



36th Euroheat & Power Congress

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New markets for surplus heat

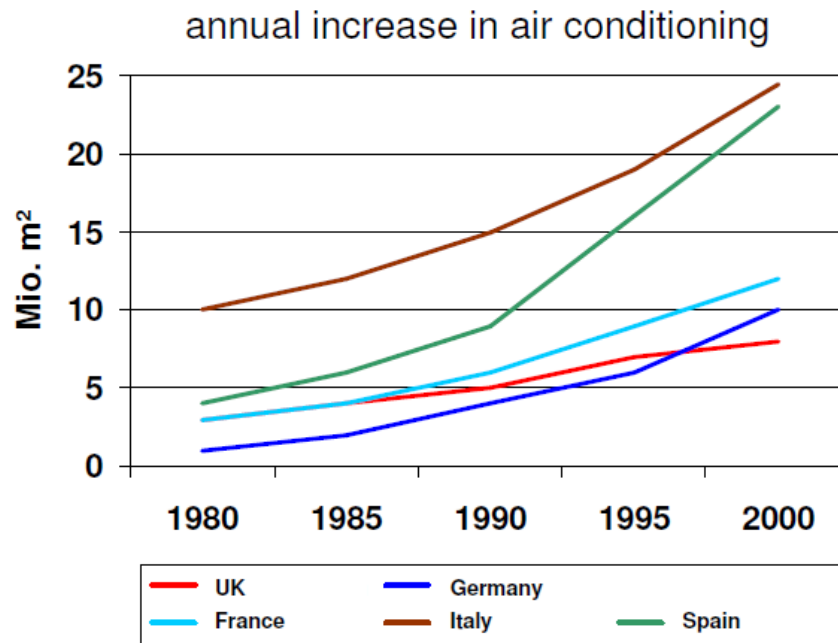
-cooling with a new generation of
compact absorption machines

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Upward trend for air conditioning in Europe and Germany



source: EU-Project Ecoheatcool

drivers for strong growth

- rising expectations regarding convenience levels; changed consumer attitudes and aspirations
- increase in in-door heat loads (computers etc.)
- growing number of hotspots in inner city areas
- belief that air conditioning leads to higher productivity
- people are ready to pay for it

Upward trend opens business opportunity for district heating based cooling



centralized versus decentralized systems

District cooling	Local cooling based on district heating
<p>principle</p> <ul style="list-style-type: none">➤ Cooling is generated apart the customer➤ Cold water is transported via a separate network	<p>principle</p> <ul style="list-style-type: none">➤ Cooling is generated at the customer's location➤ Operating power is transported via existing networks
<p>Major advantage</p> <ul style="list-style-type: none">➤ Energy efficient production of cooling➤ Economical attractiveness in urban planning areas with new to build supply infrastructure	<p>Major advantage</p> <ul style="list-style-type: none">➤ Use of existing infrastructure for district heat with free capacity in summer➤ Quick development of existing market potential possible
<p>Major disadvantage</p> <ul style="list-style-type: none">➤ Growth restrictions due to regional limitations by the cooling network➤ No guarantee for high connection speed, which is essential for economical success	<p>Major disadvantage</p> <ul style="list-style-type: none">➤ Financial attractiveness in comparison with cooling alternatives



Decentralized technology with focus on existing real estates

Vattenfall operates centralized cooling networks in

- Amsterdam
- Berlin
- Hamburg
- Uppsala



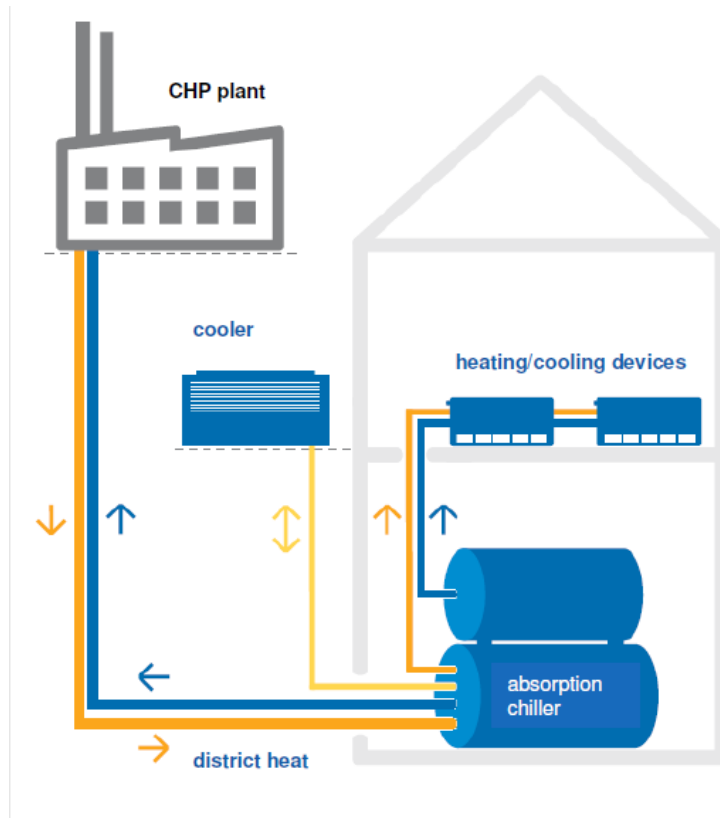
Why is Vattenfall starting to “think” decentralize?

