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LUSATIAN LIGNITE — MODERN, COMPETITIVE AND SUSTAINABLE LIGNITE MINING

1. Introduction and summary

Since May 2004, Vattenfall Europe Mining & Generation has its administrative centre for opencast mines and power plants in Cottbus, a town in Lusatia. In line with these core values the corporate head office of Vattenfall Europe Mining & Generation in Cottbus stands for the realization of a close and trustful cooperation between these two business units which will be of crucial importance for the future development of the Lusatian lignite mining area (Fig. 1).



Fig. 1. Vattenfall Europe Mining & Generation — Opencast mines and Power plants

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Since the beginning of the 90', comprehensive refurbishment and modernisation measures of the opencast mine equipment have been carried out to increase and ensure competitiveness of the opencast mines of the Lusatian lignite mining area. In the past year the four active mines have achieved a total coal production of about 60 million tons. The further development of the Lusatian lignite mining area focuses on the continuation of the coal output from the Reichwalde mine from 2010.

The development of modern and competitive lignite mining required a comprehensive rehabilitation plants and equipment of the raw coal transportation — the so-called „Coal connecting railway system Lusatia“. The system consisting of belt conveyors and railway network connects the opencast mines of the Lusatian mining area and guarantees regional coal distribution and supply.

Immission protection for the neighbourhood of opencast mines, recultivation and ambitious shaping and use of the post-mining landscape as well as socially-acceptable resettlements are challenges Vattenfall Europe Mining AG faces with regard to a sustainable lignite mining. Apart from that Vattenfall Europe Mining bears a great responsibility against the society for active participation in developing the region.

Until 2011 the importance of the energy region Lusatia will be further enhanced by the starting of the commercial operation of the Boxberg unit R with an installed capacity of 675 MW. A decisive step towards the development of CO₂-free power plants, the power plant technology of the future, was the ground-braking ceremony for an Oxyfuel pilot plant in Schwarze Pumpe on 29 May 2006. The Vattenfall pilot plant project for a CO₂-free power plant will commence operation in 2008.

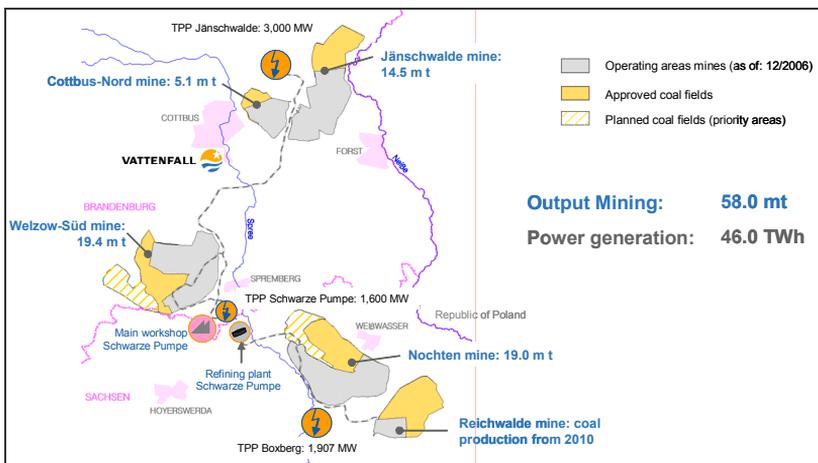


Fig. 2. Lusatian Lignite Mining Area in 2006

The long-term development of the Lusatian lignite mining area has to be considered for a period of at least 40 years. Only then it will be possible to guarantee supply of the power plants and other users with run-of-mine lignite in the long-run. Lusatia has an enormous

potential with more than 12 billion tonnes of lignite for power generation in ultra-modern, environmentally friendly and competitive power plants. The mining area disposes therefore a high potential of resources. Vattenfall will concentrate on the use of the CO₂-free power plant technology for the future use of run-of-mine lignite in modern, environmentally friendly and most of all competitive power plants.

2. Maintaining the high level of coal production

In the past year the total coal extraction of all four active mines came to 58 million tons. This high level of production of approximately 60 million tons per year has been maintained since the beginning of the decade. The two mines in the north of the region had a total share of about 20 million tons. The Welzow-Süd opencast mine in the centre of the mining region had also a production of ca. 19 million tons and the remaining quantity of another 19 million tons of run-of-mine lignite came from the Nochten opencast mine. Especially Welzow-Süd but also Nochten supply high-quality raw lignite to the refining plants at Schwarze Pumpe.

