

Energy from lignite

Nochten opencast mine

Nochten
Reichwalde
Boxberg
Energy
Site

Nochten opencast mine

Lusatian lignite is extracted free of subsidies in opencast mines. It is converted into electrical energy in the power plants nearby, in a safe, efficient and environmentally friendly way.



Deposit and geology

The Nochten deposit lies in the Free State of Saxony and stretches in a south westerly direction from the town of Weißwasser. At present, the second Lusatian lignite seam is being mined. It is 65 to a maximum of 100 metres deep and is in average of 12 metres thick. The first Lusatian lignite seam has been mined since 2006. It lies at a depth of 20 to a maximum of 40 metres and has average thickness of 3 metres. The Nochten opencast mine yields approx. 19 million tons of raw lignite annually.

Mining preparation and water management

For safe opencast mining it is a prerequisite that the deposit is kept free from water. Once the fore-field has been cleared, filter wells are drilled and using submersible pumps more than 220 m³ of groundwater is pumped per minute to the surface. The water is purified and then fed into the Spree and Weißen Schöps rivers. A portion of the pumped up water is used to supply ponds and wetlands worthy of protection in the opencast mine surrounding areas.

Overburden removal and dumping

Once the soil layers have been sufficiently drained, overburden excavators start their operations and remove the sand, gravel, and clay that lie above the lignite seam.

In the Nochten opencast mine, two bucket-wheel excavators work ahead in the pre-cut of the overburden conveyor bridge (OCB). Conveyor belts transport the overburden masses removed to the mine's dumpsite which has been previously mined. Spreaders distribute this soil material with the fertile substrate on top and thus shape the relief of the future post-mining landscape. An overburden conveyor bridge, type F 60 – an equipment complex consisting of three highly efficient bucket-chain excavators and a conveyor belt which is over 600-metre-long is used to expose the lignite. Conveyor bridges are among the largest mobile technical equipment systems in the world. They enable the transport of overburden over the shortest route across the mine to the dump side where it is dumped.



Raw coal extraction and transport

The first Lusatian lignite seam is mined between the pre-cut and the bridge operations. Pit operations run directly under the overburden conveyor bridge, bucket-

wheel and bucket-chain excavators mine lignite from the second Lusatian lignite seam.

The bucket-wheel excavators work predominantly on the high-cut, bucket-chain excavators can mine coal both with the high and low-cuts with their swivelling ability of their bucket chain system (ladder).

Conveyor systems transport lignite to the coal loading station at surface level and from there into the power plant. Every day, up to 100,000 tonnes of lignite are extracted from the Nochten opencast mine. This is enough energy to cover the needs of a city.

And what about the environment?

For those involved in the mining business it is particularly challenging to compensate for the necessary interferences in the environment as quickly as possible and to prevent or limit to a minimum the impact of such measures on man by using state-of-the-art technology. Mining claims land and, at the same time, creates new land. Mining of lignite is always followed by recultivation of the mine-site area. Native tree species like pine, oak, maple, alder and beech are used for afforestation.

An approximately 260 hectare lake is being created south of Weißwasser, in the inner dumps of the opencast mine. It will be reserved exclusively for nature conservation purposes. Indigenous species will find shelter and a habitat in the 'Offenland' and the 'Moorinitial' of the surrounding area. The boulder park which is not far from the Boxberg power plant is also an example of such a landscaping design on a postmining area. Adjacent is a mountain bike track, a tobogganing slope and adventure playground.

Facts

- 1973 Beginning of coal extraction
- 1974 Commissioning of the overburden conveyor bridge, type F 60

Raw coal quality

Calorific value:	approx. 8,750 kJ/kg
Water content:	approx. 55.5 %
Sulphur	approx. 0.5 %
Ash:	approx. 5.0 %

Overburden removal

Bucket-wheel excavator SRs 6300:	approx. 12,700 m ³ /h
Bucket-wheel excavator SRs 2000:	approx. 5,000 m ³ /h
Overburden conveyor bridge F 60:	approx. 25,600 m ³ /h

Coal extraction

Bucket-wheel excavator SRs 1301:	approx. 2,800 m ³ /h
Bucket-chain excavator ERs 710:	approx. 1,400 m ³ /h

Overburden-to-coal ratio

6,5 : 1 [m³/t]

Recultivated (until now)

