

Technical challenges and solutions for the integration of low-temperature resources into existing networks and buildings

Strategic Heating and Cooling Plan for Mongolia

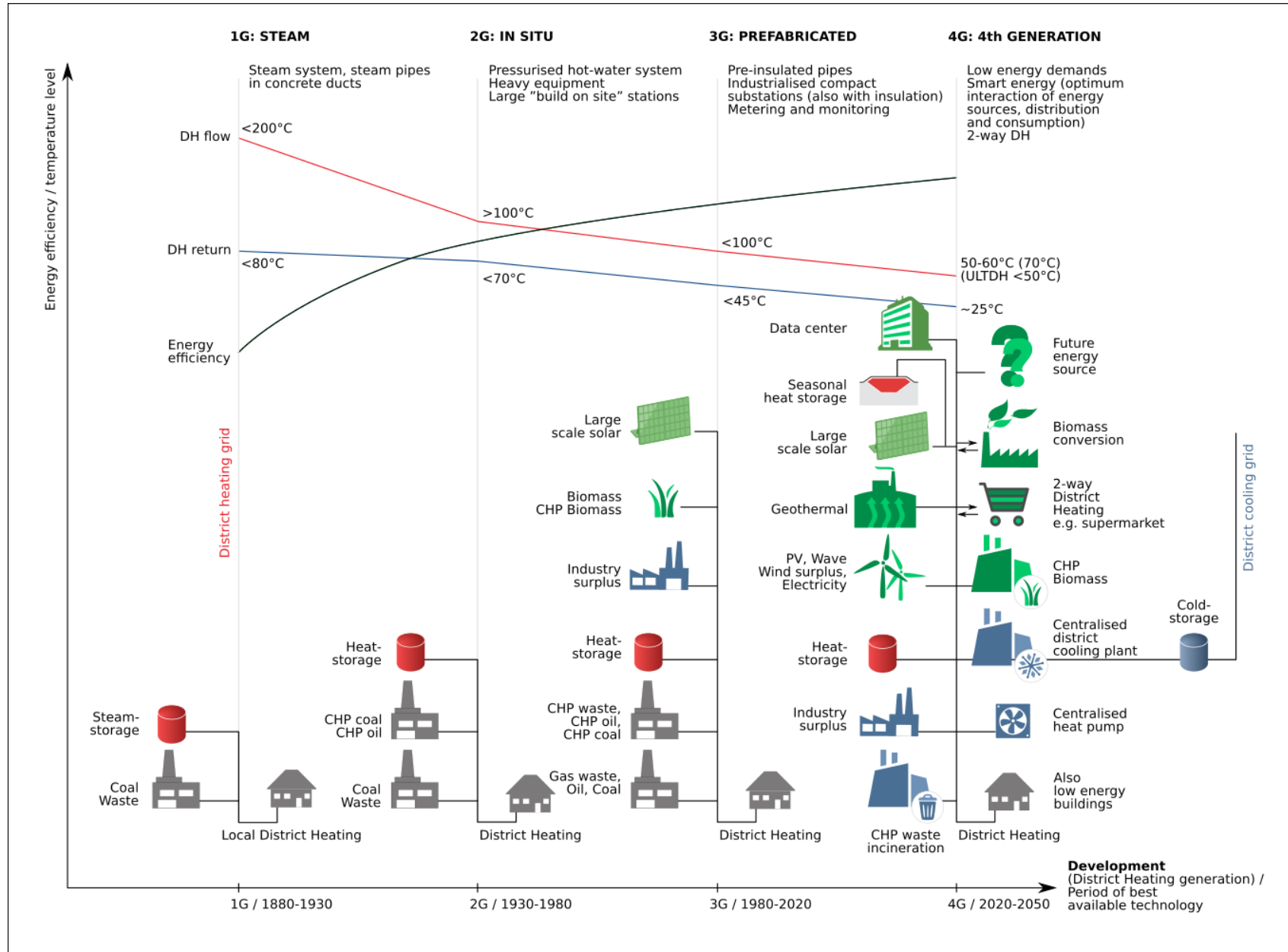
Capacity building seminar

Session 2:

