

CLUES WP 5 International Innovative Case Studies

SEAWATER HEATING SYSTEM, DUINDORP/ SCHEVENINGEN

Introduction and Concept

The City of Hague has developed an innovative district heating concept that consists of a seawater central supply unit with a heat exchanger and heat pump unit that uses the nearby sea as a temperature source. The Hague and Vestia Housing Corporation have partnered with Deerns engineering consultancy to implement this energy source in the reconstruction of 750 of the 3,000 dwellings located within Duindorp - an area along the North Sea Coast consisting mainly of small former fishermen family houses built between 1915 and 1931.



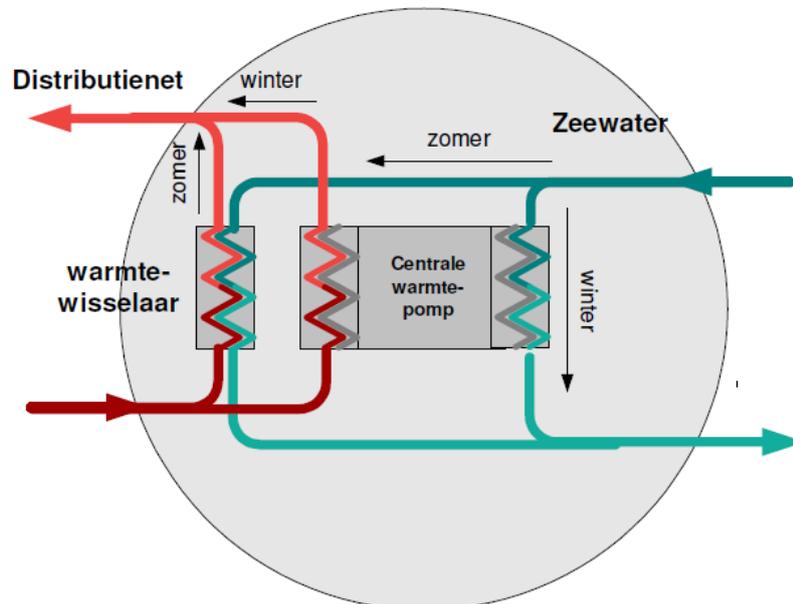
Figure 1 Image of the Duindorp houses connected to the seawater district heating system

The sea water heating plant is part of the city's plan to use more sustainable energy and is one of the steps being taken towards making the area 'climate neutral' in order to reduce energy usage. In 2009, Duindorp seawater heating plant was awarded a Climate Star for their climate protection activities.

The technologies involved are not new, but it is the way they were combined that attracts attention: it is an innovation that allows construction of a very efficient system for making seawater or surface water the source of energy for heating homes as well as heating water – and not only during a warmer season.

Technology

The seawater heating system extracts seawater and then processes it either via a heat exchanger or heat pump to supply an entire residential area with space heating and hot water.



In summer, when temperature of seawater is more than 11°C, only the heat exchanger is used. The heat exchanger feeds heated water to local grid, drawing enough heat from the seawater to cover residents' need. In the winter, when the water temperature is less than 4°C, the heat pump is used. Using electricity, the heat pump works to move thermal energy from a cold source to a warmer heat sink. The ammonia heat pump has an output of 2.7 MW and warms the water to approximately 11°C, which is then fed to the local grid. Upon reaching each household, the water is further heated by each home's own heat pump to either 65°C for hot water and 45°C for heating.

A central unit located near the harbour contains both the central heat exchanger and heat pump. Smaller individual heat pumps are installed in each home for further heating. The overall efficiency of the heat generation process with this system is more than 50% better than with conventional high-efficiency boilers, while the cost to the residents are similar to the cost of conventional heat. It is promised that over the next ten years the energy prices to the residents of the houses connected to the system is fixed. The energy yield produced by drawing heat from the sea results in a 50% reduction in CO2 emissions.

Investment

In terms of costs, at this stage of the project it is only possible to do estimates, as it is the first practical application. The annual operating and maintenance costs are estimated to be 5.7% of initial investment that is €7.5 mln. Due to the experimental nature of this project,

the costs appear relatively high. However if the fresh surface water was used, then the costs would be 10-20% lower.

Replicability

Similar systems can be installed pretty much anywhere in the world close to the body of water and it would even be cheaper in case of fresh water, because there's no need to protect the heat pump, heat exchanger and water pumps against salt corrosion.

More information can be found at:

Seawater Heating Plant. Conference presentation by Paul Stoelinga. Available at:

<http://www.kimointernational.org/Portals/0/Files/Annual%20General%20Meeting/Seawater%20Heating%20Plant.pdf>

Sea water to heat houses in Duindorp. 24 August 2009. Available at

<http://www.denhaag.nl/en/residents/to/Seawater-to-heat-houses-in-Duindorp.htm>

Sea water to heat homes in The Hague. Available at

<http://greenlinked.com/energy/projects/84-seawater-to-heat-homes-in-the-hague-the-hague.html>