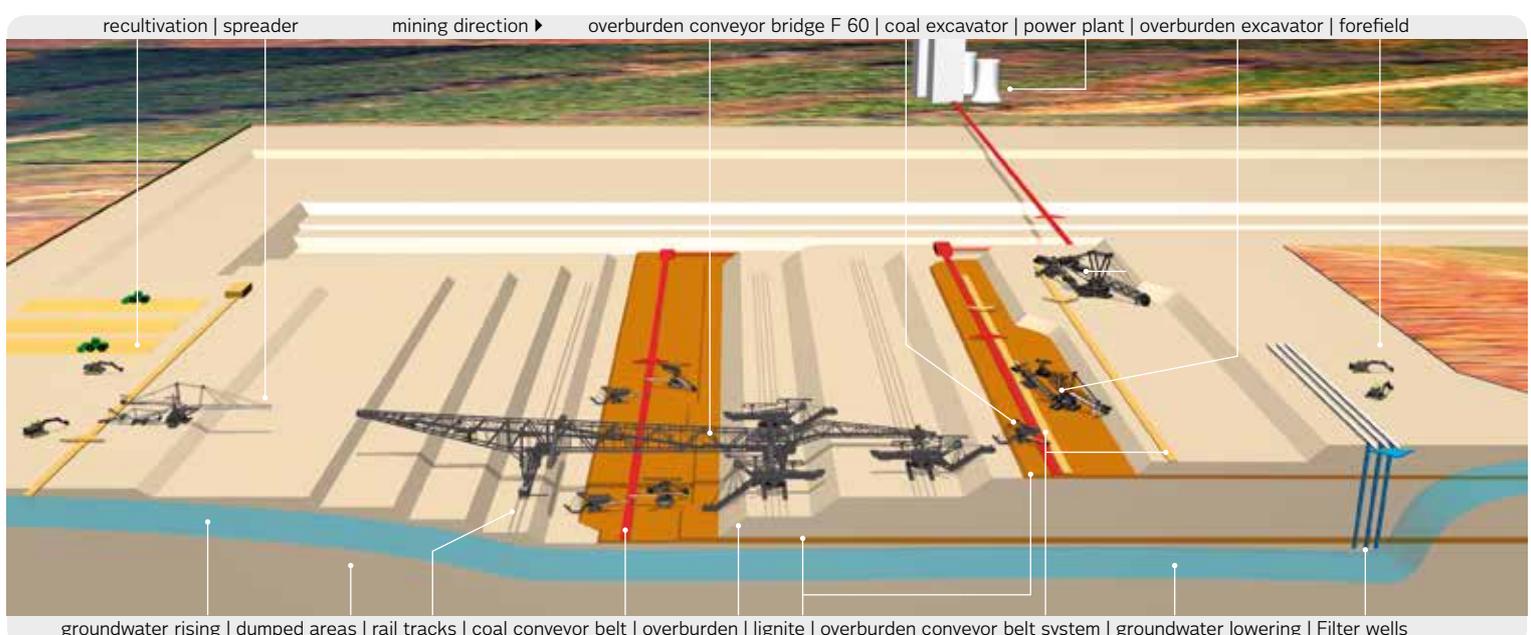
Nochten:	3,900 ha
Reichwalde:	500 ha

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Energy from lignite

Boxberg lignite-fired power plant

Nochten
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Boxberg lignite-fired power plant

Energy means life. About a quarter of the total electricity generation in Germany is based on lignite – the most important domestic energy source which is supplied directly over a short route to the power plants.



Site and overview

The Boxberg power plant is located within the district of Görlitz, approx. 15 kilometres to the south of the Saxon town of Weißwasser. The foundation stone was laid in 1968, and up to the late 90s, it was the largest lignite power plant in Germany. It is located directly next to the municipality Boxberg. The base load power plant was commissioned in the 1970s and has a total installed output of 3,520 megawatt. The old plant units, plant I and plant II (210MW units), have been decommissioned in the meantime. Since the year 2000 a 900 MW unit (plant IV) has been supplying highly efficiently produced electricity to replace these. The 500 MW plant (plant III) from the 1970s has been retrofitted with comprehensive environmental retrofitting measures and upgraded for further operations. With the construction of the new 675 MW unit R the Boxberg plant site's electricity generation capacity has been increased to 2,574 megawatt. This is enough to ensure the supply of more than 6 million households with electricity. With the new unit's worldwide leading efficiency rate of nearly 44 % the plant will emit less carbon dioxide than older plants. Thus it contributes to an economical as well as a climate friendly electricity generation.



Coal supply to the power plant

At Boxberg power plant, raw lignite from the Nochten and Reichwalde opencast mines is converted into electricity. It is transported by rail from the opencast mine to plant III and via a conveyor belt to plant IV. Operating at full capacity, about 65,000 tonnes of lignite is needed per day to supply the power plant. About one kilowatt-hour can be generated from one kilogram of lignite.

Energy conversion in the generator

The steam expands as it travels across each blade of the turbine. Its energy is converted into kinetic energy. As both the turbine and the generator are mounted to one single shaft, the rotating motion is transmitted to the inductor of the generator which – like a dynamo of a bicycle - converts kinetic into electrical energy. The 3,000 revolutions per minute in the turbine correspond to 50 Hertz, the frequency of alternating current. The electrical energy is transmitted to the substation at Bärwalde via overhead lines and at a voltage of 380 kilovolt from where it is fed into the high-voltage system of the company 50Hertz Transmission GmbH. Regional energy providers and public utilities distribute the electricity on to the consumers.