Parallel to the supply of the power plants of Vattenfall Europe Generation the opencast mines deliver defined qualities and quantities of coal also to the refining plants at Schwarze Pumpe as well as other consumers, like for example the thermal power plants of Chemnitz and Klingenberg (Berlin). The power plants had a consumption of about 53 million tons; in the refining plants more than 2 million tons of coal were processed to briquettes, pulverized lignite and fluidized-bed lignite and more than 2 million tons of run-of-mine lignite were supplied to the supraregional thermal power plants.

Our present investment activities focus on the continuation of the coal production from the Reichwalde mine located in the northern Saxon part of the Lusatian lignite mining area. This mine started lignite production in 1987. Owing to the indispensable structural adaptations in the Lusatian lignite mining industry the coal production in the Reichwalde mine ceased in October 1999. The opencast mine equipment was moved to prepared storage sites, among them the youngest and most modern overburden conveyor bridge type F60 of Vattenfall Europe Mining. More than 200 filter wells are pumping annually about 40 million m³ of groundwater to the surface to ensure that the opencast mine is free of water. From 2010 raw coal production will be continued from the Reichwalde opencast mine.

3. Modern and competitive plants and equipment

Comprehensive modernisation measures for the opencast mine equipment and systems on the one hand and manpower cuts on the other hand were carried out to ensure competitiveness of lignite mining in Lusatia. More than 400 million m³ overburden are removed annually to uncover a raw lignite quantity of about 60 million tons. The removal of overburden, in connection with the drainage measures carried out before makes high demands to the capacity and availability of the equipment and instrumentation systems.

Since the existence of Vattenfall Europe Mining and former LAUBAG all plants and equipments of the opencast mines were rehabilitated and brought up-to-date. Today, the company has efficient and most of all competitive mining machines which bear comparison to any other mining equipment in the world. The future development focuses on further automation of equipment and process control and infrastructure systems as well as telecommunication.

This includes the following main complexes:

- collection of profile data and determination of boundary surfaces by means of scanners (Fig. 3);
- positioning systems;
- picture recognition technologies;
- further development of processes for safeguarding process and production engineering;
- integration of process data in the planning process.

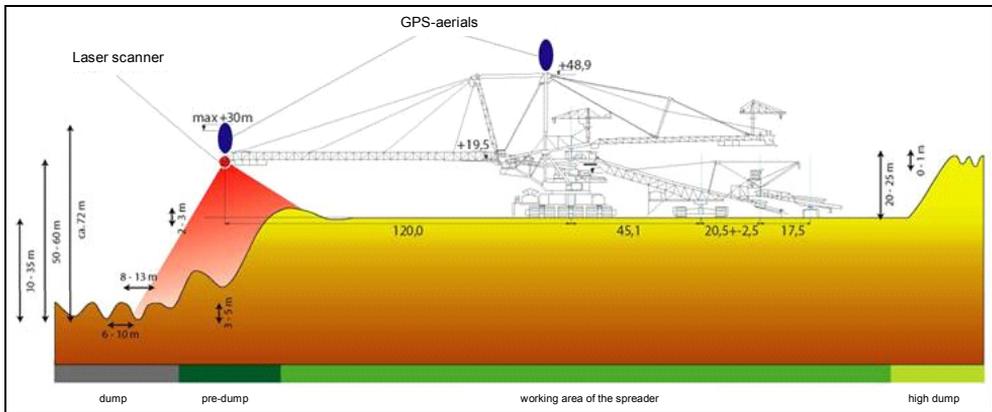


Fig. 3. Use of scanner equipment on spreaders

The increased capacity and the high efficiency of the opencast mine equipment and ensured considerable rise in productivity of coal production. Whereas in 1999 one employee in the mining industry produced about 9,000 t raw lignite, there were produced more than 15,000 tons per employee in the past year. Lusatian lignite is inexpensive and competitive; and most of all free of subsidies.

