

THE H. C. ØRSTED VÆRKET  
CHP PLANT



**DONG**  
energy

# DONG ENERGY

## H.C. ØRSTED VÆRKET

H.C. Ørsted Værket, which is located in Copenhagen South Harbour, was commissioned in 1920. At that time it was Denmark's largest power station with an output of 23 MW. Since then, H.C. Ørsted Værket has been retrofitted several times, and today the total output is 106 MW power, 318 MJ/s heat and 567 MJ/s steam.

Today, H.C. Ørsted Værket is a modern, natural gas-fired combined heat and power plant, the principal task of which it is to supply heat to the Copenhagen district heating grid. In addition, it supplies power to the power grid.

H.C. Ørsted Værket covers the heat demand of approximately 140,000 flats or about half as many single-family houses.

### A treasure gone museum

H.C. Ørsted Værket is not only a matter of modern technique. The beautiful turbine hall from the beginning of

the 1930s contains a Burmeister and Wain diesel engine with a 12 MW generator.

Until quite recently, the engine, which is from 1932, functioned as the emergency engine of the plant. The engine is capable of starting on a "dead grid" which means without power from the high-voltage grid – and then energise the other plants to make them start.

The motor has eight cylinders with a diameter of 84 centimetres and uses 3,000 t/h of diesel oil at full load. The old treasure is still operational and is started once in a while.

In connection with the severe power cut in Eastern Denmark in September 2003, the diesel engine was started to make the boilers at H.C. Ørsted Værket capable of maintaining the steam pressure in the steam-based district heating grid of Copenhagen.

Today, the building containing the diesel engine is hired out to MAN who is running the museum Diesel House.



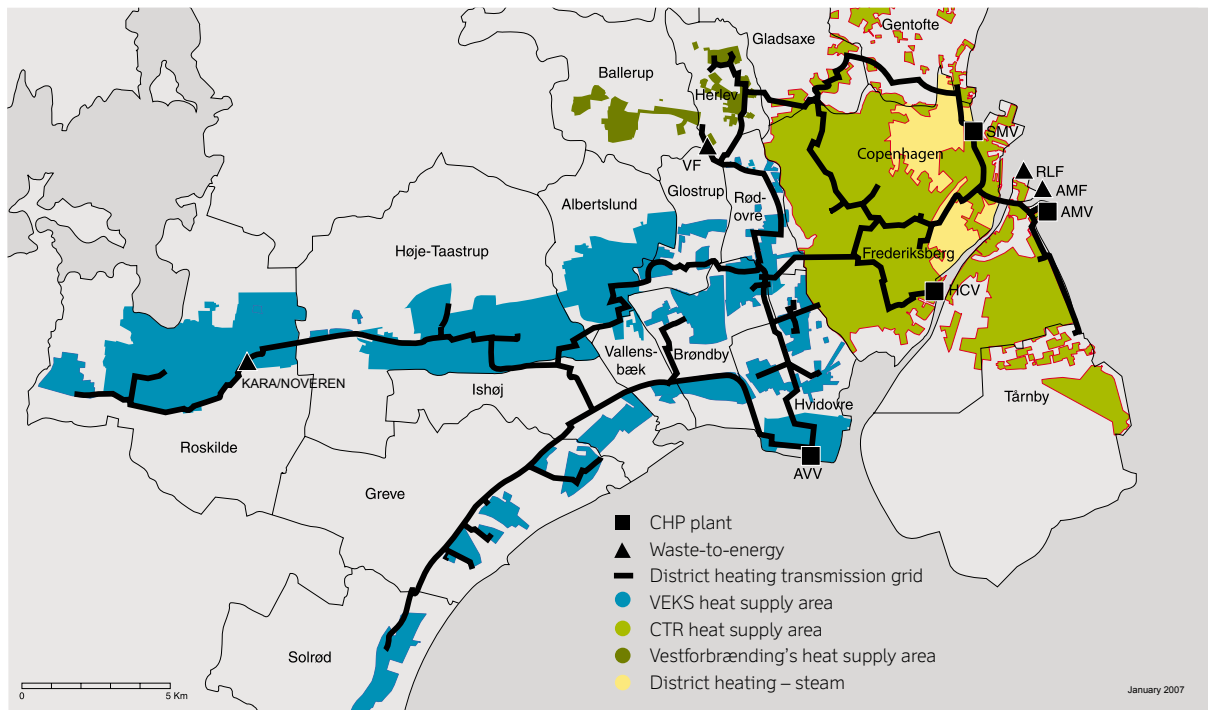
# FROM COAL TO NATURAL GAS

Until 1994, coal was the primary fuel at H.C. Ørsted Værket. The boiler plants were then converted to burn natural gas which is a far more eco-friendly fuel. H.C. Ørsted Værket uses approximately 120 million cubic metres of natural gas annually. Oil is used as spare fuel.

