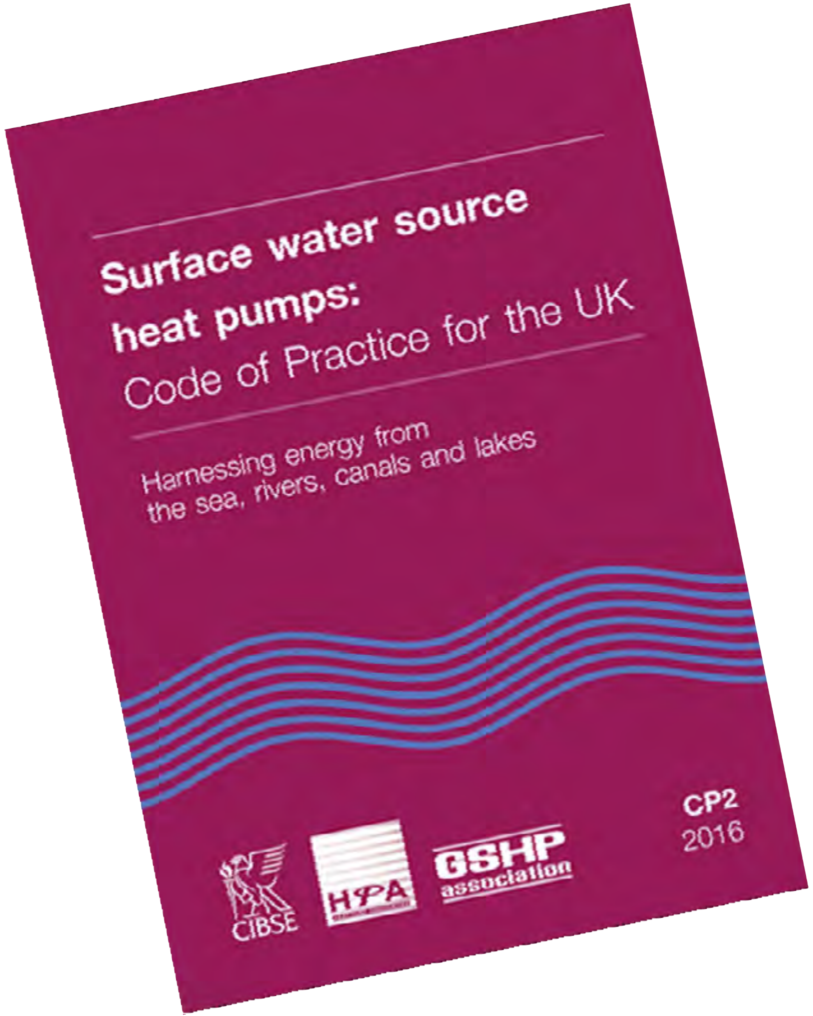
Why install a Surface Water Source Heat Pump: Challenges and Opportunities



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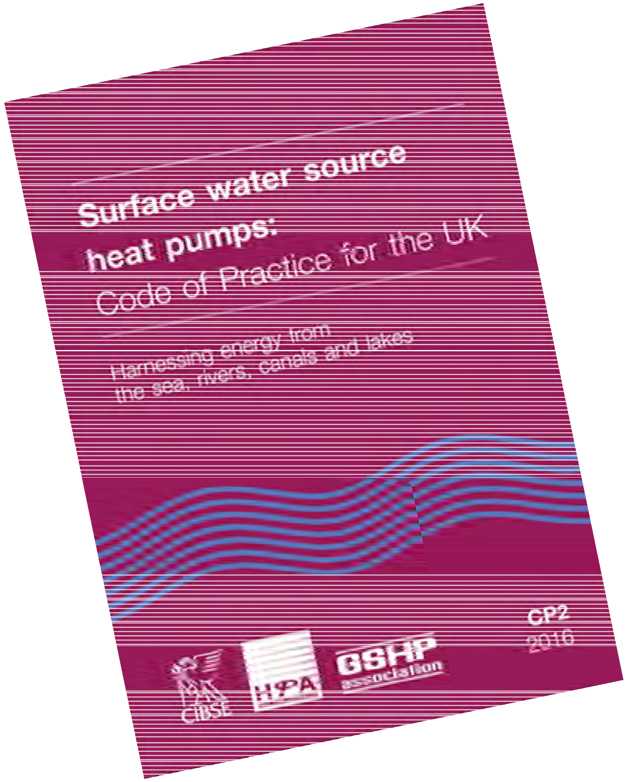
GSHP association HPA HEAT PUMP ASSOCIATION CIBSE