03-06-2022

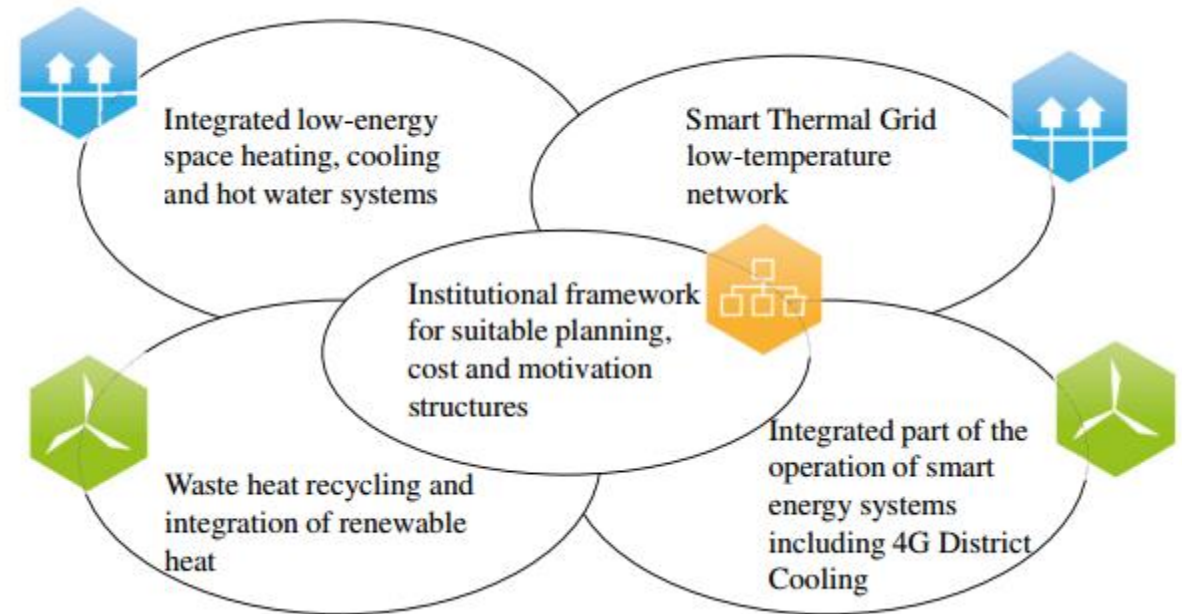
Agenda

- Low temperature district heating
 - Technical aspects
 - Utilisation of renewable sources
- The role of low temperature district heating in Smart Energy Aalborg



Low temperature district heating (4th generation)

- Utilise more of the energy
- Enable use of low temperature renewable sources



<http://www.4dh.dk/>

Transitioning to low temperature district heating

- Proper design of networks and consumer connections
- Right compatibility with the buildings stock
- Existing district heating systems
 - Adapting installations
 - Potential retrofitting of buildings
- New development areas and new district heating systems
 - In low energy buildings, low temperature district heating can be especially suitable

Compatibility with existing building stock

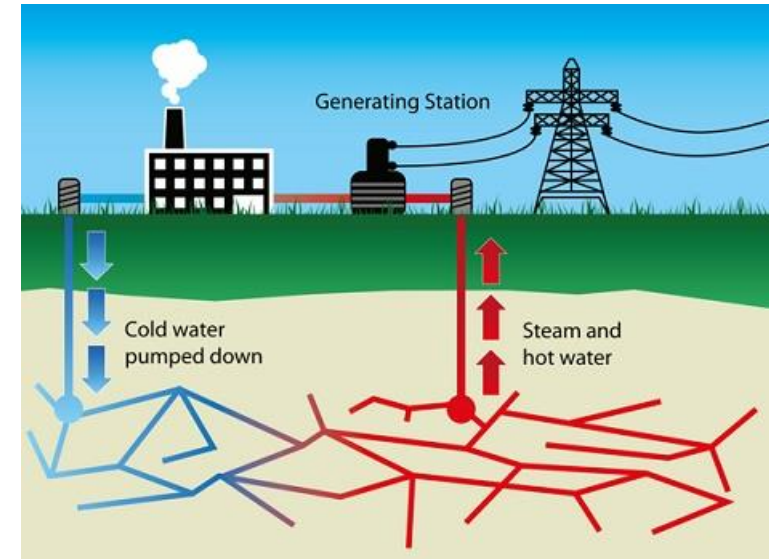
- Space heating
 - Poorly insulated buildings require more energy
 - Current equipment might not be scaled for low temperature district heating
 - Equipment changes
 - Renovation of the building stock
 - Introduce thermostatic valves to control comfort levels
- Domestic hot water
 - Low temperature can lead to legionella in the water tank
 - Plate heat exchanges can be a solution

