MAPPING OF HEAT SOURCES FOR DH HEAT PUMPS IN DENMARK

INTERNATIONAL CONFERENCE ON
SMART ENERGY SYSTEMS AND 4TH GENERATION DISTRICT HEATING

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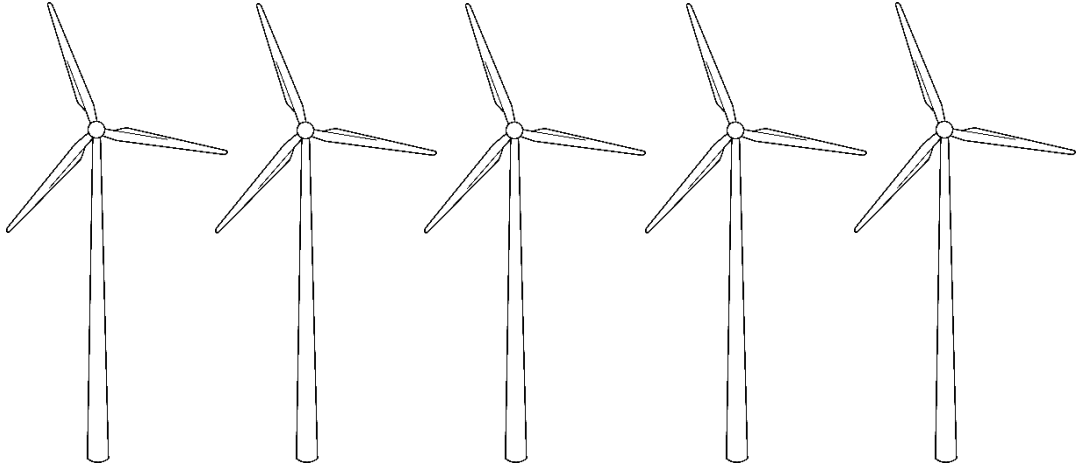
Agenda

1. Introduction: Need for heat pumps
2. Mapping methodology
3. Results: Heat source potentials
4. Future works

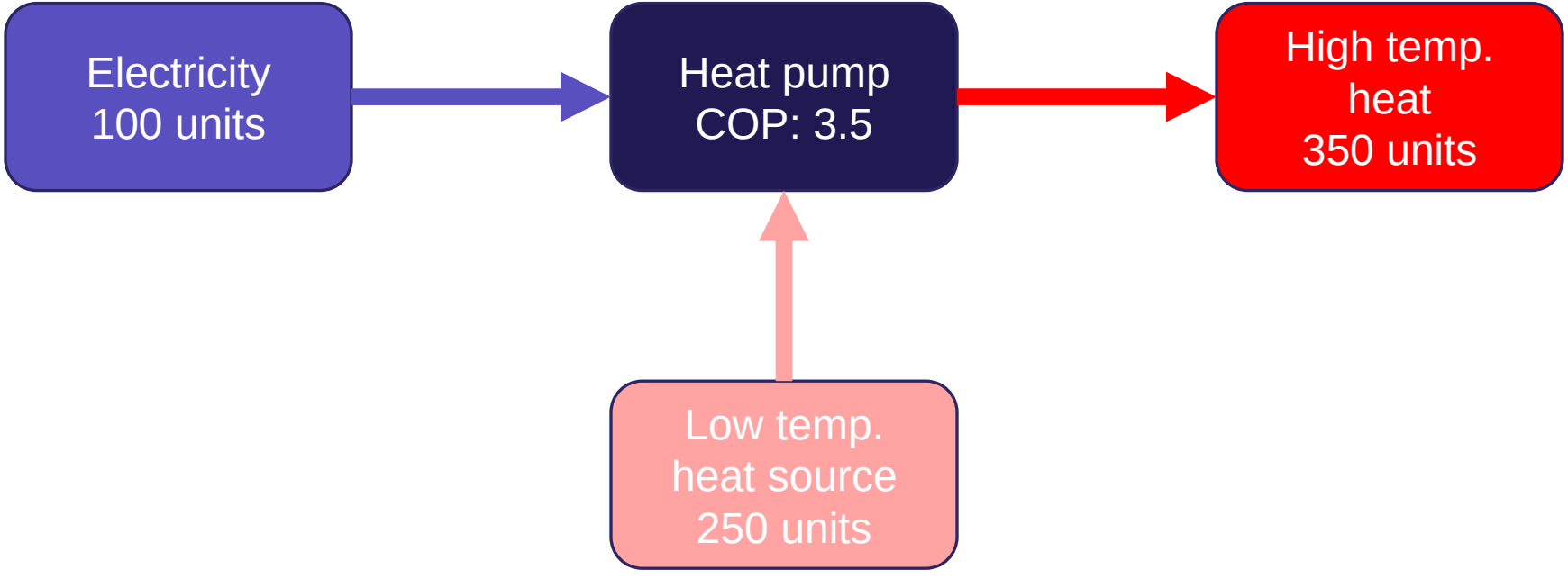
The Need for Heat Pumps in the Future



A solution:

Compression heat pumps in district heating systems

Compression Heat Pumps for DH Supply



Low Temperature Heat Sources

1. What are the potential heat sources?
2. Which temperature levels?
3. Location near to DH area?
4. Potential energy production?

