



New Moorburg combined heat and power plant

One of the world's most modern and efficient power plants for the supply of electricity and district heat is currently being built in Hamburg-Moorburg. Located on the Elbe River on a site that was previously used for electricity generation, the Moorburg coal-fired plant will make use of the latest available technology in its construction. Once in operation, the plant will meet roughly 85% of Hamburg's electricity needs and 40% of its district heating needs.

The existing power plant in Hamburg-Wedel will reach the end of its economic and technological life by 2012, and Hamburg needs a new base for its electricity and heat supply. The basis for this project is to provide customers with a reliable and secure supply of electricity and heat. Secure

What are base and peak loads?

The term **base load** describes electricity or district heating demand that exists irrespective of all load fluctuations. This constant demand is met by power plants that operate 24 hours a day, 365 days a year. **Mid-load** is the demand that occurs during only certain hours of every day in addition to the base load. Short-term peak demand is called **peak load**. Various types of power plants are used to cover the different load types – for example, coal and nuclear power plants for the base electricity load, and gas power and pumped storage plants for peaks. Wind power and photovoltaic (solar) power generate variable power, i.e., fluctuations in the supply of energy with no relation to demand. Regulating power, such as hydro power, is used to balance short-term differences between supply and demand.

energy supply is essential for Hamburg. It is a must to ensure the existence of already established major industries and the city's ability to attract new business.

Prepared for climate-neutral energy generation

It is Vattenfall's intention to keep emissions from the Moorburg plant as low as possible. Vattenfall has set itself the tangible target of reducing CO₂ emissions per generated kWh by 50% in 2030 compared to 1990.

Consequently, in November 2007, Vattenfall made a pledge to the Hamburg Senate that, as soon as the technological, legal and economic criteria allow, the Moorburg power plant will be retrofitted with Carbon Capture and Storage (CCS) technology. With CCS, CO₂ can be removed from the power plant's flue gases for permanent storage underground. The precise date for implementation of CCS in Moorburg will be determined by a commission with equal representation from the city of Hamburg and Vattenfall. Vattenfall is a global leader in the development of CCS technology. (Read more in the 2008 Annual Report, page 16 or on the web: www.vattenfall.com/ccs.)

Supporting regional development

The Moorburg power plant will create and guarantee jobs. In the future, nearly 350 people will be employed in the operation and maintenance of the power plant by Vattenfall and suppliers. This will provide the 96 employees of the Wedel power plant, scheduled for closure in 2012, with an opportunity for continued employment. At peak times



Photographic illustration of the Moorburg Plant upon completion.

during the construction process, up to 2,000 workers will be employed at the construction site. In addition, service companies in the region will receive an extra boost, while the port of Hamburg will gain in status as an international port through the addition of four to five million tonnes of bulk freight.

Hamburg will benefit not only from the newly created jobs. Construction of the power plant and the district heating pipeline will generate some EUR 2.5 billion in investment for the city of Hamburg. Based on experience, it can be expected that approximately 30% of this investment sum will benefit companies in the metropolitan area. Starting in 2012, operation of the power plant will generate significant tax revenue for Hamburg in addition to the fees charged for the use of the cooling water and for the port.

Effects of introducing a new highly efficient power plant

The new power plant will have an electrical net efficiency rate of 46.5%, which is very high compared to power plants around the world. Through the cogeneration of heat and power (CHP), this will result in a fuel utilisation rate of up to 61%. The new Moorburg power plant, with its comparatively low specific CO₂ emissions, will contribute to pushing older, less efficient plants with higher emissions off the market. The phase-out and replacement of these older plants will result in an overall decrease in specific CO₂ emissions per kWh in Germany.

Vattenfall estimates that, once operating on a continuous

Stakeholder comments on the Moorburg plant

“Building the Moorburg power plant is the only way to ensure that the greater Hamburg area is supplied with affordable electricity and environmentally friendly district heat, while simultaneously contributing to the fulfilment of Germany’s climate targets.”

Frank Horch

President of the Hamburg Chamber of Commerce and Chairman of the Federation of Hamburg Industries (Industrieverband Hamburg, IVH).

“Today 10% of Germany’s electricity is based on gas. Lignite and hard coal account for half of the electricity market. To replace coal with gas, the input of gas would have to be nearly five times higher... So much gas is not available in the market, and it also would have a great impact on the price of electricity.”

Sigmar Gabriel

Federal Minister for the Environment, Nature Conservation and Nuclear Safety, government declaration to climate policy of federal government, 26 April 2007, Berlin.

“Fossil fuels, and especially coal, will continue to be used in the newly industrialised nations of India and China for a long time to come. And for this very reason, the leading technology countries must do all they can to ensure that technologies for the “clean” usage of coal are ready for use to a broad extent. And this also includes the capture and storage of carbon dioxide through CCS technology.”

Klaus Töpfer

Former Federal Minister for the Environment, Nature Conservation and Nuclear Safety and Executive Director of the United Nations Environmental Programme (UNEP) in Nairobi; quoted in the German newspaper Welt am Sonntag, 31 March 2008.

