

The Sustainable Development Strategy of the German Hard Coal Mining Industry

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Foreword: Some characteristics of the German Economic System

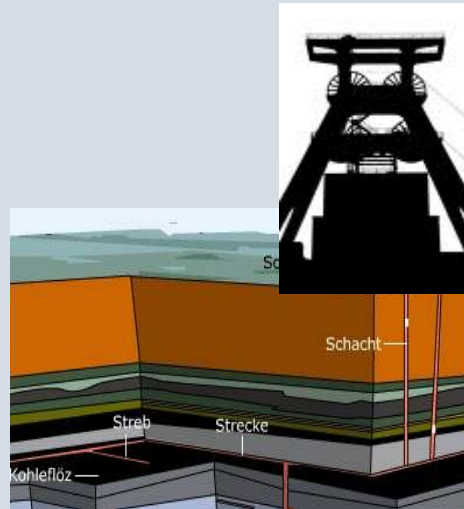
- **Germany does not have a liberal or capitalistic tradition**
- **Since the founding of the German Reich in 1871 Germany has developed “social market economy” organized by the government**
- **Companies, organisations, trade unions, banks, political parties, the churches and the government are working 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)



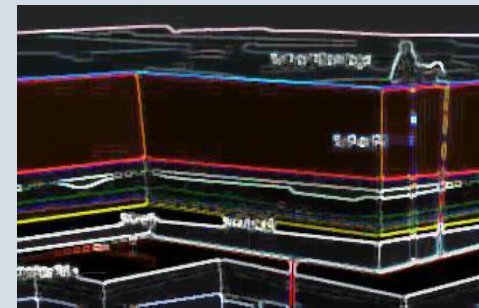
Mining



Depleted field



Post-Mining



Environmental Impact Risk Management

Short Period



Long Period



Eternity

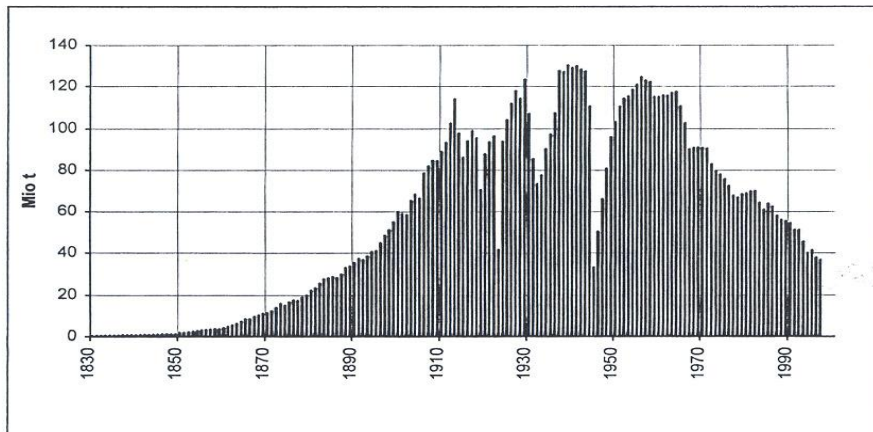
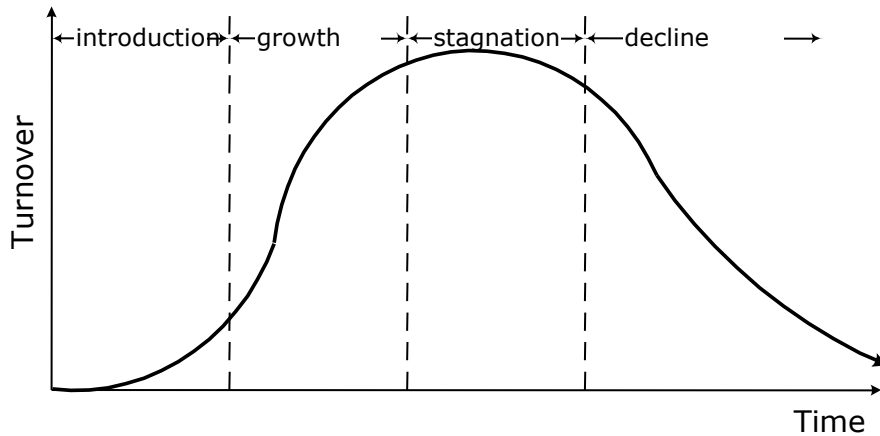


