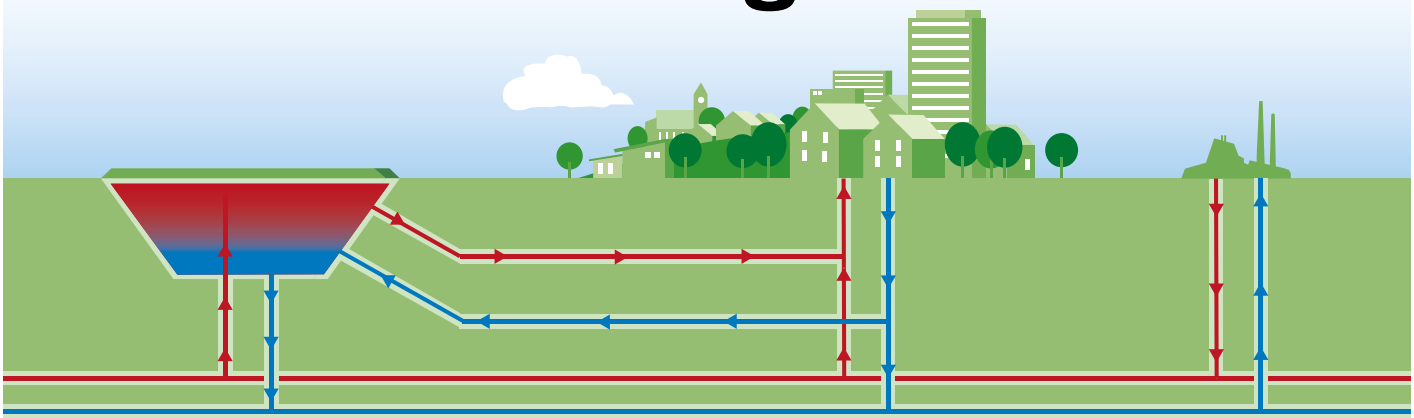
Heat pit storage optimises district heating



Høje Taastrup District Heating and VEKS have build and own a heat pit storage together. The heat pit storage add further value to district heating in the Greater Copenhagen system and contribute to the green transition.



FOTO: Ioannis Sifnaios, DTU

VEKS

HØJE TAASTRUP fjernvarme amba

Flexible energy system

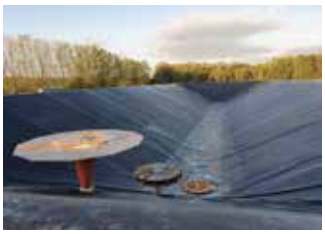
The storage is a pit hole excavated in the ground lined with a plastic membrane and isolated lid on top.

The purpose of the heat pit storage is to store the district heating when it is cheap to produce - on the other hand, distribute from the storage when it is expensive to produce. The new deposit will benefit the total power and heat system in the entire Copenhagen metropolitan area and thus the overall green transition.

From a practically point of view, the storage is charged with heat produced in the large CHP plants and waste-energy plants through the transmission system and release the heat (discharging) to the local district heating system in Høje Taastrup. The storage cannot deliver heat back to the transmis-sion system.

There is already a number of heat pit storages in Denmark, however, they only function as seasonal storages (primarily in connection with solar heat) and for decentralised district heating systems.

The storage contains 70,000 m^3 hot water and has a charging and discharging capacity of 30 MW. When it comes to energy, the plant has an energy content of 3,300 MWh which will add an annual value of approximately DKK 8 million to the district heating systems of the entire Copenhagen metropolitan area. Varmelast controls the heat pit storage and plans the heat based on optimization of the overall heating system in the metropolitan area.



The storage contains 70,000 m^3 water: The length is 180 m, the depth is 14.5 m and the width varies between 52 m and 72 m.

Project scope

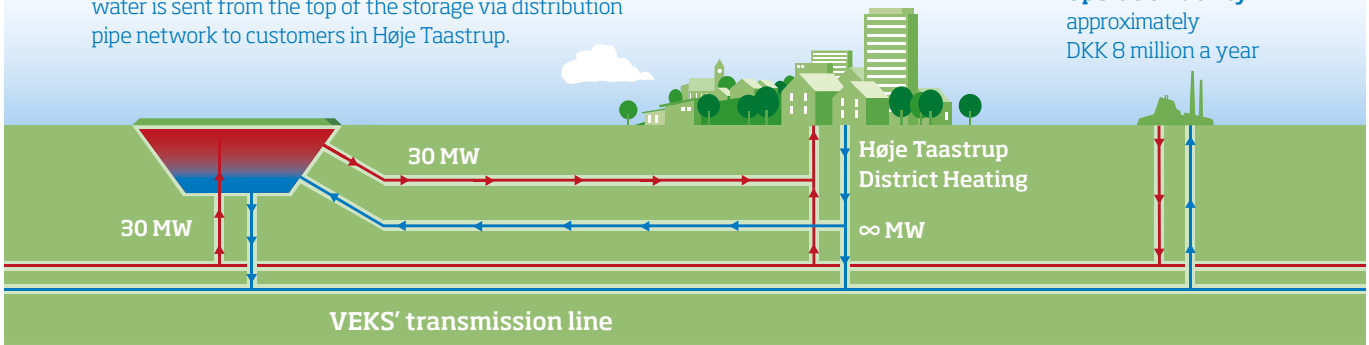
- 70,000 m^3 heat pit storage
- 130 m^2 underground pumping station
- 400 m^2 heat exchanger building
- 700 meter pipes for "charging and discharging"

