Barriers and Opportunities for Large-Scale Heat Pumps in Austrian District Heating and Cooling Networks

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CONTENT BASED ON IEA HPT ANNEX 47

Presentation overview

- District heating (DH) in Austria at a glance
- Motivation for heat pump (HP) integration
- Barriers / challenges
- Possible solutions and opportunities
- Success factors

DH IN AUSTRIA AT A GLANCE

26%
of residential heat demand covered by DH

24 TWh
DH generation in 2017
(14 TWh from CHP or 60%)

up to
52 TWh
total economic potential for DH
(in best case, depending on scenario, e.g. energy prices, connection rate, etc.)

5,500 km
DH network length
(42 km/a growth in next 10 years)

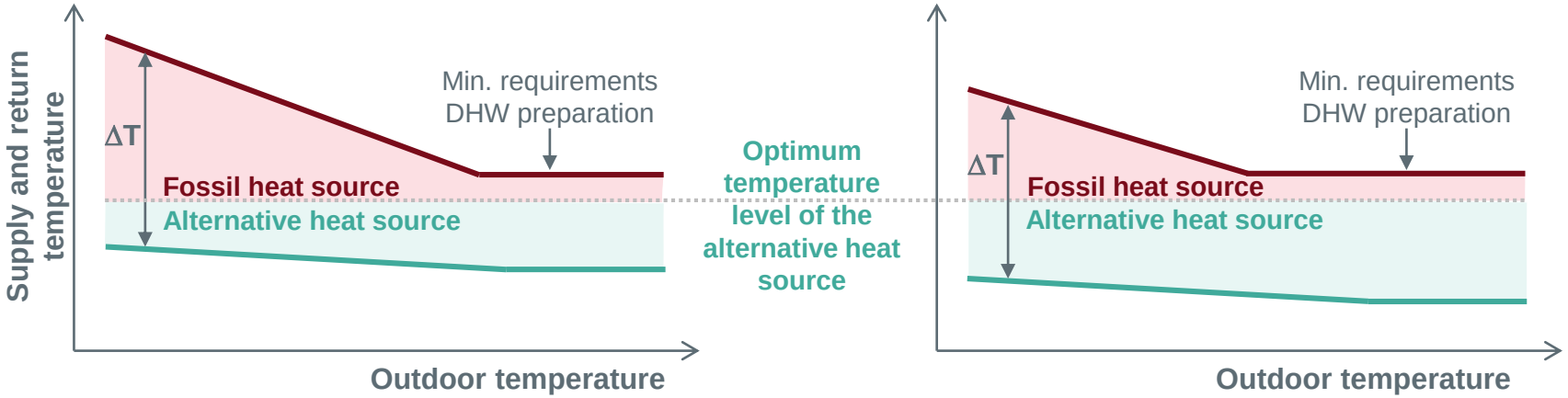
54%
based on biomass and combustible waste
(gas 36%, oil 6%, coal 4%)

Sources:
Zahlenspiegel 2018 – Gas und Fernwärme in Österreich (FGW – Fachverband der Gas- und Wärmeversorgungsunternehmungen, 2018) https://www.gaswaerme.at/media/medialibrary/2018/09/zasp2018_final.pdf
Assessment of the potential for application of high-efficiency cogeneration and efficient district heating and cooling (Büchele et. al, 2015) http://www.austrian-heatmap.gv.at/das-projekt/

MOTIVATION FOR HP INTEGRATION

The motivation to use HPs in DHC can be divided into the following areas:

