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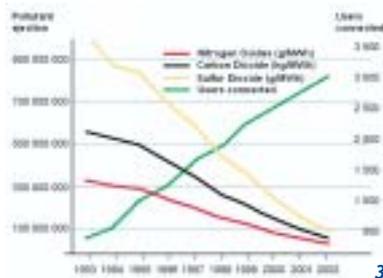
» Värtan Ropsten – The largest sea water heat pump facility worldwide, with 6 Unitop® 50FY and 180 MW total capacity

Client

AB Fortum Värme samägt med Stockholms stad
11577 Stockholm, Sweden

Stockholm's district heating system

Stockholm, the Royal Capital of Sweden, is situated on 14 islands and is considered as one of the most beautiful cities in the world. Its clean sea and air are the result of stringent environmental care. The district heating system is one vital part of the total energy supply in Stockholm.



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Almost 60 percent of the customers on Stockholm's total heat market have chosen district heating. This is corresponding to approximately 5,700 GWh sold per annum to more than 6,000 customers and includes sales of 250 GWh to neighbouring municipalities. These transactions form part of long-term joint projects aimed at achieving rational district heat supply for the region. The distribution network has a length of 765 km.

In Stockholm there is no supply of natural gas, therefore district heating competes mainly with local oil heating as well as electric heating.



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Heat supply for District Heating

Plant	Network	Heat
Värtan	Central	2,600 GWh
Hässelby	North-Western	1,100 GWh
Hammarby	Southern	800 GWh
Högdalen	Southern	1,200 GWh
Total		5,700 GWh

Fortum, a leading energy company in the Nordic countries is responsible for heat/cold production and for the district heating/cooling systems installed in the greater Stockholm area.

High amount of natural sources

The heat supply system of Fortum uses a variety of energy sources:

- 35% Fossil fuels
- 26% Bio fuels
- 26% Waste water and sea water
- 13% Electricity used for heat pumps

The heat pumps (total 420 MW) are used for base load production along with the bio fuel-fired plants (total 200 MW). Oil-fired plants are used in times of high energy demand only.

Fortums district heating production system is increasing the use of bio fuels and solar energy sources. In addition, for large heat pumps, hydroelectric power is utilized. All these measures add up to nearly 50% of renewable energy used for the production of district heat.

Värtan Ropsten district heating plant

About 60% of the total energy input for the Central Network is provided by the Ropsten district heating plant. It has the capacity to operate autonomous during spring, summer and early autumn.

At the beginning of the 1980s, rising oil prices and cheap electricity led to a growing of interest in heat pumps. With a total capacity of 180 MW, the world's largest sea water based heat pump was installed at the Värtan Ropsten plant.

Unitop® 50FY heat pump unit

The 6 heat pump units Unitop® 50FY were commissioned between 1984 and 1986. Originally, all units were operat-





ing with refrigerant R22. A permanently active seal oil system is preventing refrigerant losses during operation and standstill. The retrofit of the first heat pump unit to R134a took place in 2003.

Main features of the Unitop® 50FY

- Open-type double stage compressor
- Refrigerants: halocarbon/hydrocarbon
- Planetary or spur type gears
- Tough industrial design with vertically split casing for easy maintenance
- Suited for all drive systems
- High efficiency over the entire range
- Operating temperatures $-40^{\circ}\text{C}/+90^{\circ}\text{C}$
- Large capacity, small floor space

Heat source

In order to keep temperature drop low, large amounts of sea water are used as heat source. Warm surface water is taken during summer. In winter, the water inlet is in 15 m depth where the temperature is at constant $+3^{\circ}\text{C}$.

A large pump supplies the sea water to falling-film type evaporators of the heat pumps. A thin, steady film of water trickles down the plate surface of the



Technical Data

Heating capacity per unit	30 MW
Power absorbed per unit	8 MW
Evaporating temperature	-3°C
Condensing temperature	$+82^{\circ}\text{C}$
Sea water temper. in/out	$+2.5/+0.5^{\circ}\text{C}$
Heating water temp. return	$+57^{\circ}\text{C}$
Heating water temp. supply	$+80^{\circ}\text{C}$
Capacity control	10–100 %

heat exchangers, with short contact time. It is for this reason that falling film evaporators can be operated with very low temperature differences.

Plant control system

A Siemens PLC-type control system is used for local control and supervision of the heat pump units and for the superimposed control of the entire Värtan district heating plant.

Service and maintenance

Specialists of Fortum are supervising and maintaining the technical installations of the Värtan district heating plant. According to special agreements, Friotherm carries out the regular service works on the 6 heat pump units.

Legend

- 1 The City of Stockholm. District heating systems cover 60% of the heat market.
- 2 General view of a heat pump unit type Unitop® 50FY. Six of these units are installed.
- 3 Improvement of the air from 1963–2002, compared to no. of houses connected to the district heating system. © Fortum
- 4 Uniturbo® 50FY compressor, with base frame and integrated oil tank.
- 5 Aerial view of Stockholm-Värtan, a high industrialised area, using district heating and cooling. © Fortum
- 6 Machine room building for the six heat pump units. Two sea water intake pipes are connected to each unit.
- 7 A sea water pump each per heat pump unit is installed in the pump house.

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