

THE SKÆRBÆKVÆRKET CHP PLANT



DONG
energy

DONG ENERGY A COMBINED HEAT AND POWER PLANT (CHP)

Skærbækværket is one of DONG Energy's ten central CHP plants. Skærbækværket was built in 1951 and is beautifully located in Skærbæk at the mouth of Kolding Fjord.

Skærbækværket consists of unit 3 from 1997 with a capacity of 392 MW.

The Skærbækværket unit 3 is a combined heat and power plant which produces both power for the HV grid and supplies district heating to the Triangle Region Denmark.

Unit 3 is located west of the old units and consists of a 90 metres high boiler house, a 32 metres high turbine building, a 48 metres high storage tank and a 120 metres high stack. Thus Skærbækværket is a distinctive structure at the mouth of Kolding Fjord.

At the commissioning in 1997 the Skærbækværket unit 3 set the world record of natural gasfired plants with a total efficiency of 49 % at 100 % power production. At combined heat and power production the plant can achieve a total efficiency of 93 % which makes it one of the world's most efficient power plants.

Furthermore the utilisation of natural gas entails that the environmental impact is reduced to a minimum. Firing natural gas the power plant ensures that no particles, fly ash or considerable amounts of sulphur are produced during operation. The use of low-NOx burners reduces the formation of nitric oxides in the flue gas.

Technical key data

Commissioned	1997
Fuel type	Natural gas
Max power production (net)	392 MW
Max district heating production	444 MJ/s
Gas consumption at full load/time	76,800 Nm ³
Steam pressure	290 bar
Steam temperature	580 °C



HOW HEAT AND POWER ARE PRODUCED AT SKÆRBÆKVÆRKET CHP PLANT

The heat and power production at Skærbækværket is primarily based on natural gas, and the production is made with a strong focus on the environment and cost effectiveness. The combined heat and power production at Skærbækværket means optimum utilisation of fuel, ensuring an advantage in terms of savings in resources and protection of the environment.

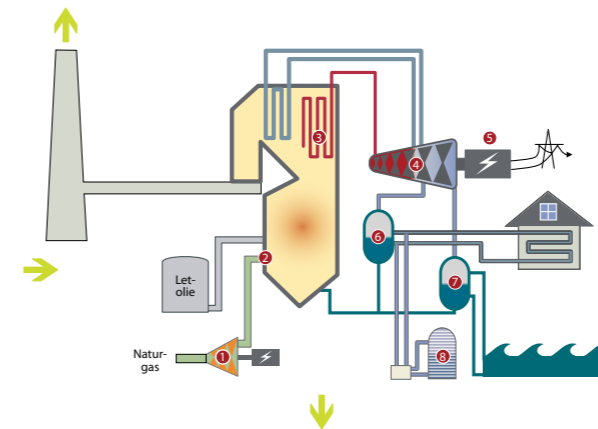
Cogeneration of heat and power

The basic process at Skærbækværket CHP plant is to convert the energy in the fuel into district heating and power. The natural gas is transported to Skærbækværket in a pipeline at a pressure of 65-80 bar. This pressure is used to produce power via an expansion turbine connected to a generator. Consequently the pressure is reduced and the natural gas is transported at a low pressure to the 16 burners of the boiler. The heating energy from the combustion is transformed in the boiler pipes into steam which at high pressure and temperature is led to the steam turbine. In the turbine the steam makes the turbine blades rotate and the energy is transformed into electricity in the generator.

According to the immediate production requirements, the steam may either be taken out on its way through the turbine steps and used for district heating production in the heat exchangers – or it may be used for maximum power production in which case the steam leaves the turbine after the LP part to be cooled in the condenser. The cooling is made by water from Kolding Fjord. In both cases the steam is condensed back into water and circulated back to the boiler to begin the process of producing power again and again. The district heating water is either circulated directly into the district heating system or stored in the storage tank.

Fuel

Skærbækværket annually consumes 280 to 310 million m³ natural gas. The natural gas is transported in a pipeline direct from the North Sea, and at full load the fuel consumption is 76,800Nm³ per hour, corresponding to 120 tonnes of natural gas per hour. Oil is used for the startup of the plant and as spare fuel. The annual consumption for this purpose is approx 3,000 tonnes of oil.