Hard-coal mining in Germany: 3 mining areas



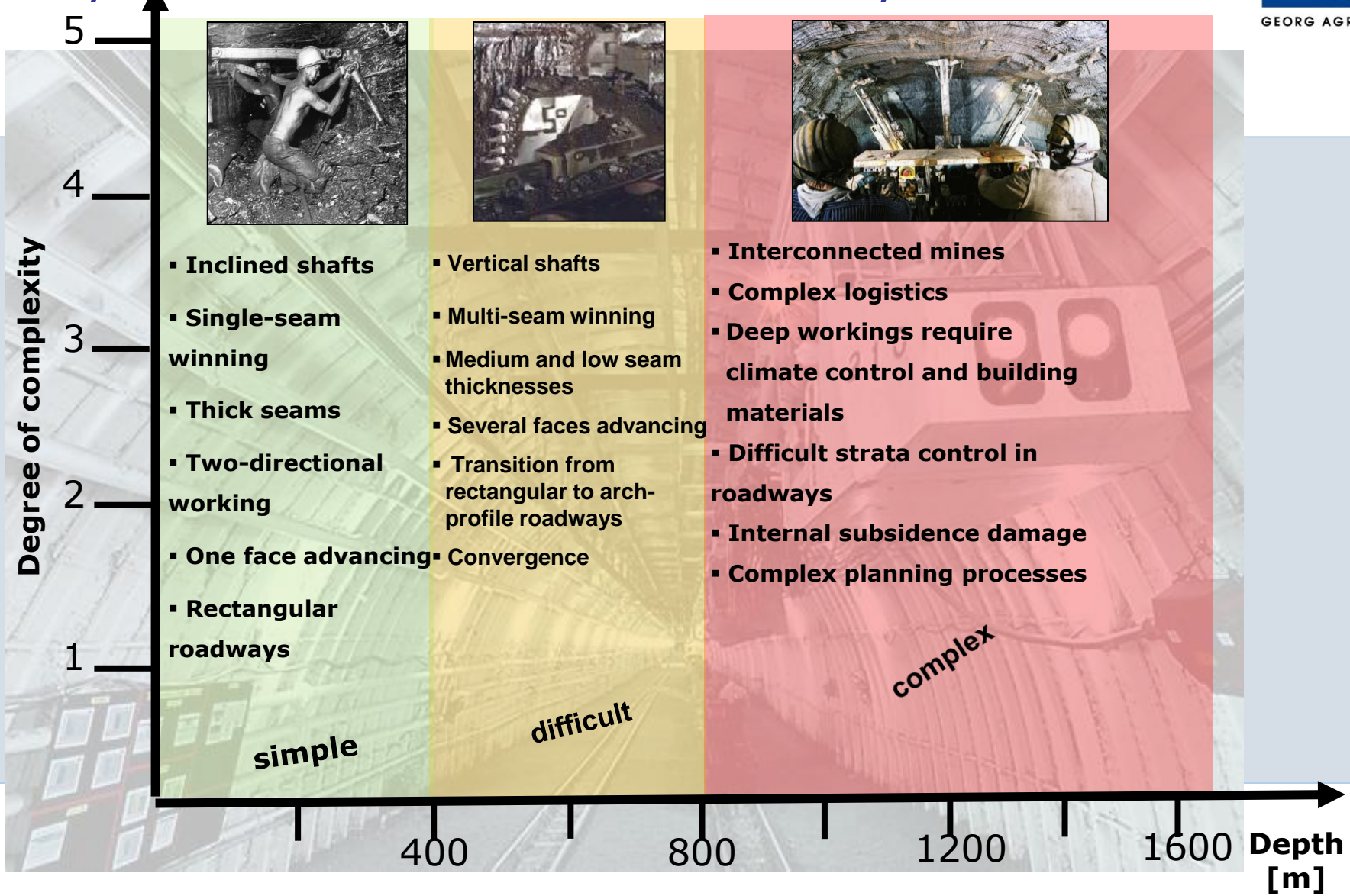
Colliery	Coalfield	Year of closure
Auguste Victoria	Ruhr area	2015
Prosper Haniel	Ruhr area	2018
Anthracite Ibbenbüren	Ibbenbüren	2018

Hard Coal from the Ruhr: Nothing is for Eternity

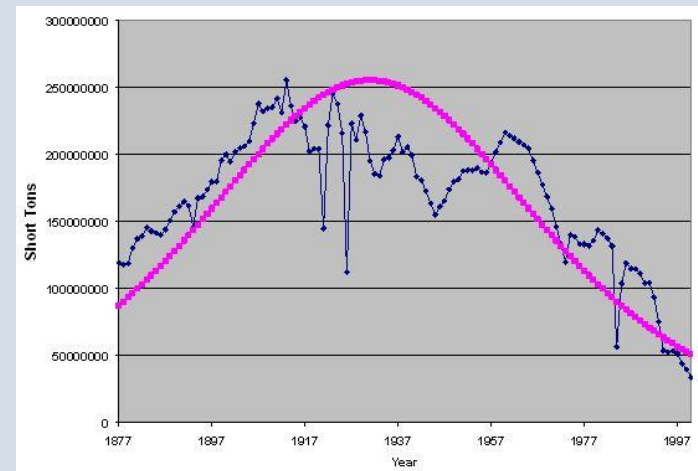
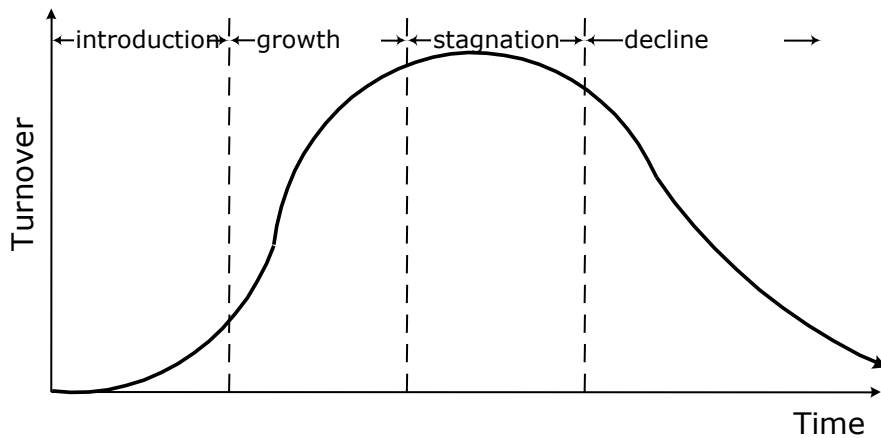


- Coal mining was the basis of Germany's „economic miracle“ after World War II. But
- Production of hard coal began to decline in the 1960ies.
- The lifecycle will probably end in 2018.

