

Heat Pumps in District Heating and Cooling Systems – Case studies

Institute of Building Technology and Energy IGE
Center for Integrated Building Technology

Diego Hangartner
Research Associate

T direct +41 41 349 39 78
diego.hangartner@hslu.ch

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Denmark

Why district heating?

**CO₂-
emissions**

**Renewable
Energy**

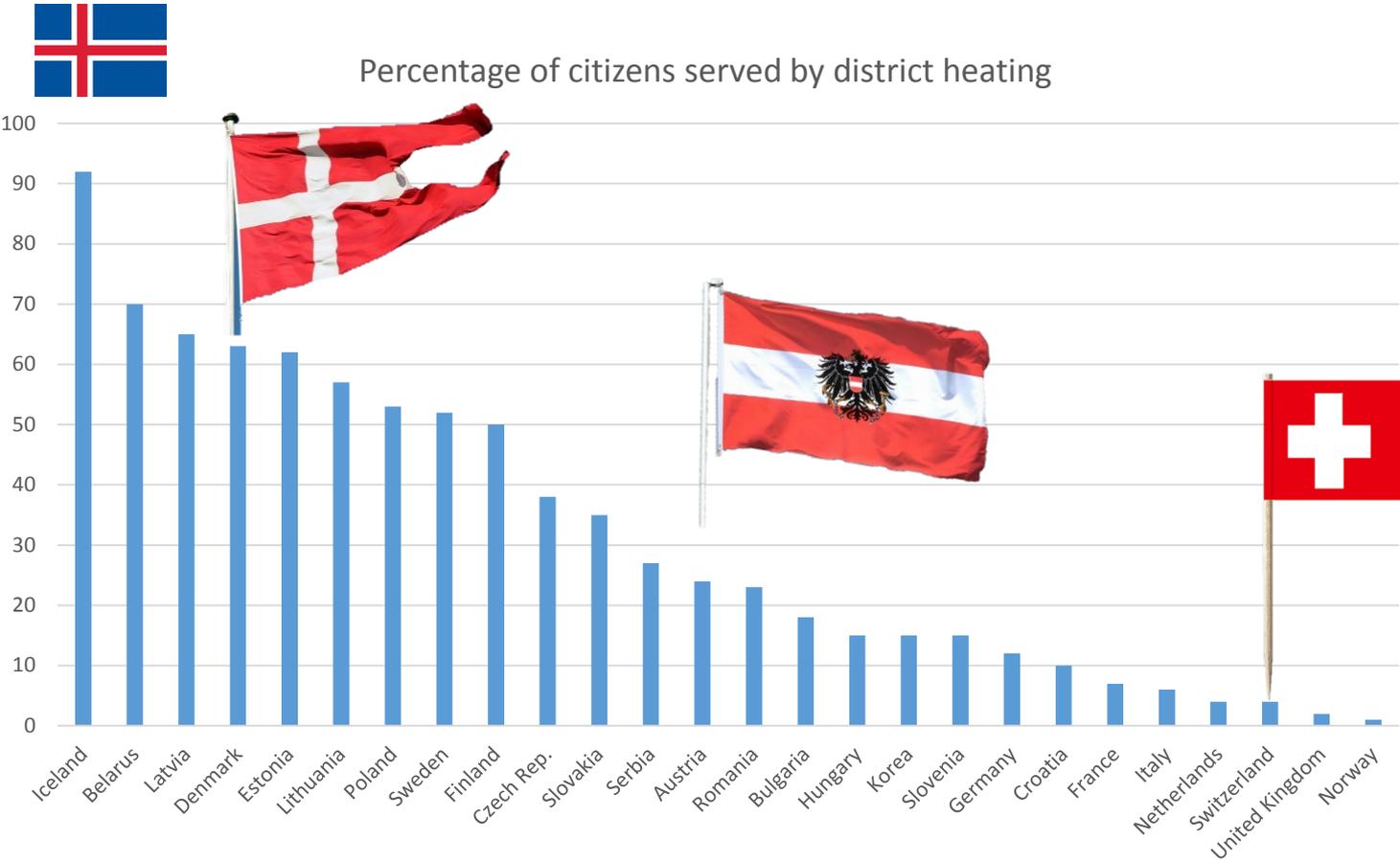
**Economically
profitable**

**Local
source**

End user

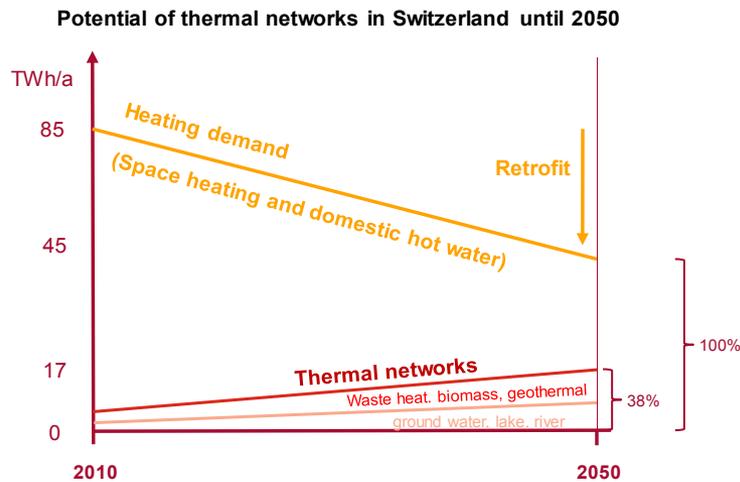
Source picture: Photo LaPresse

Situation in Europe



Source: www.euroheat.org/news/district-energy-in-the-news/top-district-heating-countries-euroheat-power-2015-survey-analysis/