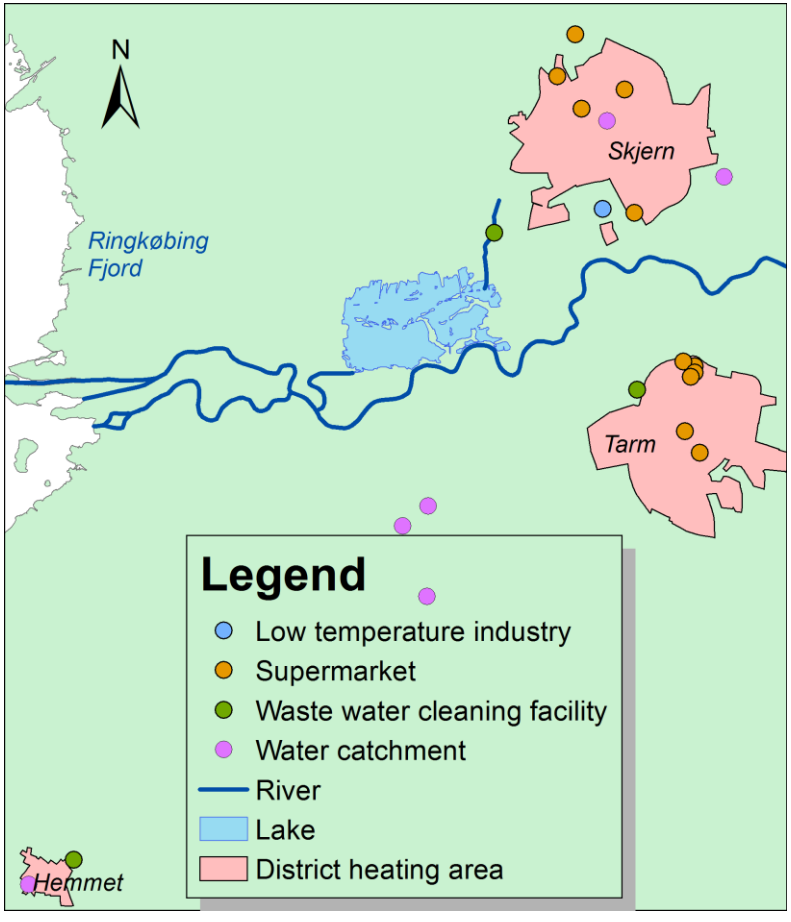
Mapping Methodology

Heat source	Main data sources
Industrial waste heat	NACE categories and IEA type processes
Supermarkets	CVR register data
Waste water	Data from Danish Nature Agency
Drinking/usage water	GEUS Jupiter database
Ground water	GEUS Project data on ground water deposits
Sea	NOVANA sea temperature measurements
River	Data from Danish Geodata Agency
Lake	Data from Danish Geodata Agency

Mapping Methodology

The data is sorted according to:

- Waste heat above 100°C
- Less than 200 MWh pr. year
- More than 500 m away from DH system
- Lakes below 1 km^2
- And others…