Today, the production plants consist of three parts: Sections 1-2 containing four old boilers of which two are natural gas- or oil-fired and two are oil-fired. Unit 7 from

1984 is fired with natural gas and oil and consists of a boiler, a turbine and district heat exchangers.

Unit 8 from 2003 consists of a natural gas-fired turbine and an exhaust boiler with after burner supplying steam to a common steam bar. Natural gas-firing provides a number of environmental advantages as the emissions of CO<sub>2</sub> and NO<sub>x</sub> are lower than the emission from coal-firing, and the natural gas is desulphurised prior to fired.



The district heating grid goes from Gentofte in the north to Solrød in the south and Roskilde to the west.

# THE PROCESS FROM FUEL TO POWER

The natural gas is lead to the plant through a pipeline. The pressure is reduced from 80 bar to 4 bar in a gas regulator. The gas is then lead to the burners in the three gas-fired boilers. The burners ignite the natural gas, which burns in the boiler at a temperature of approximately 1,000° C. The maximum gas consumption amounts to 68,000 m<sup>3</sup>/h.

The boiler walls consist of water-filled pipes. 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 temperature of 540° C and a pressure of 115 bar.

The high steam pressure in the turbine is transferred to the turbine blades, and the turbine starts to rotate. The

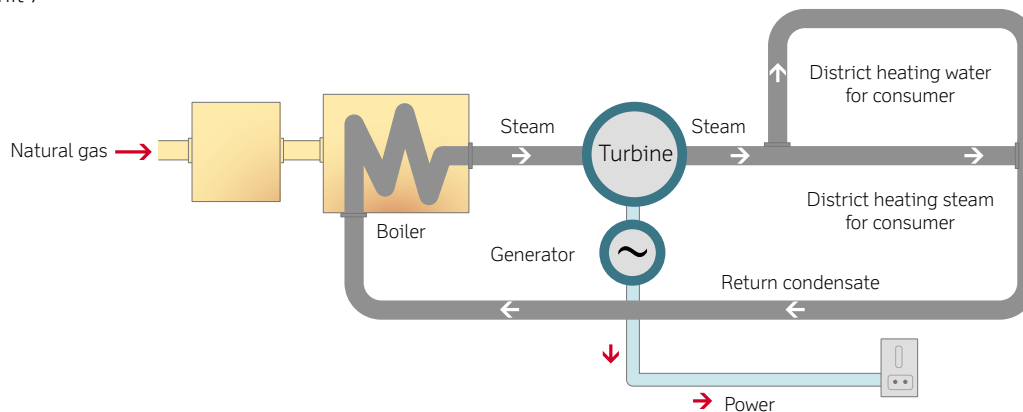
turbine rotates at 3,000 rpm and operates the generator producing power which is sent to the high-voltage grid.

Having left the turbine, the steam still contains a lot of heat. This heat is utilised in the district heat exchangers, either as steam or as hot water. When the steam has passed through the district heat exchangers, it has been cooled and is returned to the boilers as condensed vapour.

By utilising the energy of the steam for production of both power and heat, about 90% of the energy in the fired fuel is utilised. The effective utilisation of the fuel provides great environmental advantages as combined heat and power production reduces the emissions of CO<sub>2</sub>, SO<sub>2</sub> and

## Workflow

Unit 7



NO<sub>x</sub>. By way of comparison a modern power plant without production of district heating uses less than 50% of the energy of the fuel.

The production method at unit 8 is a little different as the natural gas is lead through a regulator reducing the pressure from 80 bar to 25 bar. The gas is burned off in the gas turbine furnace, causing a pressure which makes the turbine blades rotate.

