

## **Visit Avedøre Power Station – One of the top power stations in the world**



Avedøre Power Station is situated less than 10 km from the centre of Copenhagen and is one of the best Combined Heat and Power Plants in the world. Avedøre Power Station has a total capacity of about 825 MW and supplies 200,000 households with heat. It produces about 30% of the total electricity use in Zealand, which is about 1.3 million household's yearly electricity consumption.

By producing both electricity and heat at the same time, the power station is utilizing as much as 94% of the energy in the fuel. Higher energy efficiency, results in a better fuel economy and thereby a reduction of CO<sub>2</sub> emission per produced kWh.

Avedøre Power Station consists of two power units: Avedøre Unit 1 and Avedøre Unit 2. Avedøre Unit 1 was built in 1990 and uses primarily coal as its fuel source and the production of electricity and heat together means that over 90% of the energy in the fuel is being utilized. Avedøre Unit 2 was built in 2001 and is a so-called multi-fuel system that can burn a variety of fuels such as natural gas, oil, straw and wood pellets to produce the heat and electricity. The effective use of energy in the fuels at Avedøre Unit 2 is achieved by changing the vapor pressure and the temperature to levels rarely seen at other power stations around the world.

### **The biggest biomass plant in the world**

Avedøre Unit 2 consists of multiple sub units. There is a steam turbine system, a gas turbine system and a straw biomass plant. The biomass plant is the biggest of its kind in the world and has a capacity of 45 MW and uses 25 tons of straw per hour. The gas turbine system is operated so it is most active when there is a peak demand of electricity, which is in the morning and in the evening.

### **Reuse of waste products**

Before the waste gasses are released into the atmosphere they go through a treatment process which removes NO<sub>x</sub>, SO<sub>2</sub> and fly ash from the gasses. This treatment process results in a waste product of such a high quality, that they can be reused in products like gypsum, concrete blocks and isolation materials.

## Visit a gasworks which produces 30% CO<sub>2</sub>-neutral gas



Kløvermarken Gasworks uses natural gas, biogas and air to produce towngas to the city of Copenhagen. The biogas is produced at a wastewater treatment plant called Lynetten. Sludge from the wastewater is collected in digester tanks where biogas is produced. The biogas is treated to remove hydrogen sulphide, ammonia etc. The treated biogas can then be used in the towngas supply in Copenhagen without removing the CO<sub>2</sub> from the gas. This means that the wastewater will not be wasted!

The city of Copenhagen has a climate goal to be a CO<sub>2</sub>-neutral capital in 2025. This is a very ambitious goal, which means huge challenges for a range of entities, including the authorities, supply companies, traffic companies and property owners.

The production of towngas is more environmental friendly than the production of electricity, which, in Denmark, is produced from coal, oil etc. By adding 30% biogas to the towngas, it becomes even more environmentally friendly. The goal is a towngas supply which is 100% CO<sub>2</sub>-neutral. The appliances used by the customer's today would not burn correctly if the biogas content was to be increased to more than 30% because of the CO<sub>2</sub> content in the biogas. An increase in the use of biogas requires removal of the CO<sub>2</sub>.

The visit to the gasworks will also include a visit to the wastewater treatment plant Lynetten where the production and treatment of the biogas takes place.

Production capacity, Kløvermarken Gasworks	2 production lines capable of 10.000 m <sup>3</sup> towngas/hour
Biogas amount	6 millions. m <sup>3</sup> /year
Towngas costumers	300.000
CO <sub>2</sub> savings by adding biogas	About 8.000 tons/year

## Visit the future heating system – gas-fired heat pump



At the art gallery for contemporary and modern art "Gl. Holtegaard", situated in Gammel Holte north of Copenhagen, there is a heating system consisting of a stand-alone ground-source gas-fired heat pump for heating the indoor areas.

Until now the field-test installation has achieved a high energy efficiency resulting in energy savings of 30-40% compared to a gas boiler. It is possible to improve the energy efficiency even further by optimising the design and sizing using the same technology.

The technology behind the gas heat pump is based on the absorption principle (as in a gas-fired refrigerator) where the gas burner is used for running the absorption process. The process is a maintenance-free closed cycle, which means that the service of the gas heat pump can be compared with the service of a normal condensing gas boiler.

The visit will include a technical part (gas heat pump installation) and a cultural part (visit to the art gallery, [www.holtegaard.org](http://www.holtegaard.org)).

Absorption heat pump, Robur	35 kW
Heat storage tanks	0.5 m <sup>3</sup>
Heated area	450 m <sup>2</sup>