Compatibility with existing heat network

- Lower temperature can lead to higher flow rates
 - Low supply temperature requires that the return temperature is lowered too
 - From 80-40 to 50-20, still have a higher temperature difference
- New excess heat sources can require new networks
- Boosting technology can become relevant
 - To increase temperature from a supply source
 - To increase temperature certain places in the grid in cold seasons

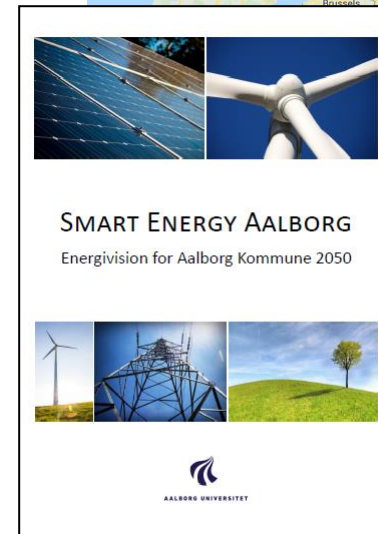
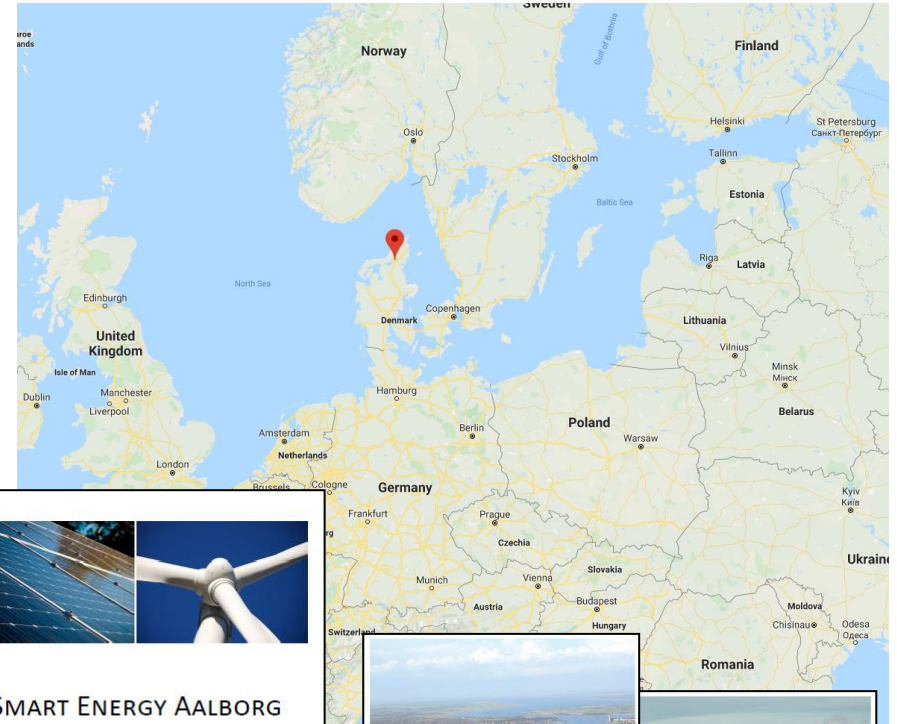
Integration of renewable energy

- Geothermal
 - Utilise heat either through heat pumps or directly in the network
 - Most resources are low to medium temperature
- Solar thermal
 - Seasonal by nature
 - Potential for large thermal storages
 - Requires space

