SVENSKA KYL&VÄRMEPUMP FÖRENINGEN

NEO ENERGY

Large Water Source Heat Pumps – The Swedish Experience

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Sediment heat exchanger

Skåvsjöholm outside Stockholm
17 km of pipe buried in the sea bed
Weights counteract ice buoyancy
~40 parallel circuits

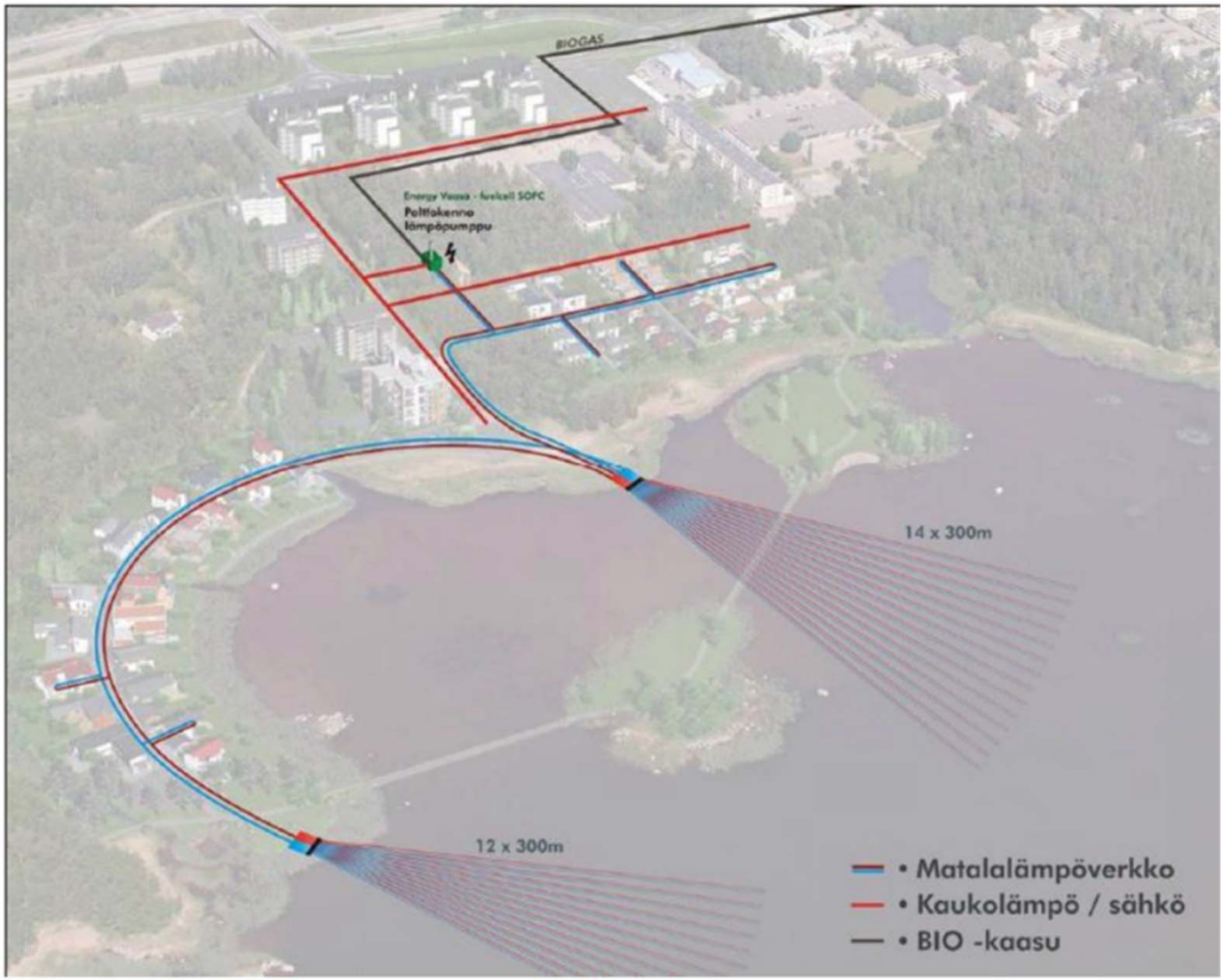
Heating power 300 kW
Cooling capacity 200 kW
Built 1994 still works fine
Hotel 91 guestrooms + 16 lecture-
COP 3→4