Workflow

1. Expansion turbine (4 MW)
2. Burners
3. Boiler pipes
4. Turbine
5. Generator
6. District heat exchanger
7. Condenser
8. Storage tank

FROM NATURAL GAS TO HEAT AND POWER

Power production

The power production from Skærbækværket is sold on market terms. This means that production may vary much from one year to the other. The power production is solely determined by supply and demand on the Nordic power market and by the relation between fuel and power prices. When the power price is low because of large domestic power production from wind turbines or large hydroelectric power production in Norway, Skærbækværket reduces its production. Correspondingly the power production will be low, if the natural gas price is high compared to the price of coal.

The power produced at the plant is sold on a daily basis at the Nordic Power Exchange, NordPool in Norway, where the price is set by supply and demand.

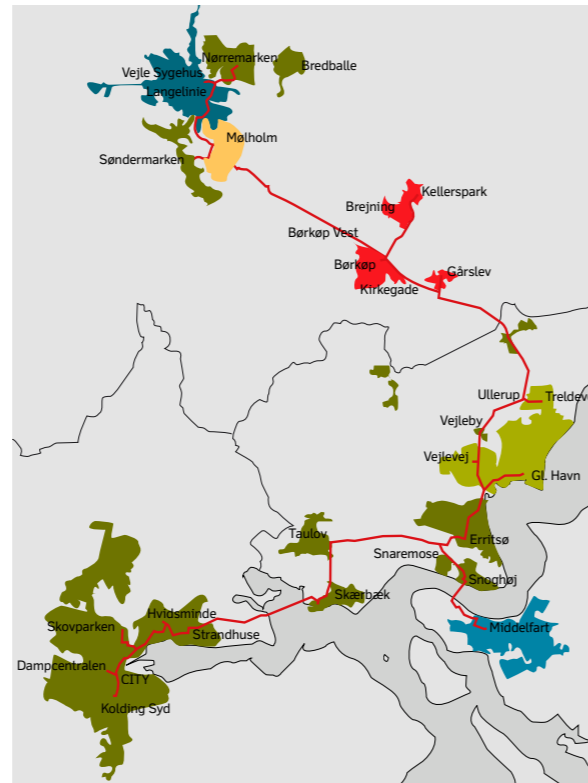
District heating

Skærbækværket utilises the surplus heat from the production of power to produce district heating. The district heating from Skærbækværket is sold to Trekantområdets Varmetransmissionselskab (TVIS) which supplies district heating to the municipalities of Fredericia, Middelfart, Vejle and Kolding.

The district heating water is stored in Skærbækværket's storage tank. The storage tank is 47.5 metres high and has a diameter of 28.5 metres. The tank has a capacity of approx 25,000 m³ of district heating water with a temperature of up to 120 °C.

The storage tank has a capacity of 5,500 GJ of heat at full load, corresponding to the quantity of heat supplied by Skærbækværket to the district heating system for eight hours on a normal winter's day.

- Mølholm heating plant
- Gæverslund district heating
- Vejle district heating
- Middelfart district heating
- Fredericia district heating
- TRE-FOR
- Transmission grid for district heating



SKÆRBÆKVÆRKET SEEN FROM ABOVE

1. Boiler house

The boiler house contains boiler plant, fans and air pre-heaters. The auxiliary steam boiler is also placed in the boiler house.

2. District heating building

The district heating building contains circulating pumps and a pressure holding vessel.

3. Turbine building

The engine room contains turbine and generator plant as well as freshwater and deionate tanks.

4. Control room

The plant is monitored from the control room which is situated on the top floor of the building in which also switch-gear and control system are located.

5. Storage tank

The storage tank for district heating holds approx 25,000m³ of district heating water.

6. Stack

The unit 3 is 120 metres high.

7. Reception desk

8. Oil storage

The fuel oil storage consists of three tanks each with a capacity of 40,000 m³.

9. Cooling water inlet

10. Cooling water outlet

11. Service building

The service building includes workshop and storage.

12. Building with old plant

Part of the building now accommodates the Inbicon plant.

