Niederaussem power plant

A plant full of energy

RWE Power

RWE

RWE Power – All the power

RWE Power is Germany's biggest power producer and a leading player in the extraction of energy raw materials. Our core business consists of low-cost, environmentally sound, safe and reliable generation of electricity and heat as well as fossil fuel extraction.

In our business, we rely on a diversified primary energy mix of lignite and hard coal, nuclear power, gas and renewable sources to produce electricity in the base, intermediate and peak load ranges.

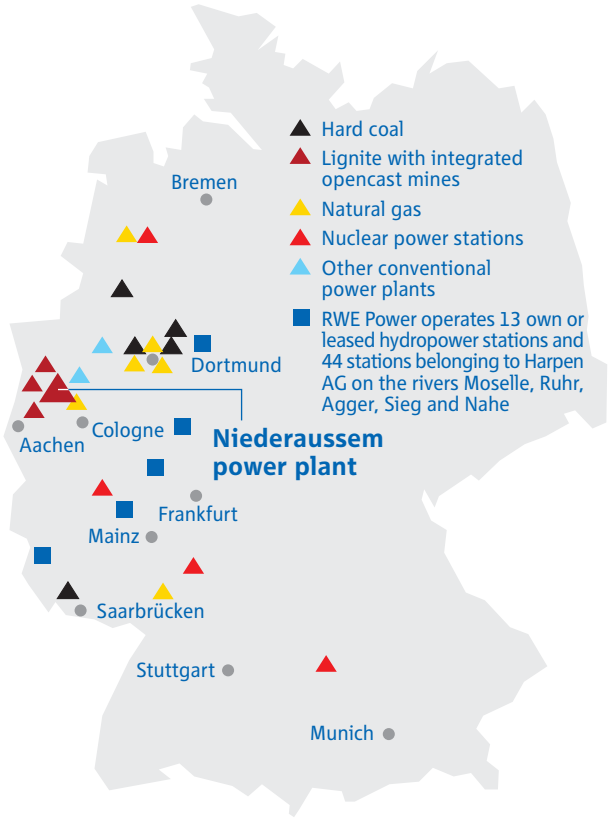
RWE Power operates in a market characterized by fierce competition. Our aim is to remain a leading power producer at national and international level, making a crucial contribution toward shaping future energy supplies.

A strategy with this focus, backed by efficient cost management, is essential for our success. All the same, we never lose sight of one important aspect of our corporate philosophy: environmental protection. At RWE Power, a responsible use of nature and its resources is more than mere lip service.

Our healthy financial base, plus the competent and committed support of some 15,000 employees, with approx. 4,000 more working at our affiliates, enable us to systematically exploit the opportunities offered by a liberalized energy market.

In this respect, our business activities are embedded in a corporate culture that is marked by team spirit and by internal and external transparency.

The bundling of all generating activities at RWE Power has made us no. 1 in Germany, with a 30 per cent share in electricity generation, and no. 3 in Europe, with a 9 per cent share. We wish to retain this position in future as well. That is what we are working for – with all our power.



Power from Niederaussem

An energy location with a future

The Niederaussem location has a major role to play in the power plant portfolio operated by RWE Power. It is not only the location with the highest output by far in the Rhenish lignite mining area, but also the biggest of all RWE's operations. The power plant's capacity of 3,900 megawatt (MW) is distributed across nine units, the largest and most modern being the lignite-fired power station with optimized plant engineering (BoA). With its efficiency of 43.2 %, it has chalked up a new all-time high for power generation from lignite.

Lignite-based electricity generation in the Rhenish mining area

Lignite-fired power plants cover one quarter of Germany's electricity needs. The energy resource is extracted in opencast operations: Germany's mining areas are located in the Rhineland, in Lusatia, to the south of Leipzig and near Helmstedt. Subsidies are not needed for this domestic energy source, and the geological deposits will suffice for generations to come.

RWE Power operates 35 lignite-fired power plant units at Frimmersdorf, Neurath, Niederaussem, Hürth and Weisweiler with a total gross capacity of 11,000 MW. These power plants consume an annual 90 million tonnes or so of raw lignite supplied by the Hambach, Garzweiler and Inden opencast mines.

They generate some 70 billion kilowatt hours (kWh) of electricity to cover 15 % of Germany's public electricity supply.

One long-term corporate object at RWE Power is to maintain the present levels of subsidy-free and competitive power generated on a lignite basis and, in this way, to promote and underpin the economic strength and employment in the Rhenish region for a long time to come.