CP2 is a collaborative publication



- Consortium funded by DECC and led by CIBSE in association with HPA & GSHPA supported by a 20+ strong, diverse steering committee of industry experts and stakeholders.

- With input from many more companies and individuals both informally and during the consultation process: www.cibse.org/CP2consultation

- Environmental groups were invited to comment and we received some very good input from Angling Trust in the final stages. www.anglingtrust.net

Environment Agency Input

The Environment Agency have been closely involved throughout.

As a direct result:

- The EA has changed a number of forms and internal systems to establish a single point of entry for all enquiries.
- They have simplified application and permitting processes and are encouraging early engagement, ideally long before the any formal application is to be made.
- They are investigating how best to engage with developers and others involved with SWSHP projects, to ensure that they have a satisfactory experience.

There is a lot of useful information here:
www.gov.uk/government/collections/ground-source-heating-and-cooling-forms-and-guidance-notes

Why install a Surface Water Source Heat Pump?

Economic benefit

In most cases the key motivating factor will be financial:

- Government - grants and incentives
- SWSHP systems return an attractive ROI and mitigate against rising energy costs.
- Any increased CAPEX will be compensated by the OPEX savings over the life of the building
- Other cost savings e.g. a gas supply and a flue may not be needed
- May be used for both heating and cooling – significantly improving efficiency and reducing cost.
- Balanced systems are compact and usually located in basement plantroom. The roof space released can be extremely valuable.

Why install a Surface Water Source Heat Pump?

Environmental and reputational benefit

SWSHPs are a low carbon alternative to using fossil fuels and reduce carbon footprint. Demonstrate social responsibility.

Legislative requirements

To comply with national and international legislation e.g.: Climate Change Act 2008, Carbon Reduction Commitment (CRC), Energy Performance Building Directive (EPBD), Renewable Energy Sources Directive (RES), and Climate Change Levy (CCL), Building Regulations etc.

Other Considerations

The strategic aims for the deployment of SWSHP system are:

- To reduce CO_2 and other greenhouse gas emissions
- To use natural resources sustainably and reduce or replace fossil fuel consumption.
- To reduce overall cost of providing heating and/or cooling.

SWSHP's can be used for heating, cooling or both, independently or simultaneously.

***CP2 leads with heating and is written from that perspective, but cooling is also discussed.*

SWSHP's use either open or closed loops to collect heat from, or reject heat into surface water bodies.

***CP2 leads with open loop installations but also discusses closed loop applications*

Heat pumps are versatile: they can used with both source and load side networks for both heating and cooling…