NGO criticism of Moorburg plant

Construction of the Moorburg plant has been criticised by nature conservation and environmental protection organisations such as Greenpeace as well as by national organisations such as BUND, Robin Wood, etc. Their argument against the Moorburg plant is that its size is not necessary for Hamburg’s energy needs, and that a smaller district heating plant would be enough. Opponents also argue that the Moorburg power plant will have a negative impact on the climate for decades to come and that it will prevent the development of renewable energies. They argue that alternatives such as gas power plants or block heating plants, and an increased usage of renewable energies, should be considered. According to these NGOs, a gas-fired plant combined with other technologies would have a lesser environmental impact.

basis, the Moorburg power plant will produce approximately 750 g CO₂ per kWh delivered to the grid (g/kWh net), compared with older coal-fired plants, which produce roughly 1,001 g/kWh. In total, this equates to an annual reduction of approximately 2.3 million tonnes of CO₂. This has been confirmed by an independent report from TÜV Rheinland, a provider of technical services (the report is published on www.vattenfall.de/moorburg).

Modernised district heating will reduce CO₂ emissions

Looking beyond electricity generation, further CO₂ reductions will be achieved through the modernisation and extension of the district heating system in Hamburg. This extension is in line with the decision by the German Bundestag to double the share of combined heat and power, to 25% of total electricity generation, by 2020. In order to achieve this, the extension of district heating systems is necessary, especially in major cities.

Today 415,000 homes are connected to the district heating network in Hamburg. By 2015 Vattenfall will supply around 425,000 homes with district heat, with this figure rising to 525,000 by 2030. The Moorburg power plant, with its high-performance efficiency, and as the largest supplier of heat in the Hamburg district heating network, will be key to meeting these targets.

Compared with decentralised gas heating, the district heat supplied by Moorburg will produce less than half the CO₂ emissions thanks to the efficiency of combined heat and power generation. Each home connected to the district

heating network – with an average area of 70 m² – will save one tonne of CO₂ annually (according to Vattenfall’s estimations). In the future, the extension of the Hamburg district heating system will lead to annual savings of approximately 160,000 tonnes of CO₂ emissions compared with heating from decentralised oil or gas-fired heating systems.

A power plant well within the statutory limits

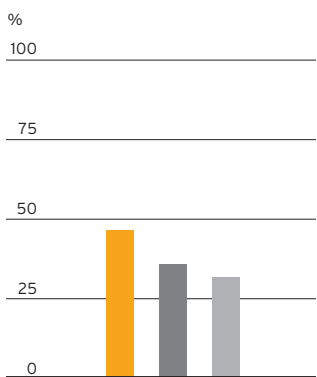
Owing to its modern flue gas cleaning system, the Moorburg plant also falls well below the statutory limits for airborne pollutants and noise pollution. Emissions will be minimised by highly effective measures such as flue gas denitrification, filtering using electric precipitators and flue gas desulphurisation. Consequently, the requirements for dust and sulphur oxides will be undercut by 50% and those for nitrogen oxides by 60%.

In addition, measures taken in the construction of the plant will reduce noise to a level that is lower than traffic and general noise levels in a city residential area.

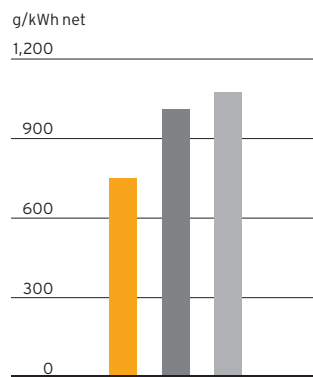
There are also other areas, beyond the statutory limits, in which Vattenfall is working to limit the effects of the power plant. For example, Vattenfall is committed to protecting the adjacent Elbe River, from which the plant will take its cooling water. The cooling system is designed to minimise any increases in temperature caused by the discharge of cooling water in the river, thereby protecting biodiversity.

Efficiency of the Moorburg plant

Net efficiency for electricity generation without district heat



CO₂ output per kilowatt hour of electricity generated



The new power plant will have an electrical net efficiency of 46.5%, which is very high compared with power plants around the world. The continuous cogeneration of heat and power will result in a fuel utilisation rate of up to 61%. The Moorburg power plant will produce approximately 750 g CO₂ per kilowatt hour delivered to the grid (g/kWh net), compared with approximately 1,001 g/kWh for older coal-fired power plants in the EU.

- Moorburg power plant
- EU coal-fired power plant average 2008
- Coal-fired power plants, worldwide average 2008

Source: Plant data and World Energy Outlook 2008, IEA



From 2007 to 2012 Vattenfall is building a new combined heat and power plant in Hamburg-Moorburg, Germany. Vattenfall's investment for the plant is valued at more than EUR 2.5 billion. The new Moorburg plant will provide approximately 85% of Hamburg's electricity and 40% of its district heating. The photo above shows the Moorburg building site in January 2009. At left is an artist's rendition of the Moorburg plant upon completion.