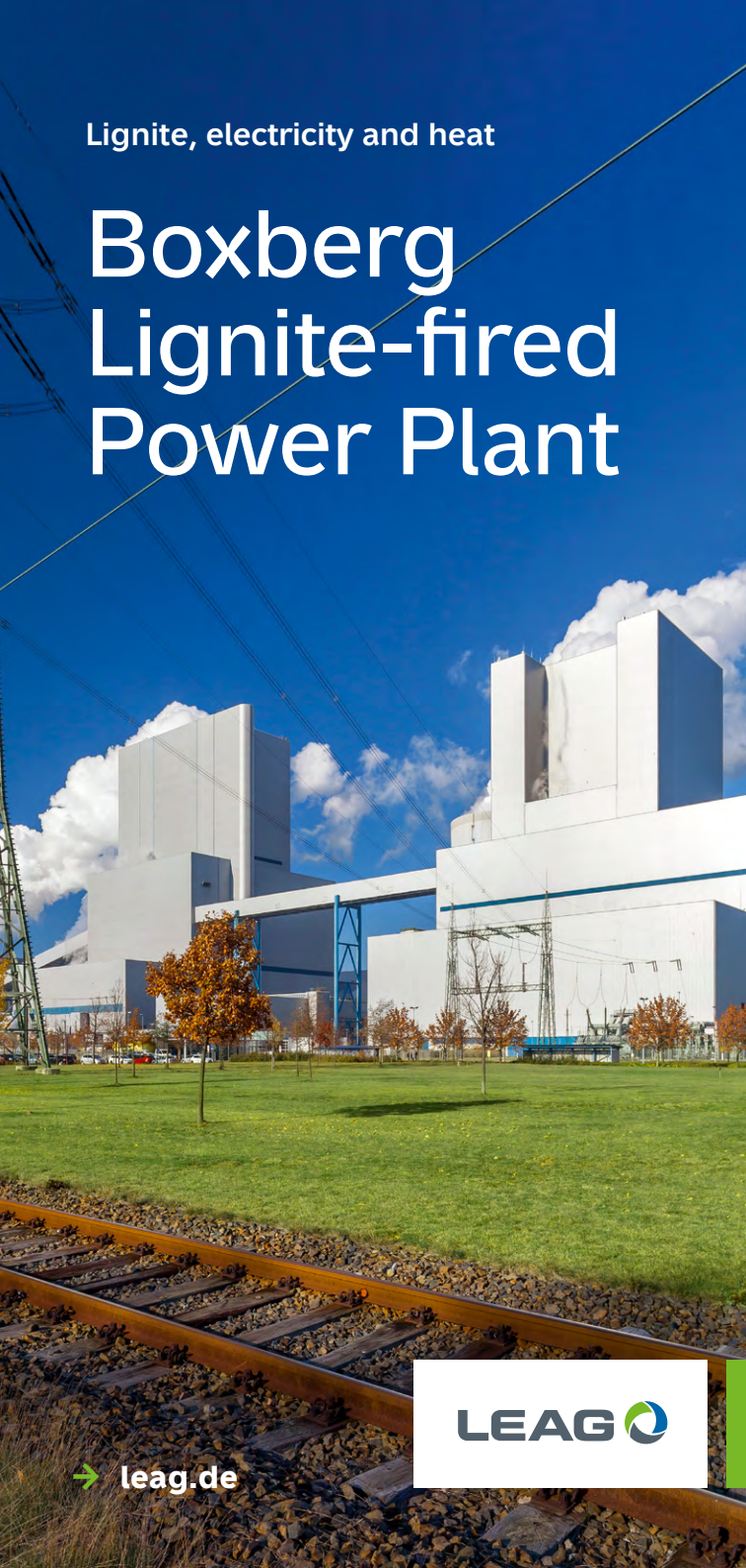
Lignite, electricity and heat

Boxberg Lignite-fired Power Plant



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Energy is the engine of our modern society. About a quarter of all German electricity generation is based on lignite – the most important domestic energy raw material. It is mined in opencast mines and reaches the power plants directly in a short distance.