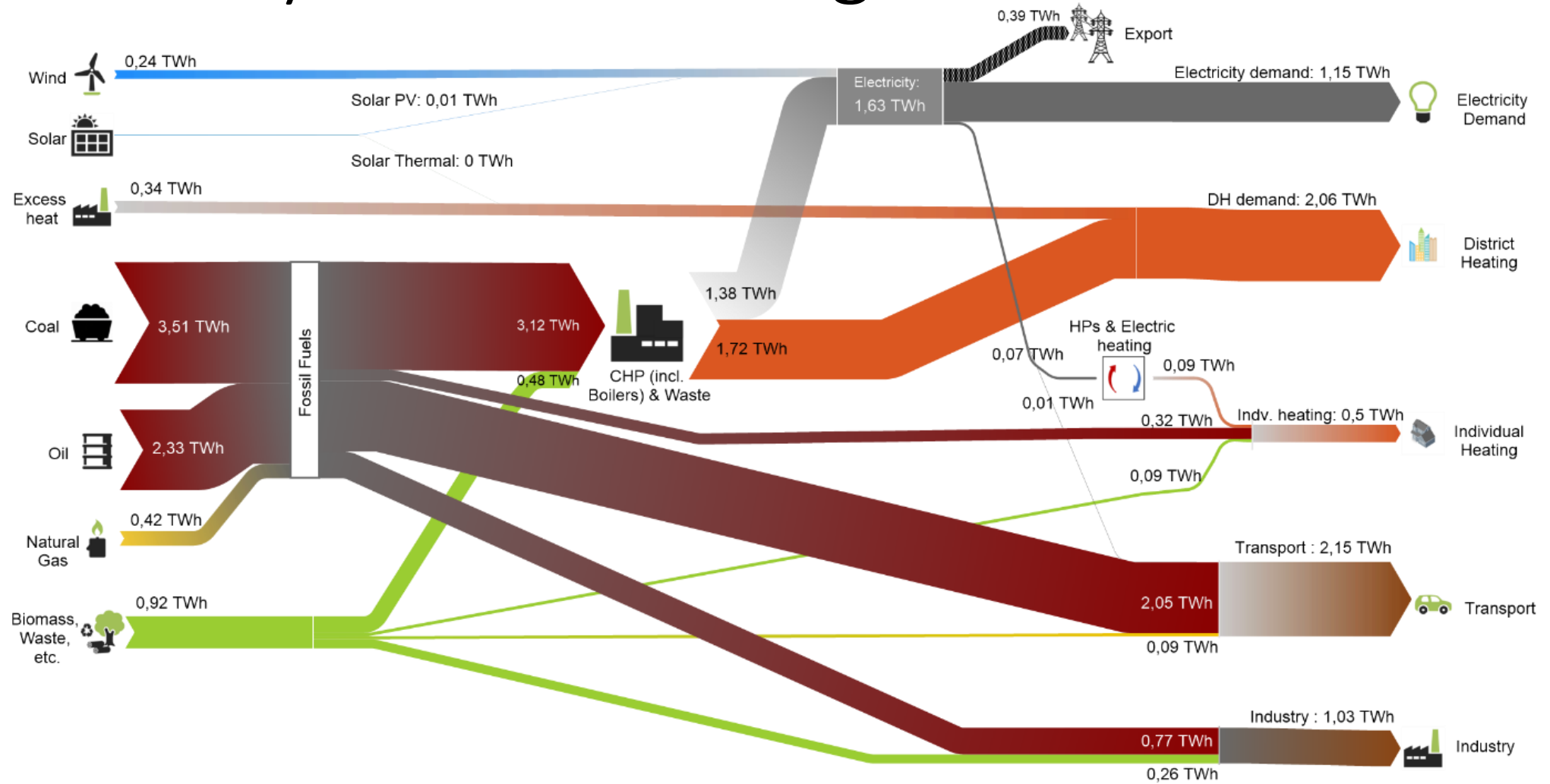


4GDH's role in Smart Energy Aalborg

- The goal is to transition Aalborg to 100% renewable energy
- Utilising the principles of smart energy systems and low temperature district heating
- Current system is 3rd generation district heating