Why did the German hard coal lifecycle end?

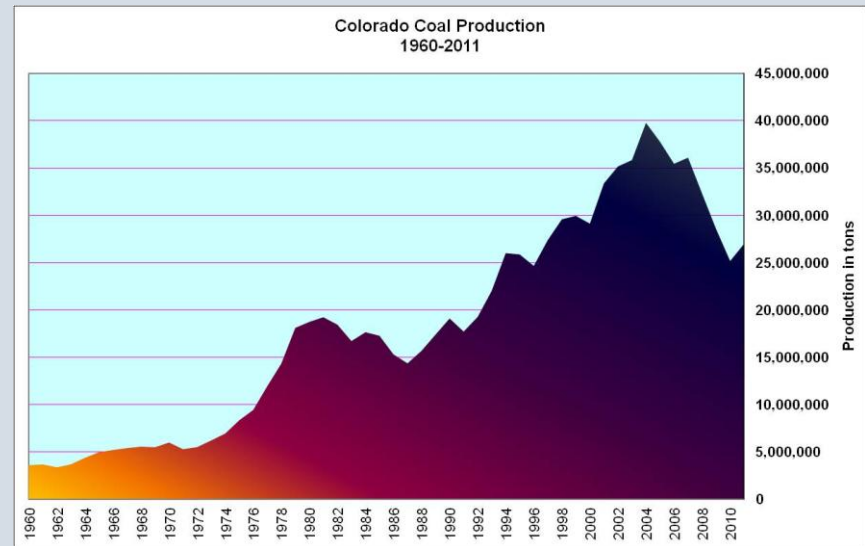
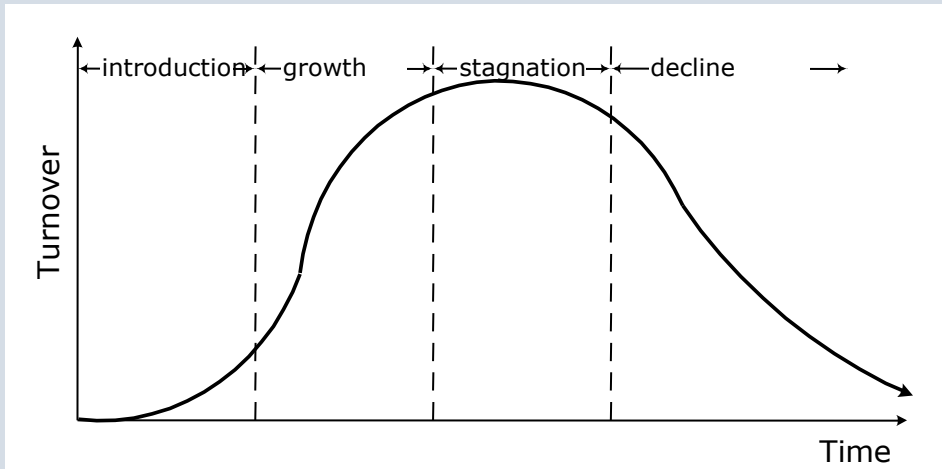


Nothing is for Eternity: Coal Production in the UK



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

Sustainability and (Post-)Mining

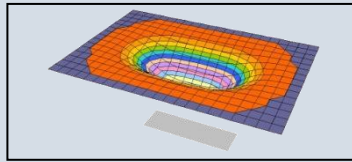
This three-dimensional approach can be applied to current mining and post-mining activities