Investment around 300 000 € (indexed to 2014)
Utilization time 3000 h/year

Saved energy 200 x 3000 = 600 000 kWh/year
Alternative cost 0.1 €/kWh (Oil = 0,15…)
Saved money 60 000 €/year

Payback period 300 000 / 60 000 = 5 years

Vaasa Finland drilled collector into the sediments



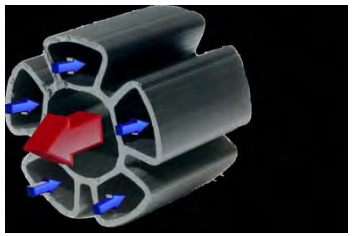
Warm sediment
14 °C brine in, every autumn

No ”anchor”-risk

Special pipes Refla
Demands drilling

Distribution of brine to the individual houses

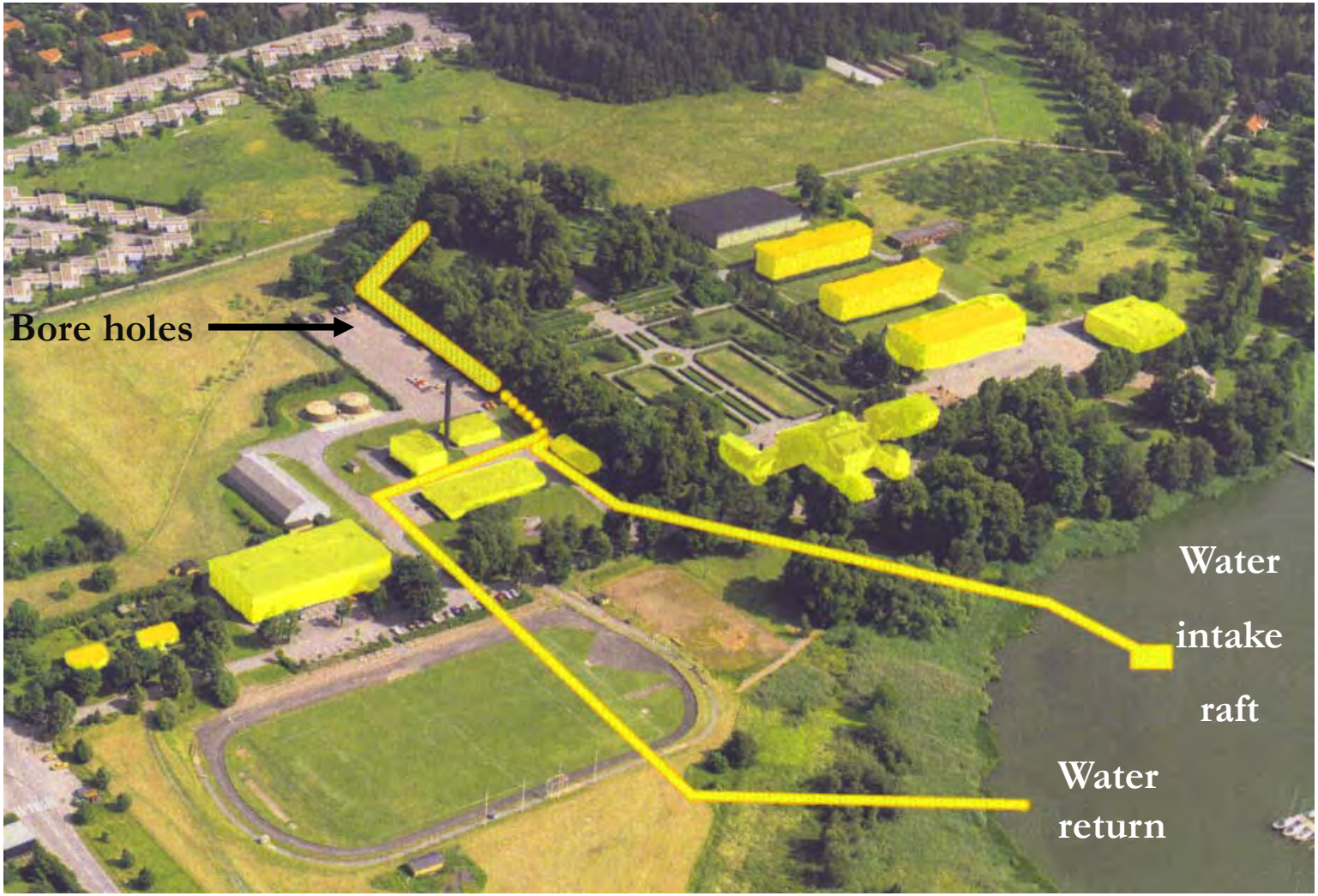