Current system in Aalborg



Transitioning to renewable energy

- The transition has to be done in a way that does not limit other countries, cities and municipalities to transition to renewable energy
- Limiting biomass use
- Including transport based on both local and global transportation
- Defining the industrial demand related to inhabitants

Included benefits from low temperature district heating

- Low temperature district heating is a key part of the vision
- Allows for better efficiencies in heat pumps
- Allows for lower losses in the district heating grid
- It requires investments in energy savings in the buildings

Industrial waste heat

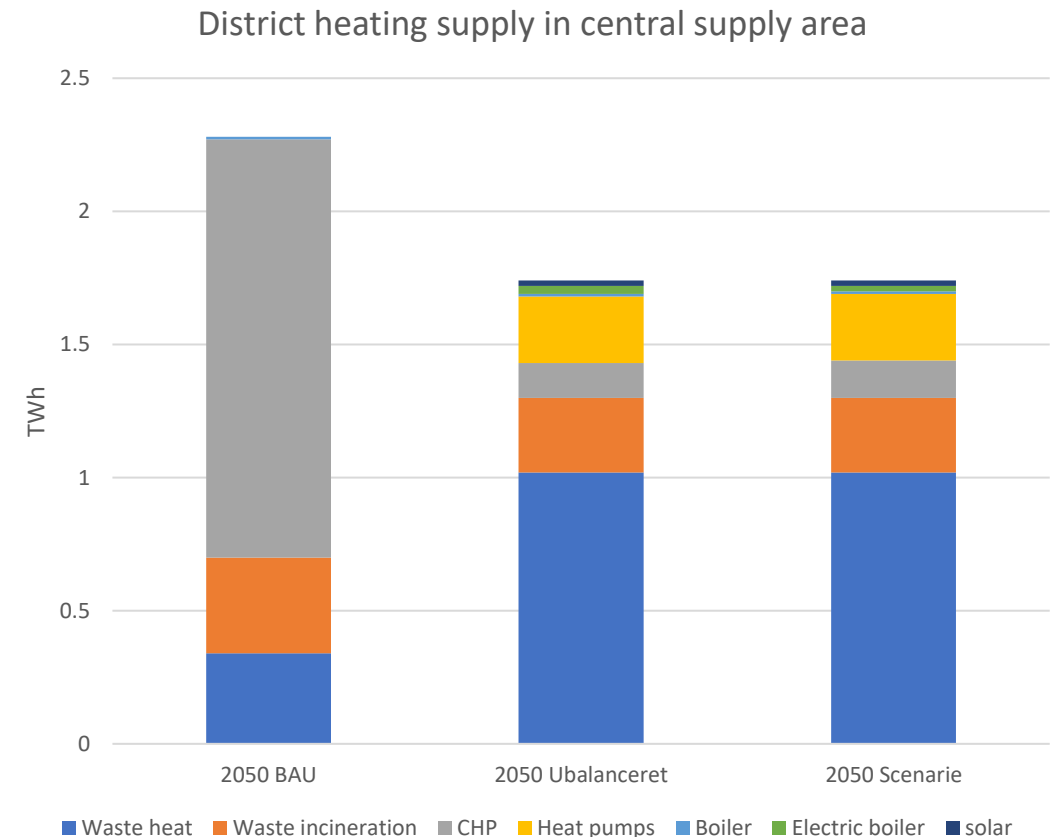
- Low temperature district heating enables increased use of industrial waste heat
- Cement industry in Aalborg
 - Currently 20% of the heat demand
- In total a potential to increase from 1200 TJ to 3100 TJ
 - We use 2600 TJ

	Projekt	Investering	Merproduktion (ift. 2016 produktion)
Forbedre udnyttelse af overskudsvarme ved eksisterende anlæg	Levere hele året ved 65°C (VG1 + VG2)	Ingen	500 TJ
	Optimering af eksisterende anlæg VG1	Investering ikke beregnet	313 TJ
	Optimering af eksisterende anlæg VG2	Investering ikke beregnet	75 TJ
Øge potentialet af overskudsvarme ved investering i ny teknologi/anlæg	Projekt 1: Varmegenvinding fra den grå ovn (grå cement)	DKK 48 mio.	350 TJ
	Projekt 3: Sænkning af returtemperaturen ved installation af varmepumpe (VG1)	DKK 16 – 25 mio.	3GDH: 122 TJ
	Projekt 4: Opsamling af strålevarme fra de hvide ovne med varmeskjolde	Forsigtigt skøn: DKK 225 mio.	540 – 610 TJ
	Projekt 5: Udnyttelse af varme fra filtratvand med varmepumpe	DKK 7 – 9 mio.	3GDH: 45 TJ