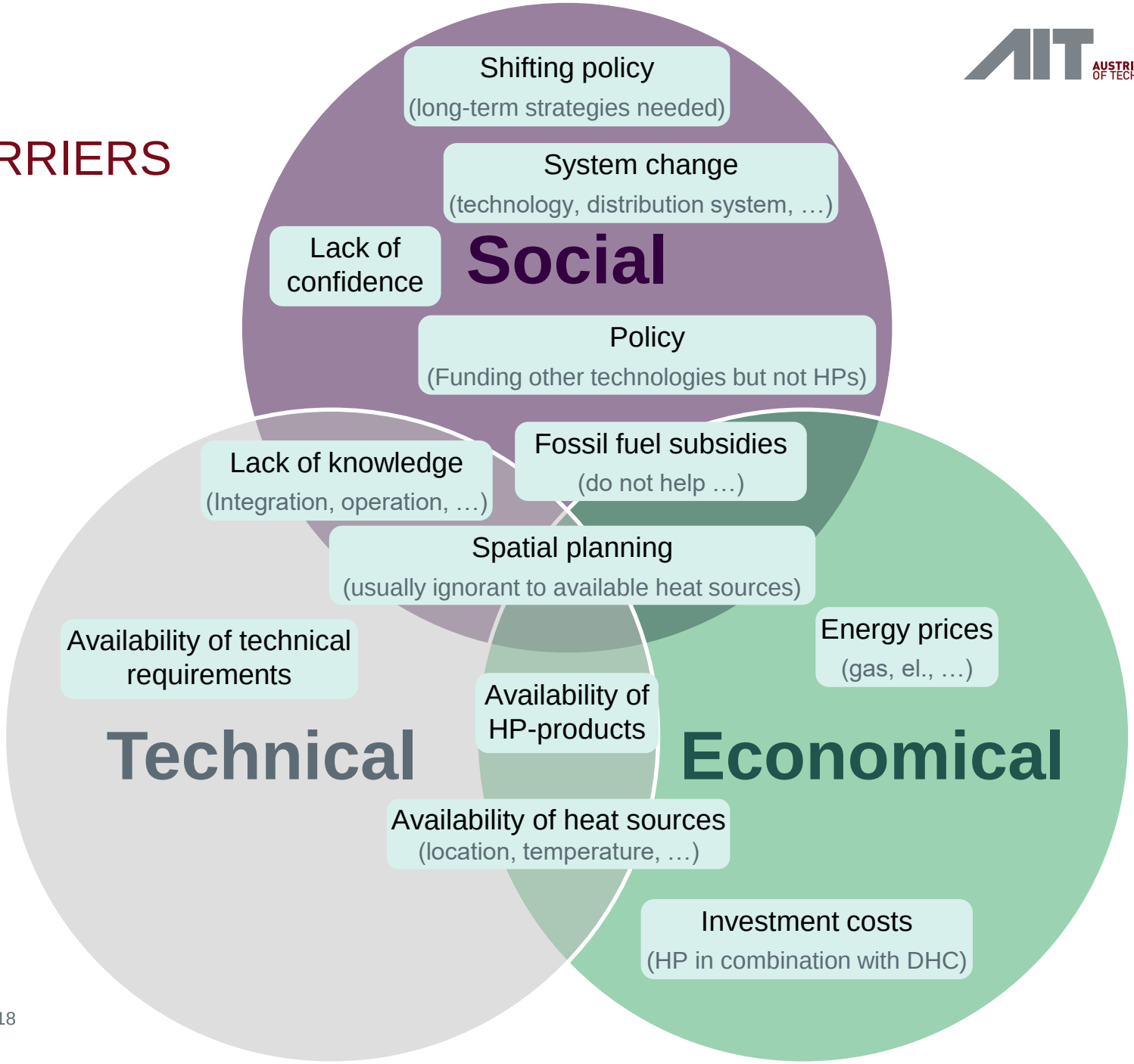
- **usage** / **capture** of low temperature alternative heat sources
- **enabler** for other alternative energy sources
- link to **electricity** grid (balance of energy domains)
- **reduction** of the network temperatures
- increasing transport **capacities** by using the return line as a source



