

The German Mining Industry and its Contribution to the European Raw Material Supply

Professors, Ladies and Gentlemen,

It is a great honour for me being invited to speak to such an honourable auditorium at the grand old mining academy of Freiberg. Nevertheless, I have the impression “to carry owls to Athens” speaking about the German mining industry to the society of mining professors, as I feel quite sure, that most of you are very well acquainted with the topic.

Anyway, I will do my very best to give you an overlook about the ongoing activities in mining, not neglecting to point out which contributions the German mining industry could make to the countries of the European Community even beyond production of raw materials.

Germany often is characterized to be somewhat short of raw materials. On the other hand, nobody denies that we have a long tradition of mining in our country. To point it out very briefly, there has been a long time of prosperous metal mining for more than thousand years in Germany. Of course, there were some ups and downs during the centuries, but the final decline came more or less just some 50 years ago.

Industrialisation led to a huge amount of hard-coal mining to meet the demands of a growing and prosperous industry which peaked somewhere in the late 50ties of the last century. The industrial development since then, widening the range of products made in

Germany and the need of providing the population within the country with all the daily necessities afford a steadily increasing stream of raw materials to be imported. On the other hand, Germany is one of the most important exporting nations in the world. A lot of raw materials leave this country after being transformed into machinery and other devices.

But still there is quite a bunch of raw materials mined and produced in our land.

- Fig. 2 -

Sand and gravel are outnumbering all other materials, but already the next in this line is the remarkable production of lignite coal. Though there has been a steep decline in production since the reunification of Germany in 1990, we are still the world leading producer of lignite. Of course, the dense population in the country needs a lot of material for building purposes, for infrastructure, and even for exports to some extent. Hard coal, due to of the massive decline from over 140 Mio tons of annual production in the late 1950ties has just in the last to years fallen below a contribution of less than 50 % of the total demand. Rock salt and potash are still big productions even from a global sight.

- Fig 3 -

The international ranking of raw materials production shows clearly, that Germany is still a quite remarkable producer. Of course, the metals have vanished from this list, as the quality of the deposits does

not longer match the international standards regarding metal content and amount of ore.

- Fig 4 -

But let us figure out some comparisons of Germany and the other states of the European Community. With the next slides I will give some examples for the amount of production in the EU-25. To make it a little bit clearer, I will refer to the former EU-15 and the incoming new member states separately.

When it comes to hard coal production, Poland is clearly the outstanding producer in Europe, about more than 3 times the production of Germany. On the other hand, we are facing an even steeper decline of the production than in Germany, as Poland came down from some 190 mio tons in the late 1980ties and is expected to decrease to some 80 mio tons within the next years, as government plans say. Naturally, the deposits are very similar to what we have in the RUHR and SAAR area. That can also be stated for the deposits in the Czech Republic. So one could guess, that there will be some related developments on the long run in a further decrease of production. Taking into account the recent shortages of coking coal and coke due to the increasing needs of China and – maybe already within the next few years – of India, there may arise some new aspects of hard-coal production within the EU, but it is much to early to think about.

- Fig. 5 -

The lignite coal production is clearly dominated by Germany, though the new member states have some very remarkable contributions too, especially in Poland and the Czech Republic. As lignite is mostly used in power plants directly related to the mine sites, it is one of the main pillars of energy supply in these countries. In Germany, some 28 % of the supply of electric power comes from lignite fired power plants. Lignite is, in most cases, the cheapest fuel for power plants and abundant for the next decades or even longer. On terms of emissions, lignite is by far the most emitting fuel. Though there are possibilities of achieving combustion efficiency levels of 43 %, as being realised in the newly committed Lignite power plant of Niederaußem, which will be followed up by two more blocks of 1,000 MW output within the next 5 years, there is the threat of the emissions trading concept to be launched within 2005. It is not yet clear, which avoidance costs of CO₂ the system and the trades will emerge. And – even more problematic – it is not clear, to which extend the governments will interfere with the terms of trade.

- Fig. 6 -

Oil production in Europe is clearly dominated by the United Kingdom. The contribution of German oilfields is somewhat marginal though there are good geological reasons to believe in some more future findings. Anyway, there is no reasonable chance of increasing the production to a scale really worth mentioning. Most experts have estimated, that the peak production in the North Sea has already passed and production height in the future will be less than in former years. Nonetheless, there are still proven reserves for some decades.

- Fig. 7 -

The production of natural gas is a little bit more balanced between the European countries, but still the vast amount is being produced by the UK. Germany is quite well off with its reserves and resources of natural gas, after the companies had managed to handle the sour gas with a high sulphur content. Total production of German gas fields is more than twice the amount of the contribution of the new accession countries in the EU.