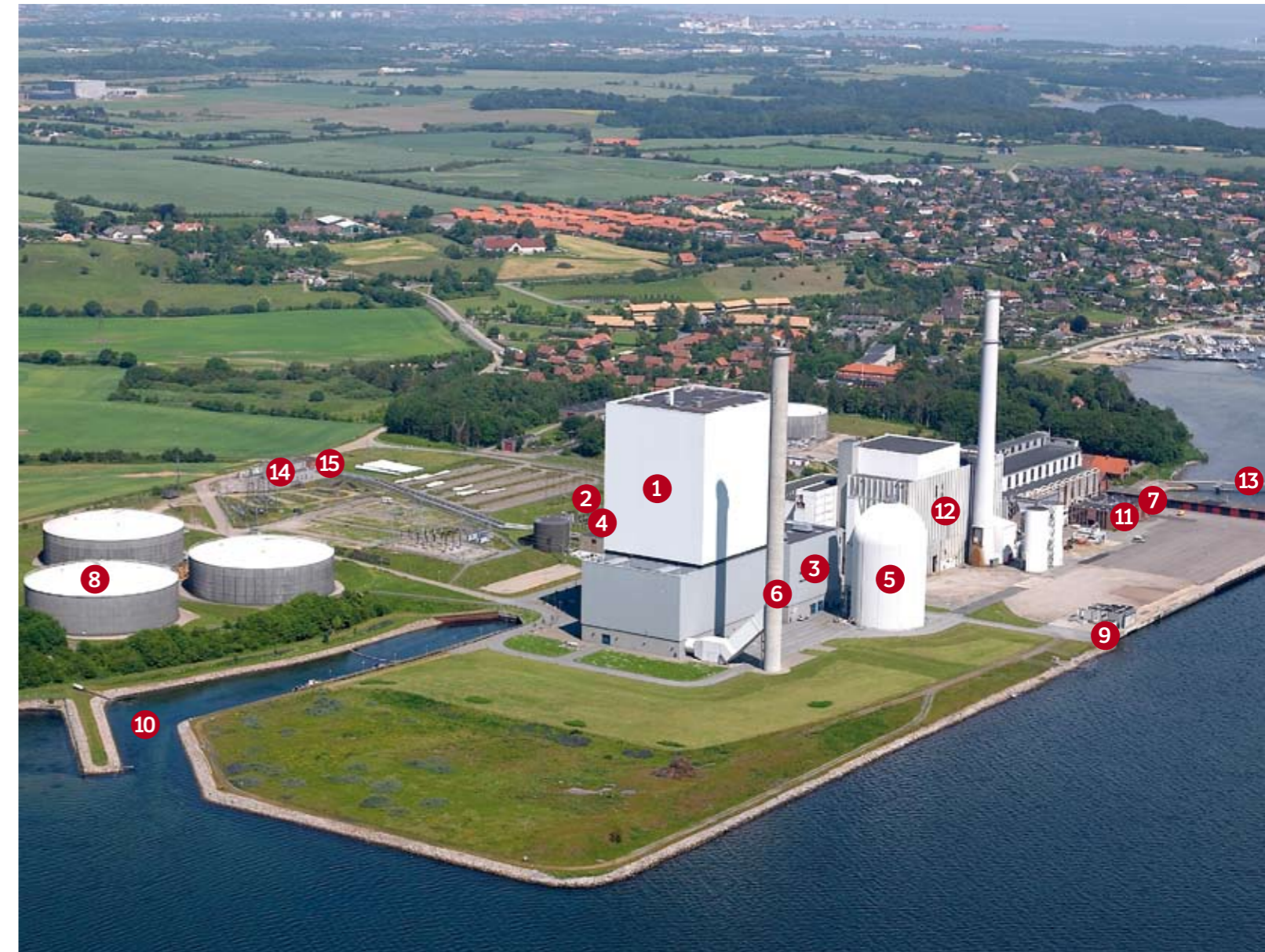
13. Oil pier

14. MR station

Includes gas pressure reduction station and turbo expander.

