

Energy is generated from Lignite

Welzow-Süd opencast mine

Welzow-Süd/
Schwarze
Pumpe
Energy Site

Welzow-Süd opencast mine

Lusatian lignite is extracted free of subsidies in opencast mines. In nearby power plants it is converted into electrical energy, safely, efficiently and environmentally friendly.

Deposit and geology

The Welzow-Süd deposit lies in the State of Brandenburg, west of the river Spree and the town of Spremberg. At present, the second Lusatian lignite seam is being mined. It lies at a depth of 90 to 130 metres below the surface level and is between 10 to 16 metres thick. In Welzow-Süd opencast mine approx. 20 million tons of raw lignite is mined annually.

Mining preparation and water management

It is a prerequisite for safe opencast mining that the deposit is kept free from water. Once the forefield has been cleared, filter wells are drilled and more than 100 m³ of groundwater is pumped per minute to the surface with submersible pumps. After the water is purified and it is fed into the Spree river and in wetlands considered worthy of protection, stabilising the regional water balance. Part of the pumped groundwater goes to the Schwarze Pumpe power plant where it is used as cooling or feed water for steam generation.

Overburden removal and dumping

Once the soil layers have been sufficiently drained, overburden excavators start their operation and remove sand, gravel, and clay covering the lignite seam. In the Welzow-Süd opencast mine, one bucket-wheel excavator and one bucket-chain excavator are operated in the pre-cut of the overburden conveyor bridge and remove soil layers which the conveyor bridge complex cannot handle due to its limited capacities. Conveyor belts with a width of 2.5 metres transport the pre-cut overburden to the mine's dumpsite which has already been excavated. Spreaders dump this soil material and thus shape the relief of the future post-mining landscape. Lignite is exposed with an overburden conveyor bridge, type F 60 – an equipment complex consisting of two highly efficient bucket-chain excavators, type Es 3750, and a more than 500-metre-long belt conveyor bridge. Conveyor bridges belong to the biggest 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 deposited.



Raw coal extraction and transport

Pit operation runs directly under the overburden conveyor bridge. This is where lignite is actually mined using bucket-wheel and bucket-chain excavators in high- and deep cut.

Different coal qualities are selectively won. A two-metre-wide belt conveyor system transports lignite to the coal loading station or to the ditch bunker on the surface level. From there, the coal is supplied to the

consumers by train. Every day, up to 90,000 tons of lignite are extracted from the Welzow-Süd opencast mine. The main consumers are the Schwarze Pumpe power plant and the refining plant.

And what about the environment?

For those involved in the mining business it is a particular challenge to compensate for 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. Indigenous tree species like pine, oak, maple, alder and beech are used for afforestation. Recultivation aims at creating new cultural landscapes for forestry and agriculture as well as for nature conservation, leisure-time and recreation. Interesting post-mining landscapes have already been created with mixed forests and recultivated areas such as the hill „Wolkenberg“, the project „Hühnerwasser“, the „Stradower Höhe“ as well as the „Energy forest“.



Key figures

Raw coal quality	
Calorific value:	approx. 9,000 kJ/kg
Water content:	approx. 56 %
Sulphur:	approx. 1 %
Ash:	approx. 5 %

History

1966 Beginning of coal extraction
1972 Commissioning of the overburden conveyor bridge, type F 60

Mining output

Overburden removal	
Bucket-wheel excavator SRs 6300:	approx. 14,000 m ³ /h
Bucket-chain excavator Es 3150:	approx. 5,680 m ³ /h
Overburden conveyor bridge F 60:	approx. 18,000 m ³ /h
Coal extraction	
Bucket-wheel excavator SRs 1301:	approx. 1,800 t/h
Bucket-chain excavator ERs 710:	approx. 1,000 t/h

Overburden-to-coal ratio

6 : 1 [m³/t]

Recultivated (until 01/2014)