- Fig 8 -

Coming to industrial minerals, Germany is one of the most important producers within the EU. Of course, the biggest share is held by salt and potash, which I will concentrate on a little bit later in my paper, but we have a considerable amount of kaolin, gypsum and anhydrite, baryte, bentonite and fluorspar in these figures. As an outcome of the sour gas production there is even a considerable output of sulphur, about 1 million tons per year, but this is originally not mined in a classical sense in Germany.

- Fig. 9 -

Before I will go into some details concerning the German mining industry, I would like to turn your interests on some facts on energy demand of the EU. Though there is some significant production of fossil fuels within Europe, we are depending on the feed and the imports from abroad. And that is going to become even a greater dependency in the next years. Natural gas is estimated to be the most

sought energy resource, thus tripling its amount within the next twenty years. But also oil and even coal will gain severely. The latter is mainly due to the fact that the European hard-coal production will decrease further.

- Fig. 10 -

Whereas dependency on imports of oil is already high, the green book of the European commission "**Towards an European strategy for the security of energy supply**" points out, that there will be an additional rise to nearly 90 %. Even more dramatically is the forecast for gas and even for hard coal. Renewable energy sources will not be able to cope with the demand, at least not within the time frame of the next twenty to thirty years and not in all countries of the European community. On the other hand we have the emission trading legislation, which already clearly drives the demand on natural gas. Following the actual political ideas on how to get along with the energy supply of Europe, some countries might find themselves sooner or later in a dead end street, where high energy prices lead to a rushing decline and an exodus of wide parts of the industry from Europe.

- Fig. 11 -

Now I would like to focus on the German mining industry. Looking at fossil fuels, we find that we are well off with lignite production, still have a considerable amount of hard coal, less natural gas and just a small amount of oil. Just to complete the picture we have to mention, that nuclear energy is contributing about 30% of the total power plant

output, but there is a political decision to get out of nuclear power generation within the next 25 years. This decision does not really fit into the CO₂ – reduction programme as the arising gap in power supply cannot be closed by things like energy saving programs or the enhancement of renewable energy like windmills, water or biomass. At the very moment, there is no clear concept in technical terms how these political aims could be realized.

- Fig. 12 -

The German hard coal industry has made a long decline in the past years. Being subsidized by the government there was certain pressure to reduce production and the number of mines. At the very moment there are 9 mines left, after a severe decrease in the last 8 years due to an adjustment programme starting in 1997.

- Fig. 13 -

When entering that programme in 1997 we had a production level of about 50 mio t of hard coal per year and some 84.000 employees in the German hard coal mines. The aim is to realize a production of 26 mio t in 2006, which will be achieved, and linked to this production goal a reduction of employees to 36,000. Due to a number of measures to be taken it could be realized that no miner had to leave into unemployment, partly due to retirement programs. Being very skilled craftsmen, most of the leaving miners were able to find new jobs in other branches of the German industries.

Government has just released new plans for the next period of adjusting the production of hard coal until the year 2012: production

has to be reduced to 16 mio t annually with a workforce of about 20,000 employees then. The DSK, German coal company, has planned to achieve these goals by closing another 4 mines up to 2010, and probably another mine in the following year.

- Fig. 14 -

The customer's structure in 2003 shows nearly 75% of production is used for power generation, and about one quarter is used for metallurgical purposes. In the year 2000 the steel industry terminated an agreement with the mining industry due to which the necessary amount of coking coal and coke had to be supplied by the German coal mines, as market prices in a global sight indicated some advantages of supply from other coal fields in the world. This year we face a shortage of coking coal and coke on the world market which led to enormous spot market prices especially for coke of more than 500 \$ per ton. Obviously there is no chance in short term to increase the production in Germany, though even our mines could easily compete with that price level. It seems to be a subtle irony of history that the newest German coking plant has just been sold to the Chinese, is being disassembled just in these days and is to be brought into production within the next years in China.

- Fig. 15 -

There are still remarkable technical achievements made in the German hard coal mines: the average face length has been brought to 340 m, with one face even exceeding 500 m. Output of some faces of more than 20,000 tons saleable coal per day could be reached.

- Fig. 16 -

Productivity is driven by fast technological developments. It would be worth while to go into some depth to point out steps having been taken in the last years and the future to come. Unfortunately doing this would by far exceed the given frame of my report. But in the last years we faced a continuously increasing productivity which shows by no ways that there is a possibly limiting ceiling in sight.