District Heating Systems – Potential in Switzerland



Heat Source	Theoretical Potential [TWh/a]	Economical Potential [TWh/a]
Waste Incineration	5.7	3.6
Waste heat industry	3.6	Not assigned
Groundwater	12.2	1.9
Wastewater plant	7.7	1.9
Lakes	97.0	5.1
Rivers	21.3	1.8
Wood	20.5	1.7
Geothermal	70.0	1.3
Total	238.0	17.3

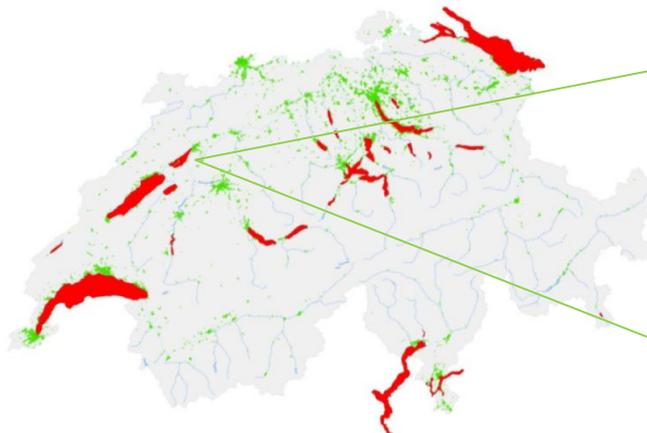


Bild 21 Die für das Wärmepotential berücksichtigten Seen sind rot eingefärbt. Grün sind die ermittelten Nah- und Fernwärmegebiete.

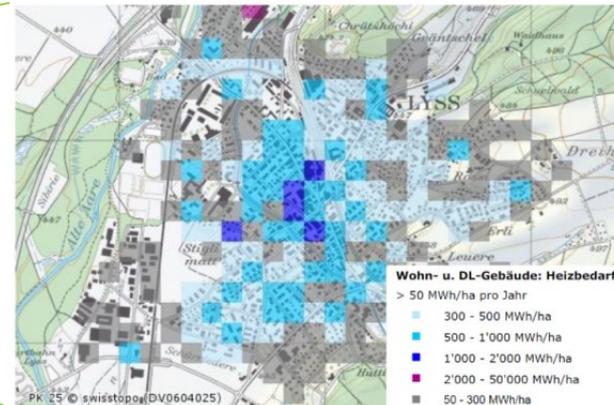
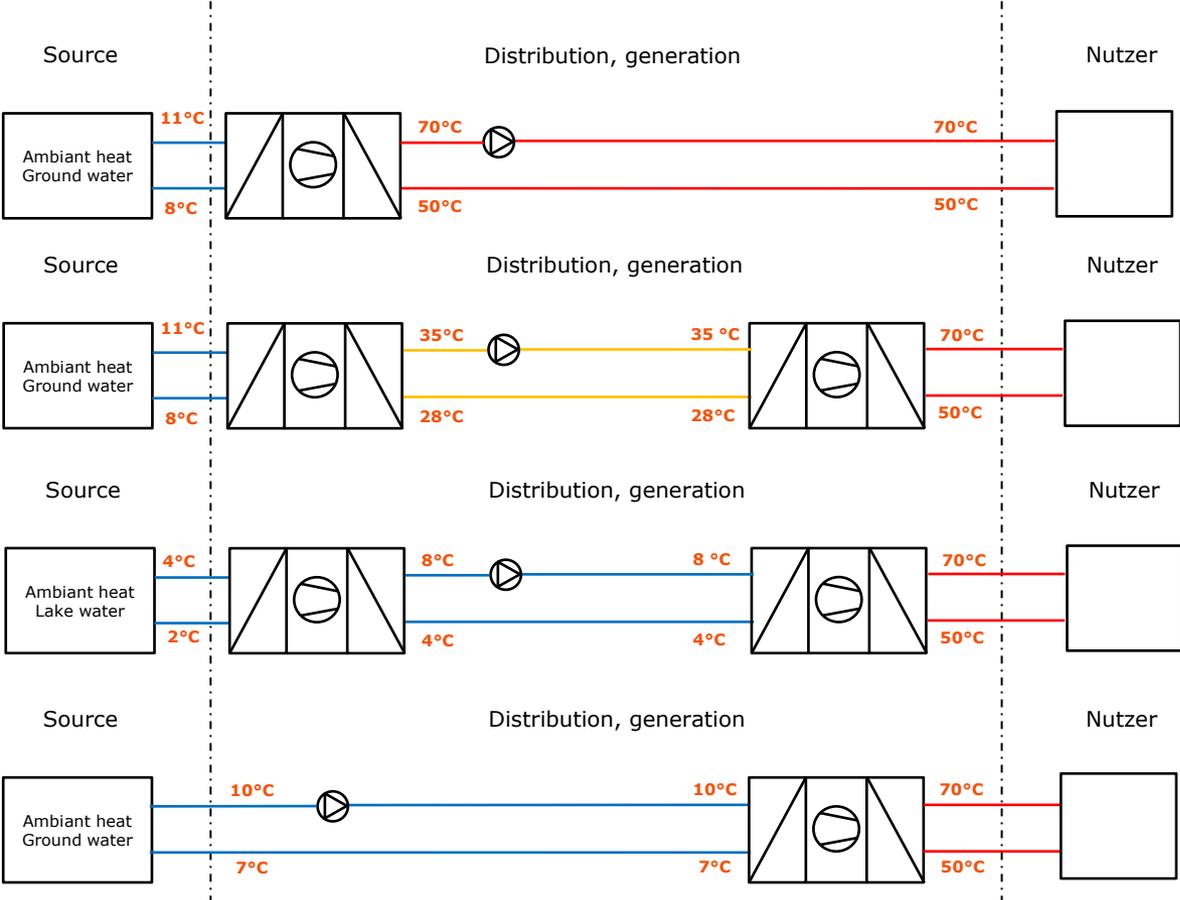