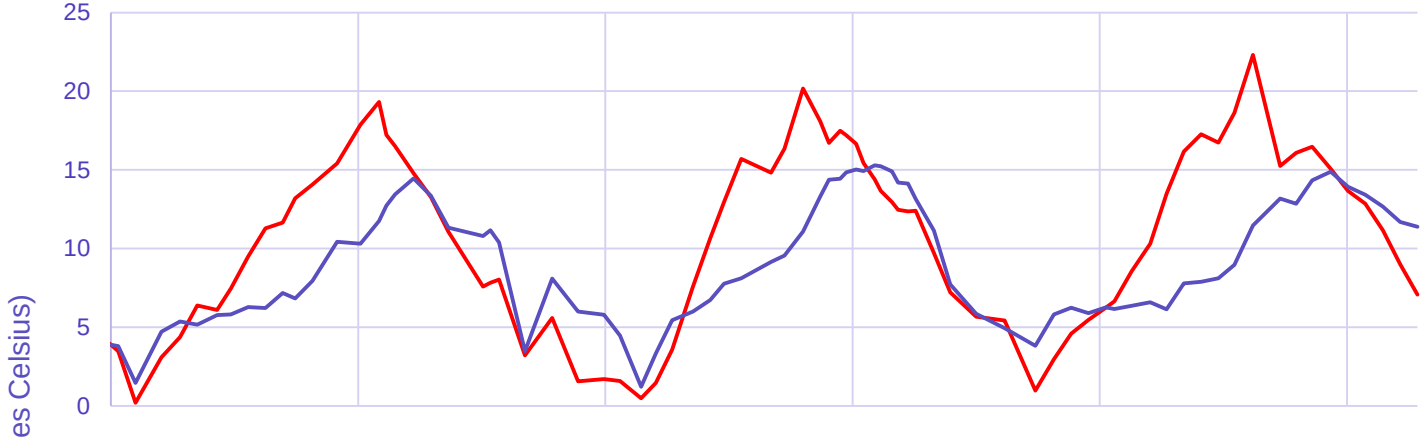


Heat Sources – Temperature levels

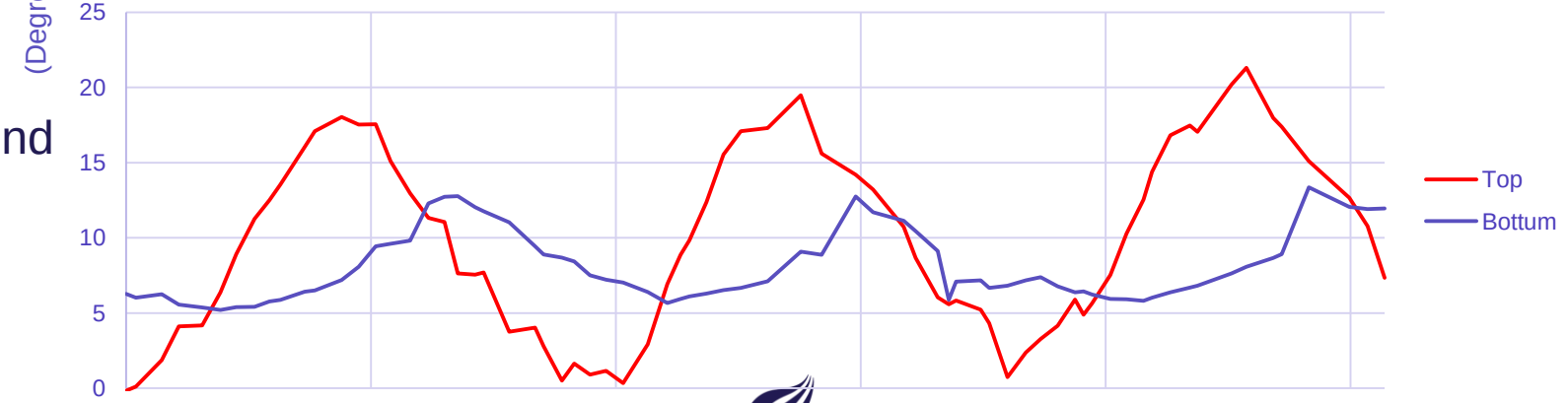
Heat source	Temperature level
Industrial waste heat	12-100 ^{o}C
Supermarkets	-
Waste water	9-21 ^{o}C
Drinking/usage water	8 ^{o}C
Ground water	8 ^{o}C
Sea	0-20 ^{o}C
River	0-20 ^{o}C
Lake	0-20 ^{o}C

Sea water temperatures 2012 - 2014

Århus-bugten 18 m



Øresund 52 m



Heat Sources – Accessibility to DH Areas

Heat source	Accessibility to DH areas	
	In numbers (%)	Annual DH demand (%)
Industrial waste heat	17	65
Supermarkets	62	96
Waste water	39	69
Drinking/usage water	65	86
Ground water	99	100
Sea	29	65
River	8	31
Lake	8	22

Heat Sources – Potential Energy Supply

Identified potentials

- Industry 3.5 TWh (Historical: 2011)
- Supermarkets 0.4 TWh
- Waste water 2.9 TWh
- Drinking water 1 TWh

(Ground, sea, river and lake not quantified here)

DH supply in CEESA 2050:

- Industry 2.5 TWh
- Heat pumps 10 TWh

To Conclude

- Potential heat sources exists near all DH areas
- Some industrial waste heat at low temperature might be utilized by heat pumps for DH production
- The heat sources have different temperature levels during the year
- Ambient heat sources will probably be necessary to reach the levels in CEESA

Future Works

- What are the limits related to the environement of the heat sources?
- How much of the demand can heat pumps cover during a year?
- Which COP’s can be expected from heat pumps?
- How will industrial processes change in the future?

THANK YOU FOR YOUR ATTENTION

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