- Fig. 17 -

The company Deutsche Bergbau Technik (DBT), a subsidiary company of RAG, delivers its technology worldwide. Over the last few years, technical maturity and powerful plants as well as the excellent supervision have attained a good market position. The DBT is aiming at becoming the number one of the suppliers of longwall technologies and is shaping up to reach the top position in the world market also in the area of room and pillar mining. Worldwide, German mining technology enjoys a very good reputation.

- Fig. 18 -

After some years of adjustment of the companies in Eastern Germany and a steep decline of production, German lignite extraction has managed to stabilize on a remarkable high level. During the last years, it was possible to increase efficiency very clearly. Declining energy prices during the preceding years have driven this

rationalisation – and it was possible to limit the extraction costs at a level which is international competitive. Today, German lignite extraction is concentrated basically in three areas:

- Fig. 19 -

With 55 % and almost 100 Mio t, the Rhineland area contributes the the greatest part to the total amount of production. More than 90 % of the Rhineland lignite is used for power generation in the local power plants. The other main extraction areas are in central Germany (MIBRAG) and in the Lusatian area (VATTENFALL). The power plants in these two areas have been radically reconditioned over the last years, and are actually working with a degree of efficiency of over 40 %.

- Fig. 20 -

The latest generating unit has been put on stream in the Rhineland area (Niederaussem) quite recently. In this plant the degree of combustion efficiency reaches about 43 %. Two more plants with 1.000 MW of similar design are to be built during the next few years in the Rhineland area. This will result in a major decline – about one third - of the output of CO₂ compared to older plants.

- Fig. 21 -

Let us have a short glance at the technical development: in the Rhineland area the concentration on a few but very high-capacity surface mining sites has led to the effect, that the long term

extraction of about 100 Mio t lignite per year will be effected from only three opencast mines. This concentration leads to a very high degree of rationalisation. The lignite reserves will last a long time after present planning horizon which reaches unto the year 2040.

- Fig. 22 -

As I already have mentioned, the German production of potash and salt ranks on top positions in European comparison as well as worldwide. The formation of the deposits enables a very efficient extraction with high productivity.

- Fig. 23 -

In the last years, the annual production was about 3,5 Mio t K_2O – with only little variation. Today, the world market for potash products is determined by increasing demands on the one hand - and constant extraction capacities on the other. Therefore, the chances of the German potash industry in the medium term could be estimated positively as prices for the products will be stable or even increasing.

- Fig. 24 -

The number of producing mines has decreased over the last few years, so that the reorganisation of the potash industry as a consequence of the German reunification has been completed. As this map shows, the active mines are located in the federal states Hesse, Thuringia, Lower Saxony and Saxony-Anhalt. The reserves by far exceed the present planning period.

- Fig. 25 -

Let us have again a look at some technical innovations: In order to improve security against downfall from the hanging wall a mobile roof-radar has been developed. Now it is possible to detect fissures inside the beds. Thus endangered locations can be explored easily and quickly and measures can be taken to secure them well directed. A very recent innovation is a loader working in the production area but being controlled from an offset remote panel. Loading and unloading is operated by remote control while moving along the roadways in the winning tracks is directed automatically by a combined camera and a laser scanner.

- Fig. 26 -

Typically, the LHD Loader will exercise a controlled learning run from the loading area to the crusher. The next runs will be guided by the laser scanning device and a camera mounted on the LHD. There have been field trials of this concept for nearly one year on one mine. By now it has been achieved, that the loader is driving in automatic control as fast as being controlled by the driver. Next step to be taken is the installation of similar components at other mines.

- Fig. 27 -

The salt industry operates sites for the production of rock salt or salt from brine in widespread areas in Germany. Although the European salt market tends to overproduce, German companies have managed

to establish a solid market position. The key production data significantly have increased over the last few years.

- Fig. 28 -

The German companies ESCO (European salt company) – a subsidiary company of the K+S Aktiengesellschaft – and SWS/Südsalz have managed to achieve a strong position on the European market. It is expected that this position will be kept – and probably could be expanded.

- Fig. 29 -

Just for completion, here is a glance on the German oil- and gas situation: The important fields are located in Northern Germany, mostly in Lower Saxony and in the far end of the German part of the North Sea, which is called “duck beak” due to its shape. Outlined in red colours are the gas-fields whereas the dark green colour indicates the oil-fields.

- Fig. 30 -

The development of production since 1945 for oil and – a little bit delayed on the time scale - for natural gas initially shows a very strong increase. While the oil extraction had already reached its maximum in the end of the 1960s respectively in the beginning of the 1970s and has steadily decreased since then, the gas production stabilized on a comparatively high level. It is assumed that there are

still geologically advantageous deposits in the North Sea. Nevertheless, the prospects for their exploration and production are somewhat doubtful as the Federal government declared most of these locations as nature protection areas.