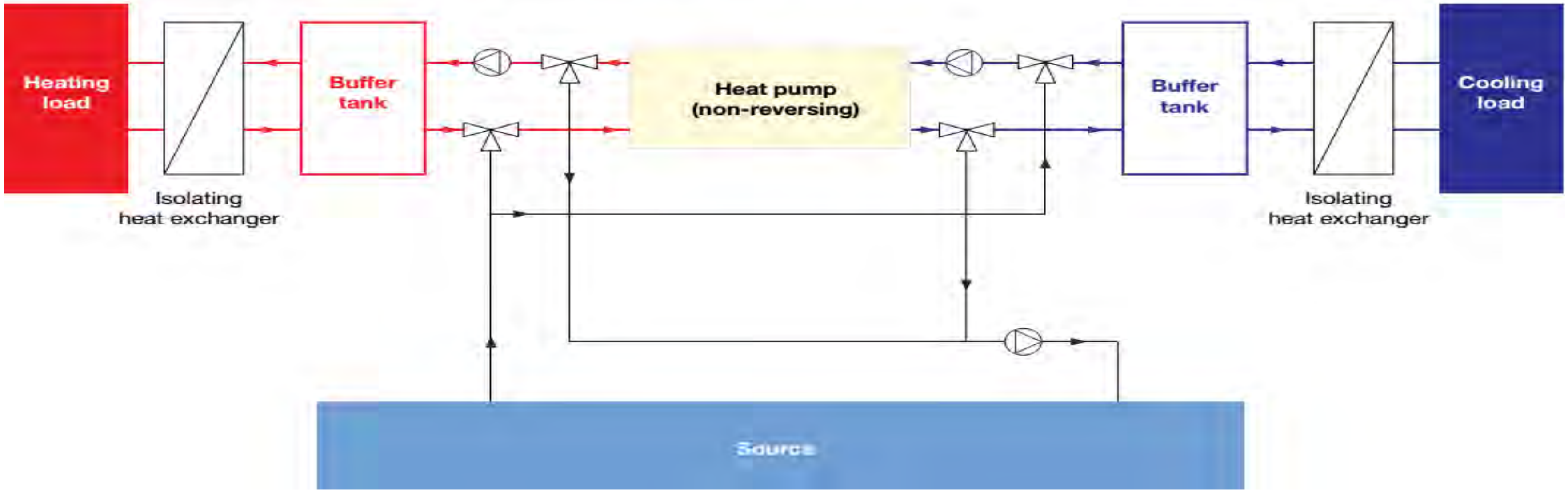
In "traditional" load side applications they may be used as a primary or secondary generator. Historic temperature constraints for high temperature applications have been overcome.

In "source" side applications single or multiple heat pumps may be attached to a low temperature network to collect or reject heat at or near ambient temperature.

Heat pumps are versatile: they can used with both source and load side networks for both heating and cooling…

They maybe used to provide heating, cooling or both either alternately or simultaneously.

Figure X: Simultaneous heating and cooling being supplied by a non-reversing heat pump (reproduced courtesy of Robin Curtis)



Applications: Challenges and Opportunities

Case Studies and examples illustrate how flexible the technology can be and can demonstrate novel and inspirational applications

1. Kingston Heights – Source side (low temp) network used for both heating and cooling
2. RNLI – Diverse novel systems developed to match widely different locations. Prefabrication
3. National Trust – Plas Newyd overcomes uncertain loads and elevation issues.
4. Canals & Rivers Trust – Making a (water) feature out of the installation
5. Horsham – Retrofit Closed Loop Source Side network supplying 5 buildings from a nearby lake
6. Kings Mill Hospital, Mansfield – Large closed loop system using Hydroplates
7. Drammen – Norway – Retrofit to High Temp Heat Network Large ΔT
8. Värtan Ropsten, Stockholm – Delivers 420MW and has done so since 1987
9. Nasby Sweden – Combined borehole surface water recharge Saving both OPEX & CAPEX
10. Vaasa, Finland – Fully integrated system using source side network GHE under shallow bay installed using HDD

SWSHP Applications #1

Kingston Heights!