Bild 4 Bild aus dem webGIS des VFS mit Wärmebedarf von Wohn- und Dienstleistungsgebäuden in der Auflösung eines Hektarraster.

Heat pumps – Applications in DHC Systems



POSITION:

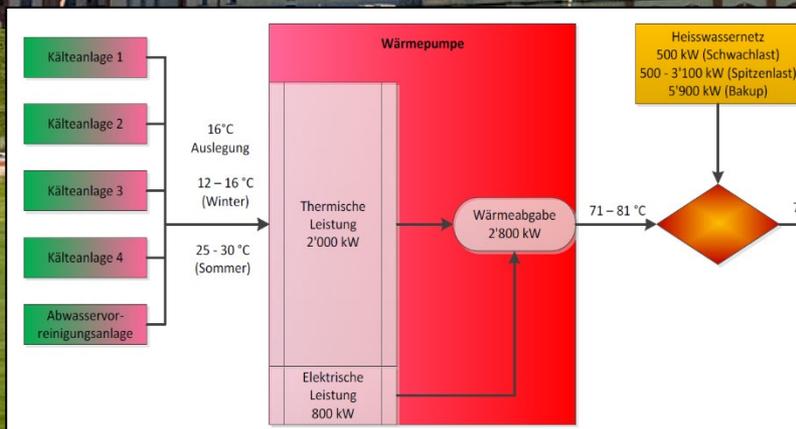
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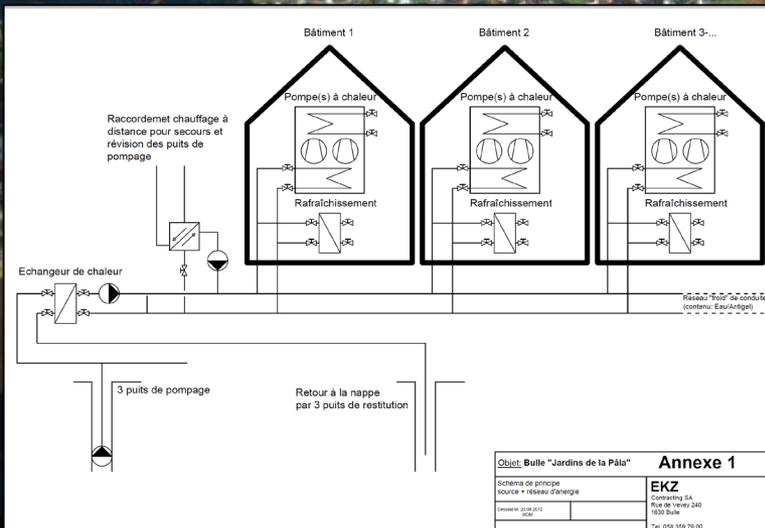
Case project – Rheinfelden-Mitte (Brewery Feldschlösschen)



- AEW Energie AG / Wärmeverbund Rheinfelden Mitte AG
- Residential, offices, restaurants, commercial buildings of Rheinfelden.
- 9.7 GWh/a (Heating + DHW)
- 5.9 MW power installed
- Ammonia HP 2 x 1 MW / COP=3.4
- Source: industrial waste heat
- T_{Network} : 70/80 °C and 50 °C.
- Investments: 20.5 Mio. CHF



Case Project – Bulle, «Jardins de la Pâla»