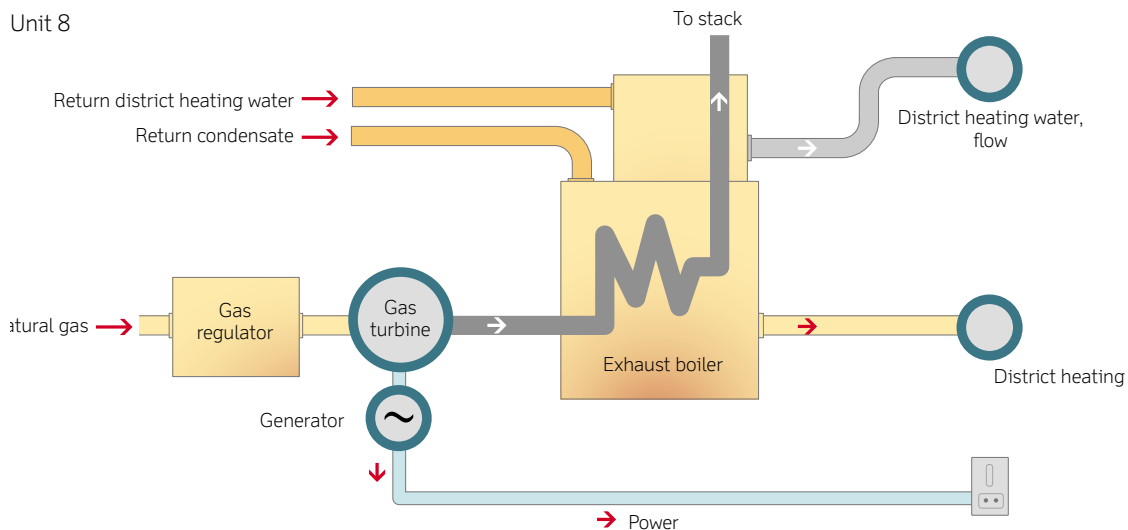
The turbine operates a generator which produces power. The flue gas, which has a temperature of 540° C after

leaving the turbine, passes on to an exhaust boiler and heats the water in the boiler until it turns into steam. In addition to the hot flue gas from the gas turbine, the boiler may also be cofired from a natural gas-fired burner in the boiler itself. The steam from the boiler flows directly into the steam pipes for heating of habitation.

In order to further utilise the energy, unit 8 is equipped with a flue gas cooler at the top of the boiler for production of district heating water.

## Workflow

### Unit 8



# TECHNICAL KEY DATA

Designation	Unit 7	Sections 1-2	Unit 8 Gas turbine	Unit 8 Exhaust boiler	Boilers 21-22
<b>Commissioning year</b>	1984 converted in 1994	1953* converted in 1994	2003	2003	2006
<b>Steam production</b>	400 t/h	400 t/h	-	130 t/h	258 ton/h
<b>Operating pressure/ temperature</b>	115 bar/ 540° C	115 bar/ 540° C	-	12-16 bar/ 250-300° C	17 bar/ 300° C
<b>Feedwater temperature at boiler inlet at full load</b>	22° C	170° C	-	120° C	
<b>Flue gas temperature at full load</b>	140° C	160° C	543° C	70° C	
<b>Fuel</b>	Natural gas/oil	Natural gas/oil	Natural gas	Natural gas	Gas oil
<b>Gross output at full load</b>					
<b>Electricity</b>	94 MW	80 MW	24.5 MW	-	
<b>District heating steam</b>	224 MJ/s	255 MJ/s	-	88 MJ/s	
<b>District heating water</b>	182 MJ/s	130 MJ/s	-	6 MJ/s	
<b>Net output at full load</b>	88 MW	80 MW	24.3 MW	-	
<b>Connected high-voltage grid</b>	30 kV	30 kV	30 kV	-	

\* To be phased out in 2009



# DONG ENERGY AND THE ENVIRONMENT

DONG Energy emphasises the importance of being among the leading environmentally conscious power and heat producing companies.

This means that the environmental aspects are always taken into consideration in connection with economy and other aspects when DONG Energy makes decisions on production and development of heat and power producing plants.

DONG Energy's power stations were the first in Denmark to be environmentally certified according to ISO 14001. H.C. Ørsted Værket was environmentally certified in 2000.