BARRIERS / CHALLENGES

Social-, economical- and technical barriers

BARRIERS


Shifting policy
(long-term strategies needed)
System change
(technology, distribution system, …)
Lack of confidence
Social
Policy
(Funding other technologies but not HPs)
Fossil fuel subsidies
(do not help …)
Lack of knowledge
(Integration, operation, …)
Spatial planning
(usually ignorant to available heat sources)
Availability of technical requirements
Energy prices
(gas, el., …)
Availability of HP-products
Technical
Economical
Availability of heat sources
(location, temperature, …)
Investment costs
(HP in combination with DHC)

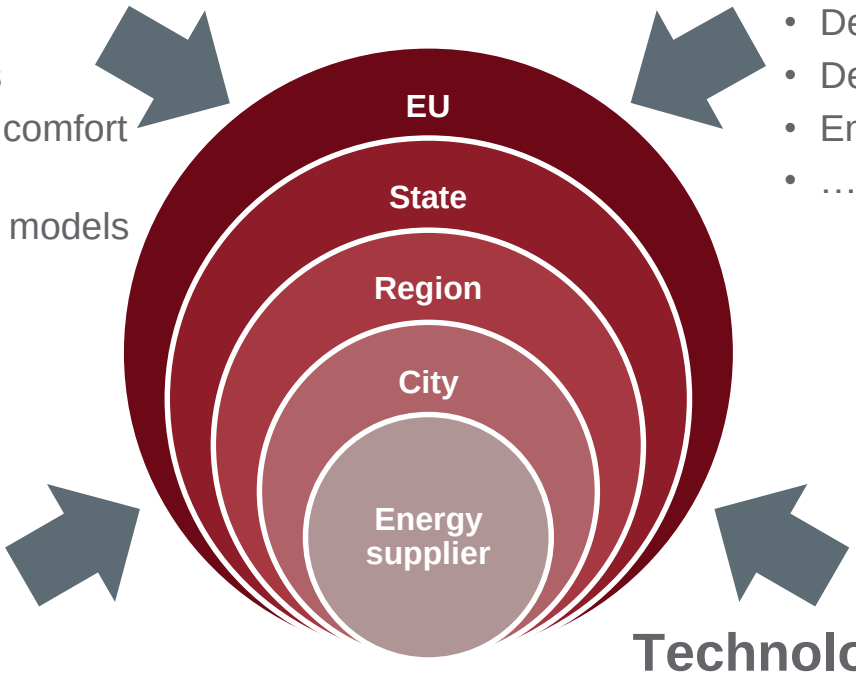
CHALLENGES

Customers

- Prosumer
- Citizens' power stations
- Service orientation and comfort (cooling requirements)
- New business and tariff models
- Security supply
- …

Society & Politics

- Demographic developments
- Decarbonization / COP21
- Energy efficiency directive
- …



Market

- High volatility, pooling of flexibilities/ balancing energy markets
- Copper plate or electric fences? (e.g. electricity price zone DE/AT)
- Energy price developments (oil, gas, …)
- …

Technology & Innovation

- Digitization & Smart Home
- Energy efficiency & storage
- Electric mobility
- …

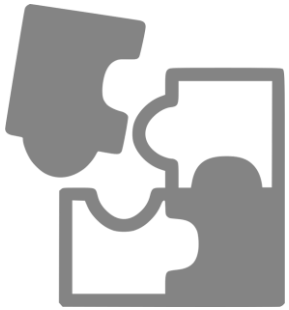
→ **Identification** and **assessment** of **chances** and **risks**