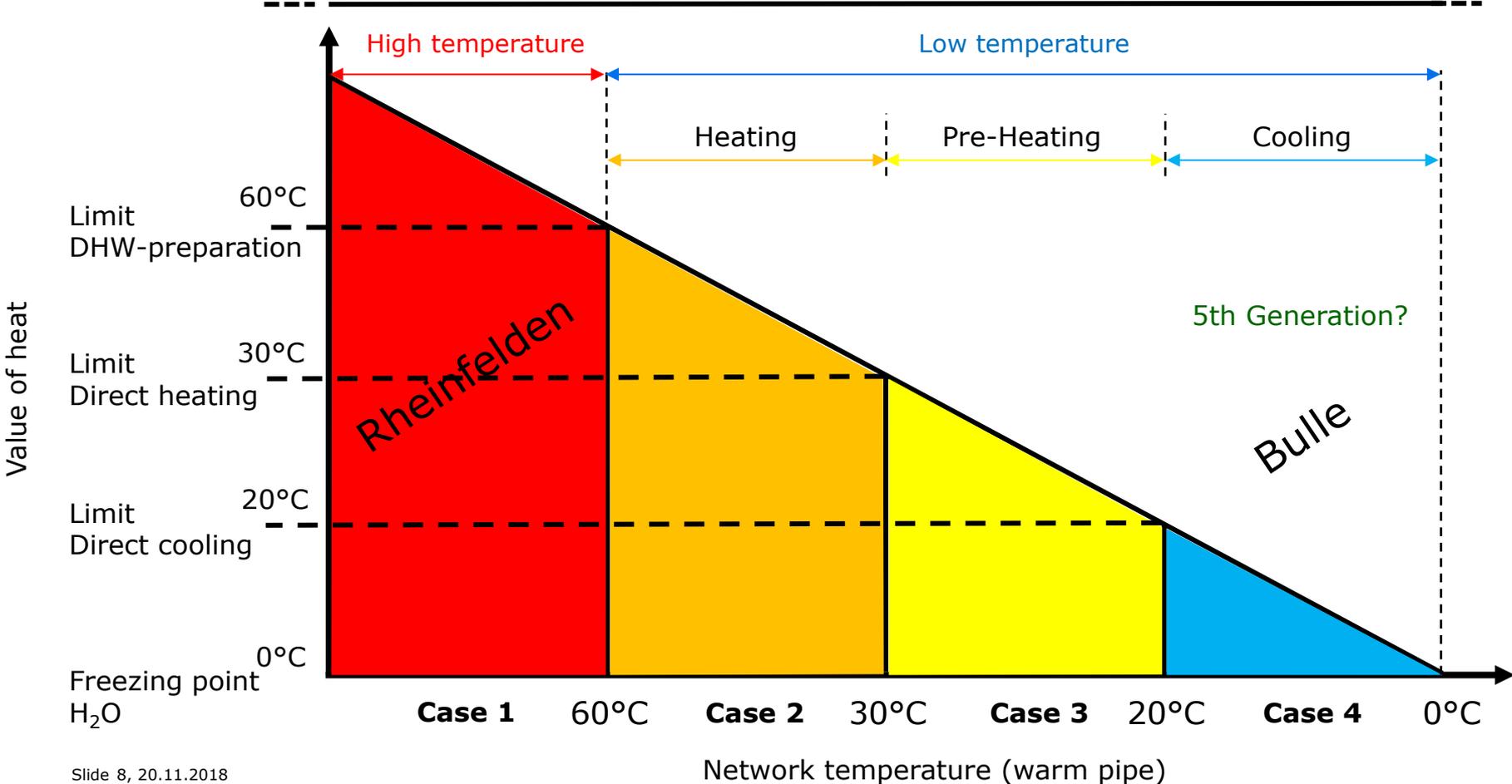


- EKZ Contracting SA
- 65'000 m² Residential + Commercial
- 3'100 MWh/a (Heating + DHW)
- 650 MWh/a Cooling demand
- 2 MW power installed (in total)
- Two-stage HP per house / COP=4.1
- Source: Ground water
- T_{Network} : between 4 °C and 17 °C.
- Investments: 6 Mio. CHF