BoA, an avowal of lignite's future-capability

One definite sign that power generation using Rhenish lignite has a bright future is the BoA plant at Niederaussem.

BoA and physics

The power plant process starts with the combustion of raw lignite in the steam generator (847 t/h raw lignite consumption, 2,663 t/h steam output), which has a thermal capacity of 2,306 MW. Using the released heat, water is evaporated and superheated under high pressure. The superheated steam then flows through rows of turbine blades (1,012 MW), which are arranged on a shaft. The steam energy sets the turbine shaft rotating, and the generator rotor connected to the turbine shaft produces electricity in the generator, which finally reaches consumers via the grid.

When the steam flows through the turbine blades, it expands, i.e. pressure and temperature fall to a negative pressure of 29 or 35 millibar. In the condenser, the steam is condensed using water provided by the cooling tower. The water-steam cycle then recommences.

The combustion of raw lignite in the steam generator gives rise to flue gases which are cleaned in several steps to ensure that statutory emission limits are strictly adhered to and often significantly improved on. The raw lignite is combusted using pinpointed additions of combustion air, which limits the formation of nitrogen oxide to the permissible levels. Over 99.9 % of the dust emitted from the steam generator with the flue gases is separated off in electrostatic precipitators.

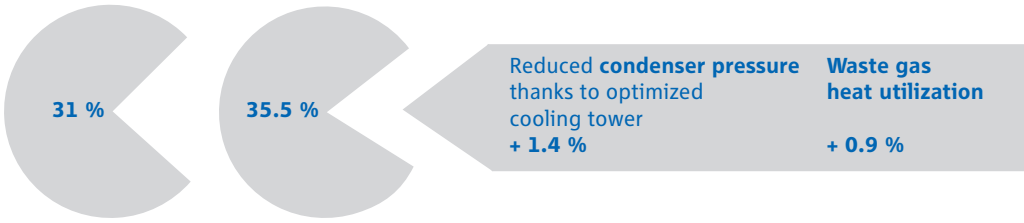
In the downstream flue gas desulphurization system, the flue gas is treated with a limestone slurry to separate the sulphur dioxide. Among other applications, the resulting gypsum has its uses in the production of construction materials. The cleaned flue gases are discharged into the atmosphere via the cooling tower.

BoA and progress

The BoA concept combines the best technologies available today for converting lignite into electricity. One crucial element in this optimization is the rise in the pressure and temperature of the superheated steam to 265/60 bar and 580/600°C resp., which are well above the figures for the older lignite-fired units. Additional heat exchangers recover some of the residual heat still contained in the flue gases. It is used to pre-heat the combustion air and the water in the water-steam cycle. This helps make better use of the input fuel and raise efficiency.

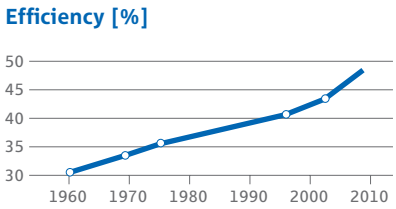
All process steps are precisely dovetailed, so that energy losses in the power plant process are reduced to the technically and economically possible minimum. The especially high and, hence, efficient cooling tower, too, makes an important contribution toward an optimized and environmentally sound power generation.

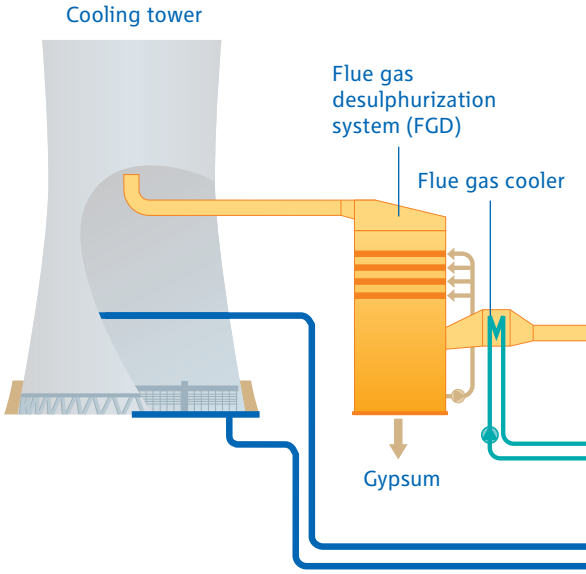
Mean efficiency gain in a 950-MW BoA unit