POSSIBLE SOLUTIONS AND OPPORTUNITIES

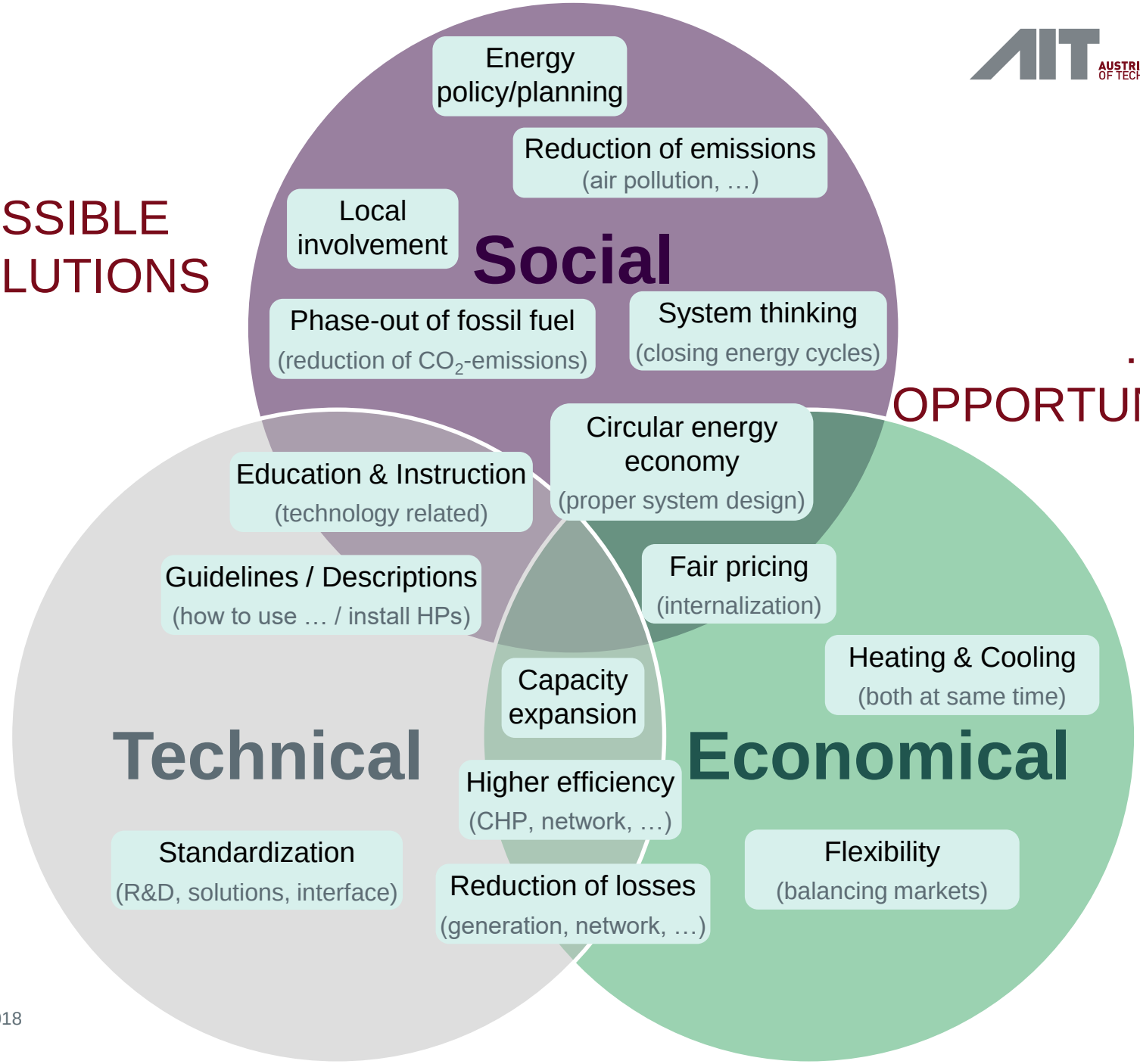
Holistic heat supply strategies

Sector coupling/ hybrid energy systems

Business models



POSSIBLE SOLUTIONS



… AND OPPORTUNITIES

HOLISTIC HEAT SUPPLY STRATEGIES

1 Assessment of **boundary conditions**

a) Decision on the evaluation criteria and the time horizon
b) Status-Quo evaluation and scenarios (heat demand…)
c) Analyses of regulations, subsidies, political targets, energy market (especially electricity price forecast)