- Because we would restrict ourselves otherwise very locally.
- Because we could not offer sustainable cooling solutions to our district heating customers outside the reaching area of centralized cooling networks.

Decentralize solutions are the ancilla for
a cooling business of relevant volumes



Our approach: district heating-based cooling



the concept:

Use of **environmentally friendly** district heat based on **CHP**.
Much of the **existing infrastructure in a house** can be used to distribute cooling services.

ecological benefit:

District heating for absorption chilling permits a higher degree of CHP utilization and avoids additional electricity usage for air conditioning.

conclusion:

District heating-based cooling is the environmental-friendly alternative to conventional air conditioning using electrically driven room air conditioners.



Technology assessment – cooling generation assets

strengths of absorption

- + technology on the point of market maturity (in particular in comparison with **adsorption**)
- + beneficial if integrate into existing buildings versus DEC technology
- + Longvity of components and lower maintenance costs (no rotating elements)
- + high share of fixed costs (stable economical basis)
- + spares resources and is environmentally friendly (due to CHP based district heating)

weaknesses of absorption

- weak transport performance
- large footprint
- more re-cool capacity required than for compression chillers
- higher total costs of cold than with other chillers

Vattenfall had developed an **innovative prototype** without these weaknesses



Design of the prototype absorption chiller

modular structure of the absorption chiller



- two separate cylinders
- modulating cooling capacities
(50, 100, 160, 210 and 320 kW)

manufacturer:

