



Utilization of seawater as a heat source

Germany, Norway

2012

-  Type : Project
-  Size : Local community
-  Area : Residential

-  District heating, Heat pump, Renewable energy

Environmental benefit

Heat delivered from the heat pump is 67GWh/year, which avoid 78Gwh of gas, whilst consuming 23GWh/yr of electricity which is practically 0.

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Drammen wished to upgrade their existing district heating which was a mixture of electric, biomass and gas/oil. They recognised the need to move from fossil and combustion fuels and so decided to utilize seawater as a heat source for an industrial heat pump. Also recognizing the danger of HydroFluoroCarbons (HFCs) and other synthetic working fluids they began to explore the use of ammonia.

The municipality of Drammen in Norway has since 2011 used seawater to provide district heat for the town. Three large heat pumps (13.5 MW) extract heat from a nearby fjord, which has a seawater temperature of about eight degrees at a depth of 18 meters all year round. The heat pumps can deliver a temperature of up to 90 °C. The heat pumps annually provide 67 GWh of heating, covering the needs of around 6,000 homes.

Costs

The costs of seawater heat utilization are related to the pipeline into the sea to extract water of a stable temperature, the heat pump plant, electricity used by the pumps, and a possible extension to the district heat network.

Non financial benefits

Replacing fuel combustion with heat pumps cuts air pollution. It also reduces the need to import fossil fuels and increases energy security. Heat pumps can be used to provide flexibility to the energy system – instead of ramping up a fossil power plant, the heat pumps can be switched off during a power demand peak.

Barriers



- To operate a seawater heat pump during colder periods, it needs access to water exceeding zero degrees. If the sea is not sufficiently deep near the shore, the piping needed can become long and expensive.
- The heat source needs to be located close to the heat users so that the investment in the extended pipe infrastructure and heat losses do not become too large, and there needs to be space available for the facility.
- The facility also requires a significant amount of electricity, so the electricity grid in the desired location must be strong enough.
- The initial investment for the heat pump facility is often large, and therefore the heat pumps require a sufficient number of load hours to keep the price of the heat down.
- A lot of electricity is needed for the heat pumps, making the profitability very much dependent on the electricity price.

Enablers

- Seawater is free and, when deep enough, a stable source of heat.
- A seashore with sufficient depth close to the network keeps the piping costs low
- Low network temperature allows the heat to be used without priming.

Source: Information on this page is retrieved from Sitra

<https://www.sitra.fi/en/cases/district-heating-from-seawater-drammen/>

More info

DHC + : https://www.euroheat.org/wp-content/uploads/2019/08/RHC-ETIP_District-and-DHC-Vision-2050.pdf



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