2 Development of **technology scenarios**

a) Characteristics of relevant technologies/ potential of alternative heat sources
b) Assessment of levelized heat generation costs,
c) Development of heat supply portfolio
d) Sensitivity analyses

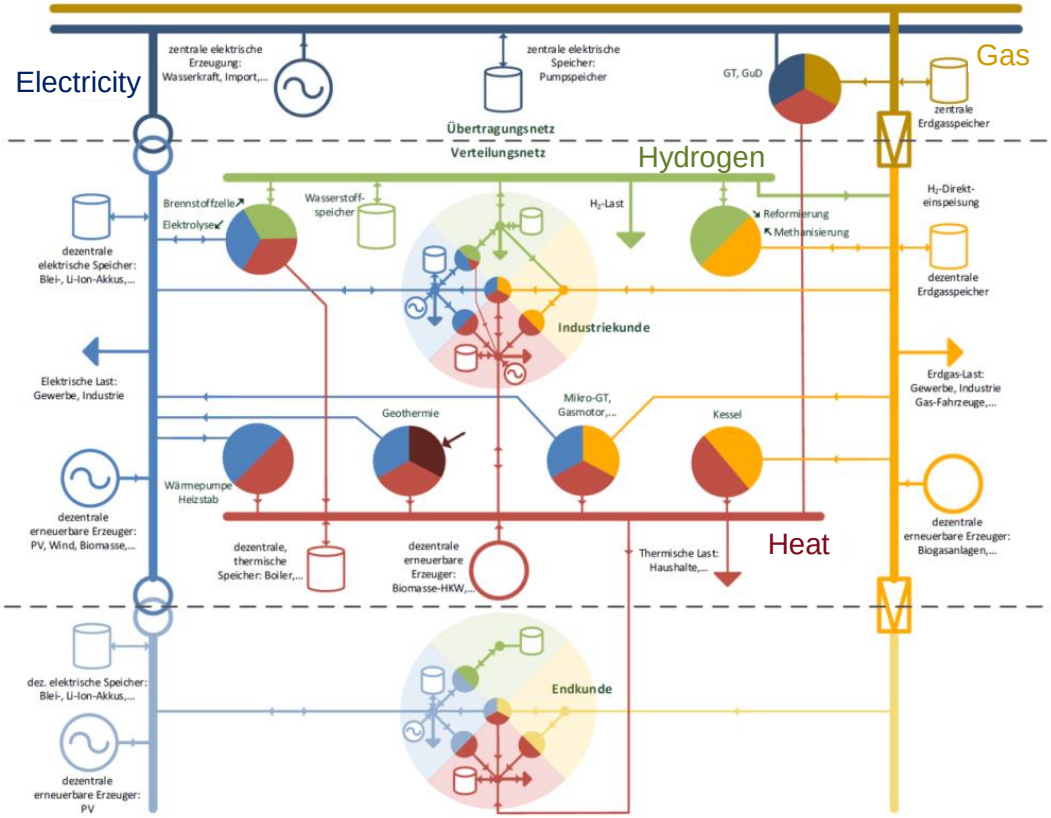
3 Decision on the **final concept**

a) Selection of different variants (supply/network)
b) SWOT-Analysis
c) Multi–Criteria evaluation
d) Transition strategy & action plan for the selected variant

SECTOR COUPLING / HYBRID ENERGY SYSTEMS

The use of HPs in times of favorable electricity prices can increase the:

- **share** of renewable energy sources and the **security** of **supply** in the heating grid
- technical **capacity** and **own consumption** in areas with a high degree of local electricity production from PV and wind energy
- **services** for power grid / energy markets



