The Sustainable Development Strategy of the German Hard Coal Mining Industry

Jürgen Kretschmann
President
TFH Georg Agricola
University of Applied Sciences
Bochum, Germany
Foreword: Some characteristics of the German Economic System

- Germany does not have a liberal or capitalistic tradition
- Since the founding of the German Reich in 1871 Germany has developed “social market economy” organized by the government
- Companies, organisations, trade unions, banks, political parties, the churches and the government are working closely together (consensus economy); typical: round table conferences
- Social peace is highly appreciated
- Tax rates are traditionally high (up to 45% income tax, 19% VAT)
Life Cycle of Coal Mining

- **Pre-Mining (Exploration)**
- **Mining**
- **Post-Mining**

Depleted field

Environmental Impact Risk Management

**Short Period** → **Long Period** → **Eternity**
Hard-coal mining in Germany: 3 mining areas

<table>
<thead>
<tr>
<th>Colliery</th>
<th>Coalfield</th>
<th>Year of closure</th>
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<tbody>
<tr>
<td>Auguste Victoria</td>
<td>Ruhr area</td>
<td>2015</td>
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<tr>
<td>Prosper Haniel</td>
<td>Ruhr area</td>
<td>2018</td>
</tr>
<tr>
<td>Anthracite Ibbenbüren</td>
<td>Ibbenbüren</td>
<td>2018</td>
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Hard Coal from the Ruhr: Nothing is for Eternity

- Coal mining was the basis of Germany´s „economic miracle“ after World War II.
- Production of hard coal began to decline in the 1960ies.
- The lifecycle will probably end in 2018.
Why did the German hard coal lifecycle end?

- Inclined shafts
- Single-seam winning
- Thick seams
- Two-directional working
- One face advancing
- Rectangular roadways
- Vertical shafts
- Multi-seam winning
- Medium and low seam thicknesses
- Several faces advancing
- Transition from rectangular to arch-profile roadways
- Convergence
- Interconnected mines
- Complex logistics
- Deep workings require climate control and building materials
- Difficult strata control in roadways
- Internal subsidence damage
- Complex planning processes

Depth [m]

Degree of complexity

- Simple
- Difficult
- Complex
Nothing is for Eternity: Coal Production in the UK
Nothing is for Eternity: Coal Production in Colorado, USA

From stagnation to decline?
Post-mining in Germany

- Necessary activities in the post-mining period have been neglected for a long time
  - Environmental impacts
  - Social impacts (especially in the mining communities)
  - Economic impacts.

- Funding for post-mining activities usually has come from the society („tax payer“).
Sustainability and (Post-)Mining

• Sustainable is “the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (United Nations 1987)

• Sustainability:
  1. Social sustainability: The share of wealth for as many people as possible
  2. Economic sustainability: A durable positive economic development
  3. Environmental sustainability: The preservation of nature
This three-dimensional approach can be applied to current mining and post-mining activities

1. Environmental dimension: Sustainable management of mining impacts on the environment
2. Economic dimension: The costs of managing mining damage and perpetual tasks should be payed by the responsible company and be kept as low as possible
3. Social dimension: Ensure good standard of living and good perspectives in the mining regions, avoid unemployment
Examples of Post-Mining Challenges

- Abandoned brownfields
- Subsidence, uplifts
- Close to surface extractions
- Surface openings, shafts
- Discontinuous faults
- Gas emissions at the ground surface
- Refuse dumps
- Surface water
- Pumping of mine water

Cross section coalfield in the Ruhr Area
RAG: the last hard coal mining company in Germany

- Since the 1960s hard coal mining in Germany has been continuously declining due to non competitive production costs.
- In 1969 most of the remaining coal mining companies merged to form an umbrella company called Ruhrkohle AG.
- RAG received state subsidies to ensure a domestic power and coking coal supply in Germany and to reduce mining jobs in a social responsible way.
The History of RAG - Overview

1969
Ruhrkohle AG established, 2nd largest private company in Germany that time

1997
Reorganised as RAG group, among top 10 private coal producers in the world

2007
Core business: mining of German coal; selling of all other coal-related activities

2018
End of subsidized hard coal production

2019
RAG continues to pursue post-mining activities (less than 1,000 employees)
The End of hard coal mining in Germany

- In 2007, the German Federal Government passed a bill to finish the subsidized hard coal production in 2018.
- RAG was split up into three parts: and converted to a new set up foundation: RAG-Stiftung (foundation)
  1. The subsidized coal mining unit plus coal trade, land management and site development and other coal related service companies (“black side”)
  2. Profitable businesses outside the coal industry, mainly concentrated under the new found EVONIK Industries (“white side”)
  3. A new foundation named RAG-Stiftung, being main shareholder of both sides.