Year 1957 Average net efficiency of a 150-MW unit

Year 1976 Average net efficiency of a 600-MW unit





BoA and air quality

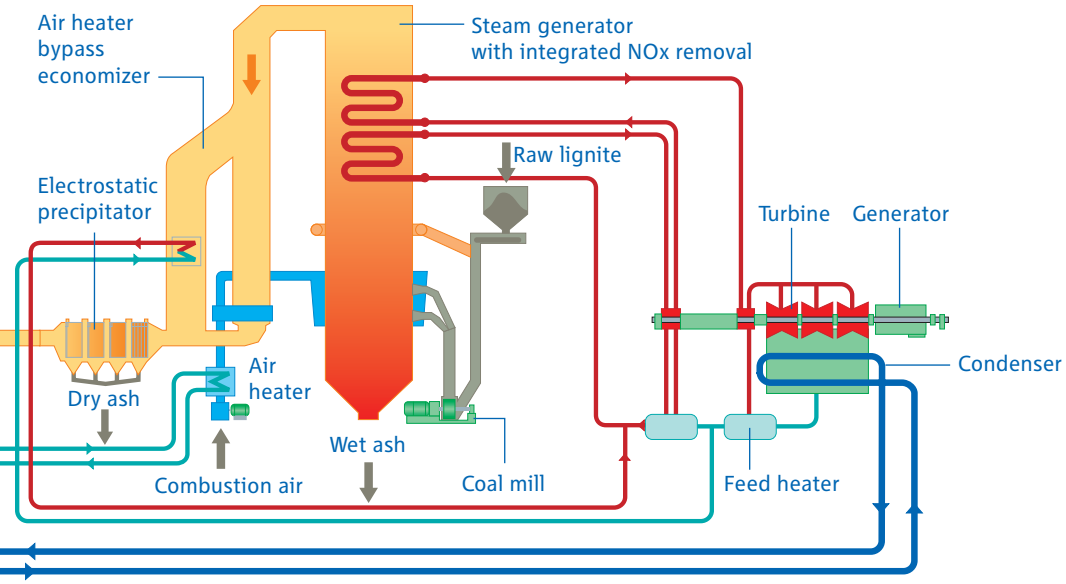
Using BoA technology, we have taken an important step toward improving environmental protection in power generation. Taking an average for the year, electric efficiency is 43.2 %, which is significantly higher than that of existing lignite-fired plant units, which manage 31 to 35.5 %.

Better utilization of the lignite and the associated lower level of input fuel, but with the same amount of generated power, translates into much lower fuel-related emissions. CO_2 emissions, for example, are reduced by as much as three million tonnes per year, and that with a comparable level of generated power, while dust, sulphur dioxide (SO_2) and nitrogen dioxide (NO_X) emissions are some 30 % lower.

Increase in **steam parameters**	**Process optimization**	Improved **turbine efficiency** thanks to advanced steam turbine	Reduced **auxiliary power requirements**
+ 1.3 %	**+ 1.1 %**	**+ 1.7 %**	**+ 1.3 %**

Net efficiency of BoA 43.2 %

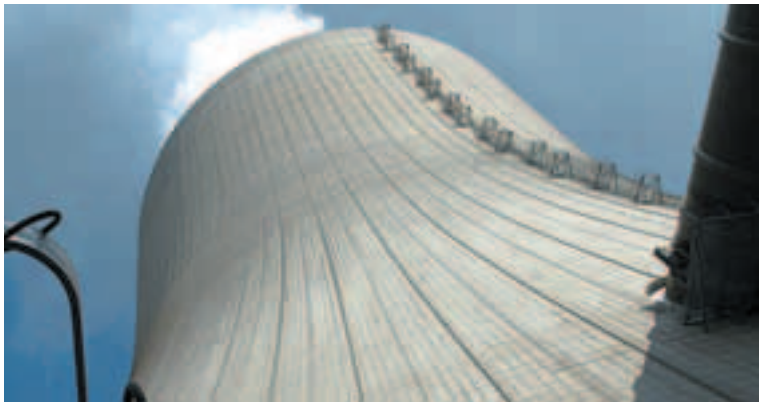
Year 2003



BoA and emission abatement

The planners, responding to statutory requirements, had set themselves the goal of tolerating as little noise, dust and odour emissions as possible. For this purpose, all plant components are encased, and building apertures fitted with acoustical packs. Also, the raw lignite is transported via a new coal-supply system located outside the plant, complete with coal bunker, crusher, iron separator and long-distance conveyor, to the equally new distribution bunker built on the power plant's terrain. From there, it is distributed to the BoA unit, but also to the other power plant units.

