



## » High demand for district cooling and heating in Stockholm 4 Unitop® 33/28CPY for the Nimrod power station

### Client/End user

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11577 Stockholm, Sweden

### The Stockholm district heating and cooling system

The district heating system is a vital part of the total energy supply of Stockholm. Almost 60 percent of the customers of the city's total heat market have chosen district heating. The distribution network has a length of 765 km.

The Stockholm City environmental programme has set very ambitious targets until 2006, such as:

- Reduction of fossil fuel use by 20% by further development of district heating
- Increasing the proportion of renewable fuel in district heating from 65% to 80%

In 1995, Stockholm Energy started supplying properties in central Stockholm with cooling from its new district cooling system. Most of the cooling energy is produced by using cold water from the Baltic Sea. Recent developments made it necessary to install additional mechanical cooling equipment to cope with the continuously growing demand.

### Fortum – Sweden's energy company

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



Alongside good economics for the customer, the products of Fortum also provide added value such as reliable supplies, simplicity and a strong environmental benefit.

### District heating developments

Every year, new connections of approx. 100 GWh to the district heating network of Stockholm contribute to a carbon dioxide reduction in the range of 33,000 tons.

The demand for peak load capacity has increased during the last decades. If the ambient temperature drops from +10°C to -10°C, the additional heating capacity required is just above 1,200 MW, thus equivalent to the demand of 100,000 self-contained houses – or the production of a large nuclear reactor.

### District cooling developments

The demand for district cooling capacity is increasing steadily. District





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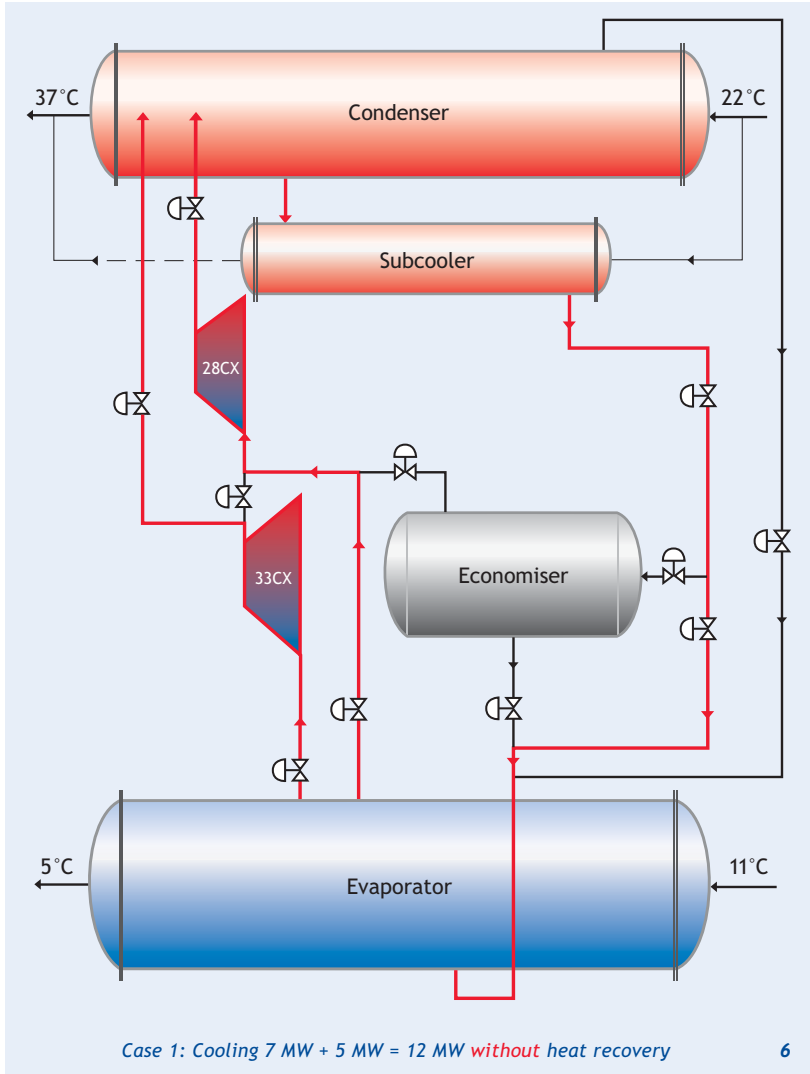
cooling replaces electrically powered local AC-units of any size. Connection is often made to the existing air distribution systems and is therefore easy to manage for the property owner.