1.2 GWh, 400 kW
9 kW → 22 kW/HP



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

http://217.114.90.22/PageFiles/192519/Refla%20Sweden.pdf

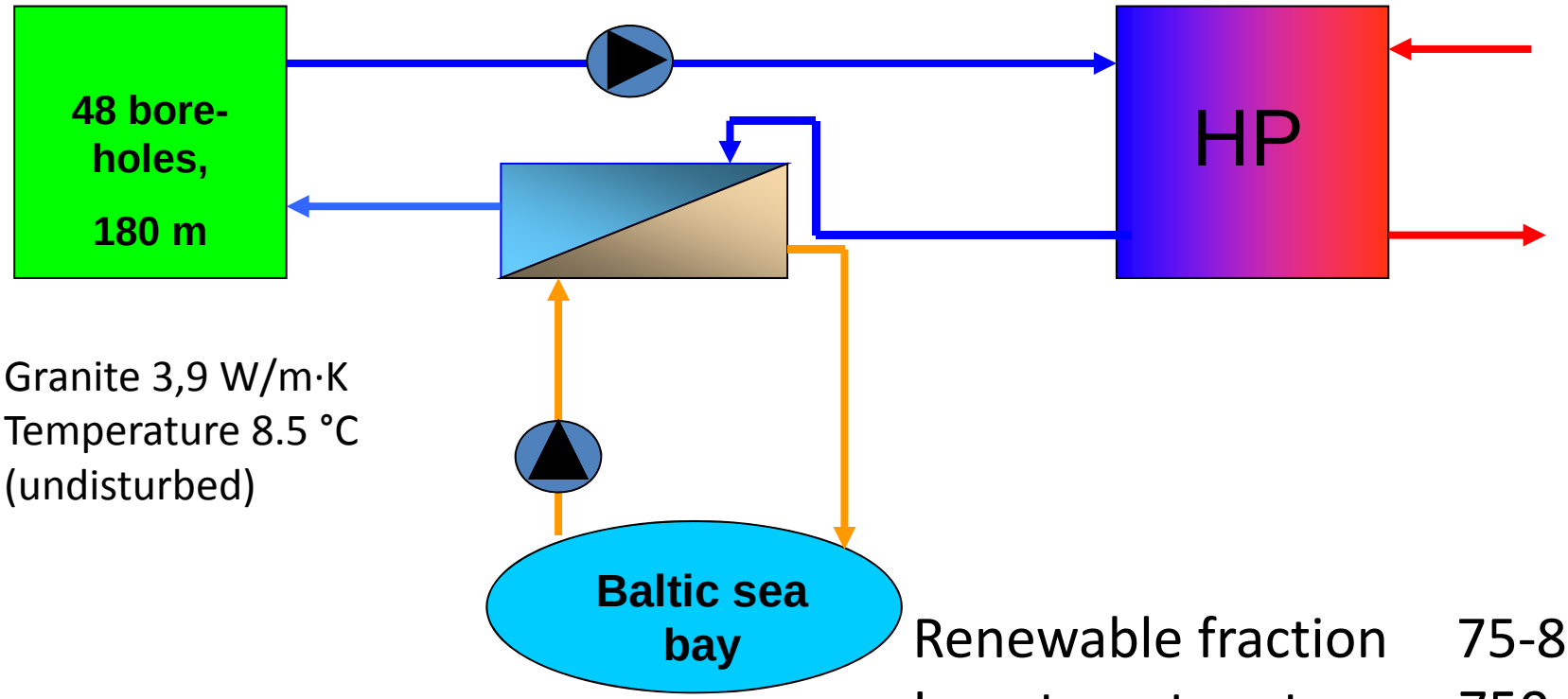
Sea water - loads the bedrock summertime



Näsbypark Castle

Näsby park Castle

Bedrock heat storage loaded from the sea



Granite 3,9 W/m·K
Temperature 8.5 °C
(undisturbed)

Renewable fraction	75-80%
Investment cost	750,000 €
Savings/year	180,000 €
Estimated payback	4.2 years
Actual payback	3 years