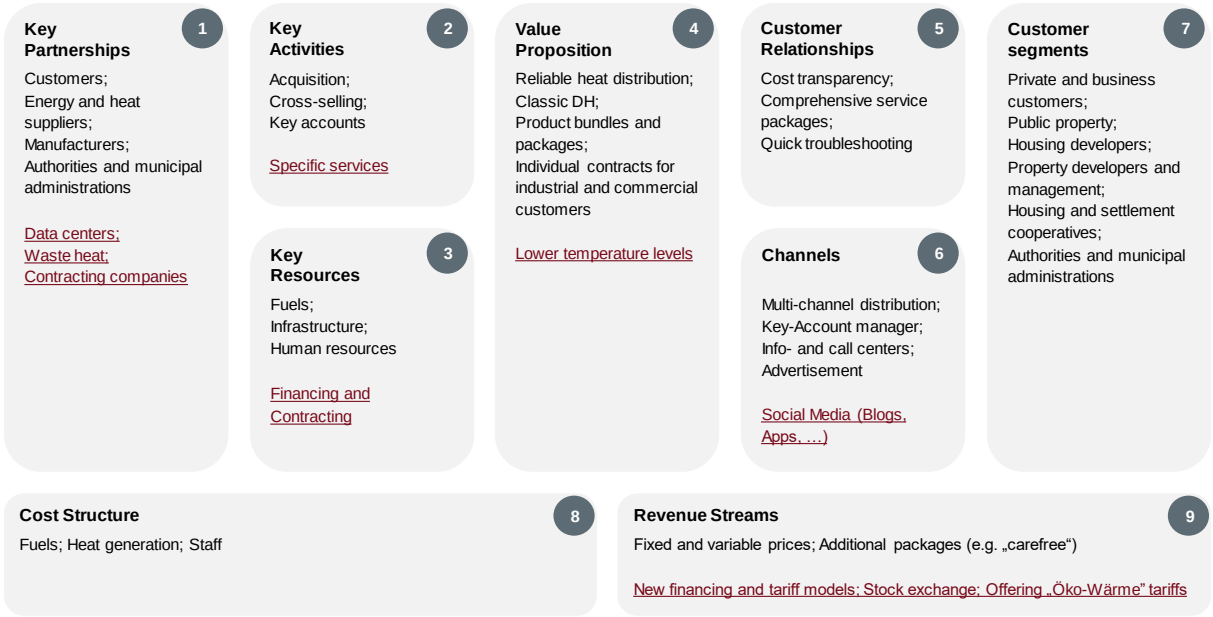
Source: W. H. M. Gawlik, M. Heimberger, R.-R. Schmidt, D. Basciotti, W. Böhme, G. Bachmann, R. Puntigam, K. Haider und E. Arenholz, „OPEN HEAT GRID - Offene Wärmenetze in urbanen Hybridsystemen," Bundesministerium für Verkehr, Innovation und Technologie, Wien, 2016.

BUT: high **complexity** and very **dynamic** behavior

BUSINESS MODELS

Innovative approaches are needed

- Digitization
- Regionality
- Fuel substitution
- Specific services
- System optimization
- Flexible tariff models
- Holistic system concept
- Financing and contracting
- Waste heat / cooling energy
- Set up “heat stock exchange”
- Reduction of system temperatures



SUCCESS FACTORS

WHAT DO WE NEED?

- Strong partners
  - companies, institutes, start-ups, etc.
- Projects
  - demo, best practice, experiences, motivation
- Learning by doing
  - requires pioneers who are willing to "pay its dues“
- Energy spatial planning
  - localizing waste heat, avoiding double infrastructure
- Standardized solutions
  - R&D, degression of costs, economy of scale
- Price signals
  - to the use of fossil fuel, reduce the burden from tax and levy on clean energy

THANK YOU!

Roman Geyer

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Federal Ministry
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Transport, Innovation
and Technology

ANNEX 47 | HEAT PUMPS IN DISTRICT HEATING AND COOLING SYSTEMS

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http://heatpumpingtechnologies.org/annex47/