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

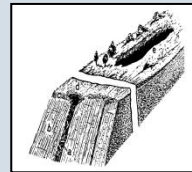
Examples of Post-Mining Challenges



Abandoned brownfields



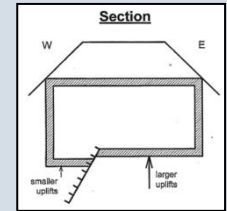
Subsidence, uplifts



Close to surface extractions



Surface openings, shafts



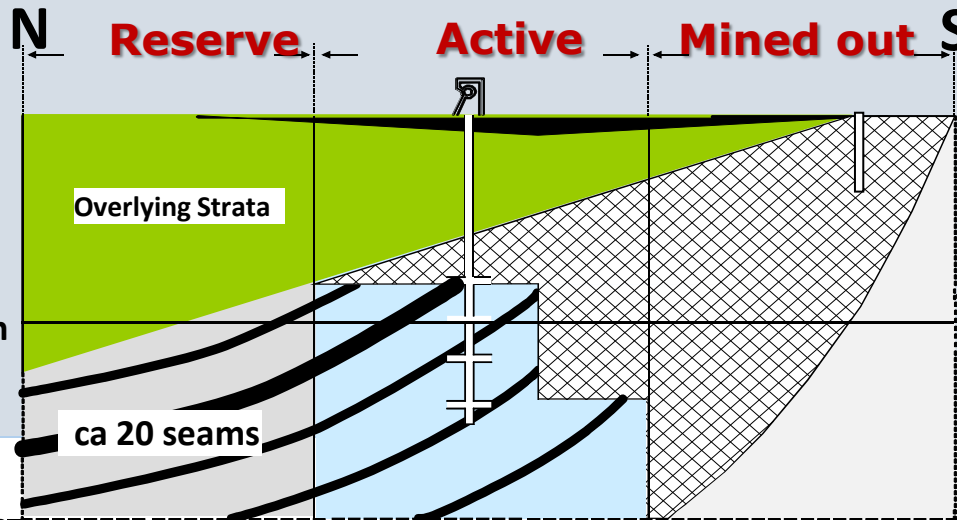
Discontinuous faults



Gas emissions at the ground surface



Refuse dumps



Cross section coalfield in the Ruhr Area



Surface water

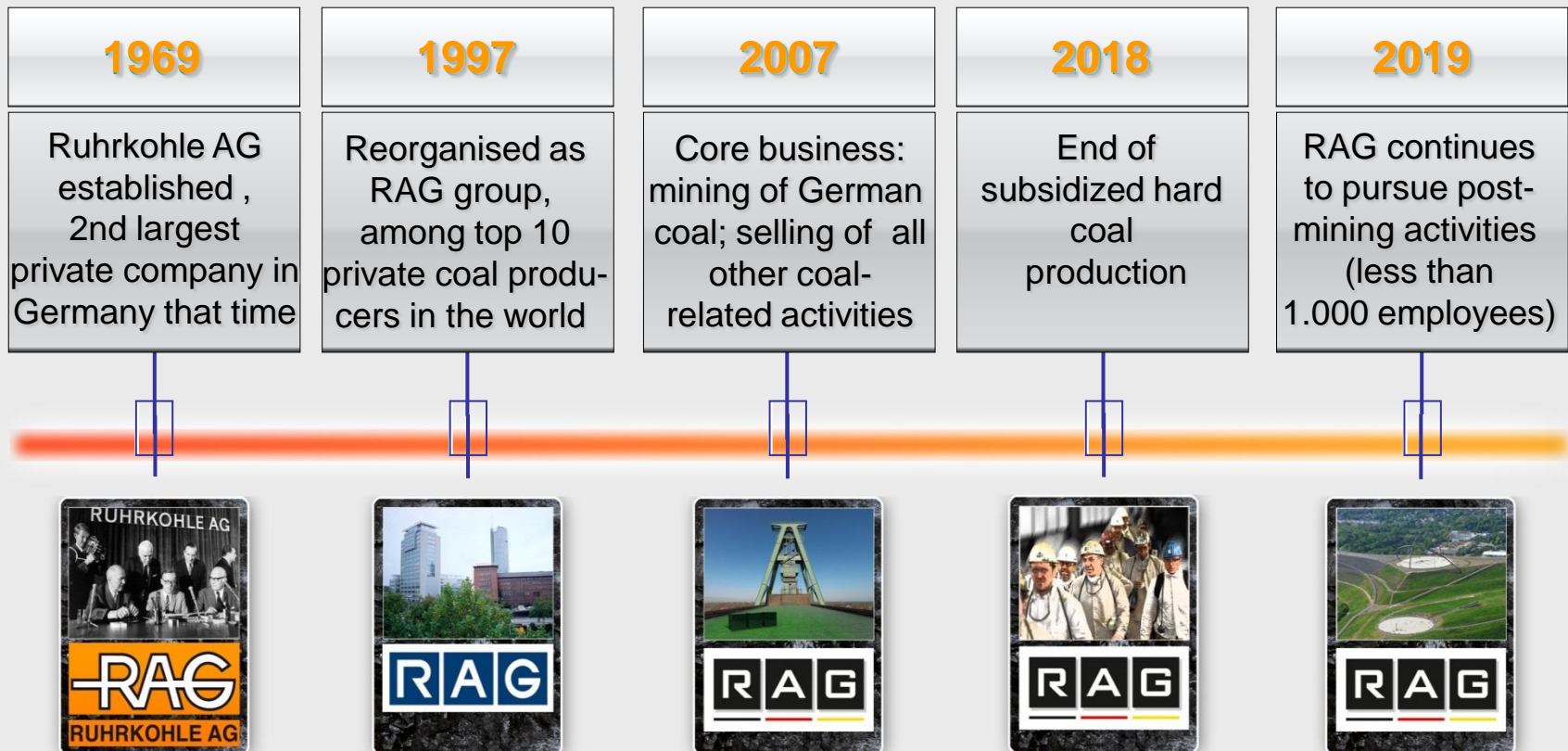


Pumping of mine water

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



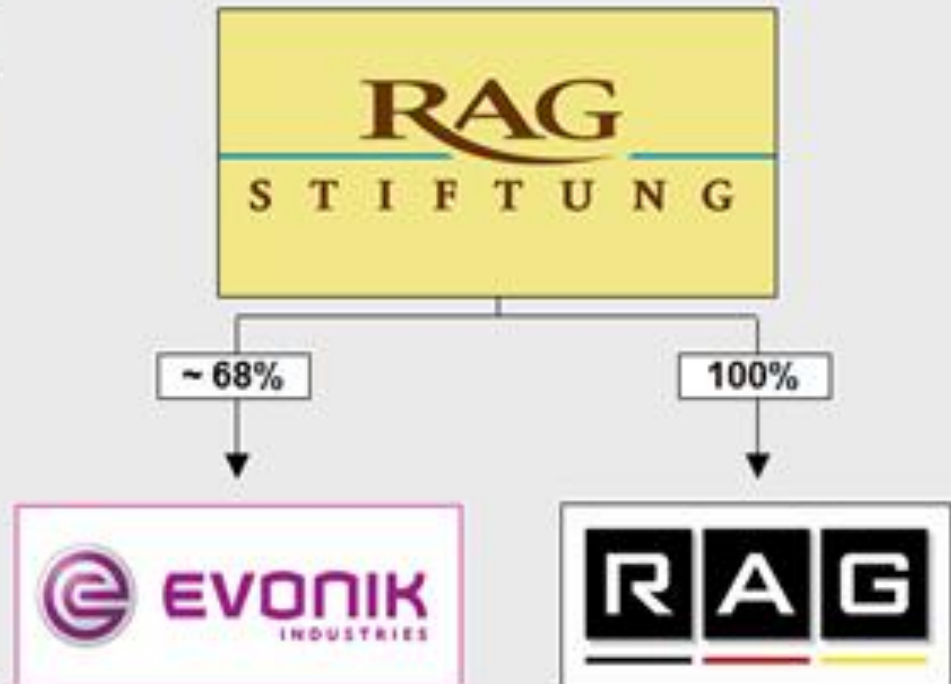
The End of hard coal mining in Germany

- 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)

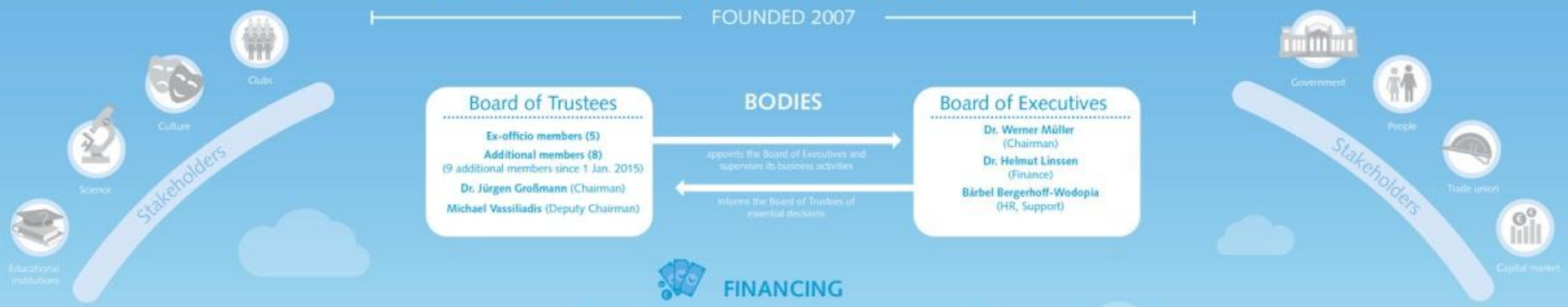
Remit of the RAG Foundation

- 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