Location and overview

The Boxberg power plant is located in the Saxon district of Görlitz, about 15 kilometres south of Weißwasser. The foundation stone was laid in autumn 1968 in the immediate vicinity of the community of Boxberg. The power plant was started in the 1970s with a total installed capacity of 3,520 megawatts (MW). It consisted of twelve 210 MW units (plants I and II) and two 500 MW units (plant III). This made Boxberg Germany's largest lignite-fired power plant until well into the 1990s.

Plants I and II have since been shut down and replaced by the modern 900 MW unit Q (plant IV) in 2000. The remaining two 500 MW units were retrofitted with modern environmental technology in the 1990s and upgraded for further operation.

The new 675 MW unit R (also plant IV) completed the Boxberg site in 2012 in its current form. With an efficiency of more than 43 percent unit R emits about 20 percent less carbon dioxide per megawatt hour than older plants.

The Boxberg power plant has an installed capacity of

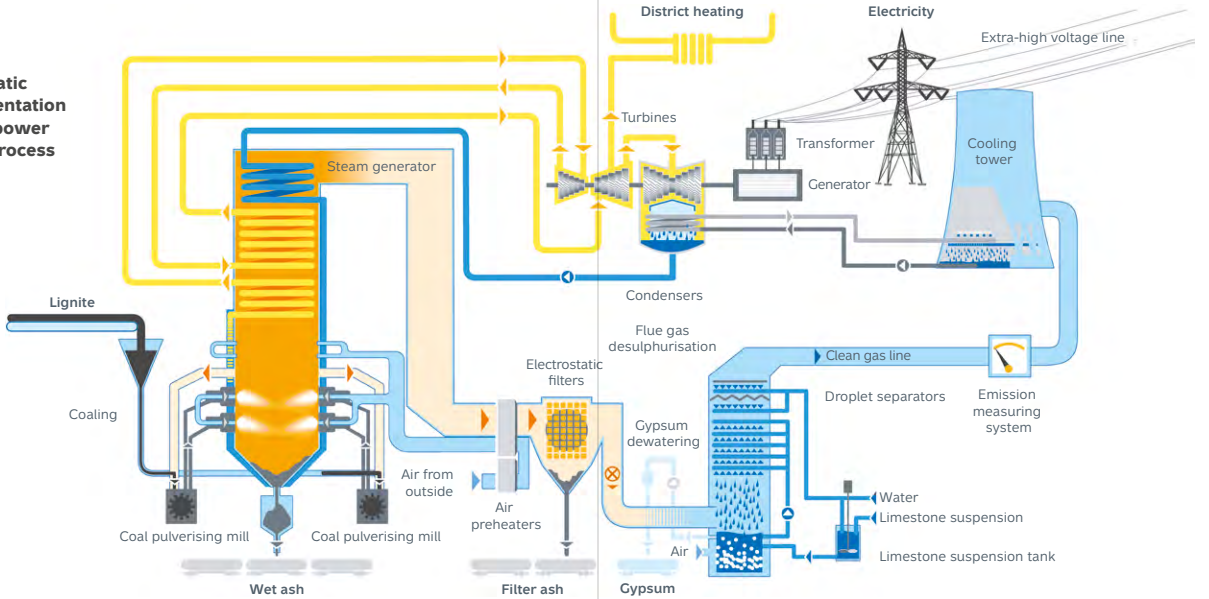
2,575 MW

Combustion in the steam generator

Lignite from the Nochten and Reichwalde opencast mines is converted into electricity in the Boxberg power plant. It is transported from the coal storage area by rail to plant III and via a conveyor belt to plant IV. The lignite is coarsely crushed, dried and ground into fine dust in coal mills. The injection of the fuel into the combustion chamber of the steam generator is carried out by special burners and with a precisely dosed air addition.

Inside the steam generator there is a kilometre-long, winding pipeline system. These pipelines contain the so-called feed water. It comes from opencast mine dewatering and is treated in an elaborate procedure for the power plant process. Temperatures of up to 1,000 °C prevail in the steam generator. The feed water evaporates in the pipes, the steam is superheated and fed into the turbine under high pressure.