- **Investment:** Total DKK 90 million

- **Operation utility:** approximately DKK 8 million a year

Heat pit storage capacity - 3,300 MWh

When the heat requirement increases, the return water is directed to the bottom of the storage, whereas hot water is sent from the top of the storage via distribution pipe network to customers in Høje Taastrup.



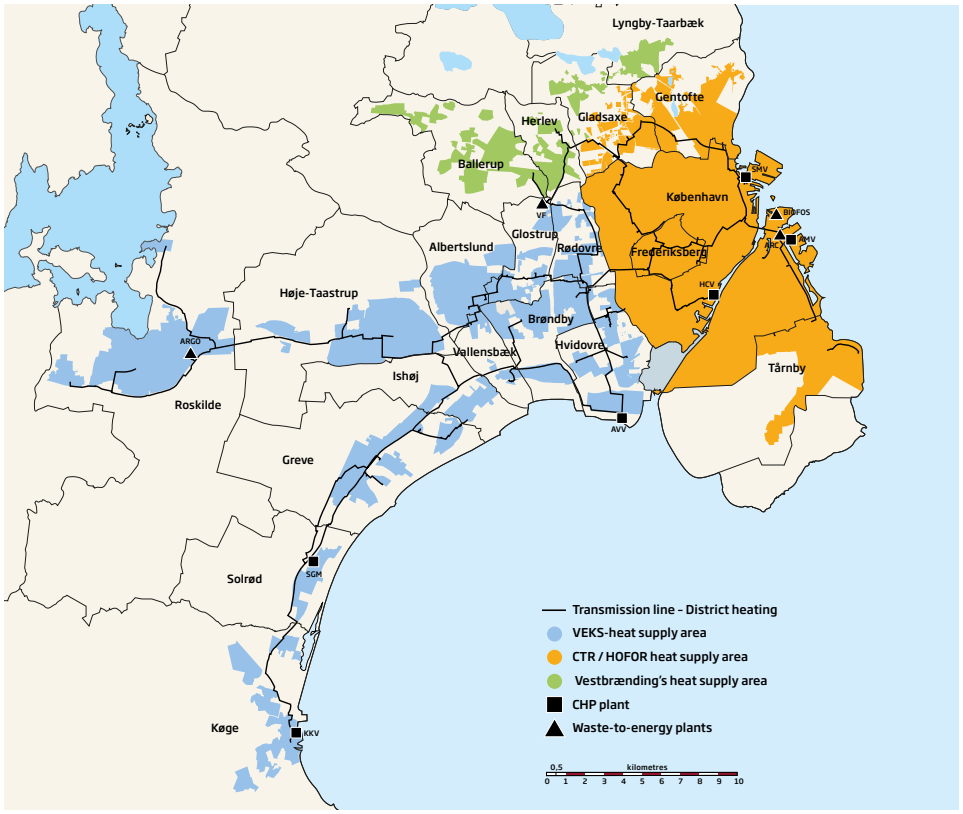
Pioneer project

Thermal heat storage is the least costly way to store energy in the energy system and is therefore important when it comes to green transition.

It is the first time this type of heat pit storage will be used in one of the very large district heating systems in Denmark. It is a development project, whose purpose is to function as a weekly heat storage - as oppposed to already existing seasonal storages. Therefore, the storage project has received a subsidy of DKK 13 million from EUDP which is the Danish Energy Agency's funds for supporting development projects.



Interconnected system



Units in the system:

- Four CHP plants of a total of 1,800 MJ/s. The plants are owned by three companies: Ørsted, HOFOR and VEKS.
- Three waste-to-energy plants of a total of 400 MJ/s
- Reserve and peak load plants of a total of 1,900 MJ/s
- Three heat steel tank accumulators of a total of 690MJ/s

Two transmission companies, VEKS and CTR delivering heat to a total of 26 local district heating companies in the Copenhagen metropolitan area.