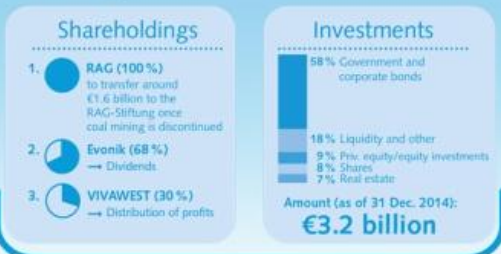


THE RAG-STIFTUNG AT A GLANCE

FOUNDED 2007



FINANCING



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.

Support for education, science and culture

Project funding is for mining-related activities in the Ruhr and Saar regions. Funding is provided for two key tasks:

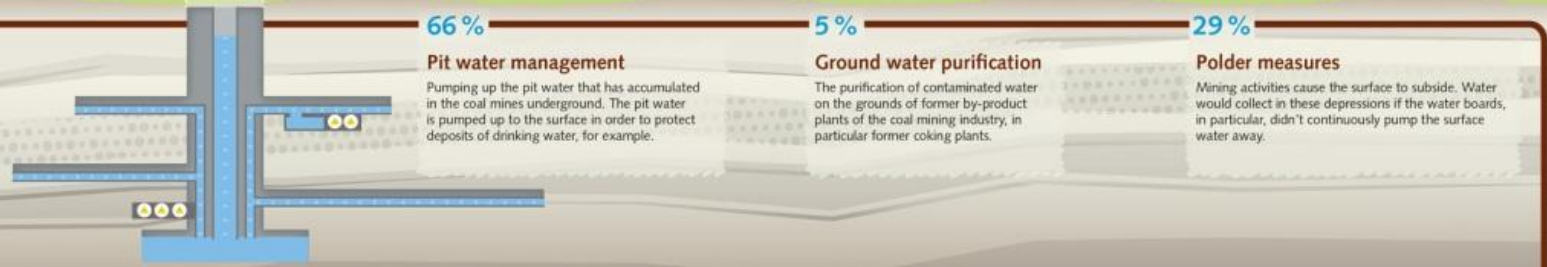
Support in 2014: **€4.5 million**
 Support in 2015: **€7.5 million**

Mining heritage & Transition support

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

Perpetual obligations

Beginning in 2019, the RAG-Stiftung will finance the perpetual obligations resulting from the coal mining activities of RAG Aktiengesellschaft. These obligations (also referred to as "inherited liabilities with unlimited duration") encompass measures that will exist in perpetuity even after coal mining is discontinued.