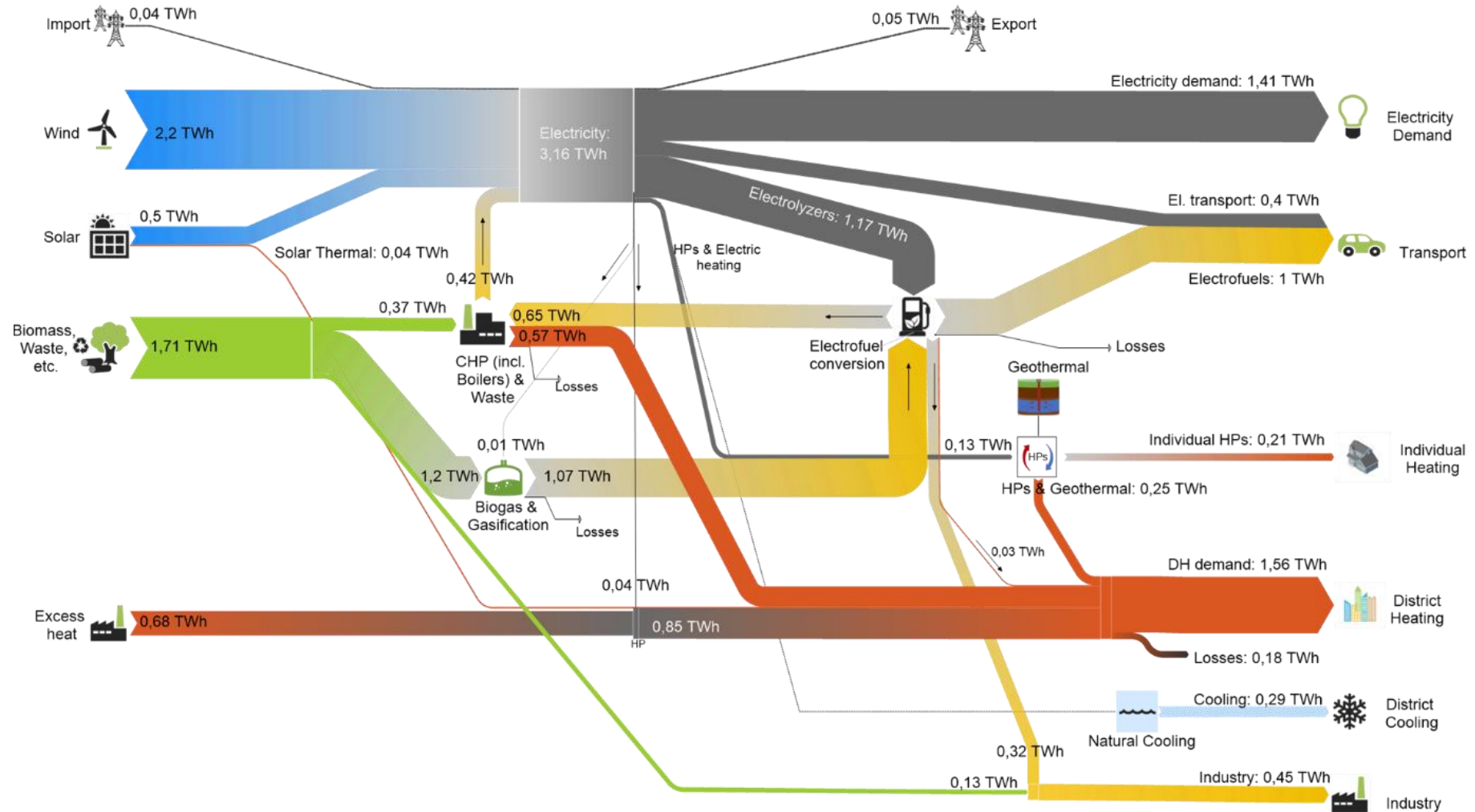
Tabel 2 – Nye overskudsvarmepotentialer ved Aalborg Portland [Aalborg Portland, 2018]