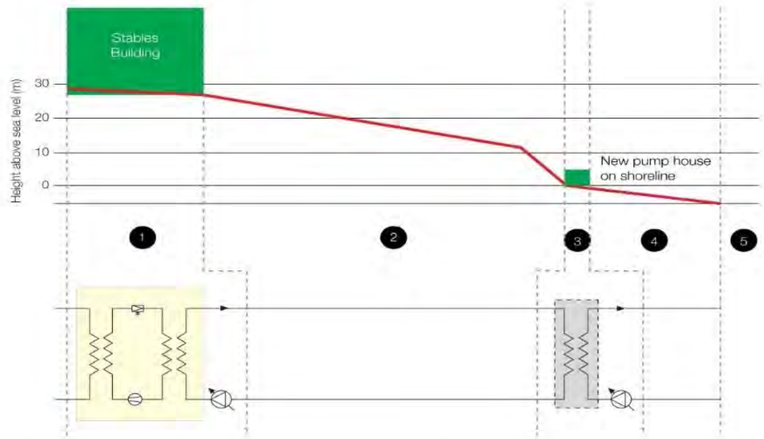
Another innovation…..

https://vimeo.com/62595912

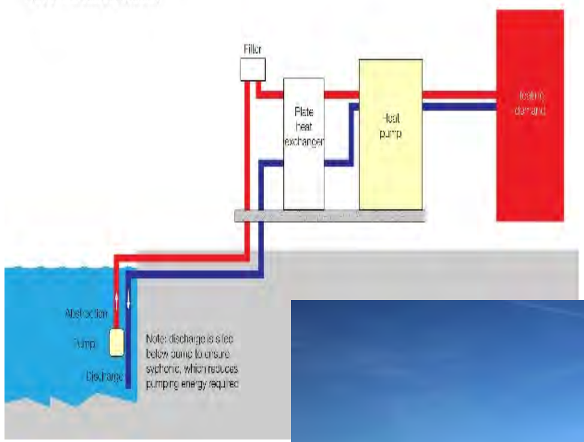
SWSHP Applications #2 and #3

Hoylake & Plas Newydd

Both RNLI & NT have innovative ongoing programmes



Notes:
1. Stables Building at 30 m above sea level contains heat pump
2. Connected by 127 m of 2×160 mm HDPE pipes carrying thermal transfer fluid to the shoreline pump house
3. Shoreline pumphouse contains heat exchangers, pumps and strainers
4. 57 m of 2×200 HDPE pipes carries sea water to the pump house
5. Intake with 200 mm strainer and discharge point



SWSHP Applications #4

GSK Brentford – Canal Cooling

Enhancing the Canal with a Water Feature
Used to cool Data Centre

SWSHP Applications #5: Source side network

Horsham West Sussex

Serving 5 buildings combined output 90kW using 18 elements submerged in nearby lake at 2.5M CoP 4.11 to BS14511 B5/W45

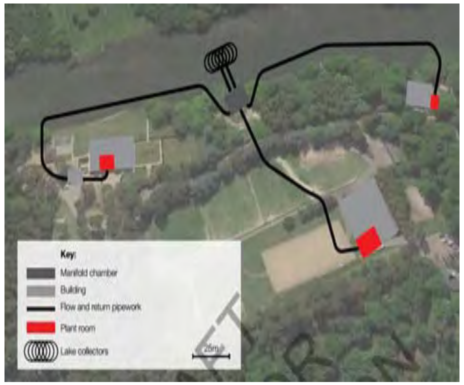
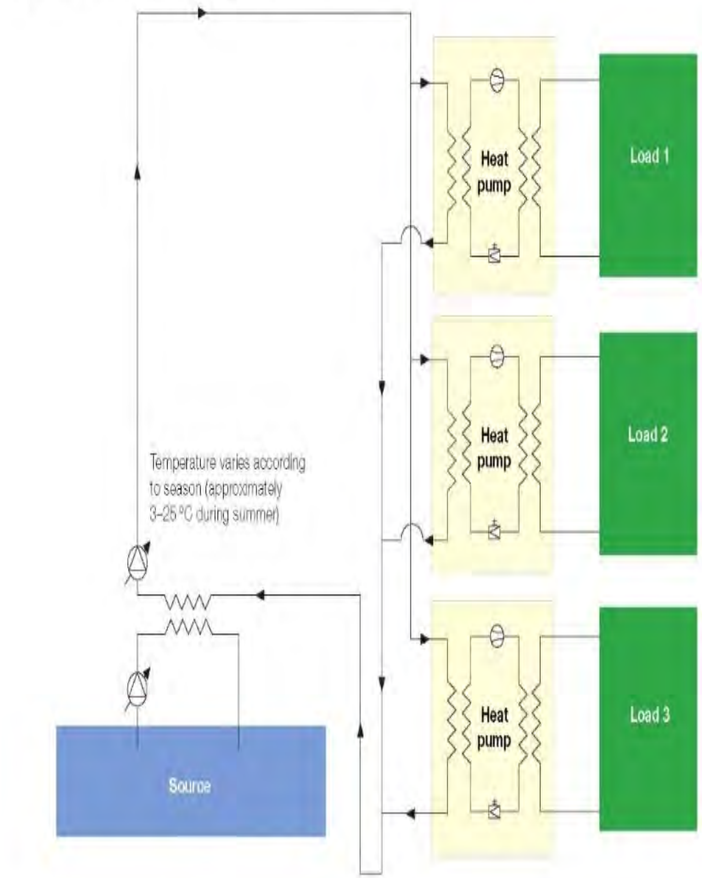


