"Blue Mining"
The Future of Mining

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SDI MI
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Mining on Silex (Flintstone) 3100 B.C.
Area of mining (500 x 500 m);
Up to 150 m road length.
Legacys from mining history

- Left: Subsidence from historic celtic ore mining
- Right: Middle-aged adit in ore mining

Sources: ARGE Frischglück Bergbau
Legacies from mining history

- German „Ruhr-Area“ in the 1950s

Source: Ruhrrevier.de
Legacys from mining history

- Harsh underground working conditions

Source: Ruhrrevier.de
Legacys from mining history

- The „Wismut“-Complex: Germany’s Legacy in Uranium Mining

Source: Deutsches Bundesarchiv
Legacys from mining history

- Hangslides in open-pit-mine

Sources: Kennecoth Copper
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Sustainability = Nachhaltigkeit

Hans Carl von Carlowitz
Head of Saxonian Mine Authority
1645 - 1714

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Brundtland Commission in 1987

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”
Sustainability

Energy

Ergonomics

Introduction  Sustainability  Definition  Energy  Example  Ergonomics  Conclusion
Blue Mining

Sustainability

Energy

Ergonomics

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Energy Efficiency

Sources: Roessing Uranium; Welterbe Rammelsberg, Breuer Motoren

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Energy production

Cold water pumped down  

Steam and hot water  

Sources: BBC UK, K+S KALI GmbH

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Energy production

A very deep and hot potash mine
Different types of coal with up to 28 m$^3$ methane in a ton of coal
Degasification of Coal Seams: Fire Damp

- Mixture of methane and air is known as *fire damp* in mining terminology

- A mixture of methane and air with 5 to 15% of methane concentration is highly explosive
  - Maximum allowable concentrations underground are regulated by mining laws
  - Degasification is possible in two ways:
    - Ventilation
    - Methane drainage
Coal Mine Methane

Gas Boreholes

Gas influx by negative pressure of gas conduit

Longwall

Gate Road

Gob
Four modular, mobile and standard units
Production of Mine Gas in NRW and Saarland

Power from Mine Gas

Quelle: GVSt

GVSt-J B-2012
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Institute of Mining, Clausthal University of Technology

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Renewables supply a fifth of Germany’s power generation

Source: Ministry of Economics and Technology.
Underground Pump Storage

Upper reservoir

Pumping operation: Energy is stored

Turbine operation: Energy is produced

Connection to grid network

Lower reservoir

Machinery cavern
Underground Pump Storage - Active Mine
Underground Pump Storage – Abandoned mine usage
Ergonomics – Automation in a plough longwall

6 accidents per 1 Mio. working hours
Ergonomics – Climate Room
Ergonomics – Automation in underground ore mining
Conclusion – Blue mining

Sustainability + Energy + Ergonomics = Blue Mining
Conclusion – Alternate energy and the connection to Mining
Conclusion – Evaluation
Thank you very much for your attention and „Glückauf!“