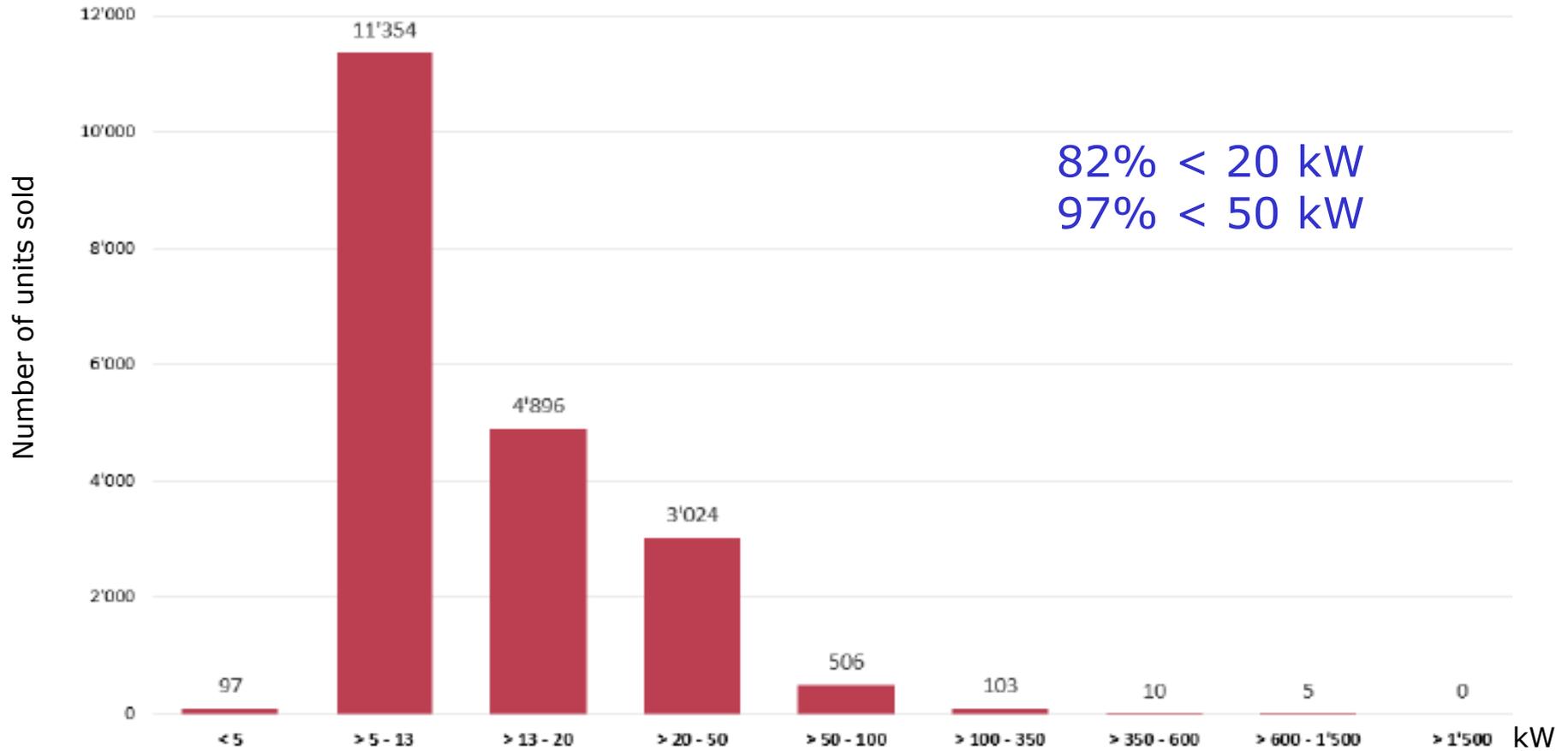
Programm «Thermal Networks» - Classification of networks

Thermal networks



Heat pumps

Power range of heat pumps sold in Switzerland in kW



Source: https://www.fws.ch/wp-content/uploads/2018/05/FWS_Statistiken_2017_V2.pdf

IEA Annex 47 – Heat Pumps in DHC Systems

- Participating Countries:
 - Denmark (Lead, Svend Vinther Pedersen)
 - Sweden
 - Austria
 - Switzerland
 - Great Britain
- Task 1. Market potential
- Task 2. Description of existing systems
- Task 3. Concepts/solutions
- Task 4. Implementation barriers
- Task 5. Dissemination



www.heatpumpingtechnologies.org

ANNEX 47 HEAT PUMPS IN DISTRICT HEATING AND COOLING SYSTEMS

HEAT PUMPS IN DISTRICT HEATING SYSTEMS - SWEDEN
Värmepumpar i fjärrvärmesystemet

Summary of the project
The aim with the project is to investigate and demonstrate new integration possibilities for heat pumps in district heating systems.
Different applications for heat pumps in district heating systems are examined in three sub-projects:

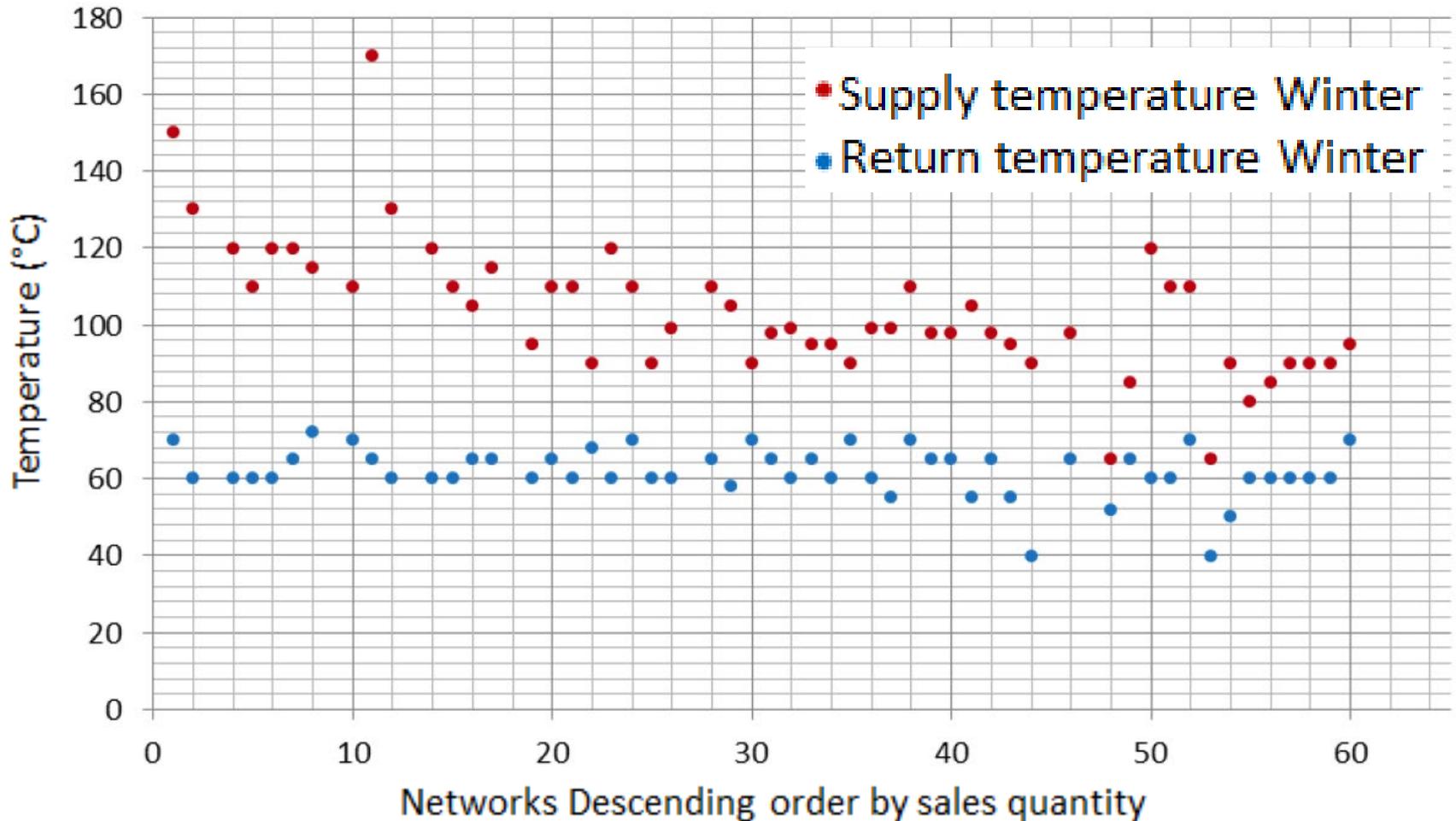
1. Heat pumps for increased efficiency for the district heating net in manufacturing industry
The sub-project is performed in collaboration with Volvo PerforMagnum, the Volvo factory plant in Gothenburg that have both heat pumps and district heating installed in order to heat the facilities. The task focuses on how to combine the two systems in the best way in order to improve the system efficiency. Based on the results the project will give general recommendations for the industry.
2. Optimized combined operation of heat pumps and district heating in facilities and multifamily houses
The sub-project looks into how heat pumps that can alter between heat pumping technology and district heating based on the lowest running cost for the building owner. The main task is to produce an algorithm that chooses the heating technology with the lowest cost for the moment based on the energy prices, outdoor temperature etc.
3. Heat pumps using district heating return flow or low temperature district heating for domestic hot water production in apartments and single-family houses
The task looks into the possibility to use district heating at a low temperature or the return flow as a heat source for producing domestic hot water with a heat pump.

TO INVESTIGATE AND DEMONSTRATE NEW INTEGRATION POSSIBILITIES FOR HEAT PUMPS IN DISTRICT HEATING SYSTEMS *

IEA Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP)