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, slag 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

ZERTIFIKAT
RAG
ISO 9001:2008
RAG Aktiengesellschaft Bereich BO
Essen
Grünschule
Buschallegraben

**Former mining:
old shafts, near-surface
mining**

**Water
management**

**Quelle: Uni
DU/E**

Renewables

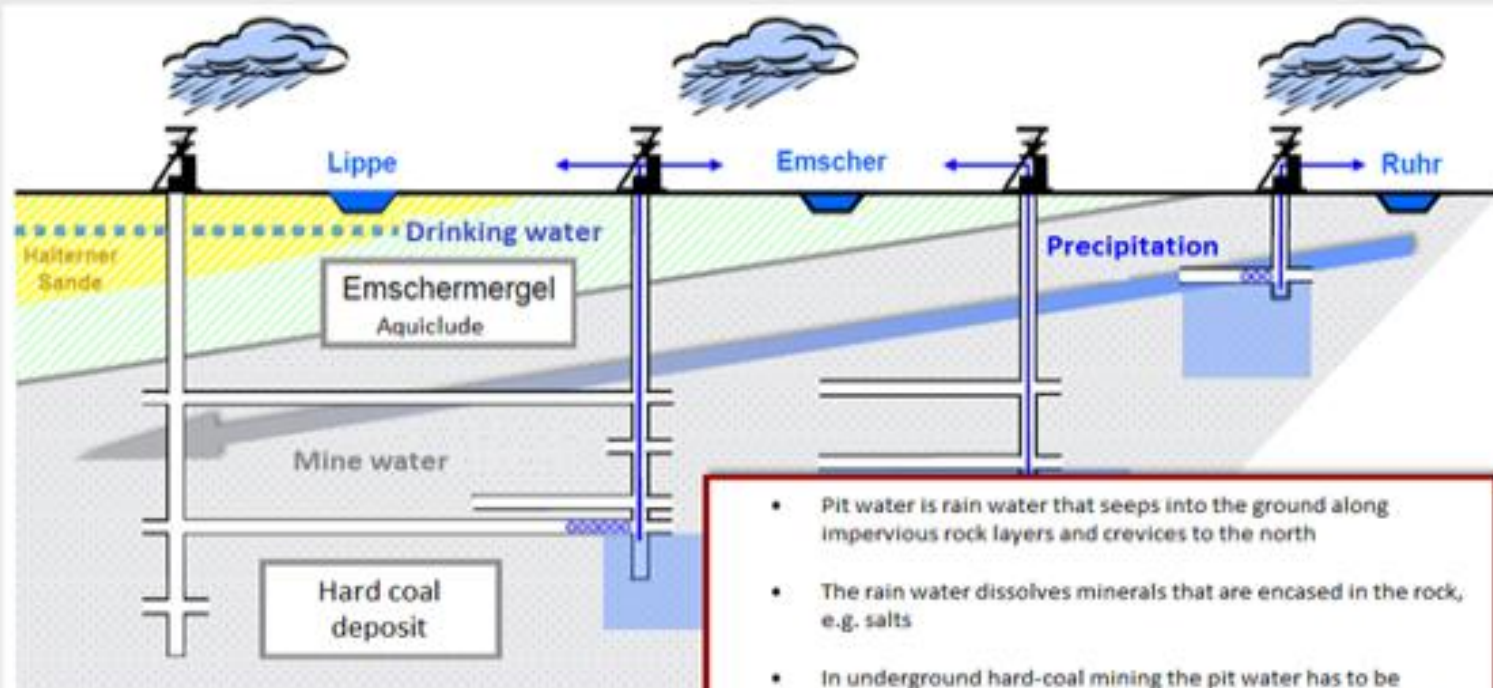
**Subsidence
damages**

**Permissions, water rights,
geodata management**

Development of real estate

Handling of Mine Water

From Precipitation to Mine Water - Ruhr



- 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.