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Some larger heat pumps

Ropsten 250 MW heat – has delivered 60% of the heat to Stockholm
COP 3
Also used for district cooling

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Ropsten - some more data (2012)

- Built around 1987 – totally depreciated by now
- Two stages with a medium pressure tank
- Can produce 80 °C forward temperature
- Can use +2 °C sea water while heating (two intakes surface/bottom)
- 4 x 27 MW R22 heat pumps turbo (Sultzer→Axima→Cofely)

  COP = 3.21, leaked 360 kg = 0.5%
- 2 x 24 MW R134a (retrofitted as above)

  COP = 2.86, leaked 0 kg
- 4 x 25 MW R134a ABB turbo on barge (→ Siemens)

  COP = 2.68, leaked 1490 kg = 1.7% also for district cooling
- Direct cooling from sea water 74 MW
- Excellent business… **marginally** ~ 5 times economic gain

http://www.fortum.com/countries/se/SiteCollectionDocuments/miljorapport-vartaverket-2012.PDF

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Hammarby sewage water heat pump

Seven HP, 225 MW heat totally
Sewage from 700 000 person equivalents
COP 3.5 produces 1.24 TWh heat/year
Utilisation 5500 h/year
Also used for district cooling

http://www.fortum.com/countries/se/om-fortum/energi-produktion/varmeproduktion-och-kraftvarme/varmeproduktion/hammarbyverket/pages/default.aspx

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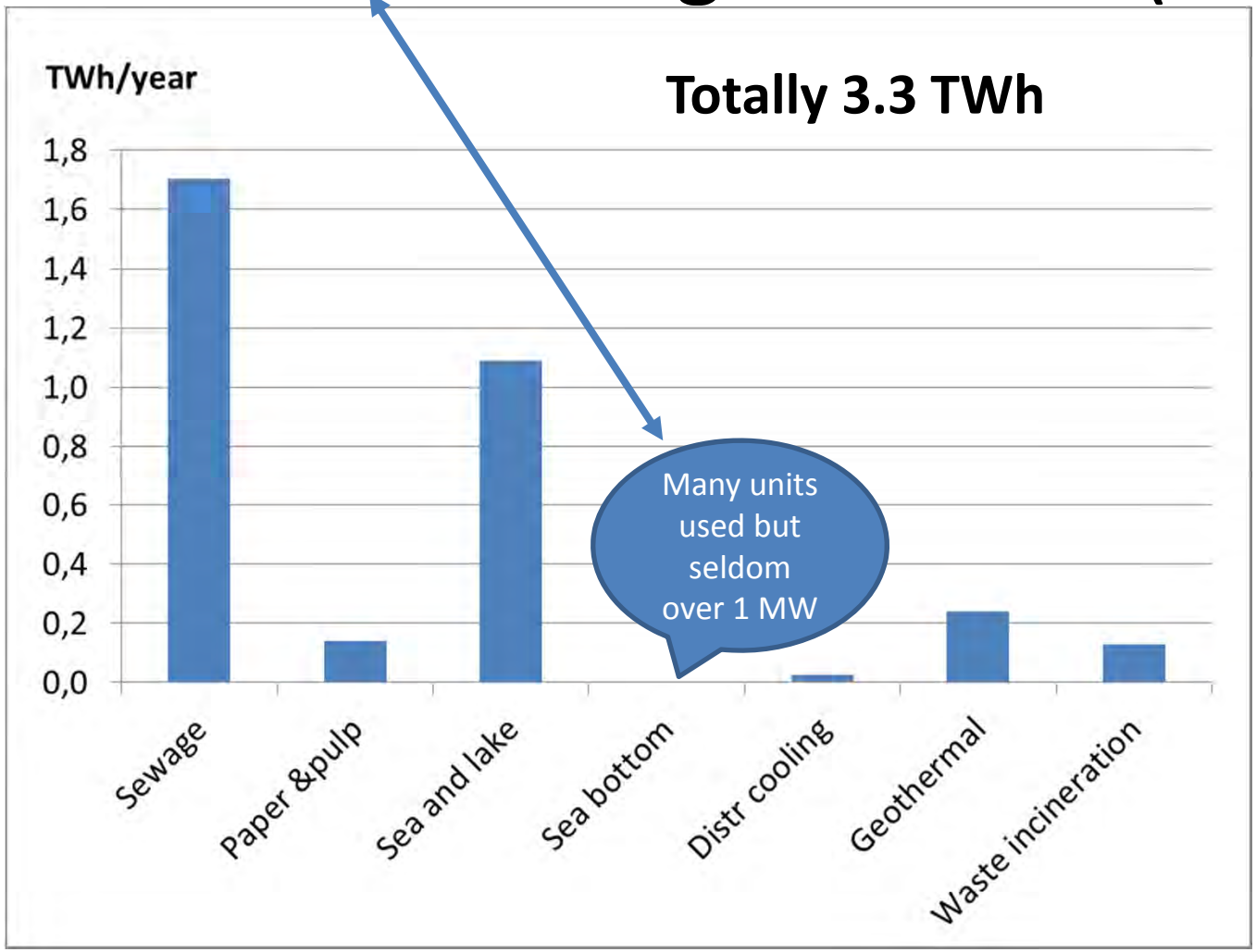
Heat taken up from various sources to district heating networks (2007)