Figure 5: SWSHP on a source side loop (reverse return)



SWSHP Applications #6

Kings Mill Hospital - Mansfield

Large Closed Loop System using Hydroplates

SWSHP Applications #7: Load side network

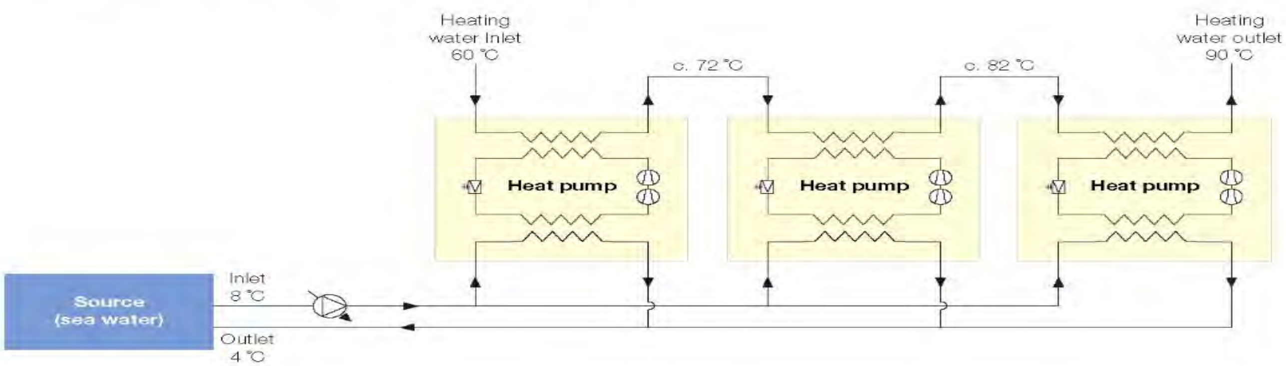
Drammen, Norway.

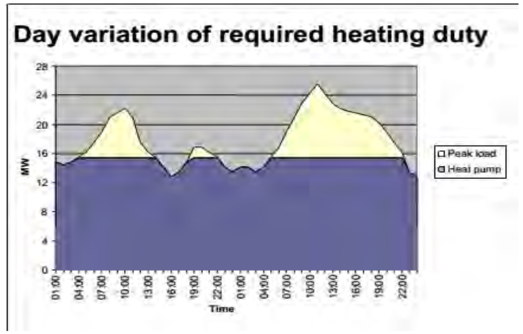
Installed Capacity. 13.3 MW

Annual CoP 3.05 Input temp ± 6°C Output 90°C

Annual Saving £2 million + 15,000 tons CO_2

Figure 11: Heat pumps operating in series, as used at Drammen





www.ehpa.org/technology/best-practices/large-heat-pumps/drammen-district-heating-norway/

