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Pay a visit to the Asnæsværket

Asnæsværket is pleased to arrange visits for groups and schools for a tour of our heat and power producing facilities.

If you would like to have more information about the visits, please contact Asnæsværket on telephone +45 99 55 06 00.

DONG Energy Power A/S

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THE ASNÆSVÆRKET CHP PLANT



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DONG ENERGY A/S ASNÆSVÆRKET

Asnæsværket is one of DONG Energy's ten central power stations and is situated at Kalundborg Fjord. The first production unit was commissioned in 1959. Since then, another four production units have been constructed from 1959 to 1981. Unit 5 commissioned in 1981 is the largest and most recent unit at Asnæsværket.

Asnæsværket is a base load combined heat and power plant which means that it is designed to produce heat and power day and night. Today, the power station has two operational units ie, unit 2 and unit 5, whereas in 2008 unit 4 was taken out of the daily production planning and now acts as a spare unit.

The oldest unit, unit 1, was shut down in 1998 after 210,000 operating hours, and unit 3 was shut down in 2002.

The power station is continuously maintained and has been technically and environmentally improved several times.

In 2002, a storage tank for hot district heating water was installed at the plant increasing the reliability of supply of district heating. In 2004, a DeNOx plant was installed on unit 5, reducing the content of nitrogen oxides in the flue gas. At the same time, the lifetime of the unit was extended so that it can produce power, steam and heat for another 12-15 years.

Furthermore, from 2010, a new desulphurisation plant will be installed at unit 2.

Asnæsværket produces power for the Nordic power grid, heat for Kalundborg and process steam for a number of companies in Kalundborg.

Asnæsværket is Denmark's largest power station with a total output of 1,057 MWe, 250 MJ/s heat and 492 MJ/s steam.

Power production

The power produced at Asnæsværket is sold on a daily basis at The Nordic Power Exchange, Nord Pool, in Norway, where the price is set by supply and demand. The total power production from Asnæsværket is sold on market terms. This means that production may vary much from one year to another. The power production is solely determined by supply and demand on the Nordic power market and by the relation between fuel and power prices: If the power price is low due to a high domestic power production from wind turbines or high hydroelectric power production in Norway, Asnæsværket reduces its production.

Fuels used at Asnæsværket

Asnæsværket is designed to fire both coal and oil for the production of heat and power. Coal is the main fuel for units 2, 4 and 5.

DONG Energy purchases coal from many countries all over the world, for instance Poland, Russia, Colombia, Norway, Indonesia, South Africa, Australia and China. The coal is transported to the power station by sea in coal barges with a capacity of up to 110,000 tonnes.

The coal is stored in the large coalyard with a capacity of 1.5 million tonnes. The oil tanks at the power station can hold 470,000 tonnes.

THE PROCESS FROM FUEL TO HEAT AND POWER UNIT 5

Unit 5 is the largest and most recent unit at Asnæsværket.

The production unit consists of coal mills, a boiler, a steam turbine and a generator. At full-load production the coal consumption amounts to approximately 250 t/h. The coal is conveyed from the fuel store to the coal mills on a long conveyor belt.

Small and large pieces of coal are pulverised in the coal mills and blown into the burners for ignition. The burners are of the low-NOx type, which reduce the content of nitrogen oxides in the flue gas.

The boiler consists of a large number of water-filled pipes forming the walls in the boiler room. The water is converted into high-pressure steam due to the high temperature in the boiler.