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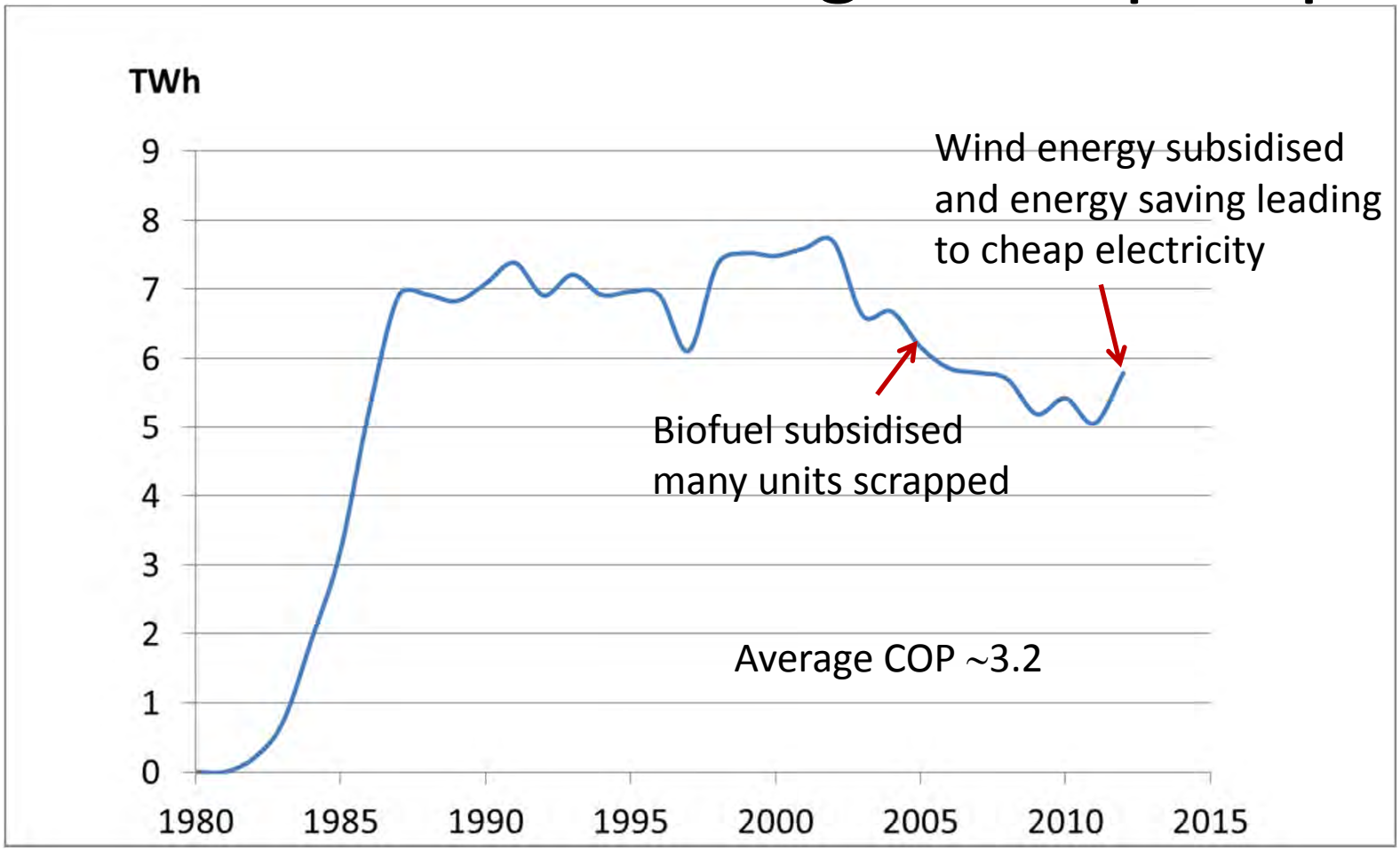
Delivered heat to district heating networks from large heat pumps