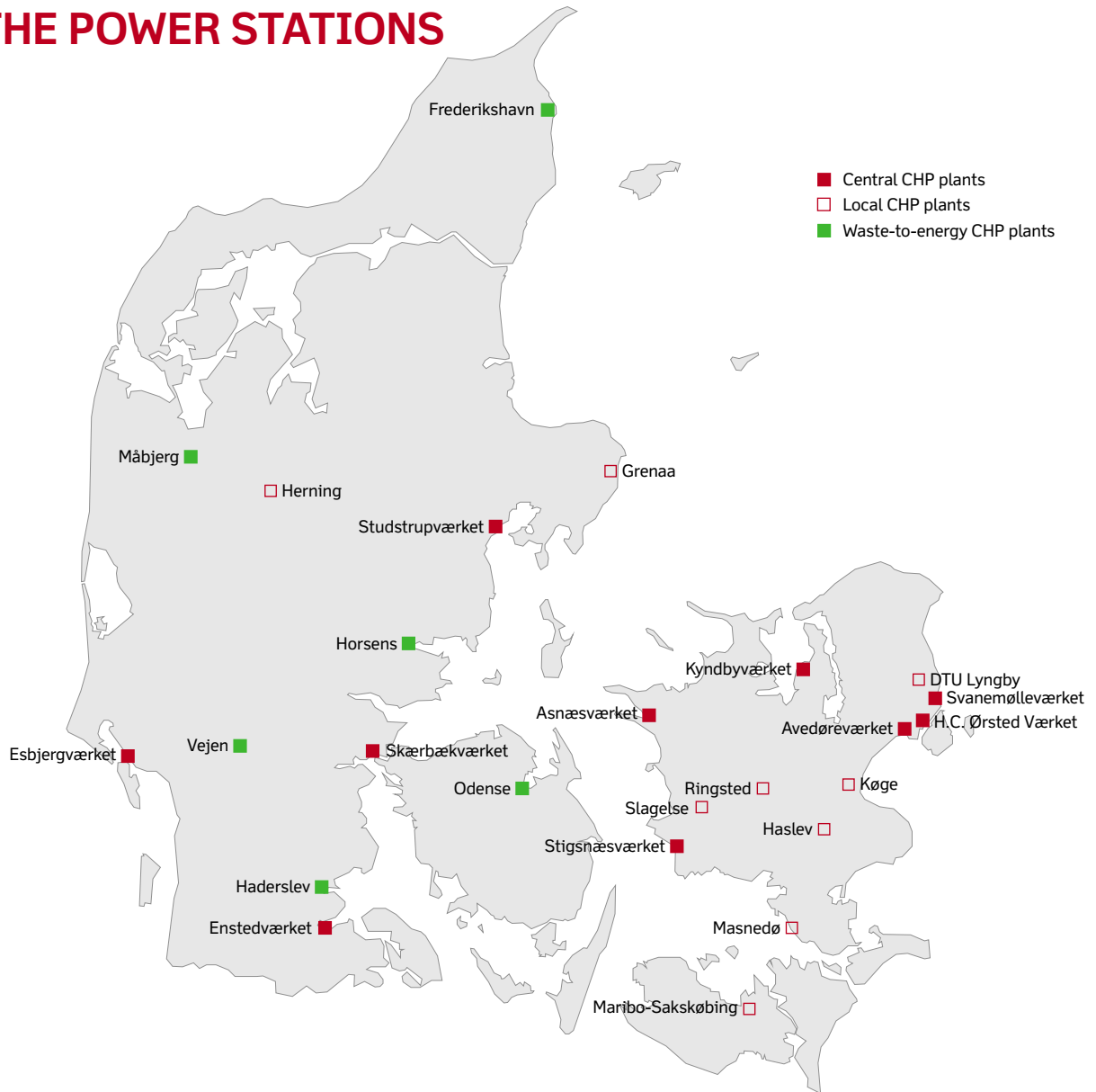
The environmental certification implies that working procedures have been thoroughly documented and optimised with a view to reducing the environmental impact.

**DONG Energy's power stations were the first in Denmark to be environmentally certified according to ISO 14001.**



Control room

# THE POWER STATIONS





## DENMARK'S NEW 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.

[www.dongenergy.com](http://www.dongenergy.com)

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