



» Geothermal energy and 3 Unitop® 33/28C heat pump/chiller units for the district heating/cooling system of Lund

Client/End user

Lunds Energi AB
22100 Lund, Sweden

Unique Lund

Situated in the centre of the attractive and expansive Öresund region in the south of Sweden, Lund is one of the oldest cities in the country with a history reaching back more than one thousand years. It has more than 100,000 inhabitants today. The university, a science-park, the multicultural atmosphere and the historical surroundings make up a unique combination.

District heating in Lund

87% of Lund is connected to district heating. The well developed district heating network is far more efficient than any alternative. This means better economy for the consumers. It has also helped to drastically reduce air emissions in Lund in the 35 years of district heating. Lund's district heating is uniquely engineered in a number of ways, thus the flexibility in production is unparalleled and Lunds Energi AB position in the deregulated electricity market is very strong.

In close co-operation with Lund University, Lund Energi AB was a pioneer in the development of geothermal heating systems based on heat pumps and underground reservoirs in the sandstone layer 800 metres below the town of Lund.

The recent investment in accumulator tanks is a good example of the flexibility strategy. The combination of heat

pumps and electrical boilers which depend on electricity, and the co-generation capacity that produces it, makes district heating profitable for the company and the consumer regardless of fluctuations in the electricity-, oil- and gas markets. The accumulator option gives an additional short-term flexibility, which also corresponds to the very high reliability of 99.99%.

The production facilities within Lunds Energi AB include:

- Geothermal heat pumps (base load)
- Heat pumps/chiller units for double use
- Bio-fuel co-generation plant
- Modern gas and oil boilers
- Electrical boilers
- Co-generation with gas turbines
- Hot and cool water accumulator tanks

District cooling in Lund

Lunds Energi AB also supplies district cooling. The customers are companies like the Lund University Hospital, with a substantial and continuous need for cooling their working environments.

District cooling is produced with heat pumps that are also connected to the district heating system. District heating thus becomes a by-product of district cooling. This means that the total energy efficiency is very high and that

the arrangement is beneficial to the customer. Again, the environmental gains are substantial, both because of the increased efficiency and better control of refrigerants.

Geothermal energy in Lund today...

In 1963, the start was made with extending the heating system of the hospital complex and at the same time providing a district heating system for the town of Lund. Initially, oil fired boilers were used, followed by a gas turbine.

The first geothermal heat pump plant was put in operation in 1984. It has been successful from the technical, economic and environmental points of view. 140 GWh/year can be extracted from the low temperature fraction. The groundwater of the system has an initial temperature of about 22°C and is re-injected after exploitation with 2-4°C.

...and in future

It is therefore not surprising that Lunds Energi AB in 2003 was choosing the geothermal energy option again to expand its heat production. The new system will utilise deep geothermal wells, using geothermal water of >100°C, from a depth of approx. 3500 m. The energy system analyses show that up



to 250 GWh/year can be extracted from the high temperature fraction.

Lund will in future draw about 65% of its total energy required from geothermal sources.

System economy is very favourable, indicating a pay-back time of between 3 and 5.5 years. Also, the environmental gain is obvious. The deep geothermal energy project in Lund will replace the use of imported fossil fuels.

The project further has a potential of reducing the emission of CO₂ with as much as 54,000 ton/year, which represent about 50% of the annual release. The average release of NO_x and sulphur emissions will be reduced by 40% and 70% respectively.

3x Unitop® 33/28C heat pump

The three Unitop® 33/28C units are equipped with shell and tube type heat exchangers for evaporation and condensation of the refrigerant type R134a and also include refrigerant sub-cooling as well as two stage expansion with an economizer. The motor drives are water cooled. Together, this ensures the highest possible coefficient of performance (COP), which exceeds 2.8 on average over the year.

As a result, 27.9 MW of heat are generated at a hot water supply temperature of 81°C, with only 9.9 MW of electrical power.

The future use of the 3 heat pump/chiller units type Unitop® 33/28C will remain unchanged by the new geothermal system as they are required whenever there is a demand for cooling.

Main features of the Unitop® 33/28C

- Open-type single stage compressors
- Refrigerants: halocarbon/hydrocarbon
- Integrated planetary 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°C/+80°C
- Multiple compressor units available
- Operation in series or in parallel
- Large capacity, small floor space

Plant control system

A SattCon type PLC control system is used for local control and supervision of the heat pump units. It is connected to the central building control system.

Service and maintenance

Specialists of Friotherm are maintaining the two Unitop® 33/28C. They also carry out the regular service works.

Technical Data

3 Heat Pump Unitop® 33/28C, each	
Heating capacity	9.3 MW
Power absorbed	3.3 MW
Chilled water temp. in/out	+10/+4 °C
Geoth. water temp. in*/out*	+22/+4 °C
Heating water temp. in/out	+81/+60 °C
COP	2.9
Capacity control	10-100 %
* used in times with high heating load and small demand for district cooling	

Legend

- 1 Aerial view of the town of Lund. 65% of the heating energy used originates from geothermal sources in future.
- 2 The district heating/cooling centre with the large cold water storage/buffer tank. © Lunds Energi AB
- 3 Inside view of Lunds energy centre, with two of the three Unitop® type 33/28C heat pump units. Left a compressor type 33 with its motor drive.
- 4 For flexibility reasons a buffer tank is installed in the district heating network. © Lunds Energi AB

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