An advantage for all - A unique business model

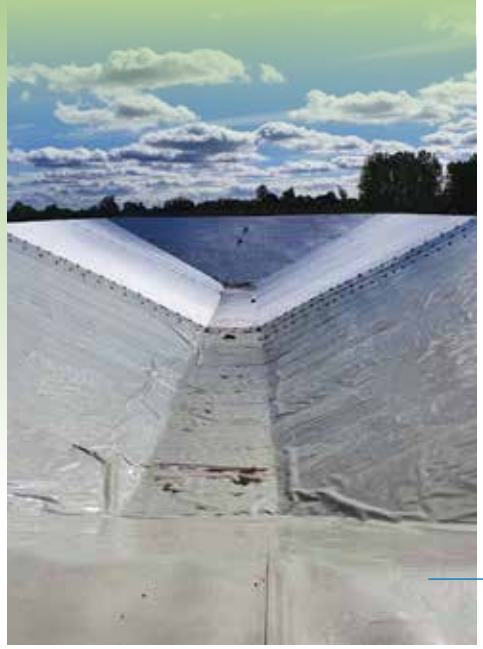
The new heat pit storage optimises the total heating and electricity production in the entire Copenhagen metropolitan area. It creates value, both for manufacturers and district heating companies, which all in all benefits a green transition.

The Combined Heat and Power plants can optimise their production regarding to electricity spot prices and the waste energy plants can produce more heat during the summer half-year.

Finally, the heat pit storage reduces the production of peak loads at local boilers where the fuel is typically fossil natural gas or gas oil.

The business model is all new and is since all parties - both heat producers and district heating companies that will benefit financially from the storage - participate in the financing. They contribute in proportion to the individual company's share of the storage utility value.

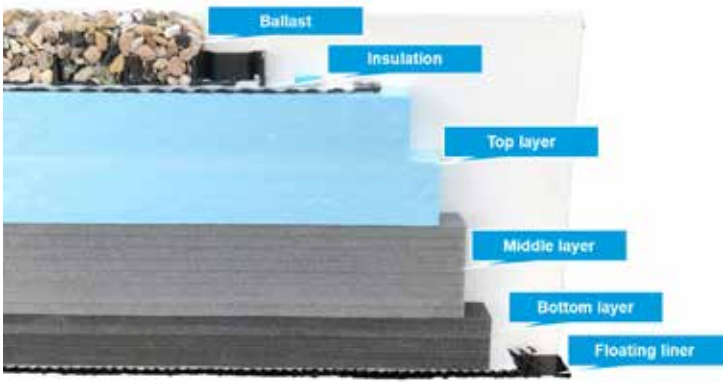
The distribution of the utility value is calculated through a complex energy model which all companies rely upon and thus can accept as the basis for distribution keys for financing the heat pit storage. This is quite unique.



The heat pit storage is a pioneer project. The development project has received DKK 13 million from EUDP which is the supporting pool of the Danish Energy Agency for development projects.

Liner and Lid

The life of the heat pit storage liner will be secured with a newly developed liner material which is specially designed for high temperatures in the district heating system during the year. Specifically, it can withstand a constant temperature of 95 degrees Celsius in the heat pit storage.



The liner is a new type of PP liner (developed by the Austrian innovation project gigaTES) with an expected life of 33 years at 95 degrees Celsius. PP stands for PolyPropylene and is the name of the plastics type which the liner is made of.

The liner is installed with a new developed leakage control for monitoring any leakage of the liner.

The lid is designed as a vapour-permeable construction which can emit vapour, if any, without damaging the insulating construction. You can walk on the lid upon inspection. The lid will moreover be divided into sections ensuring that rainfall will be diverted – and resulting in a minimum of maintenance. The total heat losses from the storage, including from the lid, is expected to be 8-9%.

Brief about the owners

VEKS, which is one of Denmark's largest district heating companies, delivers future-proof, green and secure district heating.

VEKS is an environmentally certified, intermunicipal district heating company which by way of their transmission system is selling district heating to 21 local district heating companies covering the heat consumption of 170,000 households in the area covering from west in Roskilde to Hvidovre and southwards to Køge.

VEKS' vision includes: "VEKS will speed up a green transition and deliver efficient and sustainable energy solutions through partnerships to the benefit of our customers."

Read more: **https://www.veks.dk/en**

HØJE TAASTRUP fjernvarme amba

Høje Taastrup District Heating a.m.b.a. is a consumer owned cooperative society delivering sustainable, green, and secure district heating and district cooling. The company is owned by the customers. The supply area of Høje Taastrup District Heating is Høje-Taastrup Municipality.

From Høje Taastrup District Heating's mission it appears, among other things, "to be innovative and take the lead when it comes to sustainable district heating and district cooling solutions to our customers."

More information: **https://www.htf.dk/**