GERMAN MINING INDUSTRY OVERVIEW

AT SUSTAINABLE TECHNOLOGIES IN THE MINING SECTOR
2014 INDUSTRY CONFERENCE
BRISBANE  15TH SEPTEMBER 2014

Dr Martin Wedig
Bridge to Mutual Success

- Requirements: Mine economics and cost cutting efforts
- The Australian Position: Increasing mineral production and number of mines, complexity of sizes, deterioration of deposits, strong mineral supply to world market
- The German Position: Technology leadership, automation and optimisation of processes, long history in mining (Life Cycle), experiences with maximisation of poor mining deposits, strong mineral demand in world market
- Common Potentials: Innovation and technologies, best practise, diverse geographies, market match
Annual Production of Raw Minerals in 2013

- Lignite: 183 million t
- Gravel and Sand: 236 million t
- Crushed Rock: 207 million t
- Limestone: 41 million t
- Clay: 25 million t
- Dolomite: 21 million t
- Hard Coal: 8 million t
- Natural Gas: 10 billion m³
- Quartz Sand: 10 million t
- Salt / Brines: 18 million t
- Bentonite: 0.4 million t
- Gypsum: 1 million t
- Crude Oil: 3 million t
- Quarzit: 4 million t
- Feldspar: 5 million t
- Magnesium/Potash: 7 million t
- Kaolin: 4 million t
- Dolomite: 21 million t

Source: VRB
## International Ranking

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Rank</th>
<th>Production 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lignite</td>
<td>1</td>
<td>185,432 kt</td>
</tr>
<tr>
<td>Selenium</td>
<td>1</td>
<td>0.7 kt</td>
</tr>
<tr>
<td>Feldspar</td>
<td>1</td>
<td>5,321 kt</td>
</tr>
<tr>
<td>Kaolin</td>
<td>2</td>
<td>4,348 kt</td>
</tr>
<tr>
<td>Salt</td>
<td>4</td>
<td>14,445 kt</td>
</tr>
<tr>
<td>Potash K₂O</td>
<td>5</td>
<td>3,149 kt</td>
</tr>
<tr>
<td>Feldspar</td>
<td>7</td>
<td>5,321 kt</td>
</tr>
<tr>
<td>Bentonite</td>
<td>10</td>
<td>366 kt</td>
</tr>
<tr>
<td>Fluorspar</td>
<td>12</td>
<td>54 kt</td>
</tr>
<tr>
<td>Coking Coal</td>
<td>11</td>
<td>5,891 kt</td>
</tr>
<tr>
<td>Gypsum</td>
<td>14</td>
<td>2,654 kt</td>
</tr>
</tbody>
</table>

Source: World-Mining-Data 2014
Value and Quantity of Minerals Production

- Value: 138 Billion €
- Quantity: 1330 Million t

- Fuel minerals
- Non-ferrous metals
- Iron ore
- Precious metals
- Nonmetals

- Imported: 782
- Domestic: 342
- Recycling: 202
Fuel Minerals – Hard Coal

Year 1955: 151.7 Mio. t, 175 Mines, 585,754 Employees

Year 2012: 11.4 Mio. t, 4 Mines, 17,400 Employees

Geological Cross-Section - Northern Part of Germany

Source: RAG
Longwall Mining with Caving
- seam thickness 1 m to 3.5 m
- depth 800 m to 1,400 m
- max. 20,000 t /d per longwall
- automated operation

Source: RAG
Fuel Minerals – Lignite

Lignite Production in mill. T
Electricity Generation in TWh
Power Plant Capacity
Approved Ressources
Geological Ressources

Source: DEBRIV
Lignite Mining Technologies
Rhenish mining areas

Scheme of a lignite open cut
Lignite Mining Technologies
Lusatian mining areas
Success Story:
Co-Operation THIESS and RWE

Low Cost, Sustainable Mining Solutions

Consulting, engineering, operations and maintenance services for open-cast continuous mass mining systems, including:

- Bucket wheel excavators
- Transfer conveyors
- Dump spreaders
- In-pit crushing and conveying systems (semi-fixed or mobile)
Chemical Minerals – Potash

mill. t product

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>6.7</td>
</tr>
<tr>
<td>2009</td>
<td>3.2</td>
</tr>
<tr>
<td>2011</td>
<td>5.8</td>
</tr>
<tr>
<td>2012</td>
<td>5.6</td>
</tr>
<tr>
<td>2013</td>
<td>5.5</td>
</tr>
</tbody>
</table>

1. Zielitz
2. Sigmundshall
3. Bergmannssegen-Hugo
4. Wintershall
5. Unterbreizbach
6. Hattorf
7. Neuhof-Ellers
World Potash Shares 2013

2013 (preliminary) incl. Potash sort with lower $\text{K}_2\text{O}$ content
*Compass, USA; Uzkhimprom, Usbekistan
** DSW (Israel), Iberpotash (Spain), CPL (GB)
Sources: International Fertilizer Industry Association (IFA), company data
In the flat potash deposits the room and pillar mining method is applied. The pillar size ranges between 10 and 15 metres. Due to the danger of CO₂ outbursts the potash is mined by drill and blast operation.
As the rock salt deposits contain a salt strata of up to 60 m, the sublevel open stoping mining method is adopted. The bench between upper and lower level is blasted, while LHD vehicles haul the salt to an inbye-crusher station, which feeds a conveyor belt. The open stopings have a height of 40 metres and are up to 25 metres wide.
Construction Minerals – Aggregates, Sands and Gravel

<table>
<thead>
<tr>
<th></th>
<th>Gravel &amp; Sand</th>
<th>Hard Rock</th>
<th>In total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies</td>
<td>208</td>
<td>149</td>
<td>357</td>
</tr>
<tr>
<td>Mining Sites</td>
<td>2 250</td>
<td>910</td>
<td>3 150</td>
</tr>
<tr>
<td>Production in mill. t</td>
<td>253</td>
<td>229</td>
<td>482</td>
</tr>
<tr>
<td>Turnover in mill. Euro</td>
<td>1 674</td>
<td>1 488</td>
<td>3 162</td>
</tr>
<tr>
<td>Employees</td>
<td>15 800</td>
<td>11 000</td>
<td>26 800</td>
</tr>
</tbody>
</table>

By numbers, the aggregates, sand and gravel industry is the biggest section of the mining industry in Germany. In contrast to other mining activities a lot of small and medium sized companies are involved in this business. The variety of minerals is tremendous, it covers hardrock like granite, basalt, quarzite, diabase etc., limestone and dolomite, sandstone, tuff, clay, bentonite, kaolin, feldspar, quartz sand, gypsum, gravel and sand.
Aggregates, Sands and Gravel Mining
Planning, Technology and Rehabilitation

Mine Site Planning

Dredging

Rehabilitation
Aggregates, Sands and Gravel Mining Technologies

Diabase Quarry

Limestone Stockpile

Shale Mine

Kaolin Open Cut
Advantages of Collaboration

• Increased new market access and reach of technology partners.

• Process Optimisation/Automisation provides benefits for low cost, high-volume and low labour mines.

• Environmental protection is number ONE issue in mining. Both Australian and German mining have to be competitive with the potential to reach new industry heights.

• Despite Germany’s sophisticated environment wages, taxes and general costs are moderate and make Germany attractive for investments in mining.

• Main advantages for Australian companies collaborating with Germany are: Reliability of mining procedures, qualified workforce and skilled engineers, excellent infrastructure, stabile political conditions, sound and inspiring business relations.
Further information

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Glückauf!