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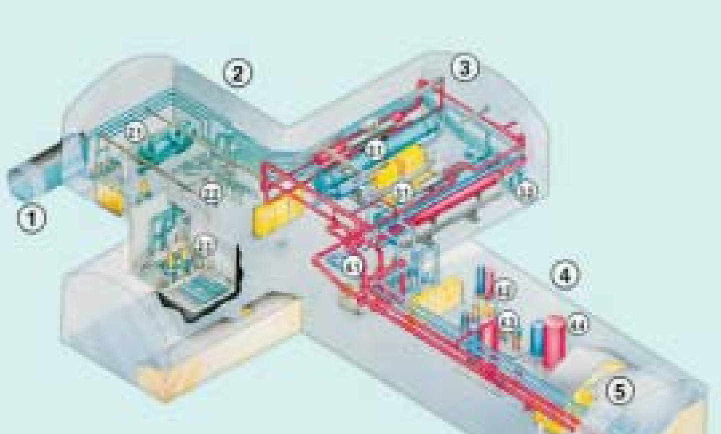

1 Sewage water channel
2 Filter station
2.1 Mechanical filtration
2.2 Sedimentation
2.3 Sewage water pump
3. Energy production
3.1 Heatpump units/ Refrigeration plants
3.2 Change-over valve
4. Machine room
4.1 Circulation pump
4.2 Vacuum bleed valve
4.3 Pressure maintenance system
4.4 Expansion tank
5. Control room

2

Energy from sewage water – District heating and district cooling in Sandvika, with 2 Unitop® 28C heat pump units

Client

Baerum Fjernvarme AS
1338 Sandvika, Norway

Baerum Fjernvarme AS

Located in the Oslo region, Baerum Fjernvarme AS is the leading supplier of energy in Norway, with distribution networks for district heating and district cooling. Originating from a local electrical company, Baerum today is part of the Finish Fortum group.

Distributing energy

Sandvika, a suburb of the Norwegian capital Oslo, is using energy recovered from sewage water for heating and for cooling purposes.

The production plant is of high importance to Baerum Fjernvarme AS, as well as to their customers: The security of supply is granted at all times and the energy prices are very moderate (compared to local level); both of importance to the consumers. For Baerum on the other hand, the district heating and district cooling networks provide a good and stable business. The exploitation of energy from waste water also pays an important contribution to the good quality of the air around Sandvika.

The best solution is a heat pump

During the 1980's, Sandvika showed a strong grow rate. A new urban centre was built on 300,000 m^2, with offices, housing and recreational facilities. According to a decree of the local parliament, a district heating system had to be provided for the entire area.

Baerum Fjernvarme AS received the order for this project. Starting point for the engineering was a study comparing various possibilities of energy provisions. The most favorable costs finally resulted for the solution with the double use of the heat pumps.

Both networks, one for district heating and one for district cooling are led in parallel, thus providing the supply required by each consumer in Sandvika.

Adapted to the needs of northern communities, heating energy is further used to defrost pavements in winter; this in contrast to a country like Switzerland where the use of energy for this purpose is not allowed.

Besides purely economical advantages, the solution chosen also is favorable towards ecology: The total amount of refrigerant required is reduced and the generation of air pollutants (SO_2, NOx) is minimised.

One of the largest waste water channels of Norway, connecting a major part of Oslo, is the source of the energy for the heat pumps. The average waste water flow rate is 3000 l/s. The plant is operating since 1989.

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Subterranean machine rooms

The main machine room with the two heat pumps is next to the waste water channel, inside a subterranean cavern, excavated from bedrock. To cope with peak load times, an already existing heating station, with 3 oil burning vessels and a conventional refrigeration unit were integrated into the Sandvika energy production network. These plants are within a distance of a few hundred meters of the cavern.

The two heat pump units, each with a capacity of 6.5 MW (heating) and 4.5 MW (cooling) cover approx. 80% of the capacity required. The part of energy, originating from waste water is 52% of the total energy supply.

Pre-cleaning the waste water

Due to the big extraction capacity, a heat exchanger submerged in the waste water channel, as installed in smaller plants in Switzerland and Germany, would have resulted in a surface requirement too large to handle.

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It is for this reason, that the amount of waste water required is pumped from the main channel, cleaned in a two step process (mechanically and by sedimentation) and finally is passing through the shell and tube heat exchangers of the two heat pump units.

After extraction of the energy the waste water is lead back to the main channel.

Advantages of a double use strategy

The simultaneous use of the heat pumps in order to cover heating and cooling requirements is of high importance in regard to basic investment and costs for regular service and maintenance. The additional costs resulting for the production of chilled water are relatively low compared to a plant installed exclusively for this purpose.

According to the engineers in Oslo, the equivalent refrigeration capacity generated by decentralised, local air-conditioning units would result in a power requirement ten fold compared with the Sandvika plant.

Unitop® 28C: reliable and durable

Both heat pump units Unitop® 28C were commissioned in 1989, at that time with Refrigerant R500. Refurbishment to R134a took place in 1993.

Main features of the Unitop® 28C

- Open-type single stage compressor
- Refrigerants: halocarbon/hydrocarbon
- Integrated planetary type gears
- Heavy industrial design with vertically split casing for easy maintenance
- Multiple compressor units available
- Suited for all drive systems
- Large capacity, small floor space
- High efficiency over the entire range
- Operating temperatures −40 °C/+82 °C

Technical Data

Buildings served heating/cooling	56/18
Total length of district	
- heating network	10 km (final)
- cooling network	4 km (final)
Heating capacity (heating mode)	13 MW (2x6.5 MW)
Refrigeration capacity (cooling mode)	9 MW (2x4.5 MW)
Annual heating capacity	47 GWh
Annual cooling capacity	11 GWh
Energy from sewage	52 % (of total)
Basic connection price	550 Fr./a (355 €/a)
Energy rate	6.5 Rp/kWh (4.2 Cents)
Annual demand rates	
- for heating	59 Fr./kW (38 €/kW)
- for cooling	70 Fr./kW (45 €/kW)

Plant control system

A SattCon type PLC control system is used for local supervision. It is connected to the central building control system.

Service and maintenance

Specialists of Baerum are supervising and maintaining the technical installations of the Sandvika plant. Friotherm carries out regular service works on the two heat pump units according to special agreements.

Legend

1 *Sandvika, a suburb of Oslo, is situated on the idyllic Oslo fjord.*

2 *52% of the heating/cooling demand of Sandvika are covered by the plant which is installed completely underground in a cavern.*

3 *Piping for district heating/cooling and circulation pumps visible centre right. On the left, one of the Unitops.*

4 *The waste water tunnel (3 m diameter). In the center the return feed pipe of the branch current used for energy recovery.*

5 *The two heat pumps type Unitop® 28C operating with availability at all times since commissioning in 1989.*

6 *Mechanical filtration of the waste water preventing contamination of the heat exchangers of the two heat pump units.*

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