The Reichwalde opencast mine will continue coal production in 2010 to ensure the long-term output capacity of Vattenfall Europe Mining to the amount of about 60 million tons per year. The coal field of Reichwalde contains 366 million tons of high-quality raw lignite. The mine is especially characterized by a favourable overburden-coal ratio of 5.9. In this opencast mine up to 14 million tons raw lignite can be mined annually. Investments of ca 300 million € are planned for the installation of new equipment and plants and further-

more include measures for extending the coal stockyard of Nochten/Reichwalde at the Boxberg power plant.

The planned production level for the Reichwalde opencast mine will be achieved by implementing the “Complex plant-technical program for the Reichwalde opencast mine“ (Fig. 4).



Fig. 4. Refurbishment of the overburden conveyor bridge F60 in the Reichwalde mine

Based on almost 17 years of experiences regarding modernization and capacity increase of the plant and equipment in the opencast mines of Vattenfall Europe Mining and the predecessor LAUBAG, the work of the already appointed project teams concentrates on the following issues regarding plant technology:

- erection of the equipment and plants on the highest technical level,
- use of results of innovations from the past ten years,
- optimization of conveying technology,
- capacity increase of the coal stockyard and blending site of Nochten/Reichwalde at the Boxberg power plant site.

4. Efficient raw coal transportation

The development of modern competitive opencast mines demanded a comprehensive modernization of the plants and systems of the raw coal transportation. This system of conveyor belt and railways is called “Coal connecting railway system of Lusatia“. The ZEB department of the Vattenfall Europe Mining AG occupies an outstanding position in this interconnected system. The railway network of the central railway operation connects the

opencast mines within the Lusatian mining area and ensures regional efficient coal distribution and supply. About 90 percent of lignite run-of-mine is transported by means of coal trains of the ZEB to the consumers, mainly the power plants of Vattenfall Europe Generation. Therefore, modernization of the railway plants and equipment was of essential importance. The new electronic signal box centre in Schwarze Pumpe as well as the running rejuvenation program for the railway vehicles (especially the modernization of E-locomotives) is exemplary for the previous development.

The signal box control centre of the ZEB is the logistic core of the raw coal transportation. It is furthermore responsible for the control and supervision of transporting the power plant residues and the connecting railway operation of Schwarze Pumpe (connection to the public railway network). The signal box centre monitors the total about 440 km long railway net-work (Fig. 5).

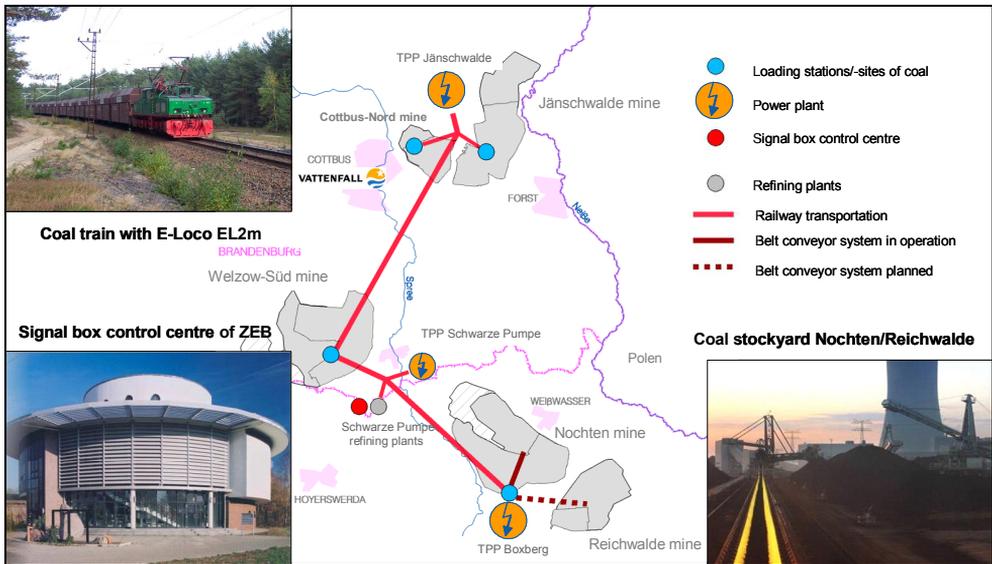


Fig. 5. Coal connecting railway system of Lusatia

The coal distribution and transportation system also includes two 30 km long, long-distance conveyor belt systems of the Nochten and the future Reichwalde opencast mines.

