Stockholm / Hornsberg project: Energy storage 45,000 m³

This huge storage in a rock cavern will add 80 MW to Stockholm's district cooling capacity. During nights the water storage will be loaded with free cooling.

Introduction

Fortum (AB Fortum Värme samägt med Stockholms stad) is realising this huge storage to manage the increasing requests for district cooling. Fortum is a Finnish energy company and the major supplier of heating and cooling in the Stockholm region.

In 2004 Termoekonomi started to develop the idea to use cold lake or seawater to load a storage at night and use it at peak hours in the day. Termoekonomi is designing all installations except the switchgear room and will be managing the installations and commissioning. The plant will be in commercial operation in the summer 2009.

The city of Stockholm is probably the capital with the highest percentage of district cooling. DC was introduced in 1995 and has had a fantastic development. Today some 500 customers are connected and others want to join. Limitations in the distribution network make it impossible to install and use more capacity at the existing production plants. The new plant is located in the western part of the city opposite the existing plants.

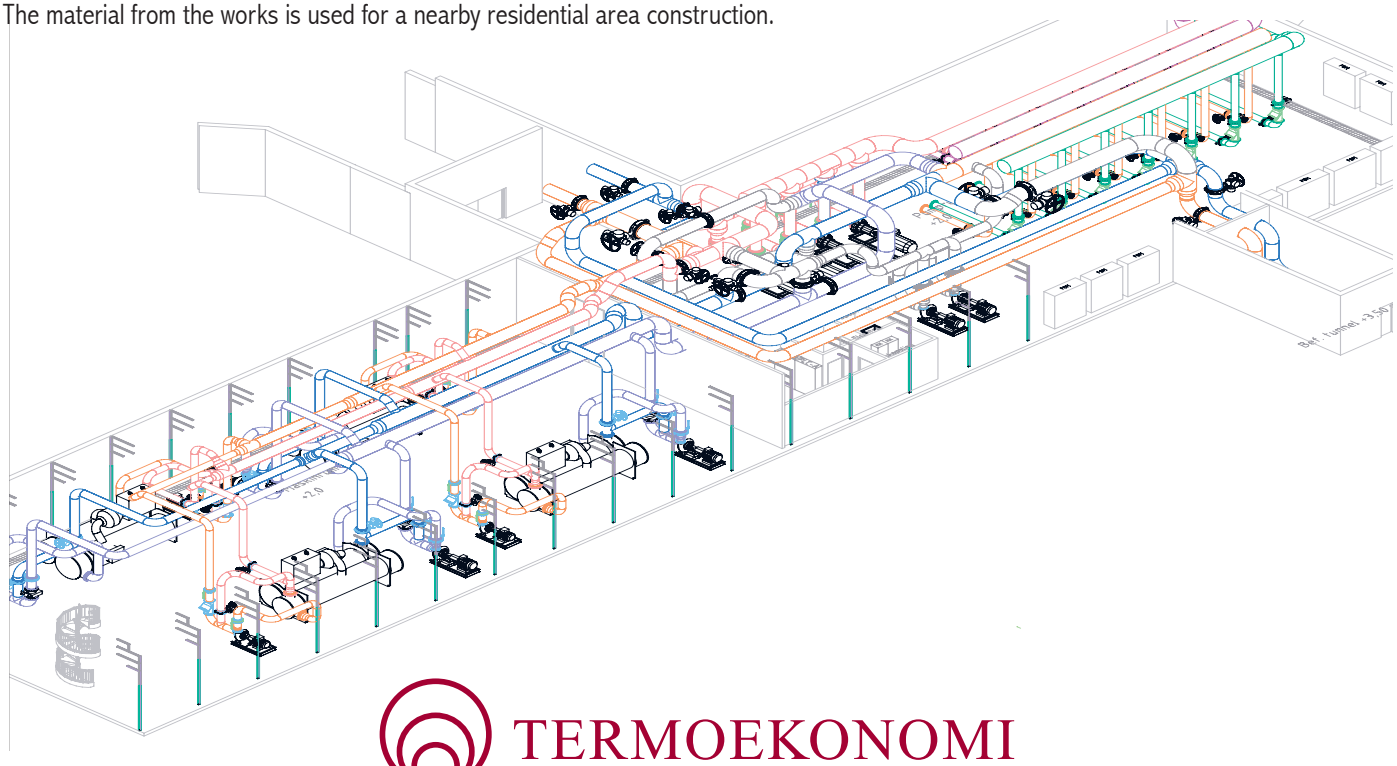
Facts:
- Cooling capacity: 80 MW at 3 °C
- Chiller capacity: 24 MW
- Unloading flow: 5,159 cbm/h
- Loading flow: 3,500 cbm/h, of which 1,400 cbm/h is internal
- Seven identical heat exchangers
- Four identical chillers
- Four identical DC Pumps
- Three identical Storage Pumps
- Distribution pipe diameter: 2x700 mm