Heat pumps and geothermal

- Utilise 100 MW thermal capacity on heat pumps
 - Can be seawater heat pumps or geothermal
- 20 MW heat pumps running on waste heat from industry
- Utilisation of a large 40 GWh seasonal storage



The 100% renewable Smart Energy Aalborg



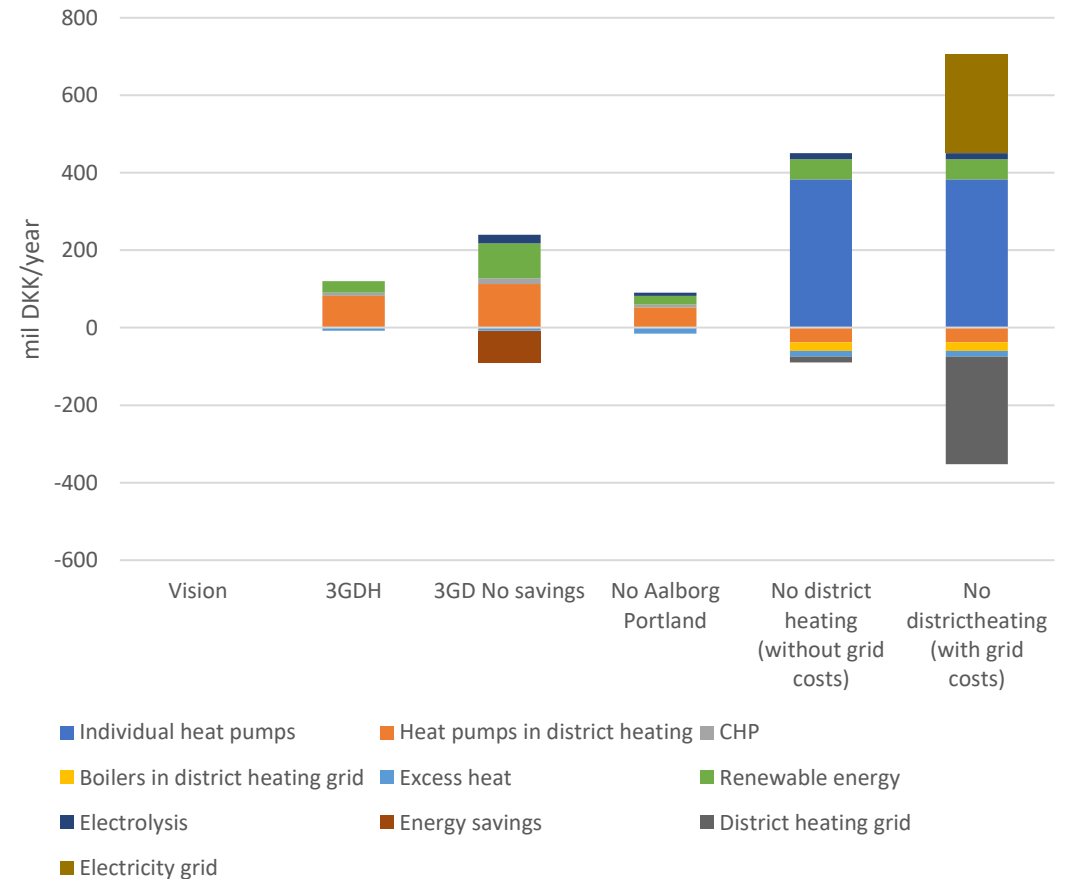
If no low temperature district heating

- We do not gain benefits from reduced losses and increased efficiencies
- Result of not achieving savings



If no district heating

- If we do not have district heating, what is the consequence of changing to individual heat pumps



Summary

- It is technical possible
- It gives technical and socio-economic benefits
- It requires planning