CHEAP AND EFFICIENT ENERGY WITH HEAT STORAGE PITS

HEAT PRODUCED IN SUMMER CAN BE STORED FOR USE IN WINTER

Traditional solar heating plants cover heat demand by only 15-20%. But with a heat storage pit, solar heating can cover 50-65% of demand. In larger district heating systems, a pit is a cheap energy source that can save peak loads and reduce the price of heating.

What is a heat storage pit?
A heat storage pit resembles an enormous buried thermos that utilizes heat from various sources such as the sun and wind, combined heat and power (CHP), and residual heat from industrial plants.

Heat storage pits combine three existing technologies - landfills, hot water tanks and offshore steel technology - with new insulating floating cover components.

World record in Vojens
As a consultant for Vojens District Heating in Jutland, Denmark, Ramboll has designed and constructed a 200,000 m² heat storage facility in an old gravel pit. It was powered by expanding the existing solar heating plant from 17,500 m² to 70,000 m² - breaking the world record in the process. The entire project was carried out without subsidy and has reduced the cost of heat production substantially.

New projects on the way
A 125,000 m² heat storage pit has been established in Gram in Jutland and new pits are on the way in Toftlund (70,000 m²) and Løgumkloster (150,000 m²) in southern Jutland. Ramboll is acting as a consultant on all three projects.

Future perspectives
Producing and consuming electricity in a market where demand fluctuates, and energy supply from wind and solar power can vary, is a challenge.

With heat storage pits, more electricity can be produced at power plants during hours with high prices, and more electricity from electric boilers and heat pumps can be consumed in hours with low prices. In between these times, heat from the storage pit can cover the entire production.

Heat produced from waste at waste-to-energy plants, where heat is often cooled during the summer, is also an option being considered, and Ramboll expects this new method has significant potential in the future.

Ramboll’s experience
Ramboll is one of the world’s most experienced consultants in district heating and renewable energy. The successful planning and design of the heat storage pits in Gram and Vojens reveal a unique insight into the efficient storage and use of energy sources.

01. EXCAVATION
The Vojens heat storage pit is housed in an old gravel pit, making it easier and quicker to construct.

02. PLUMBING
Plastic membranes lined up and ready to be installed.

03. LINING
The excavation is lined with a high-tech HDPE membrane resistant to high temperatures.

04. COVER ON
An insulated lid, made of a layer of expanded clay between two plastic membranes, retains heat and drains rainwater.

Heat is stored in an excavated old gravel pit nearby and water is separated from district heating water by a heat exchanger. A huge plastic bag ensures that the water remains clean and does not disappear into the sand. This bag is made of a high-tech HDPE membrane with the ability to withstand high-temperatures and is a major reason why storage is so efficient. Finally, the water surface is covered by an insulated lid draining the system to remove rainwater.

It is hoped that eventually the plant will cover nearly 30 percent of all district heating.

Ramboll has not only designed the storage pit, but also headed construction and provided consultancy to Vojens District Heating throughout the process, focusing on ensuring an economically and technically optimal solution.

VOJENS LARGE-SCALE SOLAR PLANT AND HEAT STORAGE PIT
Vojens District Heating (a.m.b.a), 2013-2015

The world’s largest heat storage pit and solar plant is located in Vojens in Jutland, Denmark. In summer 70,000 m² of solar panels heat up 203,000 m³ of water in a heat storage pit. In winter the heat is fed into the district heating system and piped to 2,000 consumers.

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