GSHP association
HPA
CIBSE

SWSHP Applications #8: Load side network

Värtan Ropsten, Stockholm

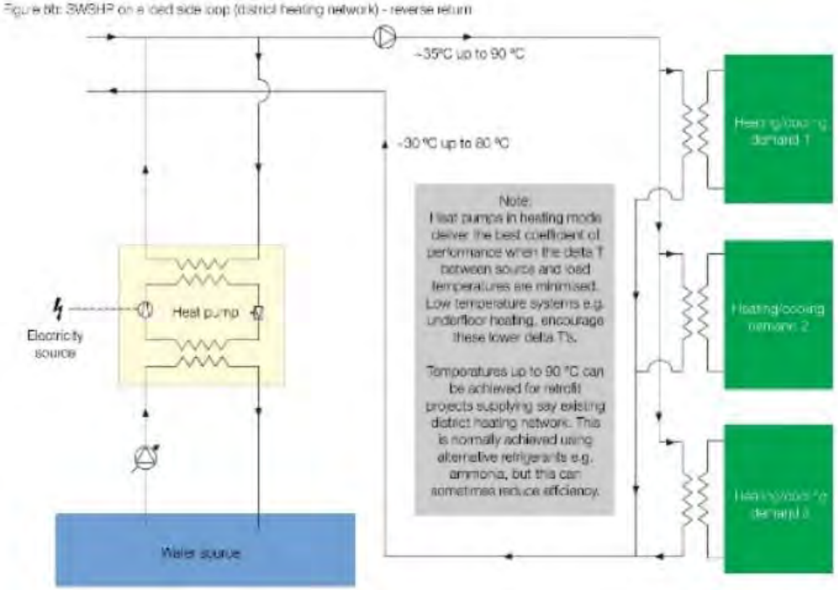
Installed between 1984-86 uses Sea water from Stockholm Harbour as the heat source

6 x 70MW Heat pumps (total 420MW)

Input Temp ± 2.5°C output to 80°C

Capacity Range 100% to 10%.
CoP Max 3.75

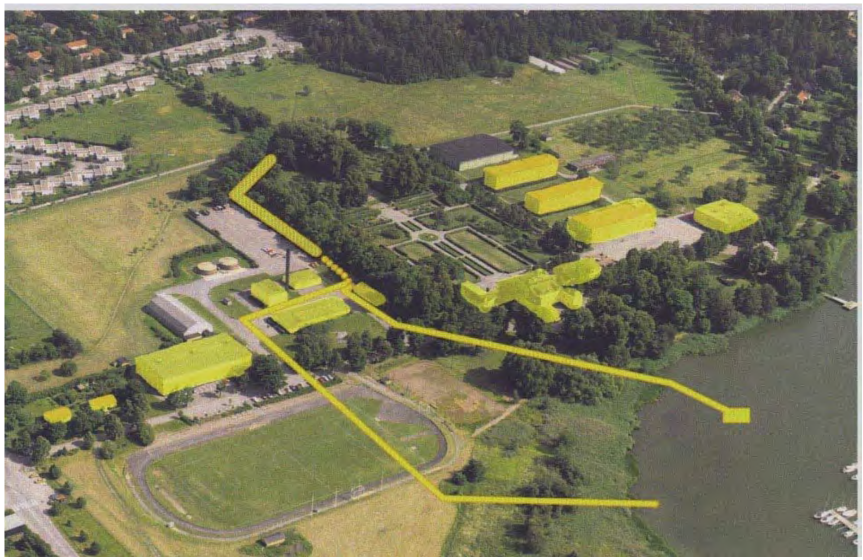
Figure 6b: SWSHP on a load side loop (district heating network) - reverse return