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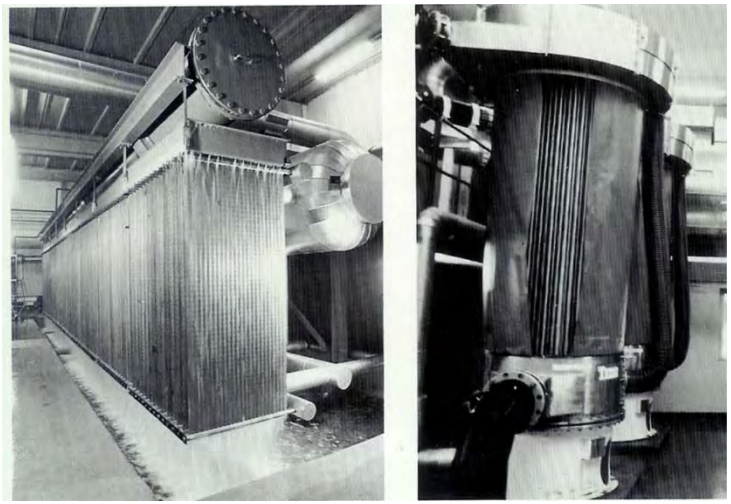
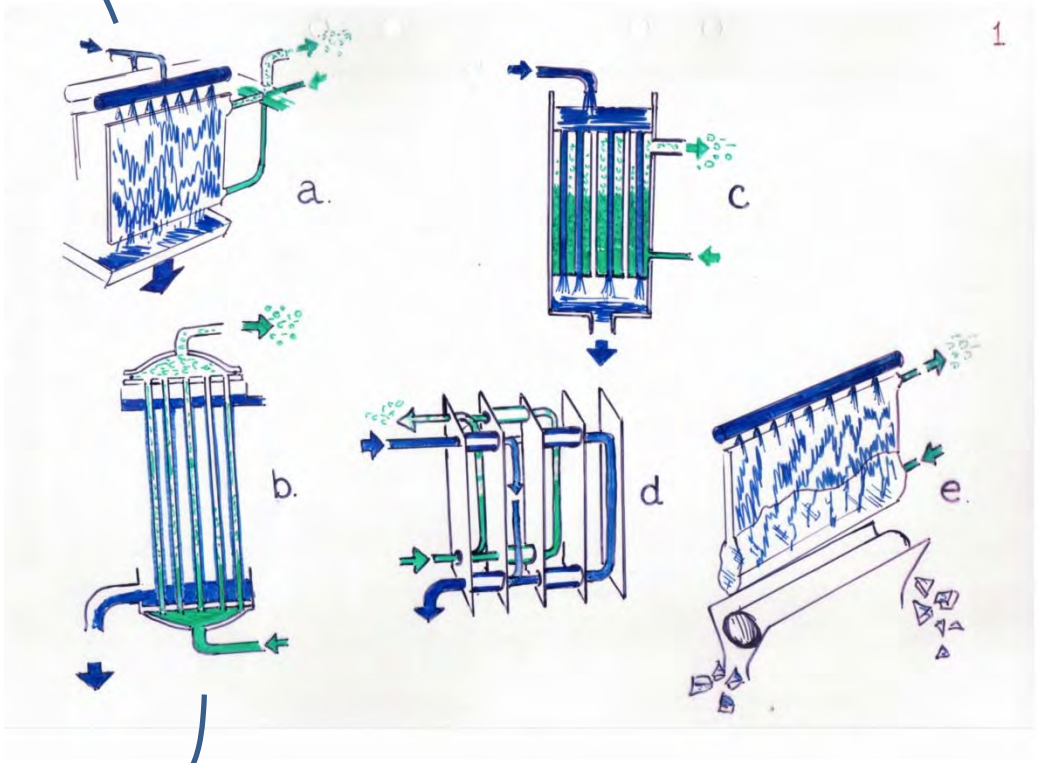
Some methods to exchange heat