The BoA unit and its ancillary infrastructure ensure safe adherence to all statutory limit values for emissions and a long-term improvement in the noise, dust and odour situation at Niederaussem.

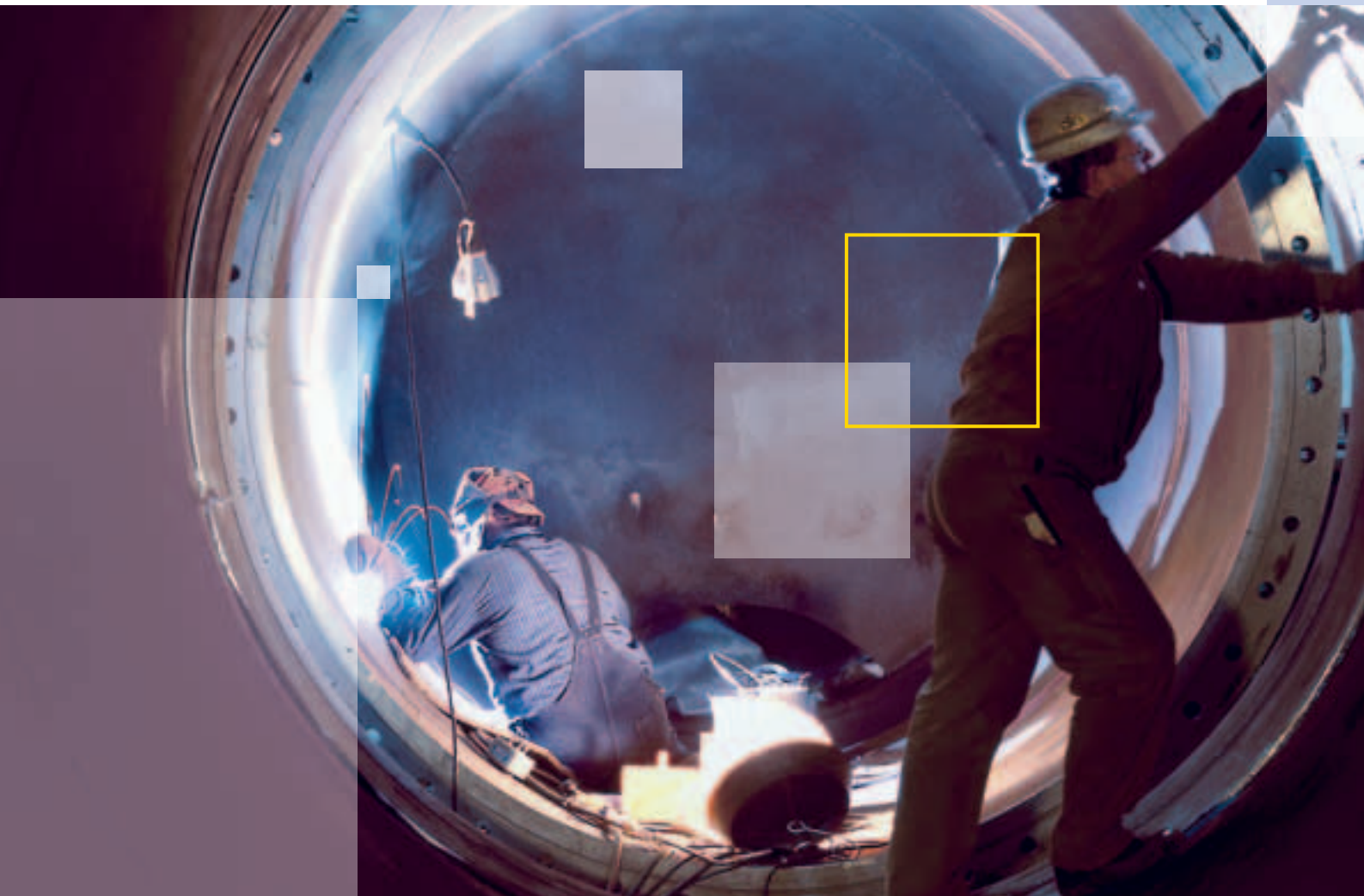


The Niederaussem location

The Niederaussem power plant is located on the terrain of the county town of Bergheim (Rhein-Erft county), some 15 km northwest of Cologne. It went on stream with 150-MW units in 1963 as Werk IV of the near-by Fortuna power plant, which was demolished in 1988. By 1974, the power plant had been expanded to a total gross electric capacity of 2,700 MW. In the mid-1980s/early 1990s, extensive refurbishing work was carried out to reduce emissions. Besides flue gas desulphurization (FGD) equipment, the converted firing systems (lower NO_X emissions) have since then ensured adherence to Germany's strict limit values for emissions. To make the gypsum produced in the FGD plants capable of use in the building industry, the early 1990s saw the construction of a facility right next to the power plant to process the gypsum into marketable products.