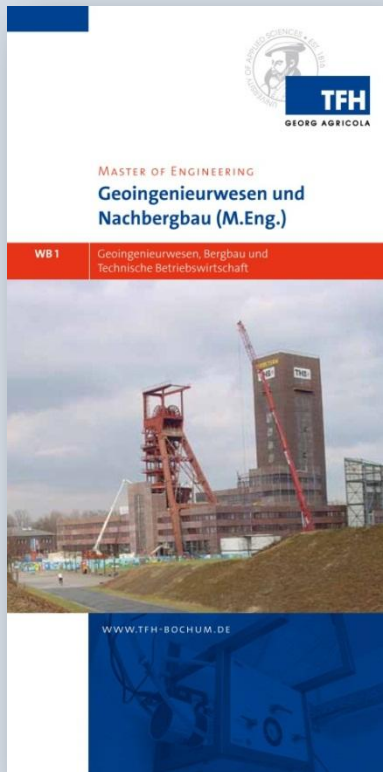
Post-Mining as an academic Discipline

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

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



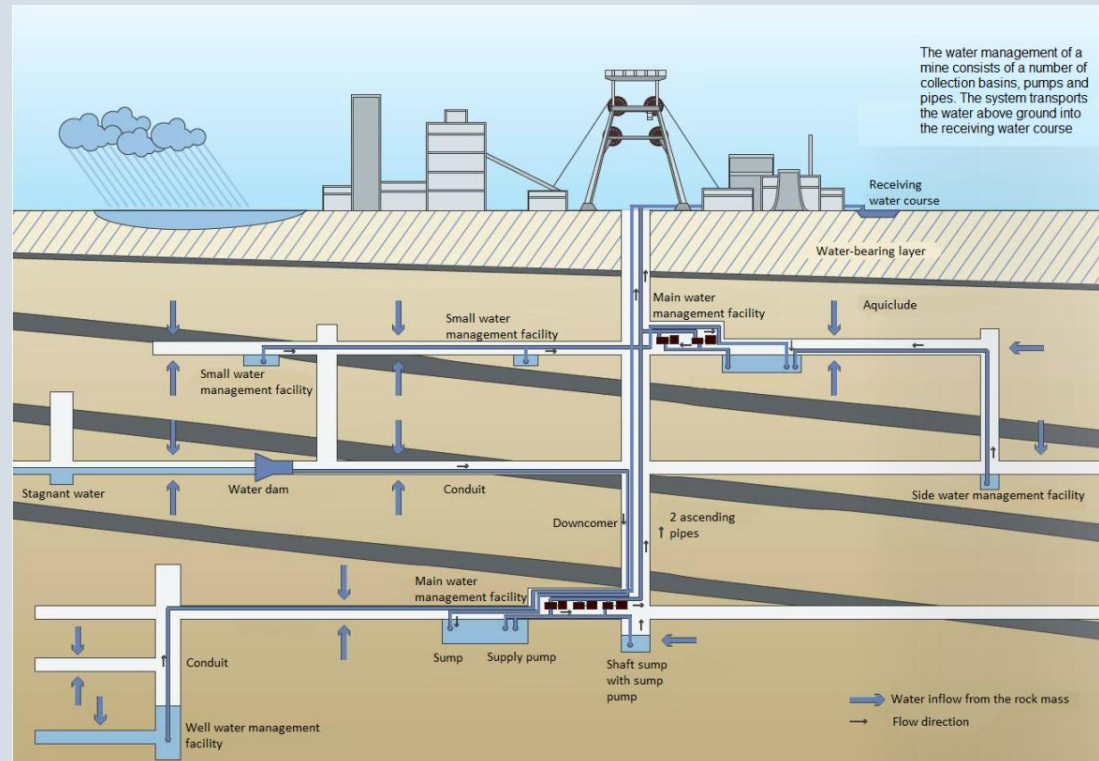
Master course Geoengineering and Post-Mining (MGN)



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

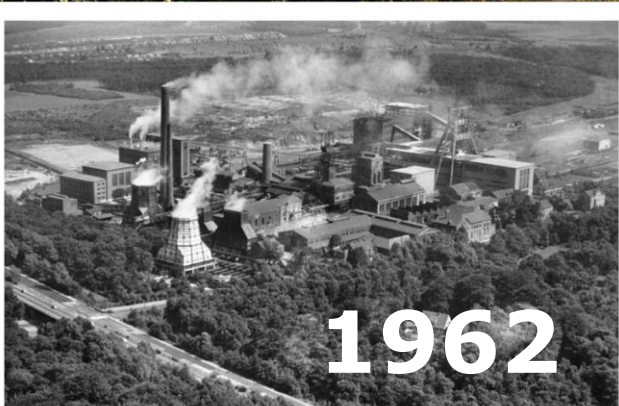
Ewald Colliery: An Example of a Reinvented Post-Mining Location