Environmentally friendly cogeneration

The Boxberg power plant is certified according to the German laws governing all waste disposal businesses to dispose of sludge and to treat communal waste water. Additional facilities in plant III make cogeneration, firing both waste and lignite together in the combustion chamber possible, creating a synergy effect and contributing to an environmentally friendly disposal.

And what about the environment?

As with other fossil fuels, the combustion of lignite produces flue gas. The combination of highly efficient measures such as low nitric oxide combustion, flue gas dedusting by electrostatic precipitators and flue gas desulphurisation with limestone suspension - a chemical process in which gypsum is produced - efficiently reduce emissions. Irrespective of the load that Boxberg power plant is operating at, it always remains below the limits stipulated in the environmental protection regulations.

Key figures

	Plant III	Plant IV	
	Unit N and P	Unit Q	Unit R
Rated capacity	2 x 500 MW	900 MW	675 MW
Unit efficiency (net)	36 %	42 %	43.7 %
Live steam temperature	535 °C	545 °C	600 °C
Intermediate steam temperature	540 °C	581 °C	610 °C
Live steam pressure	163 bar	266 bar	286 bar

Energy conversion

- Chemically bound energy (lignite as the raw material)
- ▼
- Thermal energy of the steam (steam boiler)
- ▼
- Rotational energy/kinetic energy (turbine)
- ▼
- Electrical (generator)

District heat from lignite

Part of the heat produced during electricity generation is extracted from the process and used to supply district heat to the location Boxberg and Weißwasser. This raises the fuel utilisation ratio in the power plant making separate heat generation for the consumer no longer necessary.

Environmental protection

- Reduction of emissions using environmental protection technology:
- by approx. 99 % for dust
 - by approx. 96 % for SO₂
 - by approx. 63 % for NO_x

The specific emissions (g/kWh) refer to net work including equivalent for generated heat.

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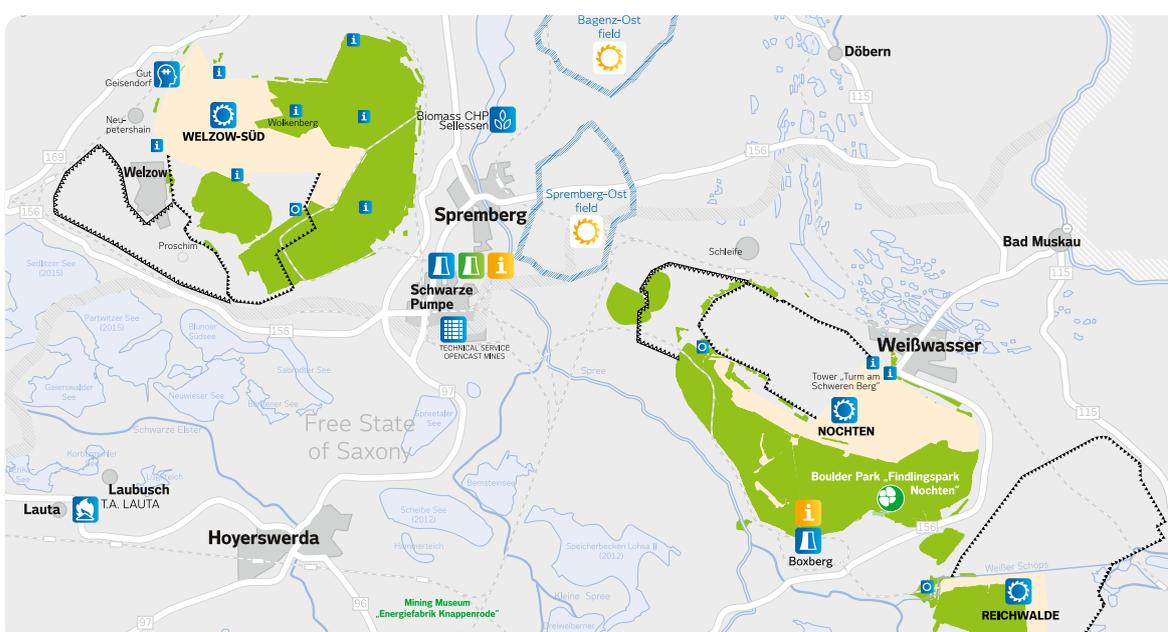
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Combustion in the steam generator

After the lignite has been crushed and ground into fine pulverised lignite in coal mills it is fed into the combustion chamber of the steam generator in a near dry state. The pulverised lignite is blown into the furnace through special burners with air flow that is a precisely dosed. The heat generated during the coal combustion process is taken up by the feed water, which is kept in a kilometre long piping system, built into the steam generator. The water comes from the opencast mine dewatering system which is then purified in a sophisticated process. The steam from this water is superheated, and fed into the turbine under high pressure. After the steam generated from water has been overheated, it is fed into the turbines.



-  Lignite opencast mine
-  Permitted border to mine
-  Permitted border to mine that has been applied for
-  Future fields
-  Operational fields
-  Recultivated areas
-  Lignite power plant
-  pilot plant for carbon capture
-  Vantage point of opencast mine
-  Communication centre power plant
-  surface installations opencast mine