To increase efficiency in lignite-based power generation and, in this way, spare raw-material resources, the power plant's turbines have been part-renewed since 1994. With unchanged coal input, better energy exploitation in the turbine installations with optimized fluidics yields an increase of over 150 MW in nominal capacity.

With BoA, whose construction started in 1998, a milestone was set on the road toward enhanced efficiency in lignite-based electricity generation. Owing both to its high capacity and to excellent efficiency, the BoA unit, which started regular operations in 2003, is setting new standards in power plant engineering.



With a gross capacity of some 3,900 MW, the Niederaussem power plant is among the biggest coal-fired power stations in Europe. With an annual production of about 27 billion kWh, the plant can cover the electricity needs of more than 20 million people (reference quantity: a specimen household of three members with annual consumption of 3,500 kWh).

At the Niederaussem location, RWE Power currently has a workforce of over 700 on its payroll. Thanks to orders placed for services and materials, the Niederaussem power plant is an important economic factor in the Rhein-Erft county.

The employment effect of „Power from Niederaussem" concerns more than our own workforce: in a rough estimate, it may be assumed that every job at the Niederaussem plant creates one more job in supplier companies. It also secures several hundred jobs in the opencast lignite mines and at companies that supply the mines.

In the direct vicinity of the power plant is a centre for the vocational training of young people. Going beyond its own needs, RWE Power is training over 150 youngsters at this facility in electrical, IT and metal-working trades and professions, and to become mechatronic technicians.

Units of the Niederaussem power plant

The units	Gross capacity	Commissioned in
Unit A	144 MW	1963
Unit B	152 MW	1963
Unit C	335 MW	1965
Unit D	320 MW	1968
Unit E	315 MW	1970
Unit F	320 MW	1971
Unit G	630 MW	1974
Unit H	636 MW	1974
Unit K	1,012 MW	2003

Lignite – energy raw material for the power plants

Hallmark: bucket wheel excavators

Lignite, the energy resource used in the Niederaussem power plant, can only be mined in opencast operations. Located above the lignite seams are thick, loose layers of sand, gravel and clay. So, lignite mining must literally move mountains. This is done by employing a specially developed, efficient opencast mining technology that involves big, mobile units of equipment in continuous operations. The hallmark of this technology is the bucket wheel excavator (BWE).

The BWEs, up to 240 metres long and just under 100 metres high, expose the lignite seams. They start by removing the top soil layer consisting of humus and loess, proceed to shift the so-called overburden – clay, gravel and sand – and then mine the lignite proper: to the tune of 100 million tonnes, year in, year out. Conveyor belts and industrial railways move the masses on: the lignite to the power plants and upgrading facilities, the loess and overburden to the depleted sections of the opencast mines to act as backfill. There, spreaders discharge the material, so that recultivation of the landscape can start straight away.

So the Niederaussem power plant was once within sight of one of the biggest mines on earth: the Fortuna-Garsdorf opencast mine. In the meantime, this mining field has been completely recultivated – fertile land for agriculture, and a nature reserve and recreation area with ever-growing appeal.

Open for dialogue

Information on the mining area

If the need to use lignite is to be appreciated, but also accepted, you must provide broad-based information on both the benefits and the problems of this industry. For this purpose, RWE has set up, among other things, a visitor centre in the more than 400-year-old Paffendorf castle near Bergheim (Rhein-Erft county), which displays all aspects of lignite mining and lignite-based power generation.

Paffendorf castle and the Niederaussem power plant with its BoA unit are just two of nine stops on the "Energy Trail" which familiarizes cyclists and motorists with various features of power generation and recultivation. In addition, viewpoints and information panels have been installed at all opencast mines. Also, several times a year, the Company invites visitors on coach tours of the Garzweiler mine. RWE Power wishes to provide the most comprehensive information possible.

The aim is to obtain agreement on facts. Using these facts as basis, assessments can then be made. And if they differ, this need come as no surprise, given the multi-faceted nature of the subject.

Please check the Internet for opening times, route planners and further information at www.rwe.com and www.paffendorf-erft.de.

We look forward to welcoming you!

RWE Power AG

Essen · Cologne

T +49 (0)201/12-01
T +49 (0)221/480-0
E info.rwepower@rwe.com
I www.rwe.com

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