The steam passes on to the turbine at a pressure of 180 bar and a temperature of 545 °C. The energy of the steam

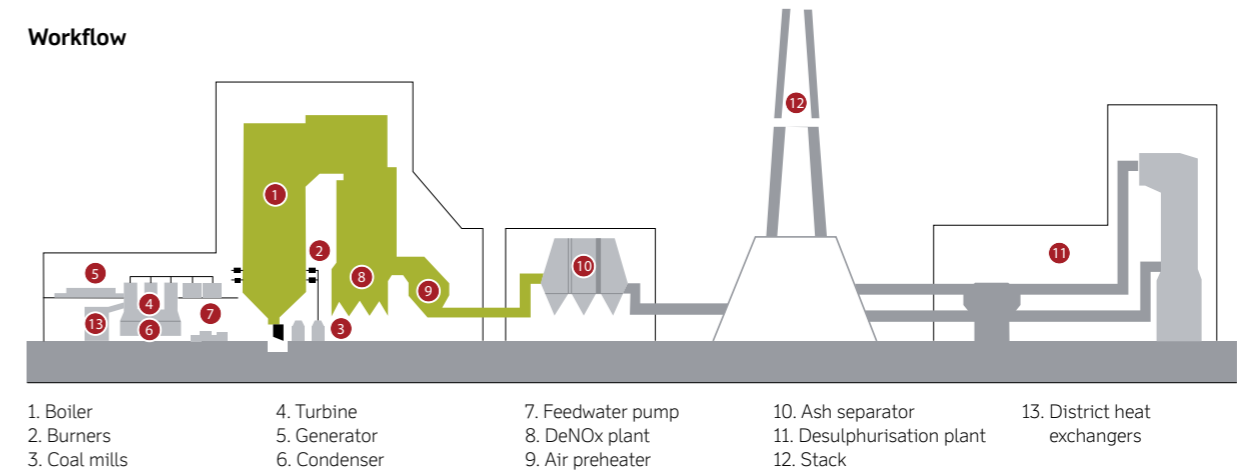
rotates the turbine shaft at 3,000 rpm. The turbine shaft is connected to the generator producing the power.

Before the power is sent to the high-voltage grid, it passes a generator transformer, transforming the power from 21 kV to 400 kV.

The turbine plant consists of high-pressure, intermediate-pressure and low-pressure turbines.

From the intermediate-pressure turbine the steam is distributed between the low-pressure turbine and the district heat exchangers according to the amount of district heating produced. In the district heat exchangers the district heating water is heated to 100-120 °C before it is pumped into the district heating system. Upon passage through the turbine, the steam is condensed in the sea-water-cooled condenser. Then the cooled steam – now condensate – is pumped back into the boiler after which the process starts over again.

Workflow



ASNÆSVÆRKET

WHAT HAPPENS WHERE?

1. Boiler house, units 2-4
2. Boiler house, unit 5
3. Administration
4. Central workshop
5. Desulphurisation plant
6. Electrostatic precipitator
7. DeNOx plant
8. Oil tanks
9. Coal pier
10. Coal store
11. Heat storage tank
12. Ash silos
13. Bioethanol plant



The environment

When the flue gas leaves the boiler, it first passes a catalyst in the deNOx plant. In the catalyst, the content of nitrogen oxides (NOx) in the flue reacts with ammonia. This process converts up to 85 percent of the nitrogen oxides into nitrogen-free water. The flue gas is then led through an electrostatic precipitator which collects more than 99 per cent of the fly ash in the flue gas. The fly ash separated from units 2-5 is used in the cement and concrete industry or for road construction.