Drilling equipment at work.

The building construction

The huge storage is 125 m long by 16 m broad and its height is 22 m. It is together with all installations located in newly constructed rock caverns. The machine room with chillers, heat exchangers, pumps, switchgears etc has a volume of 10,000 cbm. In total 70,000 cbm of solid granite is taken away.

The material from the works is used for a nearby residential area construction.



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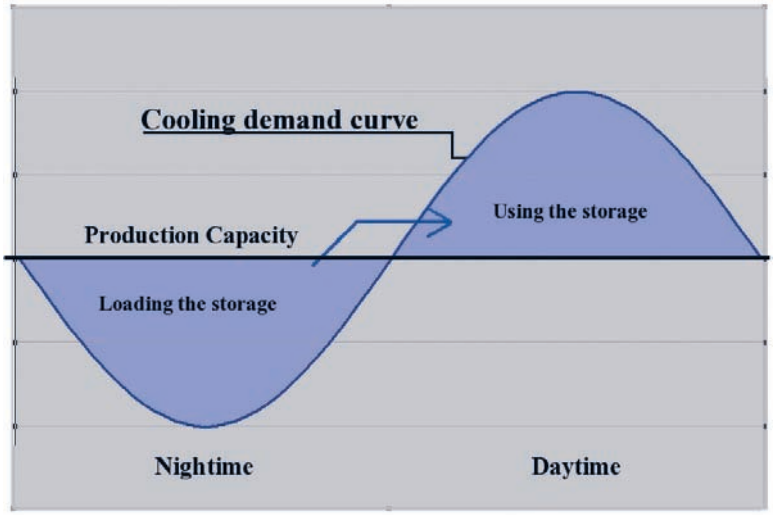
The Hornsberg project presents a new energy storage principle

When using DC distribution pipes, free cooling from far away can be stored and thus reduce the electricity consumption for AC and process cooling.

Principles for design and operation

An excellent environmental performance was a ruling factor from the very beginning of the Hornsberg project. Many more buildings should be connected to district cooling, and that is already a good way of environmental protection compared to the alternative conventional AC. In addition, the district cooling should be produced naturally with free cooling as much as possible.

The final solution was to use cold water from the Baltic Sea taken from where the existing production plants were located, 7 km away. The seawater is cooling the water in the district cooling pipes via heat exchangers. At nights when the cooling demand is low this cold water is distributed all the way to Hornsberg where it passes other heat exchangers. Here water for the huge storage is cooled down to about 5 °C.
The condenser heat from the chillers, stored during the previous day, is taken away by the district cooling return pipe and dismissed to the Baltic Sea at the existing production plants.



At daytime the same heat exchangers will use water from the storage to produce district cooling. The outlet temperature can be secured with four large chillers. The condenser heat from the chillers is stored in the storage.

The Hornsberg project presents a new way of using existing distribution pipes to load a district cooling storage and take away condenser heat. Natural cold seawater is used in both modes, which enables a very economic and environmentally friendly way of producing AC and process cooling in Stockholm city.

The entrance to the rock caverns.

Looking into the thermal energy storage.

Checking the work in the machine room.

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