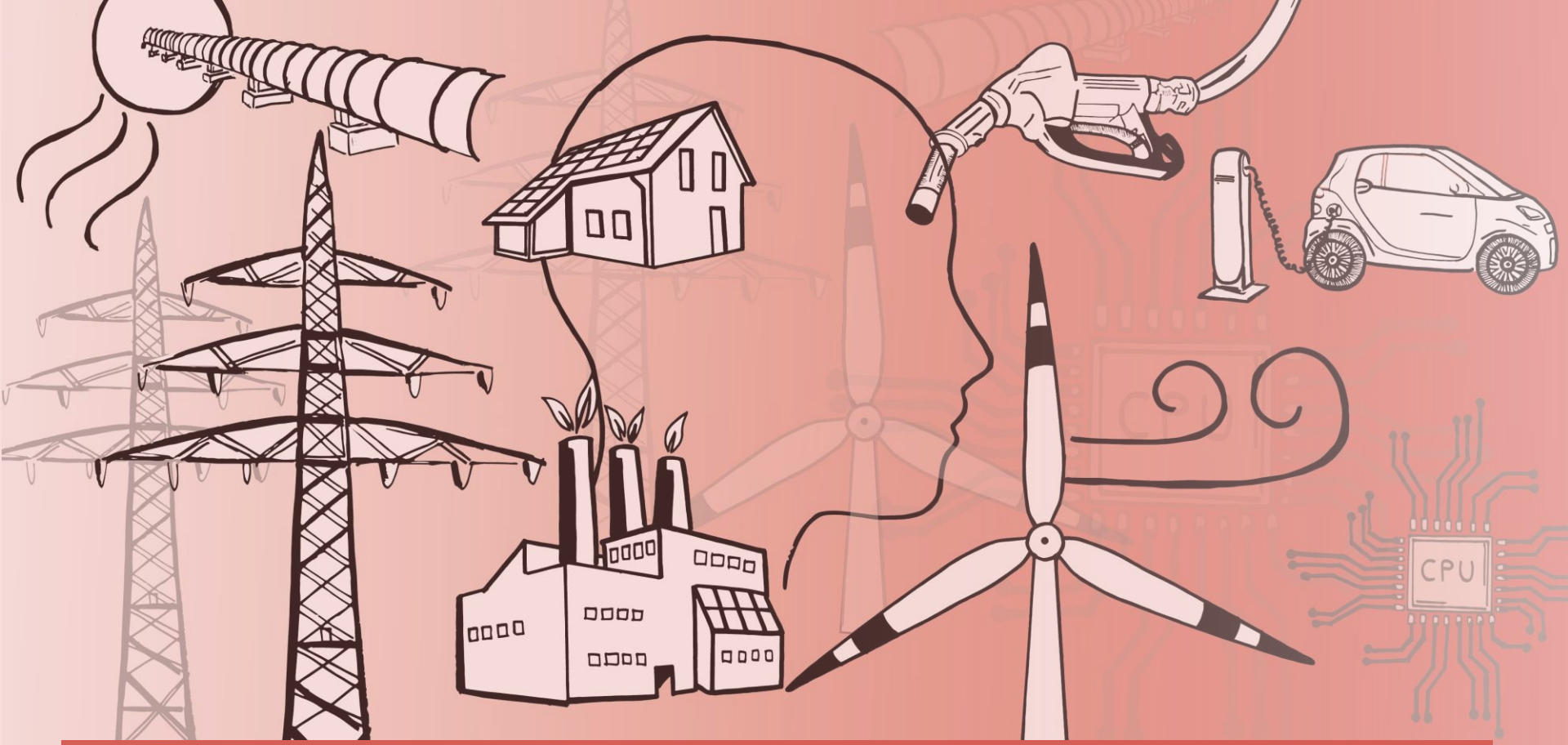

Heat Dispatch Center – Symbiosis of renewable generation units for sustainable thermal energy supply

Britta Kleinertz, Dr. Götz Brühl, Theresa Faber

Research supported by BAFA fund Wärmenetze 4.0

23.09.2018

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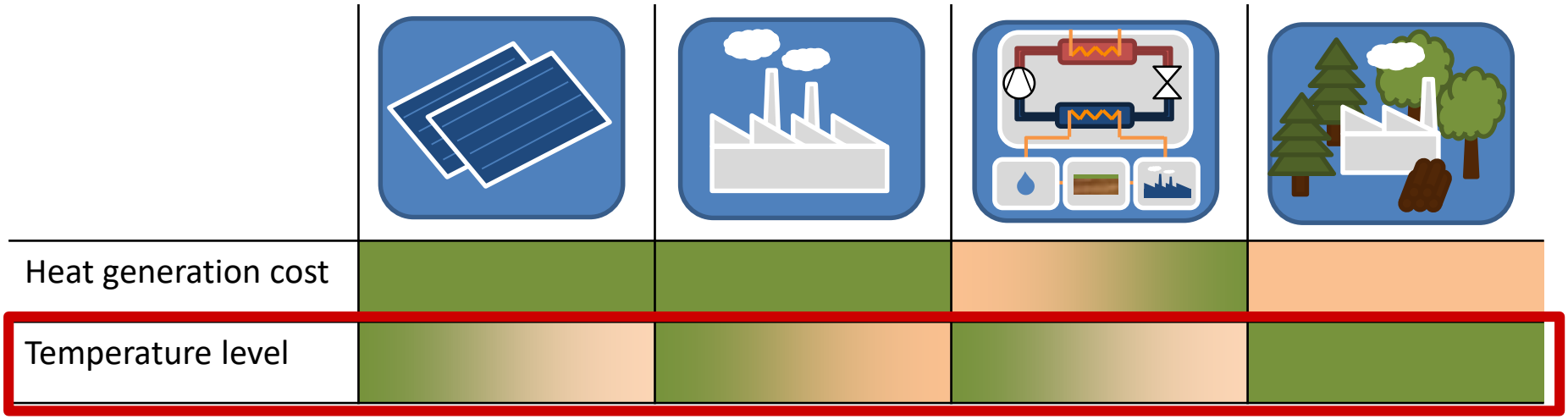
Content