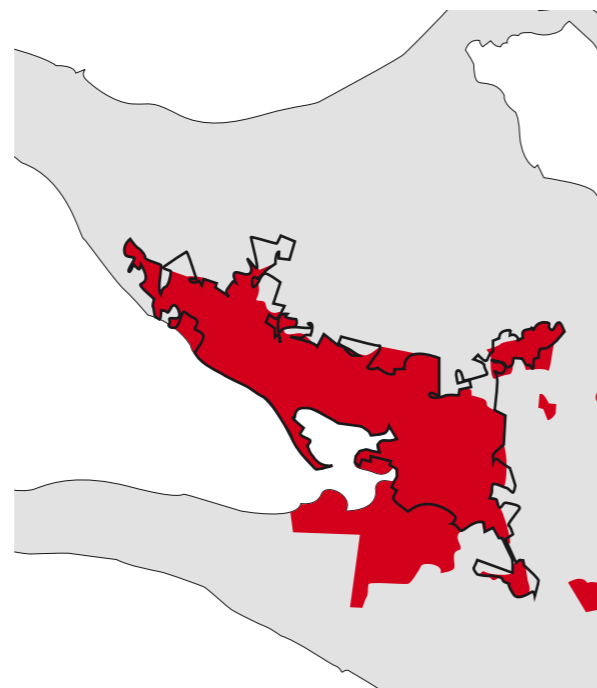
From the electrostatic precipitator the flue gas is led to the desulphurisation plant which removed more than 98 per cent of the sulphur dioxide (SO2) from the flue gas. It is a chemical process where the flue gas is "washed" with lime sludge. Lime, water and sulphur form the mineral product gypsum separated in filters and led to the gypsum store. The gypsum is used for the production of plaster boards and cement for the construction industry. Units 2 and 5 of Asnæsværket produce a total of 300 tonnes of gypsum a day. Unit 4, which is a spare unit, is not equipped with a desulphurisation plant or a deNOx plant. Unit 2 is equipped with low-NOx burners reducing the formation of nitrogen oxides in the combustion process.

The gypsum produced at the Asnæsværket desulphurisation plant is among other things used for the production of plasterboards at the neighbouring company Gyproc. The fly ash from the coal-fired units is sold for the production of cement and concrete. The fly ash is collected by lorries and ships.

District heating

Asnæsværket uses part of the excess heat from the production of power to produce district heating. The district heating from Asnæsværket is sold to the municipal district heating company in Kalundborg. The district heating water is

sent either directly to the district heating system or stored in the storage tank. It is a gigantic vacuum jug with a storage capacity of 20,000 m³ of hot water to be used in the district heating system at times with a low district heating demand. This ensures a large flexibility in the production of heat and power, and the heat storage tank can supply the district heating system in Kalundborg one winter day or an entire weekend in the summer. The storage tank makes it possible to plan the production of heat and power at all hours for an optimum utilisation of the fuel of benefit to both the environment and the economy.



- Urban area
- District heating area of Kalundborg

Technical key data

| | Unit 2 | Unit 4 | Unit 5 |
|------------------------------------------------|-------------------------|-------------------------|-------------------------|
| Commissioning year | 1961 | 1968 | 1981 |
| Renovated | 1991 | | 2004 |
| Normal working pressure at su-perheater outlet | 155 bar | 180 bar | 180 bar |
| Normal steam temperature at superheater outlet | 545°C | 545°C | 545°C |
| Fuel | Coal and heavy fuel oil | Coal and heavy fuel oil | Coal and heavy fuel oil |
| Heat production (heat and steam) | 244 MJ/s | 50 MJ/s | 308 MJ/s |
| Net performance at full load | 147 MW | 270 MW | 640 MW |

| | |
|--------------------------|-----------------------|
| Auxiliary steam boilers: | 42 MJ/s steam |
| Boiler: | 98 MJ/s steam |
| Heat storage tank: | 20,000 m ³ |