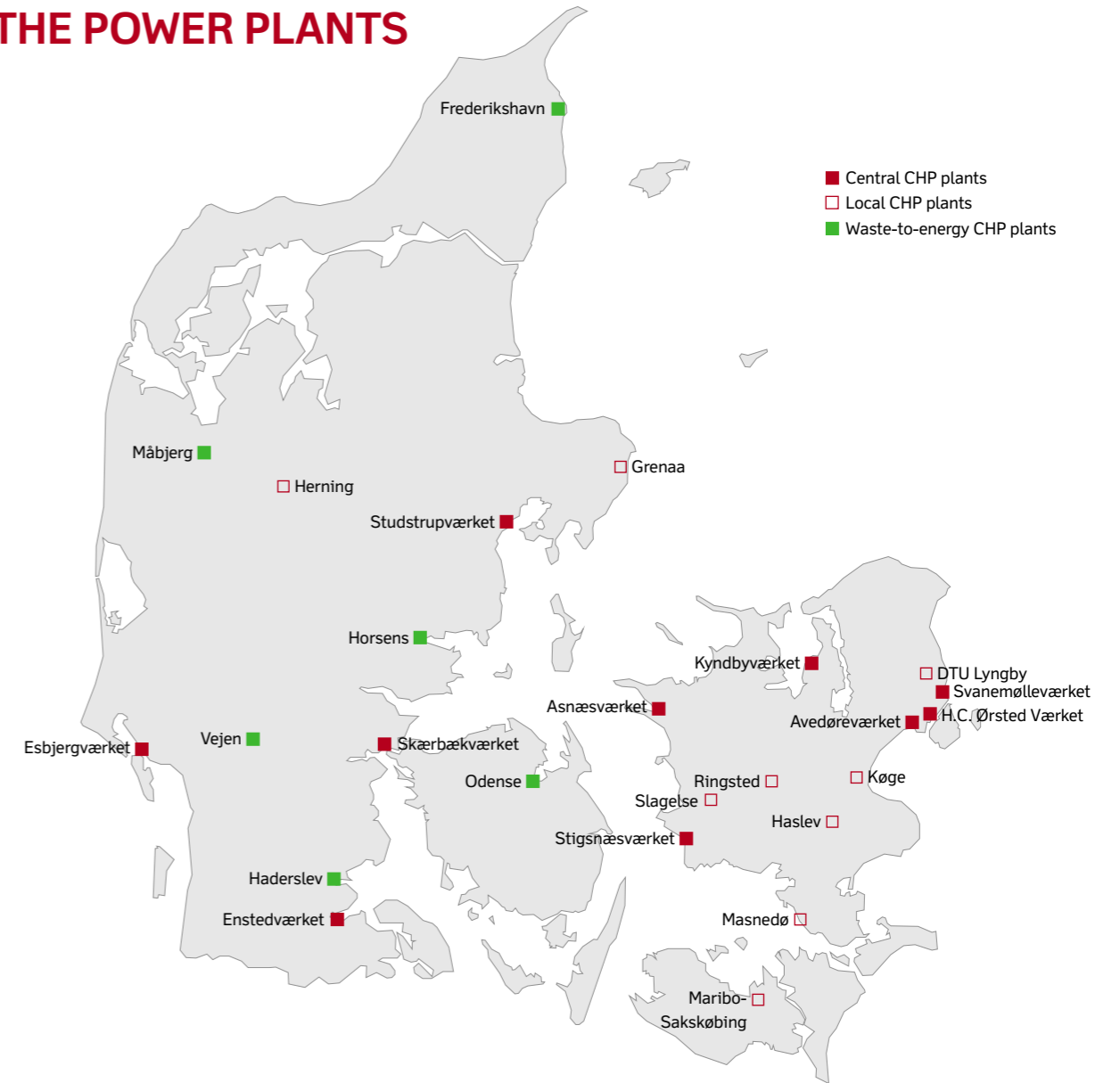
15. Distribution station

Distribution station for TVIS.





THE POWER PLANTS





DENMARK'S NEW ENERGY COMPANY

DONG Energy is Denmark's new energy company established in 2006.

DONG Energy is active in all links of the energy supply chain – from offshore oil rigs in the North Sea, power plants producing heat and power, and wind farms, until to marketing the energy and transport it all the way to our customers' doorsteps in Denmark and abroad.

This ensures a highly reliable supply of energy and gives us the necessary expertise for developing our company for the future.

DONG Energy has many years of experience. For more than a hundred years we have been supplying power to the Danish consumers and developed the special Danish tradition of combining the production of heat and power.

Since the beginning of the 1980s, we have also supplied oil and natural gas to the Danish consumers.

Innovation is a natural part of how we work. We have been involved in the extraction of the North Sea's reserves of oil and natural gas for 25 years, and our power plants are some of the most efficient and eco-friendly in the world.

We are also at the cutting edge in the development of renewable energy, not least in the establishment of offshore wind farms.

DONG Energy has increased its international activities significantly and is now an international energy company focusing on the North European energy markets. On the liberalised market the customers are free to choose their energy suppliers and DONG Energy competes every day against other energy companies to be the consumers preferred supplier.

Yet, still being a small player on international scale, DONG Energy is rapidly developing its activities in all aspects of energy supply to be well-positioned for future competition on the energy market.

www.dongenergy.com

Pay a visit to Skærbækværket

Skærbækværket is pleased to arrange visits for groups and schools for a presentation of our CHP producing facilities.

If you would like to have more information about the visits, please contact Skærbækværket on tel. +45 99 55 99 70.

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