- The foundation has to ensure that the proceedings from the profitable businesses will be used to cover the costs of the post-mining activities to avoid the use of tax money.
RAG-Stiftung (RAG-Foundation)

Remit of the RAG Foundation:
- Socially responsible restructuring of the coal mining industry up to the end of 2018
- Taking EVONIK Industries AG into the capital market
- Financing of inherited liabilities from the coal industry after 2019
- Promotion of training, science and culture in the coalfield regions
THE RAG-STIFTUNG AT A GLANCE

Founded 2007

Board of Trustees
Ex-officio members (5)
- Additional members (8)
  - 9 additional members since 9 Jan. 2015
  - Dr. Jürgen Goirlans (Chairman)
  - Michael Vassiliades (Deputy Chairman)

Bodies
- appoints the Board of Executives and supervises its business activities
- initiates the Board of Trustees of essential decisions

Board of Executives
- Prof. Werner Müller (Chairman)
- Dr. Wolfram Linsen (Finance)
- Dieckel Bergerhoff-Weloska (HR, Support)

Financing

Shareholdings
1. RAG (100%) - 16.6 billion to the RAG Stiftung once coal mining is discontinued
2. MVK (68%) - Investment
3. VIGNIK (38%) - Distribution of profits

Investments
- 51% Government and corporate bonds
- 18% Liquidity and other
- 11% Equity and equity investments
- 8% Shares
- 7% Real estate

Amount (as of 31 Dec. 2014): €3.2 billion
Support in 2014: €4.5 million
Support in 2015: €7.5 million

Financing:
- Support for education, science and culture
- Project funding for mining-related activities in the Ruhr and Saar regions
- Funding is provided for two key tasks:
  - Mining heritage & Transition support

Perpetual obligations

Starting point
Discontinuation of subsidised coal mining (end of 2018)

The purpose of the RAG-Stiftung is to ensure the orderly and socially acceptable transition to the post-coal era and to permanently finance the perpetual obligations.

Amount required each year to finance perpetual obligations beginning in 2019: approx. €220 million

Pit water management
Pumping up the pit water that has accumulated in the coal mine underground. The pit water is pumped up to the surface in order to protect deposits of drinking water, for example.

Ground water purification
The purification of contaminated water on the grounds of former by-product plants of the coal mining industry, in particular former coking plants.

Polder measures
Mining activities cause the surface to subside. Water would collect in these depressions if the water boards, in particular, didn’t continuously pump the surface water away.
The Legacy of Coal Mining and Perpetual Tasks

- RAG has defined two different kinds of challenges in post-mining regarding:

1. **Legacy:** The old mine structures (former collieries, coking plants, slap and coal heaps etc.), the removal of mining damage caused by e.g. subsidence and the securing of abandoned shafts and former close-to-surface mining panels.

2. **Perpetual tasks:** Measures to handle permanent features that result from the end of underground hard-coal mining by the RAG, i.e. the pit water drainage, the landfill measures where mining subsidence occurs, and the cleaning of groundwater at former mining locations.
Examples of challenges to master mining impacts technically

Former mining: old shafts, near-surface mining
Subsidence damages
Permissions, water rights, geodata management
Water management
Renewables
Development of real estate
Handling of Mine Water

- Pit water is rain water that seeps into the ground along impervious rock layers and crevices to the north.
- The rain water dissolves minerals that are encased in the rock, e.g., salts.
- In underground hard-coal mining the pit water has to be pumped overground as otherwise it would flood the pit and make any exploitation of raw materials impossible.
Handling of Mine Water

• RAG pumps 92 million cubic meters of mine water per year in its three coal fields.

• RAG is currently operating a total number of 16 drainage systems including active and abandoned collieries. It is intended to reduce this number to 8 drainage systems.

• This project will lead to a cost reduction, and it would help to discharge some water bodies that still receive strongly mineralized mine water today.

• In the future this system is to be replaced by a well drainage where immersion pumps will be used.
Post-Mining as an academic Discipline

TFH Georg Agricola has established Post-Mining in research and education:

- Post-Mining Research Institute
- Master Course Geo-Engineering and Post-Mining (MGN)
Master course Geoengineering and Post-Mining (MGN)

Bärbel Bergerhoff-Wodopia, Member of the board of the RAG-Stiftung, welcomes the first generation of MGN students
Current Research Projects

- Acquisition of density stratification in flooded mine workings
- Monitoring of underground flooding processes
- Analysis of water-bearing adits or drainage adits
- Analysis of terminated flooding processes of mines in Germany, Europe and worldwide
Securing social Sustainability in the Communities

• Effective post-mining activities can not only avoid or mitigate risks, but provide opportunities by reinventing brownfields to create new jobs from e.g.:
  – Energy-producing utilization of methane that is released from coal beds
  – Wind wheels on refuse dumps
  – Production of biomass on former mining areas
  – Pump-storage power plants either on refuse dumps or underground in existing mine structures
  – Photovoltaic plants on mining areas
  – Heat from mine water or exhaust heat
  – Geothermal energy
Ewald Colliery: An Example of a Reinvented Post-Mining Location
Securing social Sustainability: Reduction of Workforce

More than half a Million jobs in Renewable Energies until 2020

Source: 2002: DIW, 2004-2006: BMU,
Securing social Sustainability in the Communities

- **Main Idea:** The mining past is not a burden, it is a precious heritage to enhance towards the future („Industrial Culture“).

- **What is necessary:**
  - Changes in mentality, culture, strategy and action
  - An evolutionary process based on the strengthening of strengths in the mining regions
  - Integrated regional planning and milestones (decade projects)
  - Lighthouse projects widely visible (heritage sites and future sites)
  - Strategy and public relations.
Vision: Ruhr Metropolis 2030

- In 2030 the Ruhr Metropolis will be a model region for sustainable solutions of global challenges
- a „boomtown“ like 200 years ago
- a knowledge region with a Meta-Cluster Energy-Materials-Logistics as USP
- The education system will be international outstanding.
- Ruhr Metropolis will be a Hot Spot for talents worldwide.
Thank you for your kind attention and Glückauf!

Jürgen Kretschmann
kretschmann@tfh-bochum.de
www.tfh-bochum.de/en