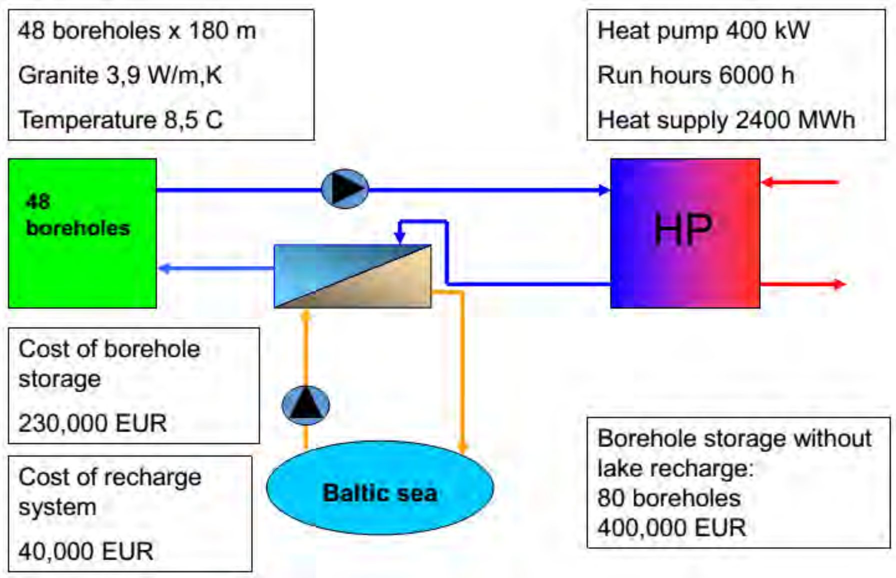


SWSHP Applications #9: Hybrid

Nasby Park, Stockholm

Surface Water BTES Recharge - Borehole numbers were reduced (and hence CAPEX) by recharging with the warmer surface water during the Summer

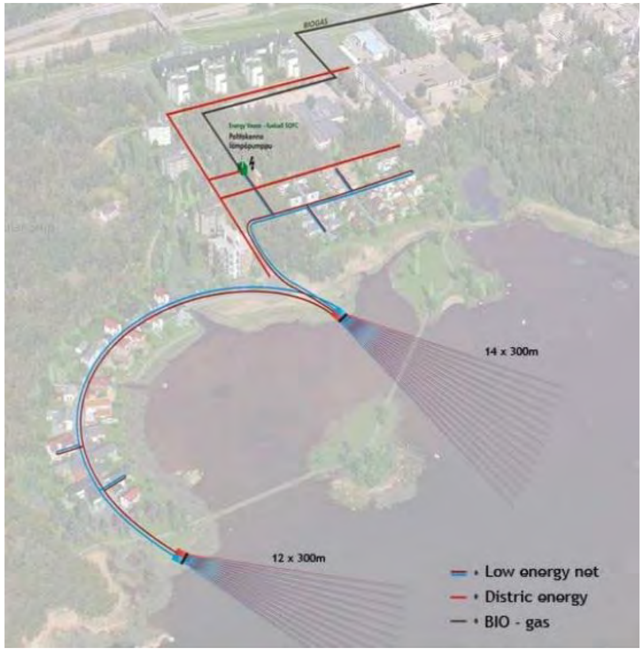




CAPEX Saving 130,000 EUR (in 2004)
Est payback 4.2 Years actual 3 years

SWSHP Applications #10: Source side

Energy Vaasa, Finland

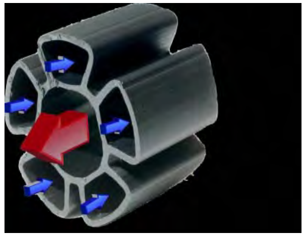


Collector embedded into ”Warm” sediment (14 °C)

Novel collector pipes installed by Horizontal Directional Drilling (HDD). This avoids sea bed ”anchor”-risk

Thermal Transfer Fluid goes to a heat pump in each property at source temperature

Annual average energy supplied 1.2 GWh,
Total Heat Pump power 400 kW
Individual Heat Pumps range from 9 kW → 22 kW



https://www.youtube.com/watch?v=eoleWYJlc1E

Thank you

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