5. Sustainable lignite mining

To protect the neighbourhood of the opencast mines Vattenfall Europe Mining AG carried out extensive measured reduce immissions.

The company concentrates on the following technical and landscaping measures:

- casing of bucket chutes and bucket wheel drives,
- use of gears of modern type and noise-reduced motors,
- enclosure of drives,
- use of noise-reduced idlers,
- intermediate greening of overburden conveyor bridge dumps,
- quick forestation of dump- and boundary areas,
- protective plantations in front of locations,
- establishing and greening of noise protection walls in front of locations,
- installation of noise-protection walls in front of belt conveyor- and railway plants.

Post-mining landscapes are proactively shaped to meet the ecological demands. Sustainable principles and strategies have been developed and implemented already since the 90'; among others:

- immediate recultivation of the mine-site areas after finishing the mining operations,
- development of a post-mining landscape with model character,
- shaping of high-quality landscape types taking account of the neighbouring areas,
- creation of site-compatible and sustainable utilizable ecosystem,
- shaping of sustainable, multiply useable landscape typical of the region,
- the development of a cultural landscape and economic resource for the following generations (Fig. 6).



Fig. 6. Immediate recultivation — Welzow-Süd opencast mine

Recultivation in the Lusatian mining area creates real NEW LAND — attractive and of a high value, even if the results cannot be seen at first sight — recultivation requires patience and time.

Sustainability also comprises the subject of “Renewable raw materials”. Together with partners, Vattenfall Europe Mining is looking for alternative forms of utilization for the post-mining landscape. Renewable raw materials offer potential perspectives of an economic and ecologic use at the same time. Test areas of fast-growing tree species and Alley-Cropping-systems were established in cooperation with the Brandenburg Technical University of Cottbus. The results achieved so far are promising.

The use of a lignite deposit sometimes means also resettling villages. Vattenfall Europe Mining takes responsibility for the socially acceptable implementation of resettlements against the people concerned and the society.

Already mid of the 90’, the following principles of socially-acceptable resettlements were developed and realized:

- integration and active participation of the concerned people,
- joint resettlement to one location,
- “Transparent compensation practice“ — functional indemnification,
- dialogue within the process of resettlement,
- establishing of identification at the resettlement place and the new place,
- maintaining and supporting activities of clubs and associations,
- maintaining and continuing of small enterprises.

These principles form the basis for the settling of a resettlement contract between the village to be resettled and Vattenfall Europe Mining “for the benefit of a third part“ (Fig. 7).



Fig. 7. Resettlement place of Haidemühl

6. Climate protection through innovation

Until 2010 the importance of the energy region Lusatia will be further enhanced by the erection of the Boxberg unit R. The ultra-modern lignite-fired unit will have a capacity of

675 MW and an efficiency of almost 44%. Therefore, the modern and efficient lignite-fired power plants of Vattenfall Europe Generation will have a total installed power of about 7,200 MW in the Lusatian lignite mining region.

Continuous improvement and environmentally acceptable modernization of the power plants are Vattenfall's substantial contribution for developing energy solutions for the future. Simultaneously, our measures concentrate on the world-wide protection of climate.

We focus our activities in Lusatia on developing competitive CO₂-free power plants. On 29th May 2006 the ground-braking ceremony for an Oxyfuel plant was conducted in the presence of the German Chancellor, Mrs Dr. Angela Merkel, and the Prime Minister of the Land of Brandenburg, Mr Matthias Platzeck, at the power plant site of Schwarze Pumpe. The power plant is the first of that type (Fig. 8).

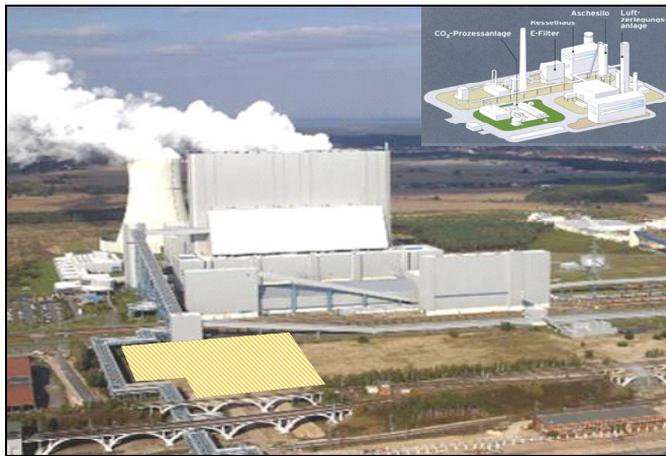


Fig. 8. The Vattenfall Pilot project — CO₂-free power plant

Having a thermal capacity of 30 MW, the plant represents a decisive step towards this new environmentally friendly power plant technology and will be put into operation in 2008. At the end of this ambitious scientific and technical process there will be a competitive large-scale CO₂-free power plant with an installed capacity of about 1,000 MW. It will start operation at about 2020.