- Fig. 31 -

Perhaps it is less known, that German companies are also engaged worldwide in the oil- and gas production. After all, nearly the same amount of natural gas and more than twice as much of the amount of oil is extracted abroad. German companies have developed quite a good reputation in oil and gas drilling and processing.

- Fig. 32 -

The importance of the production of building materials in Germany can be demonstrated with some few figures: In roughly 4,000 companies more than 130,000 employees produce a whole variety of raw materials for the constructing industry. Overall, a turnover of nearly 19 billions € is gained in this area. – As you see in this table, the corresponding figures have been considerably higher a few years before, for today the building industry is experiencing an economic slowdown.

- Fig. 33 -

Taking into consideration the remarkable amount of mining activities in Germany one could assume that consequently the landscape

would suffer extreme impacts. Even if this might be the perception in the direct neighbourhood of a mine or mining area, nevertheless the comparison between areas in Germany, which are used for mining and areas that are declared nature protection areas of diverse types shows us that, overall, mining means only a nearly negligible impact for the nature – and, furthermore, it is only a temporary impact. The presentation shown here is drawn to scale. The usage of land for mining is below 0.5 % of the total surface area in Germany. Nevertheless, when listening to some political statements one could believe that we are digging up the whole republic. On the other hand most people in Germany – and I would consider it to be similar in other parts of the world – have no real idea how much their life is accompanied by the use of raw materials.

Herewith we come to the last chapter of my paper: the treatment of the surface after mining activities have been abandoned. A description of the German mining activities would not be complete without mentioning some remarkable examples. And surely I think, that our experiences gathered in this subject could also turn out to be quite valuable and be also a contribution to the mining industry of the European community.

- Fig. 34 -

The Deutsche Steinkohle AG transforms the old mining sites after the necessary demolition works and after eventually hazardous waste cleanup into areas for new utilizations: As location for other industries, as dwelling areas or – as you can see here as a very interesting

example– as a park being part of a “Landesgartenschau”, a horticultural show.

- Fig. 35 -

In the eastern parts of Germany the uranium production undertaken by a – at the times of the cold war – secret soviet – german enterprise has left considerable damage to the environment. A lot of cleanup works had and has to be done by the WISMUT, which is a state owned company for the only purpose of rehabilitating these areas.

Because of radio-active burdens the recultivation workings in the area of WISMUT are associated with special difficulties. Also it is essential to transform the extremely changed landscape into a state that is worth to live in.

- Fig. 36 -

In this special case, a former opencast pit is filled completely with the masses of dumps that are located all over the landscape. The recultivation workings which have started after the German reunification in the 1990s have already reached a very advanced stadium.

- Fig. 37 –

Most of the underground redevelopment has been completed, though there will be ongoing monitoring and conditioning of the water still coming out of old mines. Surface redevelopment will certainly take

some more time, as the target is not only to remove or mask dumps and abandoned sites but find ways of integrating these into new utilizations of the landscape.

- Fig. 38 –

One of the biggest projects in terms of changing the landscape is the restructuring of the former lignite mining areas in the eastern parts of Germany. A lot of recultivation works had to be done, open-cast mines had to be developed to a secure final stage after production having been terminated and of course, the mass deficit will result in one of the biggest man made areas of lakes. LMBV is the company in charge of redeveloping the former lignite mining areas which are no longer in production. Two main areas can be distinguished: the mining sites around the city of Leipzig, which we call the “Middle German area” and the Lusatian area in northern Saxony and southern Brandenburg. A lot of conceptual work was necessary to develop the later use of the redeveloped landscape. The biggest task was to establish a well adapted concept for the rehabilitation of the water balance in these areas.

- Fig. 39 -

When mining operations were abandoned, these areas faced a water deficit of approximately 13 billions m³. The aquifers have to be replenished and the remaining open areas of the former mines had to be filled up. Unfortunately this area is not characterized by sufficient rainfall, so a concept had to be developed to collect water from rivers and water reservoirs. By now, more than half of the job of re-

establishing the water balance has already been done, but it will take some 20 years longer for the concept to be completed.

- Fig. 40 –

Anyway, creating new landscapes is a challenging task and as you may see in the film, the first results are not too bad. These areas of Germany which have faced the biggest lignite production ever been established on our planet, are turning into a paradise for nature and people and it can be assumed, that this area will become of certain interest for tourism.

I thank you very much for your patience and attention.

I sincerely hope that my lecture has not left open too many questions, as a nightmare during my time as a student of mining engineering at the University of Clausthal was to be questioned by so many professors at a time.

Glückauf!