The plants are controlled and monitored from the control room

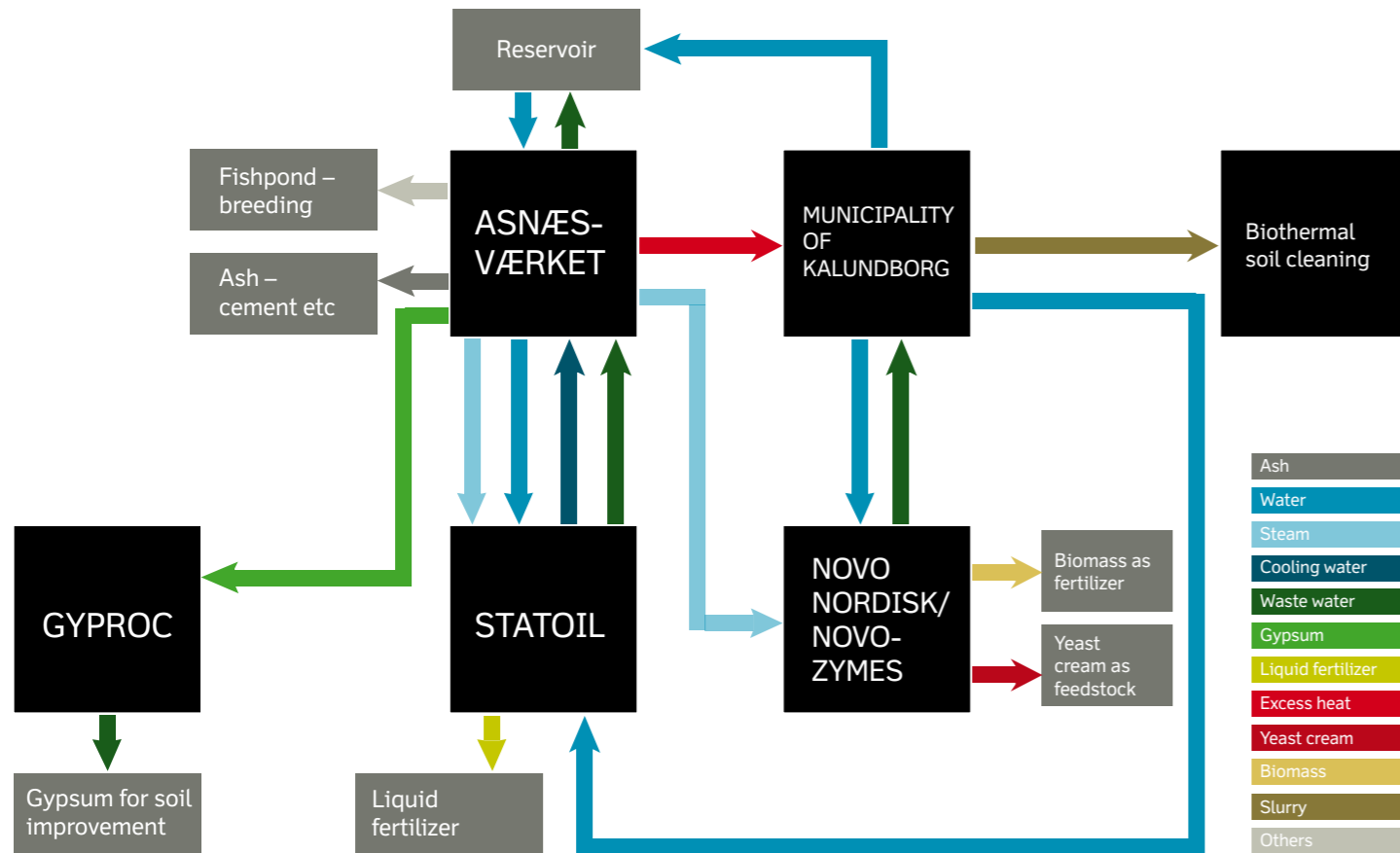


Asnæsværket in industrial symbiosis

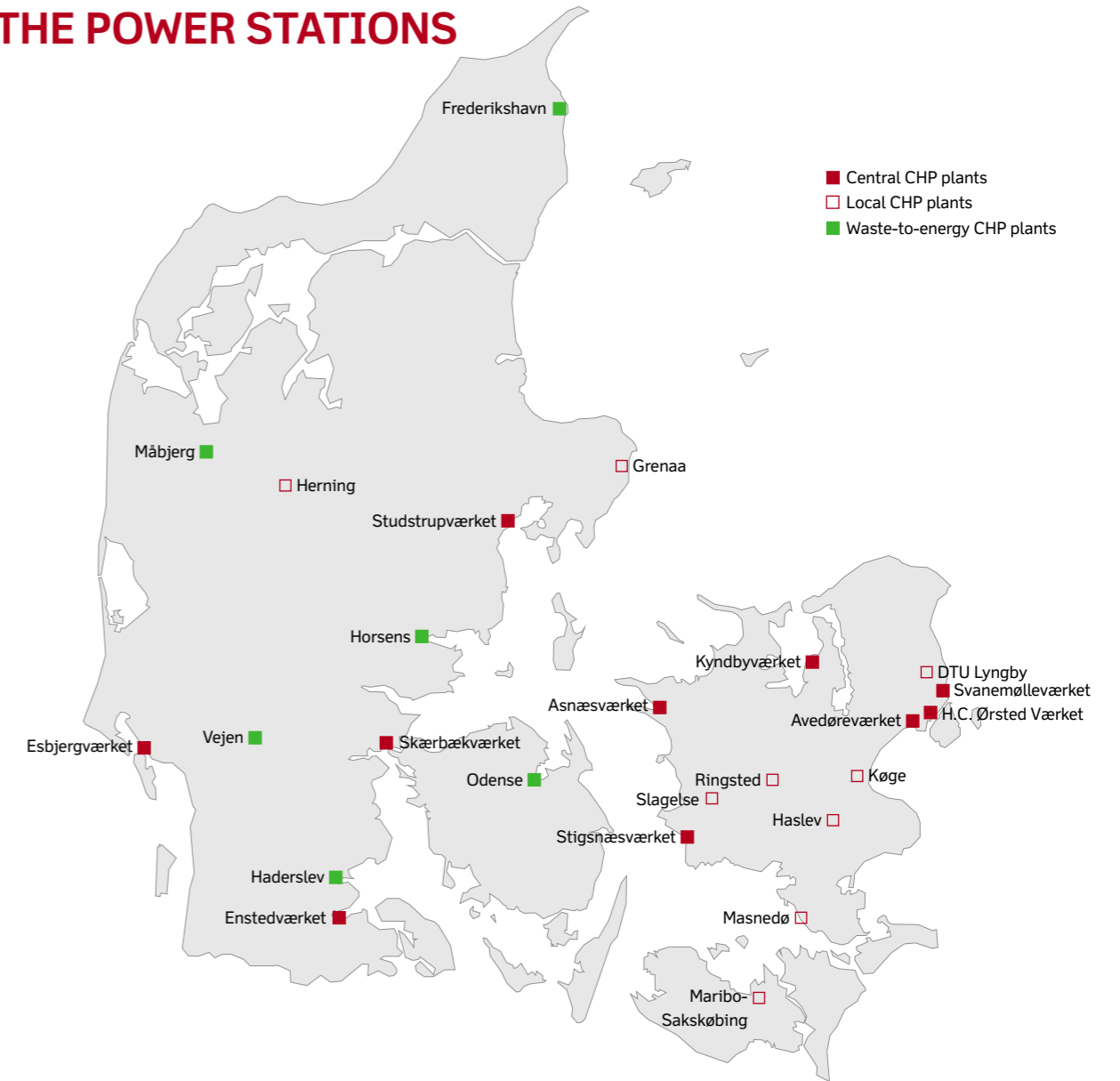
Asnæsværket is attending an industrial symbiosis in Kalundborg. The industrial symbiosis is a network cooperation between five large companies in Kalundborg and the municipality of Kalundborg.

The idea of the symbiosis is for Asnæsværket, the plasterboard factory Gyproc, the medical and biotechnology factory Novo Nordisk, the refinery Statoil and RGS 90 A/S to

utilise each other's by-products. By-products from one company may be an important resource for the other company. The result is a lower resource consumption and less environmental impact. The exchange of by-products is based on sound economic principles for the benefit of all parties involved.



THE POWER STATIONS





DENMARK'S ENERGY COMPANY

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

DONG Energy is active in all phases of the energy supply chain – from offshore oil rigs in the North Sea, power stations producing heat and power, and wind farms, until we market 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 to develop 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. For more than 25 years we have been involved in the extraction of oil and

natural reserves in the North Sea, and our power stations are among 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 customers' preferred supplier.

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