Source: <http://heatpumpingtechnologies.org/annex47/>

Supply and return temperatures of DH – Case Austria

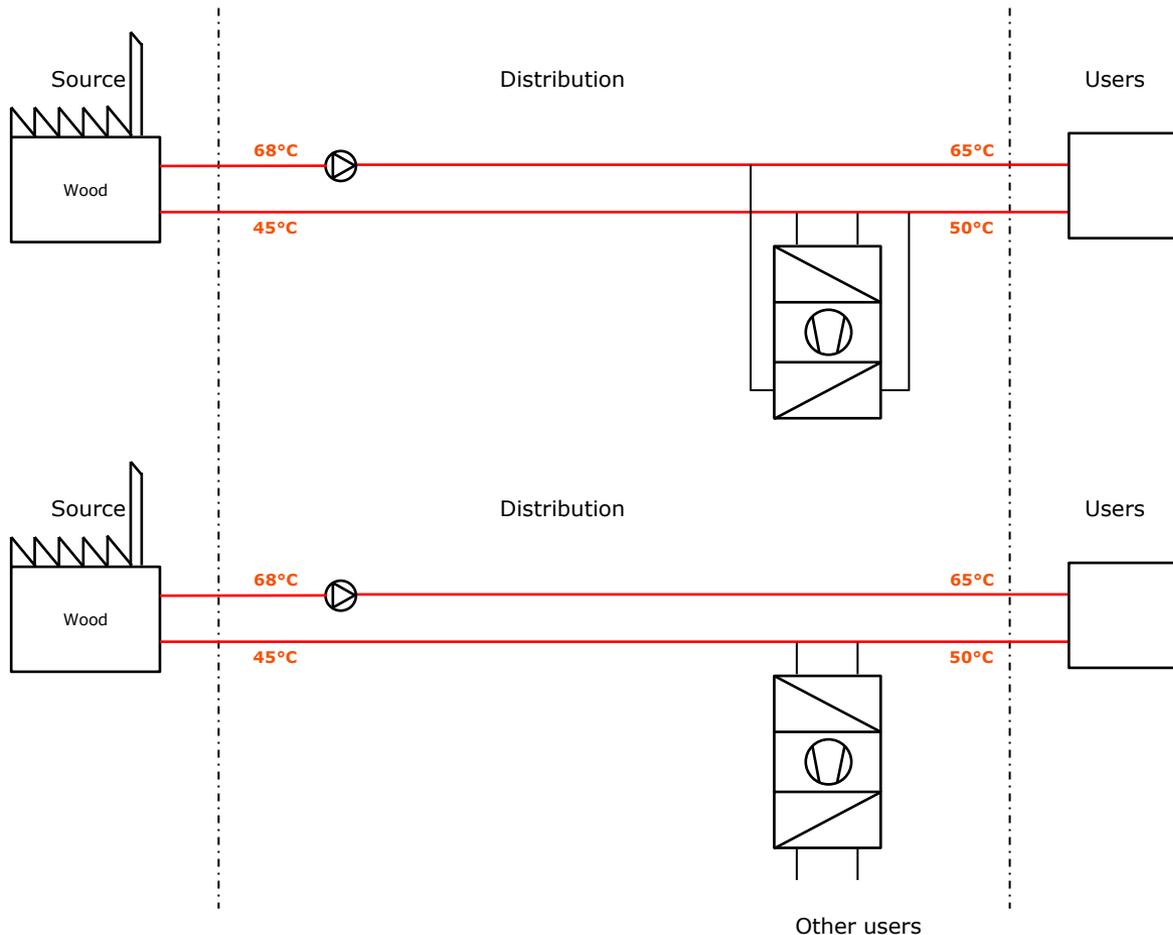


Heat pumps – Application possibilities in thermal networks

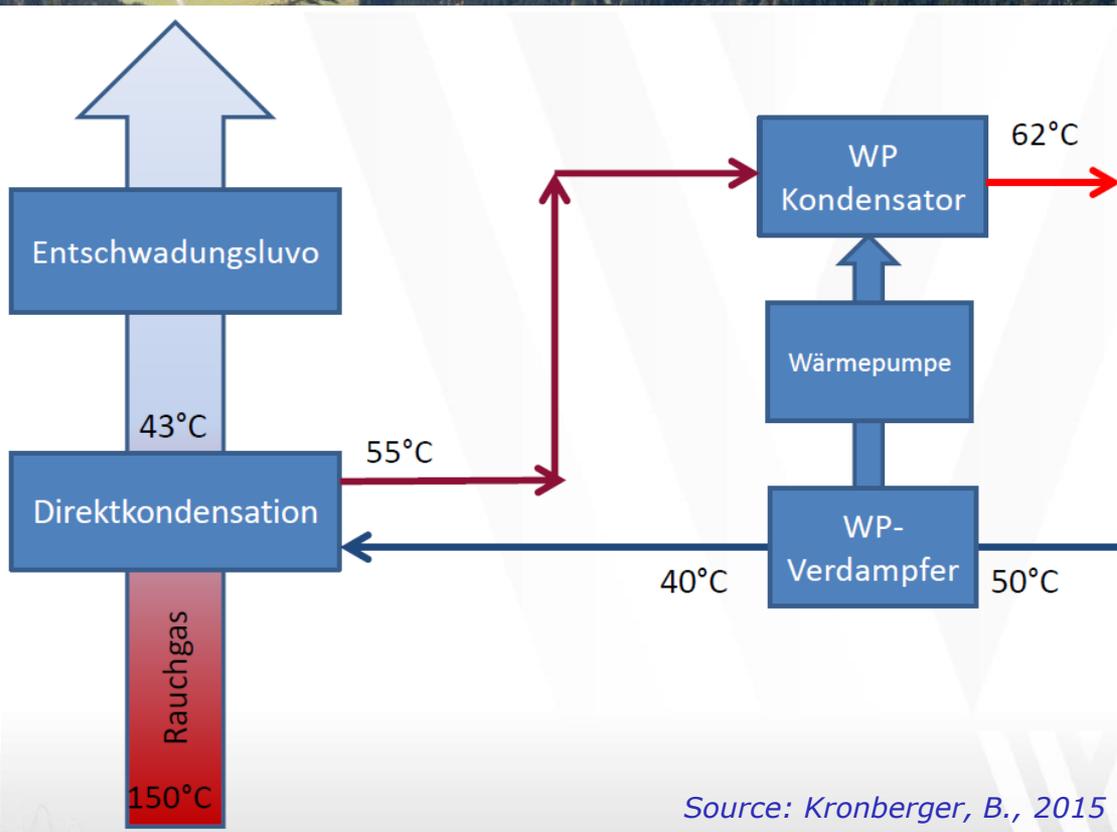
Increase the
capacity of the

Own network

Other networks



District heating Tamsweg – Using return temperatures as heat source



- Increase network capacity
- Improve efficiency of burner due to better flue gas condensation
- 20 % more energy out of the same amount of wood
- 0.9 MW heat pump, COP 6