BS Nova

BS Nova Apparatebau GmbH
Eiserfelder Straße 70
D-57072 Siegen

160 kW absorption chiller

length: 1,95 m
width: 0,86 m
height 2,05 m

50 kW absorption chiller

length: 1,75 m
width: 0,68 m
height 1,59 m

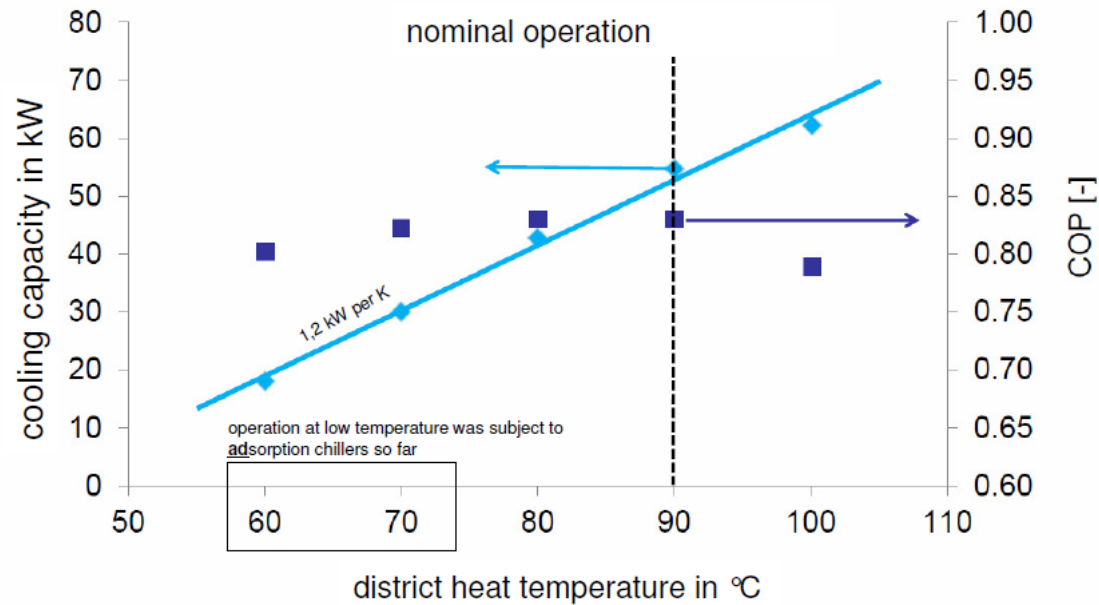


Operation parameter of the absorption chiller prototype

design, operational behavior, efficiency

cooling water $t_{in} = 30^{\circ}\text{C}$ $\dot{V} = 3,8 \text{ l/s}$

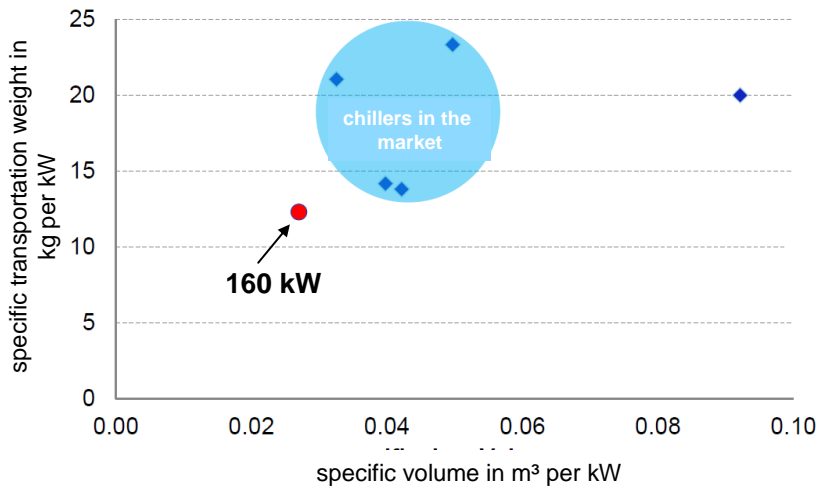
cold water $t_{in} = 21^{\circ}\text{C}$ $\dot{V} = 2,4 \text{ l/s}$



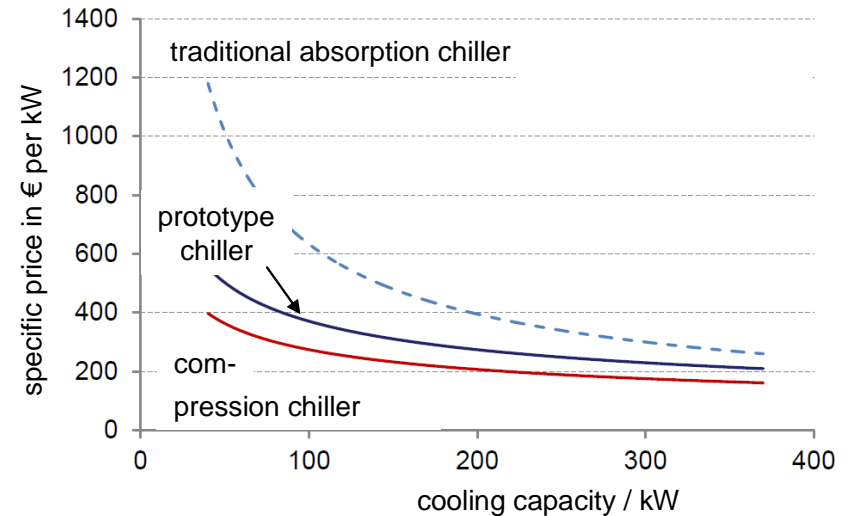
source: Technische Universität Berlin • Institut für Energietechnik



The prototype chiller in market comparison



investment costs in comparison





2012: Vattenfall started market introduction

rollout of the product concept on the premises of the first district heating customers in the scope of further pilot installations

first property in Hamburg:

Users of indoor cooling on the ground floor: Fa. Samson AG

One property was partially fitted with indoor cooling in order to demonstrate concepts for partial supply :

(no necessity for all building users to get connected)

Energy cost allocation in compliance with the German Ordinance on Heating Costs, implemented together with vendor *ista*.





Support for the absorption breakthrough in EU

German District heating association **AGFW** and Technical University Berlin took the initiative to get support from the Federal Ministry of Economics and Technology **BMWi**:

2013 starts a German-wide **field test project** of absorption chiller technology.



support market penetration of innovative cooling machines
and communicate the return on experience

Would



like to take a leading role on a

demonstration project ?



Summary

- environmentally friendly interior cooling also for existing buildings at acceptable prices
- customer target groups: tertiary sector, residential sector

	<p>concept of an innovative interior cooling</p> <ul style="list-style-type: none"> • utilization of district heat based on CHP with unused capacity in summer. • also applicable in existing buildings, due to utilization of existing infrastructure for interior cooling. 	<p>district heat based cooling</p>
<p>ecological benefit</p> <p>absorption technology using district heat increases utilization of CHP and reduces electrical power consumption for air conditioning.</p> <p>district heat based cooling is the ecological alternative for traditional air conditioning based on electrical driven room air conditioners.</p>		<p>customer's benefit</p> <ul style="list-style-type: none"> • value adding product • pleasant indoor climate – all over the year • solutions for every need

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