7. Perspectives

A long-term opencast mine development comprises periods of about 4 to 50 years. Only this way it will be possible to guarantee the coal supply to the available power plants according to their useful life of at least 40 years as well as to other customers. For Vattenfall Europe Mining AG this most of all means to integrate the priority areas of the opencast mines of Welzow-Süd (partial field II Welzow-Süd) and Nochten (priority area Nochten) in the long-term opencast mine planning. At the end of 2020 the coal reserves will be exhausted

in the approved fields apart from Reichwalde. The exploitation of the priority areas with a reserve of over 500 million tons of high-quality lignite enables a safe supply of the customers beyond 2040. Vattenfall Europe Mining is preparing the required permit planning for the occupation of this coal fields. In 2015 latest permits shall be available for the two priority areas (Fig. 9).

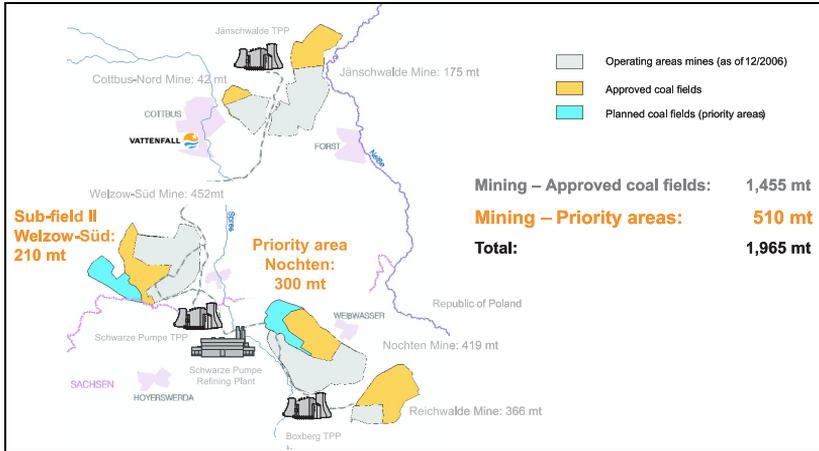


Fig. 9. Priority areas

Additionally 12 billion tons of high-quality lignite are deposited in the Lusatian lignite mining area. Thus, Lusatia provides an enormous potential of the competitive raw material lignite and the bases for its use in modern and environmentally friendly power generation processes in CO₂-free power plants (Fig. 10).

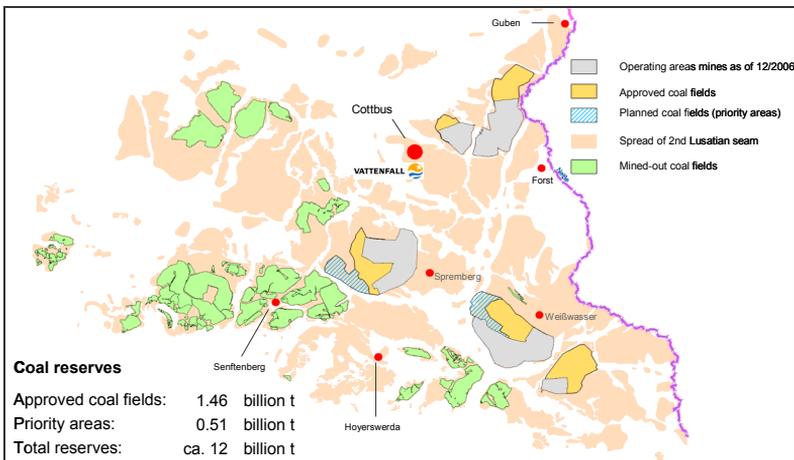


Fig. 10. Coal reserves in the Lusatian lignite mining area