Schematic representation of the power plant process



Energy conversion in the generator

The steam flows over the blade wheels of the turbine and sets them in a rotary motion. Its energy is converted into kinetic energy. Since the turbine and generator are located on a shaft, the rotary motion is transmitted to the inductor of the generator, which – like the dynamo of a bicycle – converts kinetic energy into electrical energy. The 3,000 revolutions per minute in the turbine correspond to the mains frequency of 50 hertz.

The electrical energy is transferred with a voltage of 380 kilovolts via overhead lines to the Bärwalde transformer station and from there fed into the extra-high voltage grid. Municipal utilities and regional energy suppliers pass on electricity to end consumers.

District heating from lignite

Part of the heat generated during power generation is decoupled from the process and used to supply district heating for the municipality of Boxberg and the town Weißwasser. This increases the degree of fuel utilisation in the power plant and avoids separate heat generation at the consumer. The power plant thus also secures its own heat requirements and those of all companies located at the site and in the industrial and commercial area.

Reliable and flexible

For a stable power supply, generation and consumption must always be in equilibrium. Lignite-fired power plants are characterised by their high availability and their planned and controllable operation. As they are designed as base-load power plants, they can reliably provide electricity around the clock. At the same time, technical optimisations have made them more flexible than ever before.

This flexibility helps to compensate for fluctuations in electricity generation from renewable energy sources. This is particularly in demand in phases with low power consumption and high renewable generation, for example on sunny and windy public holidays. Since electricity from renewable sources has priority by law to be fed into the grid, lignite-fired power plants adapt and reduce their output if necessary. If wind or sunshine subside or electricity consumption increases, the flexible operation of the power plants guarantees that a rapid increase in output is possible and the power supply remains reliable.

Approx.

18 billion kWh

electricity is generated by Boxberg power plant annually.

About

5 million

households could cover their electricity needs with Boxberg power plant.

LEAG's power plant fleet can reduce its production down to

25 %

of the installed capacity. Important criteria here are a reliable district heating and system services for the grid operator.

Effective co-incineration

The Boxberg power plant is a certified specialist company for the disposal of sewage sludge from municipal waste water treatment plants. Additional technical equipment in plant III ensures environmentally compatible disposal with synergy effects through joint combustion with lignite in the existing combustion facilities.

What about the environment?

The combustion of lignite and other fossil fuels produces flue gas. Pollutant emissions are effectively reduced by combining highly effective measures such as low-nitrogen oxide combustion, flue gas dedusting using electrostatic precipitators and flue gas desulphurisation. In all operating conditions, the Boxberg power plant falls below the legally prescribed limit values for the protection of the environment. The purified flue gas is discharged together with water vapour via the cooling towers.

A mixture of water and finely ground limestone is used as the reaction agent for binding the sulphur dioxide contained in the flue gas in the flue gas desulphurisation facility (FGD). The reaction product is gypsum, which is at least equal in composition and processability to that of natural deposits. As a recyclable material, it is mainly processed further in the building materials industry.

The ash produced during the combustion of the lignite is temporarily stored in silo containers. Among other things, it is used for the construction of the Spreyer Höhe landscape structure, a raised area in the postmining landscape of the Nochten opencast mine.

In order to keep the power plant's water requirements as low as possible, the operating water is used several times. Technological waste water is purified and returned to the water balance without any qualitative restrictions.

Key figures for the power plant

	Plant III	Unit Q	Unit R
Installed capacity (gross)	2 × 500 MW	900 MW	675 MW
Unit efficiency (net)	36 %	42 %	>43 %
Steam generating capacity per boiler	815 t/h	2,422 t/h	1,708 t/h
Live-steam pressure	163 bar	266 bar	286 bar
Live steam temperature	535 °C	545 °C	600 °C
Reheat steam pressure	40 bar	58 bar	54 bar
Reheat steam temperature	540 °C	581 °C	610 °C
Mills per steam boiler	6	8	8
District heating extraction	max. 150 MW_{th}		–
Cooling tower height	113 m	176 m	155 m
Boiler house height	80 m	158 m	135 m

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