Heat pumps in thermal networks - Summary

- Heat pumps key technology
- Efficiency improvement and CO₂-reductions
- More application possibilities

Heat source	Application	Power range	Temp. range	Delta T
Ground water	Central lift	> 1 MW	11°C to 70°C	60 K
Ground water	Decentral lift	100 kW – 1 MW	11°C to 65°C	55 K
Lake water	Central low temp. lift	> 1 MW	4°C to 8°C	4 K
Return DH	Central or decentral	100 kW – 1 MW	50°C to 70°C	20 K

- Still technical and social-economical barriers to overcome!
 - Availability products
 - «New» technology

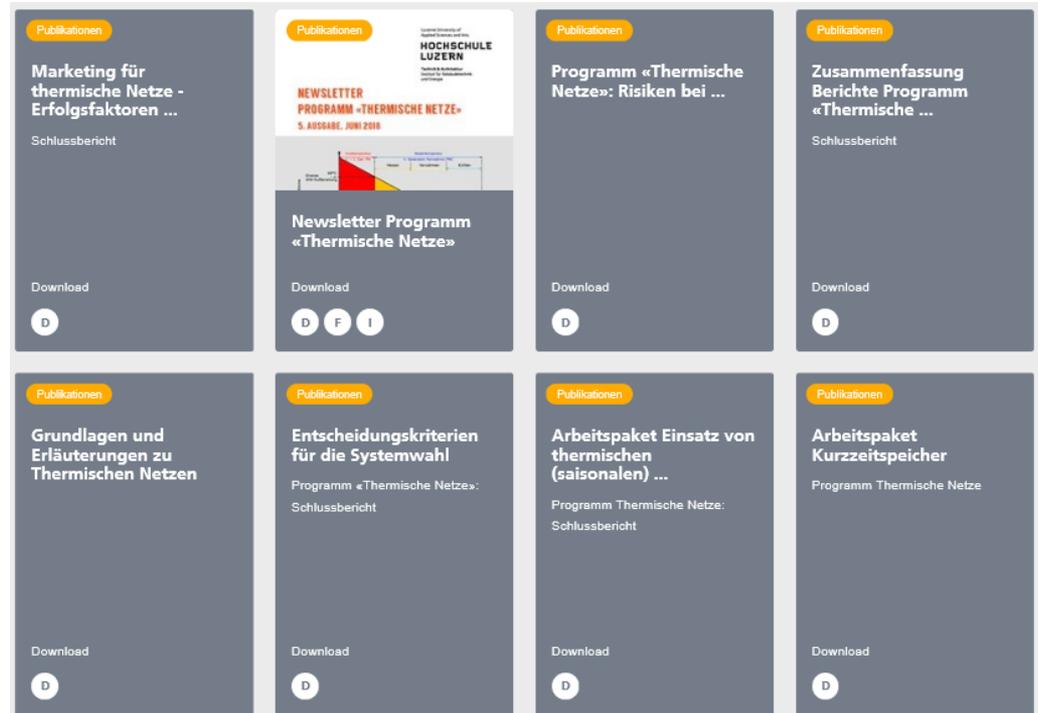
Thank you for your support and attention!

Annex 47

Programm
«Thermal Networks»

<https://heatpumpingtechnologies.org/annex47/>

www.energieschweiz.ch/thermische-netze



The image displays a grid of eight publication cards, each representing a document available for download. Each card features a 'Publikationen' label in a yellow circle at the top left, a title, a subtitle, and a 'Download' button with a circular 'D' icon at the bottom left. The cards are arranged in two rows of four.

- Card 1 (top-left):** Title: 'Marketing für thermische Netze - Erfolgsfaktoren ...'. Subtitle: 'Schlussbericht'.
- Card 2 (top-middle):** Title: 'Newsletter Programm «Thermische Netze»'. Subtitle: '5. AUSGABE, JUNI 2018'. Includes a small thumbnail image of the newsletter cover.
- Card 3 (top-right):** Title: 'Programm «Thermische Netze»: Risiken bei ...'. Subtitle: 'Schlussbericht'.
- Card 4 (top-far-right):** Title: 'Zusammenfassung Berichte Programm «Thermische ...»'. Subtitle: 'Schlussbericht'.
- Card 5 (bottom-left):** Title: 'Grundlagen und Erläuterungen zu Thermischen Netzen'. Subtitle: 'Schlussbericht'.
- Card 6 (bottom-middle):** Title: 'Entscheidungskriterien für die Systemwahl'. Subtitle: 'Programm «Thermische Netze»: Schlussbericht'.
- Card 7 (bottom-right):** Title: 'Arbeitspaket Einsatz von thermischen (saisonalen) ...'. Subtitle: 'Programm Thermische Netze: Schlussbericht'.
- Card 8 (bottom-far-right):** Title: 'Arbeitspaket Kurzzeitspeicher'. Subtitle: 'Programm Thermische Netze'.