District cooling is produced in a more environmental friendly manner than other forms of cooling. Even in case mechanical cooling is required, a district cooling system is reducing the total amount of refrigerant and also minimises the emissions which contribute to the greenhouse effect.

Apart from the system for central Stockholm based on cooling with sea water, the company operates two additional large-scale systems in the Stockholm area. Both are equipped with Unitop® units from Friothersm.

**“Best collective value for customers”**

The customers for heating and cooling are real estate companies in private and public ownership as well as industrial companies. District heating and district cooling are currently of higher importance than investments in possible alternatives. Prices of Fortum’s products are determined by comparing market alternatives; principally oil and electricity.



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**The Nimrod power station**

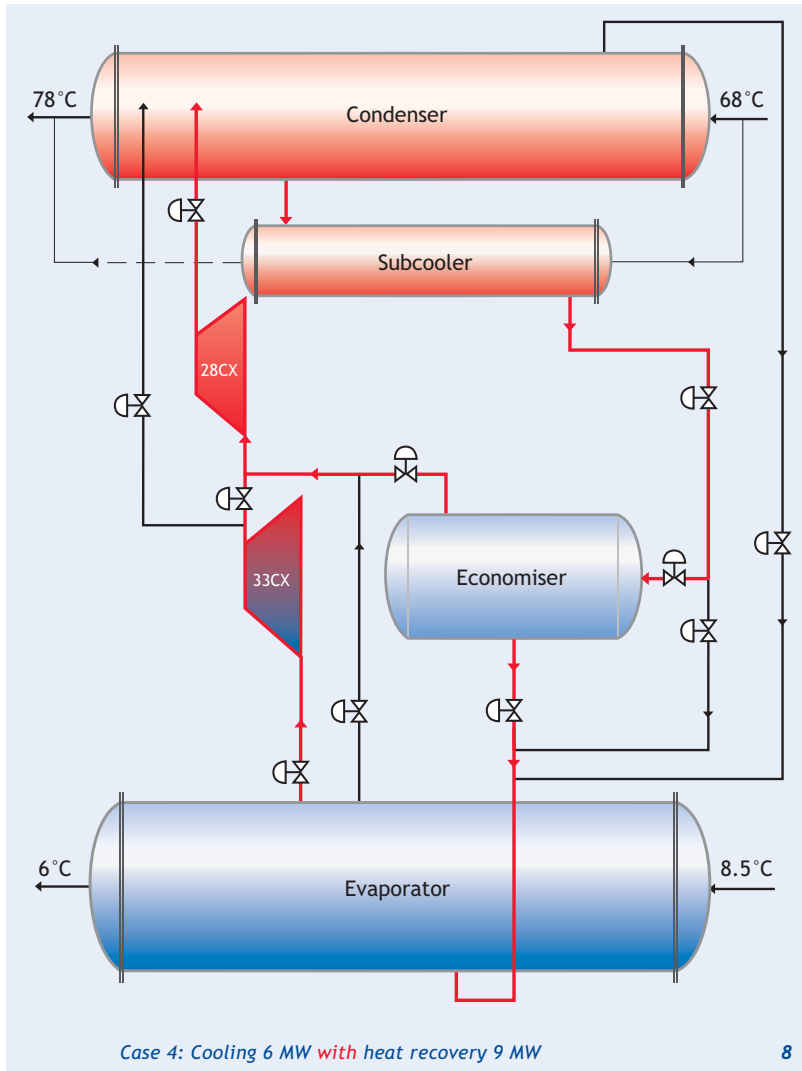
Today’s Stockholm’s Nimrod quarter is close to the centre of the town and far from being the suburb it was in the early 1900’s, when the Nimrod power

station was commissioned. The industrial touch of the red brick buildings is considered a national heritage, with little changes allowed on the outside.