approx. 4,740 hectares

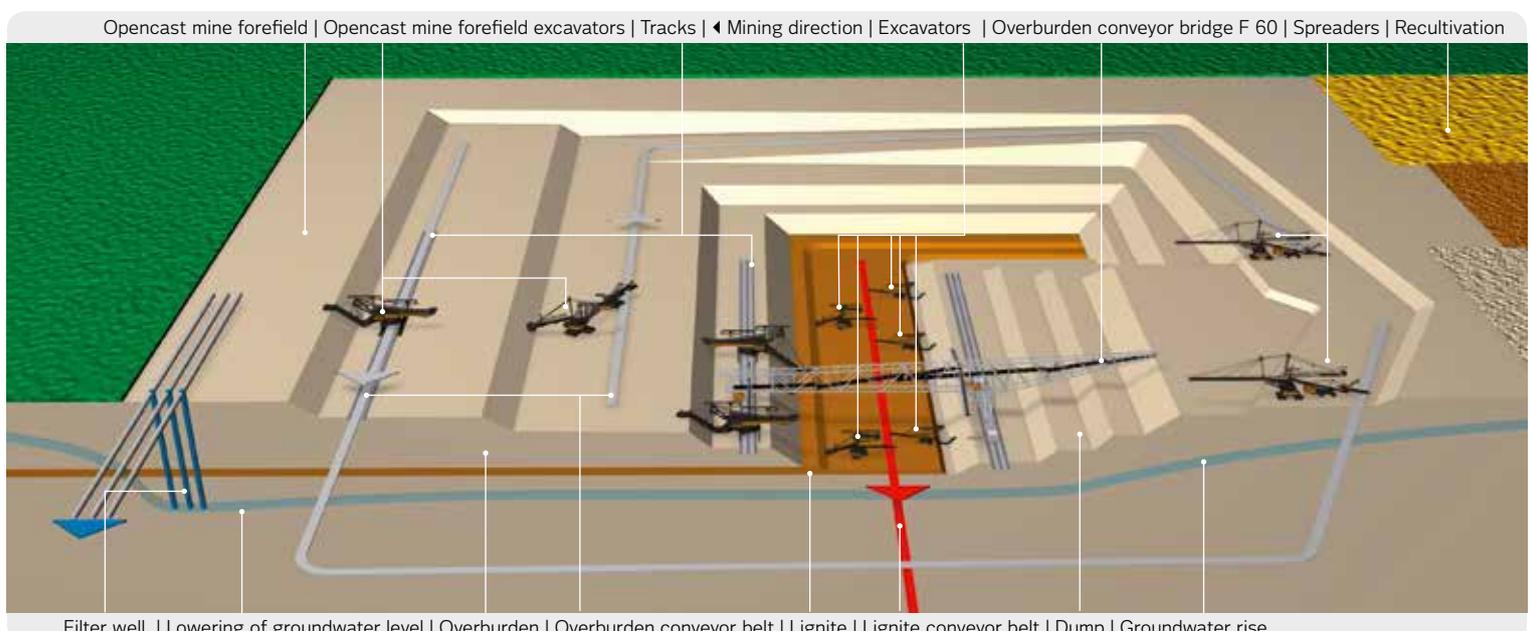


Mining & Generation
Vom-Stein-Straße 39
03050 Cottbus

P +49 355 2887 3050
F +49 355 2887 3066

info@vattenfall.de
www.vattenfall.de
Vattenfall Europe
Mining AG

Your contact person on
the site: Lutz Picard
T +49 3564 69 5135
lutz.picard@
vattenfall.de



Energy is generated from Lignite

Schwarze Pumpe lignite-fired power plant

Welzow-Süd/
Schwarze
Pumpe
Energy Site

Schwarze Pumpe lignite-fired power plant

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



Site and overview

The Schwarze Pumpe power plant, is located near the town of Spremberg in Brandenburg, approx. 30 kilometers to the south of Cottbus. The foundation stone was laid in Autumn 1993. Almost four years later, the first 800 MW unit went into operation. The second 800 megawatt unit was commissioned half a year later. The Schwarze Pumpe power plant is a lignite double-block system as well as the first of a new generation of lignite-fired power plants setting a new benchmark with regard to environmental protection standards on a national as well as international level.

Coal supply to the power plant

At Schwarze Pumpe power plant, raw lignite mainly from the Welzow-Süd as well as the Nochten opencast mine is converted into electricity. Lignite is transported by rail from the opencast mine to the bunker area at the power plant. At full capacity about 36,000 tons of lignite are needed per day for the power plant. About one kilowatt-hour can be generated from one kilogram of lignite.

Combustion in the steam generator

After the lignite has been crushed, pre-dried and ground into fine pulverised lignite in coal mills it is fed into the combustion chamber of the steam generator. The pulverised lignite is blown into the furnace through special burners with a precisely dosed air flow. 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. After the steam generated from water has been overheated, it is fed into the turbine under high pressure. The water mainly comes from the dewatering system of the opencast mines. In the power plant it is specially treated for the use in boilers. The dry and wet ash resulting from the combustion process is disposed of on a storage site for valuable materials provided for this purpose.

Energy conversion in the generator

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 on 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 rotations per minute in the turbine are equivalent to 50 Hertz, the frequency of alternating current. The electrical energy is fed to the substation at Graustein 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 redistribute the electricity to the consumers.

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 electrical filters and flue gas desulphurisation with limestone suspension - a chemical process in which gypsum is produced - efficiently reduce emissions. Irrespective of the load that Schwarze Pumpe power plant operates at, it always remains below the limits stipulated in the regulations to protect the environment.

Key figures

Net efficiency approx.	ca. 40 %
Fuel utilisation ratio approx.	ca. 44 %

Consumption and generation balance

Electrical energy:	2 x 800 MW
District heat:	2 x 60 MW _{th}
Process steam:	2 x 480 t/h
Lignite:	36,000 t/d
Ash:	1,500 t/d
Limestone:	1,000 t/d
Gypsum:	1,600 t/d
Water:	72,000 m ³ /d

Energy conversion

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

District heat and process steam

Part of the heat produced during electricity generation is extracted from the process and used to supply district heat to the towns of Hoyerswerda, Spremberg and Schwarze Pumpe. Moreover, process steam from the power plant is supplied to the neighbouring industrial area for briquette, paper and corrugated cardboard production. The heat is used to dry the lignite in the production of briquettes, pulverised and fluidised bed coal and for paper drying. This raises the fuel utilisation ratio in the power plant making separate heat generation for the consumer no longer necessary.

Environment

Environmental protection reduction of emissions by environmental technology on site

- by 99 % for dust
- by 97 % for SO₂
- by 80 % for NO_x



Production
Lignite Mining & Generation
Vom-Stein-Straße 39
03050 Cottbus

P +49 355 2887 3050
F +49 355 2887 3066

Schwarze Pumpe
power plant
An der alten Ziegelei
03130 Spremberg

info@vattenfall.de
www.vattenfall.de
Vattenfall Europe
Generation AG

Your contact person on
the site: Kerstin Schilling

P +49 3564 35 3317
kerstin.schilling@
vattenfall.de