500 kW of
cooling each
Built 1983 for Vattenfall
Baltic sea water, 1.5 °C incoming
3 MW of heat
Taken over by Fortum 1998
Too small and scrapped 2012

Common Shell and Tube heat exchangers

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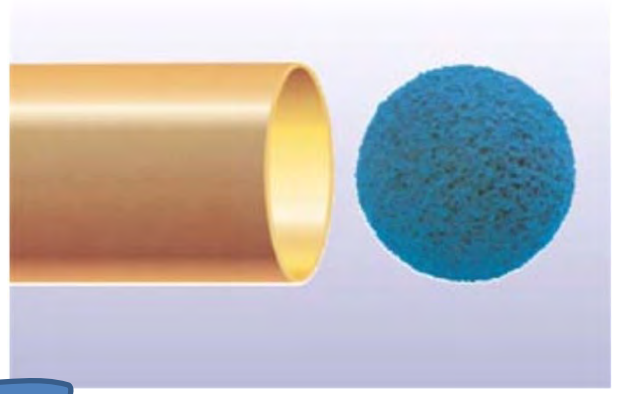
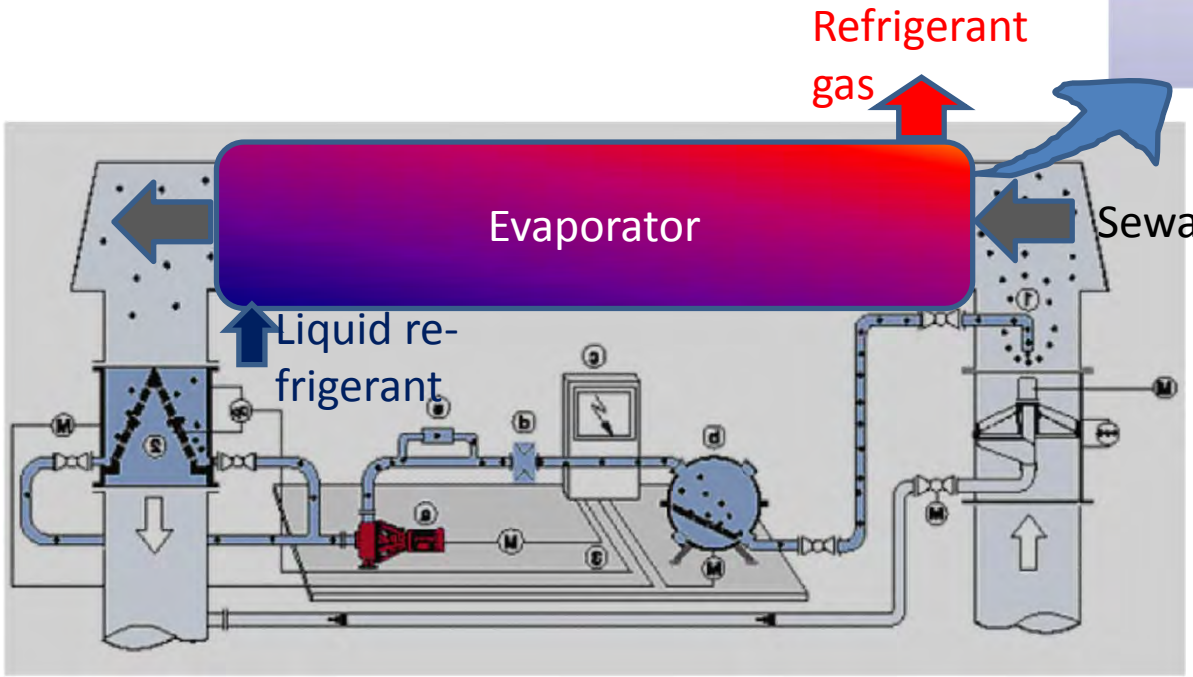
The **Taprogge** cleaning system





http://www.taprogge.de/products-and-services/in-ta-sR/cleaning-balls/index.htm

The **AHTT** cleaning system 4-way reversing valve and:

http://www.heattransfer.com.au/?page_id=477

A new method…..

Should be able to use
0 °C sea water

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