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One of the buildings, formerly housing steam turbines, was chosen to accommodate the new district cooling units.

Friotherm AG delivered four Unitop® Turbo units, with a refrigeration capacity of 12 MW each and a chilled water supply temperature of 5°C.

#### Various operation modes

For the production of the refrigeration capacity required during summer, two compressors type Uniturbo® 33CX and 28CX are operating in parallel, type 33CX with a refrigeration capacity of 7 MW and type 28CX with 5 MW respectively. At times with low cooling load, the capacity of both units is reduced to approx. 20% of full load, resulting in excellent part load values. During summer, heat is rejected to sea water flowing through the condensers of the Unitop's®.

In spring, autumn, winter and – if required – also in summer, the combined refrigeration and heating mode operation of one or several units is possible.

In this case, the Uniturbo® 33CX and the Uniturbo® 28CX are operating in series, the first and larger 33CX as 1st stage unit and the second, smaller 28CX as second stage unit, thus reaching the 78°C supply temperature required.

Pressing a push button is sufficient to change the operating mode by actuating the respective valves (see diagrams 6 and 8).





### Unitop® 33/28CPY district cooling units

Three district cooling units type Unitop® 33/28CPY were commissioned in 2000; another one in 2001. The two compressors of each unit can operate either as standalone, in parallel or in series, depending on the actual requirement. To optimise the efficiency of the three Uniturbo® 33CX even further, it is possible to operate these units in heat pump mode only. The design of the plant allows the use of 35°C waste heat originating from the flue gas cleaning process of the power station. (This feature is an option and not yet operational).

### Main features of the Unitop® 33/28CPY

- Open-type double stage compressors
- 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 (COP) over the entire performance range
- Operating temperatures -40°C/+80°C
- Large capacity, small floor space

### Plant control system

A Siemens PLC-Type control system is used for local control and supervision of the district cooling units at the Nimrod power station as well as for the superimposed control of the entire Värtan district heating plant to which Nimrod belongs.

### Service and maintenance

Specialists of Fortum and Termoekonomi are supervising and maintaining the technical installations of the Nimrod district cooling and heating plant. According to special agreements, Friothers carries out the regular service works on the 4 district cooling units.

### Operating data:

Operating mode	Summer	Winter
Capacities	36,000 kW	17,700 kW
Cold water in/out	11/5°C	11/5°C
Cooling/heating cap.	43,300 kW	26,700 kW
Cold/heat water in/out	22/37°C	68/78°C

### Legend

- 1 Birds eye view of Stockholm seen on a summer day. The city boasts the largest district heating- and district cooling networks worldwide, with a yearly increase in capacity demand of approx. 100 GWh. © Staffan Trägårdh
- 2 Map indicating the greater Stockholm area with district cooling facilities and the area served. The Nimrod facility is part of Värtan and therefore is not shown independently. © Fortum
- 3 View of the Nimrod site during erection. The 4 district cooling units are installed inside a sound reducing cabinet, one behind another. © Termoekonomi
- 4 One of the Unitop® 33/28CPY ready for transport to Sweden. Dim. (LxWxH): 13.2 m x 4.5 m x 4.2 m. Operating weight: 65 tons/unit.
- 5 The ancient building at Nimrod power station in which the 4 district cooling units Unitop® 33/28CPY are installed.
- 6 Principle diagram of a two stage district cooling unit operating in cooling mode only. Both compressors are working in parallel, with single step compression and expansion of the refrigerant.
- 7 A Unitop 33/28CPY arriving on site. The unit is completely factory insulated and pre-wired, thus reducing erection time and costs.
- 8 Principle diagram of a two stage district cooling unit operating in combined cooling and heating mode. The compressors are working in series and the expansion of the refrigerant is done in two stages.
- 9 Older parts of Stockholm are changing rapidly as former industrial quarters are transformed into quiet living areas.

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