2011



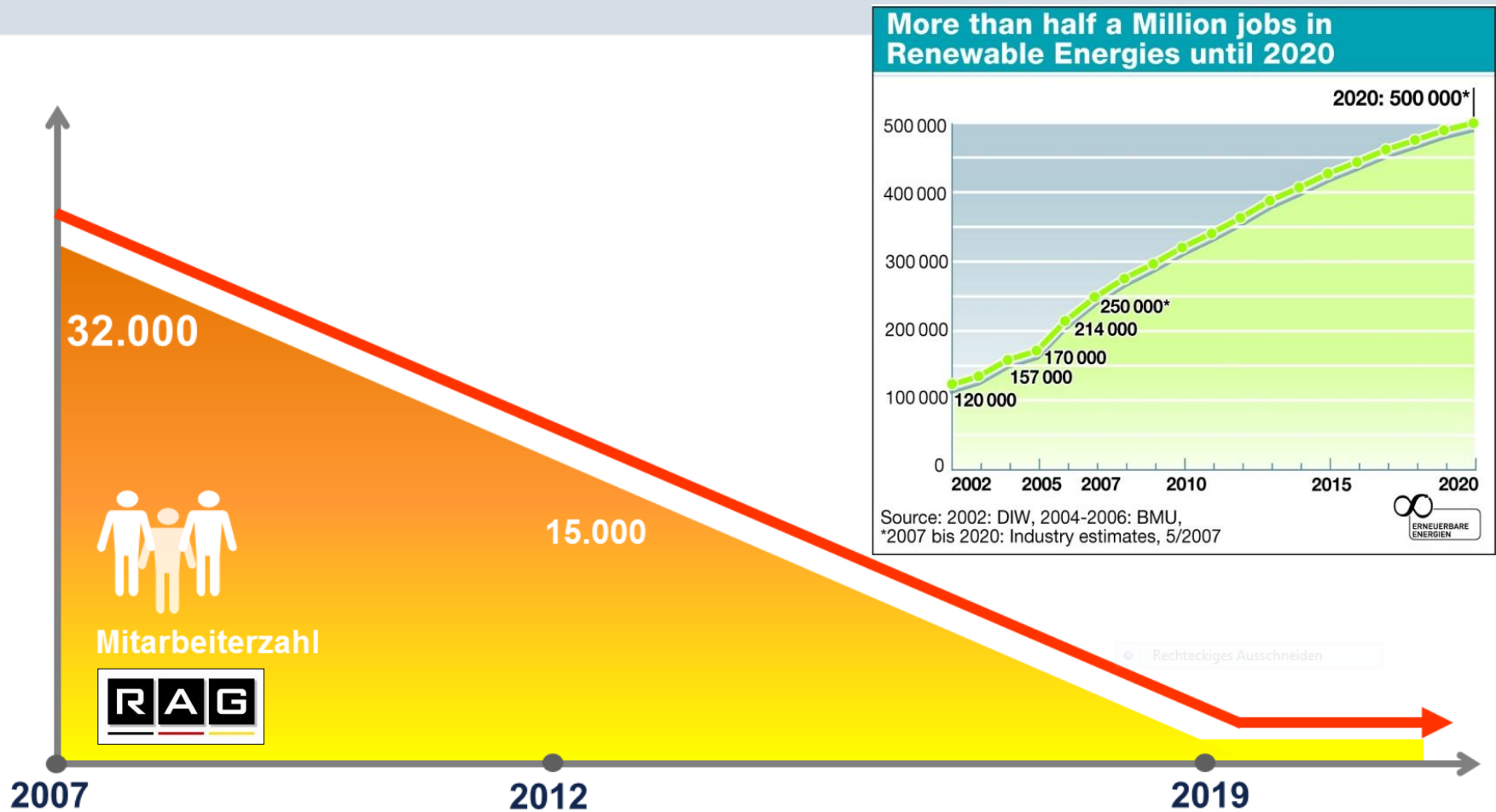
2015



1962



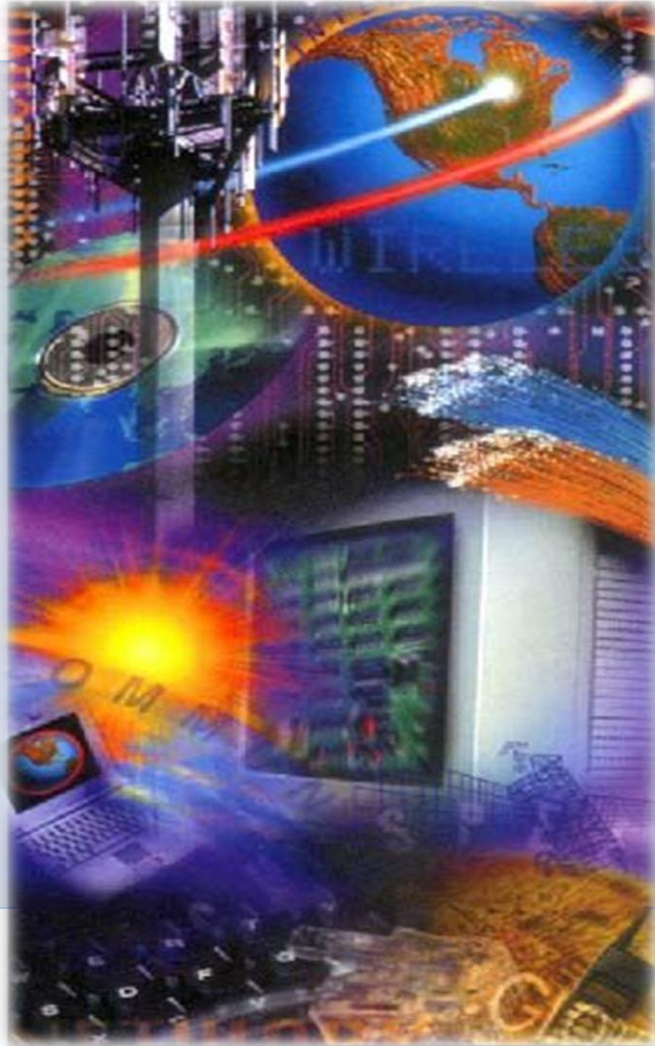
Securing social Sustainability: Reduction of Workforce



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!



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