avoidance von CH_{4} emissions: approx. 1.5 million tonnes

Shareholders:
- Evonik Grubengas-Holding NRW GmbH * 60.0%
- * 40.0%

* Evonik Grubengas-Holding NRW GmbH
Evonik New Energies GmbH:
Experience with coal mine gas extraction by suction since 1908
(more than 100 years)

Overall 14 gas extraction plants with
• 42 gas suction units : capacity 90,000 m³/h
• 32 gas condensers : capacity 60,000 m³/h
• 15 gas driers : capacity 68,000 m³/h

of these only 1 suction unit is in operation in an active coal mine

• More than 100 km long coal mine gas pipeline above ground
Evonik New Energies GmbH:
Experience with coal mine gas utilisation since 1948 (more than 60 years)

Facilities:
- 5 of our own coal mine gas utilisation plants (gas motors, gas turbines, gas boilers) with an output of 55 MW$_{el}$
- industrial customers (power stations, steelworks, chemical industry, gypsum plant)
- first JI project in Germany (flare stack on an active coal mine)
Combined output (MW) of all installations

- 2000: 60 MW
- 2001: 80 MW
- 2002: 130 MW
- 2003: 150 MW
- 2004: 185 MW
- 2005: 185 MW
- 2006: 185 MW
- 2007: 185 MW
- 2008: 185 MW
Electricity production + CO₂ reduction combined

Electricity production (GWh/p.a.)

CO₂ reduction (million tonnes/p.a.)

Graph showing electricity production and CO₂ reduction from 2000 to 2008.
Coal mine gas fields in the Ruhr region

Gas-rich zone

West East
CHPP locations in North Rhine-Westphalia
Projects in disused coal mines

Ickern-Methan 1

Blumenthal 7

Datteln-Methan 1
The full service spectrum

Planning
- Exploration and evaluation
- Feasibility studies
- Engineering
- Site development
- Approvals management
- Financing

Construction
- Extraction of coal mine gas
- Coal mine gas processing plants
- Gas engine-CHPP-modules with 0.3-1.5 MWel
- Infeed of energy into the existing grid-infrastructure

Operation
- Technical operations management
- Commercial management
- Power production
- Heat production
- Measurement and control by means of remote technology

Service
- Servicing
- Maintenance
- Remote control
- Supply of spare parts
The full service spectrum

- Identification of potential methane gas fields
- Determination of starting points for drilling
- Drill scheme creation
- Project planning and execution of deep drilling work
- Development of extraction concepts
Drilling projects - locations

- Victor Gas
- Waltrop Gas
- Castrop Gas
- Hardenberg Gas
- Emscher-Lippe Gas

- In operation
  - Emscher-Lippe Gas
- Under construction
  - Victor Gas
  - 580 m
  - 390 m
- Not enough gas
  - Waltrop Gas
  - 614 m
- Planning stage
  - Lünen-Süd-Gas
  - approx. 450 m
- Under development
  - 279 m
  - Castrop Gas
  - 154 m
  - Hardenberg Gas
• construction and operation of mobile and containerised CHPP facilities
• preventive risk avoidance and minimisation of methane volumes escaping on the surface by CO₂ reduction of more than 3.1 million t/a
• climate protection by cutting CH₄ emissions from deep coalmining in the Ruhr region by the exploitation of 400 million Nm³ (Federal Climate Protection Programme, North Rhine-Westphalia climate protection concept)
• contribution to the sustainability of domestic energy supplies by conserving resources (220 tonnes/day coal equivalent)
• creation and safeguarding of jobs
The advantages of optimised extraction and energy generation from coal mine gas

The extraction, treatment and conversion of coal mine gas into energy leads to:

• a reduction of the accidents in coal mining
• increased production in high-performance mines
• reduced operating costs thanks to longer operating times in mining
• thermic exploitation for electricity, heating or cooling purposes either at the coal mine itself or for external sale
• avoids the generation and use of electricity and heat
• savings in primary energy
• reduction in impact on the environment and damage to the climate
• credit for CO₂ emission rights / additional revenues
Future prospects

**Domestic:**
- Consolidation of the power station facilities in North Rhine-Westphalia
- Making coal mine gas with low methane concentrations usable in CHPP motor units ($< 25 \% \text{CH}_4$)

**International:**
- Analysis of risks and opportunities in joint mining projects under the umbrella of the North Rhine-Westphalia state initiative on energy sources of the future together with partner countries with special regard to emissions trading (know-how transfer from North Rhine-Westphalia, JI and CDM projects)
Evonik Steag GmbH
Michael Kaminski
Rüttenscheider Str. 1–3
45128 Essen, Germany
Tel.: +49 (0) 201 801-2661
michael.kaminski@evonik.com

Evonik New Energies GmbH
Stefan Schneider
St.-Johanner-Str. 103
66115 Saarbrücken, Germany
Tel.: +49 (0) 2681 94942910
stefan1.schneider@evonik.com

This presentation is also available as a download at www.minegas.com.
Thank you for your attention
<table>
<thead>
<tr>
<th><strong>CBM (coal bed methane)</strong></th>
<th>Gas from the virgin coal bed Methane content &gt; 90%, i.e. natural gas quality</th>
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<tbody>
<tr>
<td><strong>CSM (coal seam methane)</strong></td>
<td>Gas extraction from active coal mines Methane content 25 – 45%</td>
</tr>
<tr>
<td><strong>CMM (coal mine methane)</strong></td>
<td>Gas extraction from disused coal mines Methane content 30 – 70%</td>
</tr>
</tbody>
</table>
1) Coal seam
2) Protego vent cap
3) Suction of coal mine gas through piping from the hard coal deposit (existing equipment or "borehole mining")
4) Extraction station
5) Compression of the extracted mine gas
6) Combustion in conventional gas engines
7) Electricity generation by generators
8) Heat production by utilisation of engine and exhaust gas heat
9) Energy feeding input close to the consumer
Technical principle of coal mine gas use (2)

Extraction station

Electricity fed into the public grid

CHPP

Heat
Gas extraction pipeline opened up by drilling
Current status of coal mine gas use in North Rhine-Westphalia

- A power station (130 MW) at 30/40 locations
- Decentralised direct use of the extracted volumes of coal mine gas
Actual distribution of deposits
Reduced methane content resulting from the entry of air
Coal mine gas extraction and utilisation since 1948 until 2008 by Evonik New Energies

![Graph showing coal mine gas extraction and utilisation from 1948 to 2008]