1 Motivation for connection of renewable heat sources

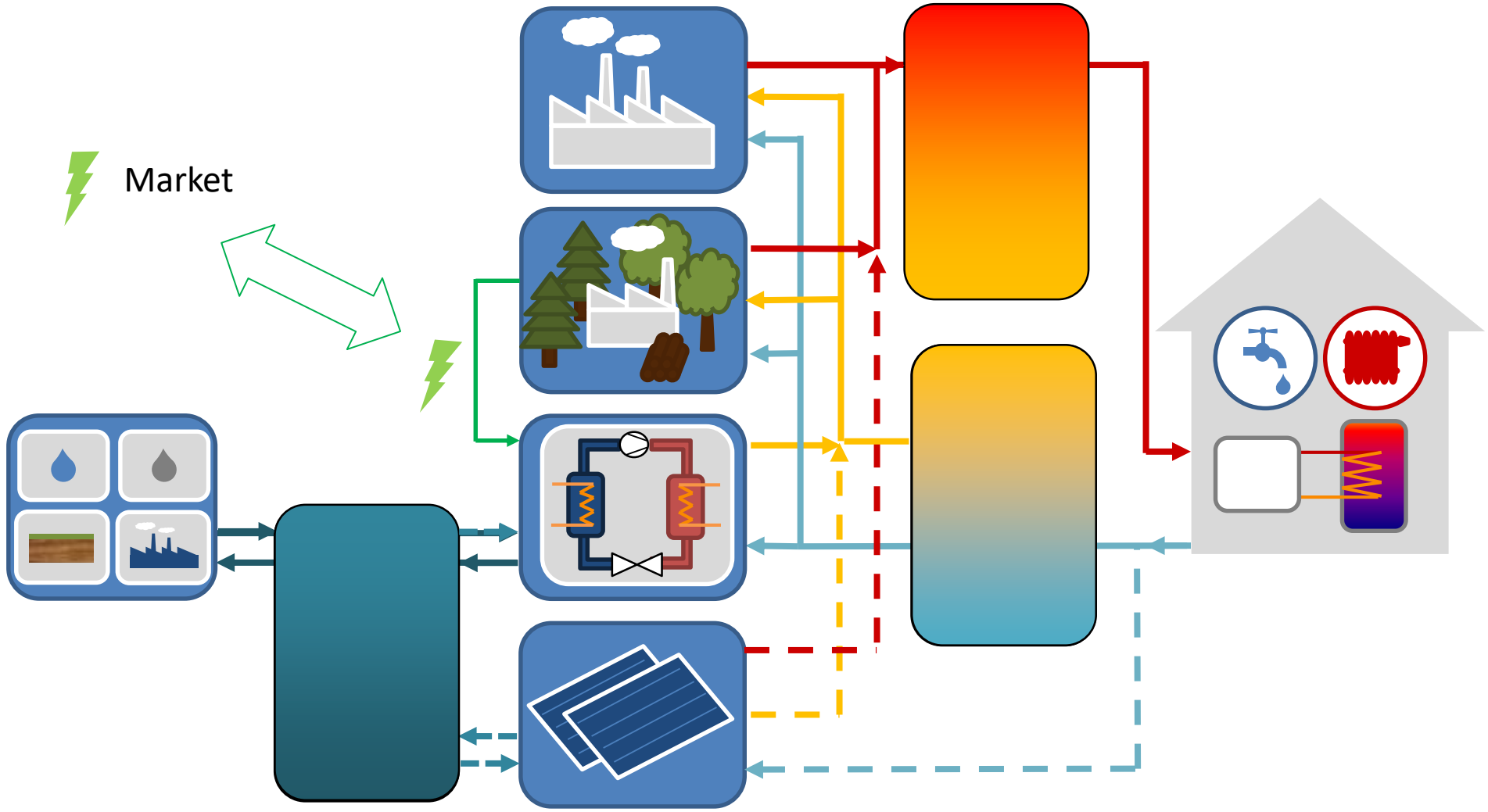
Limitations of renewable heat sources



Interconnection of renewable heat sources by temperature level

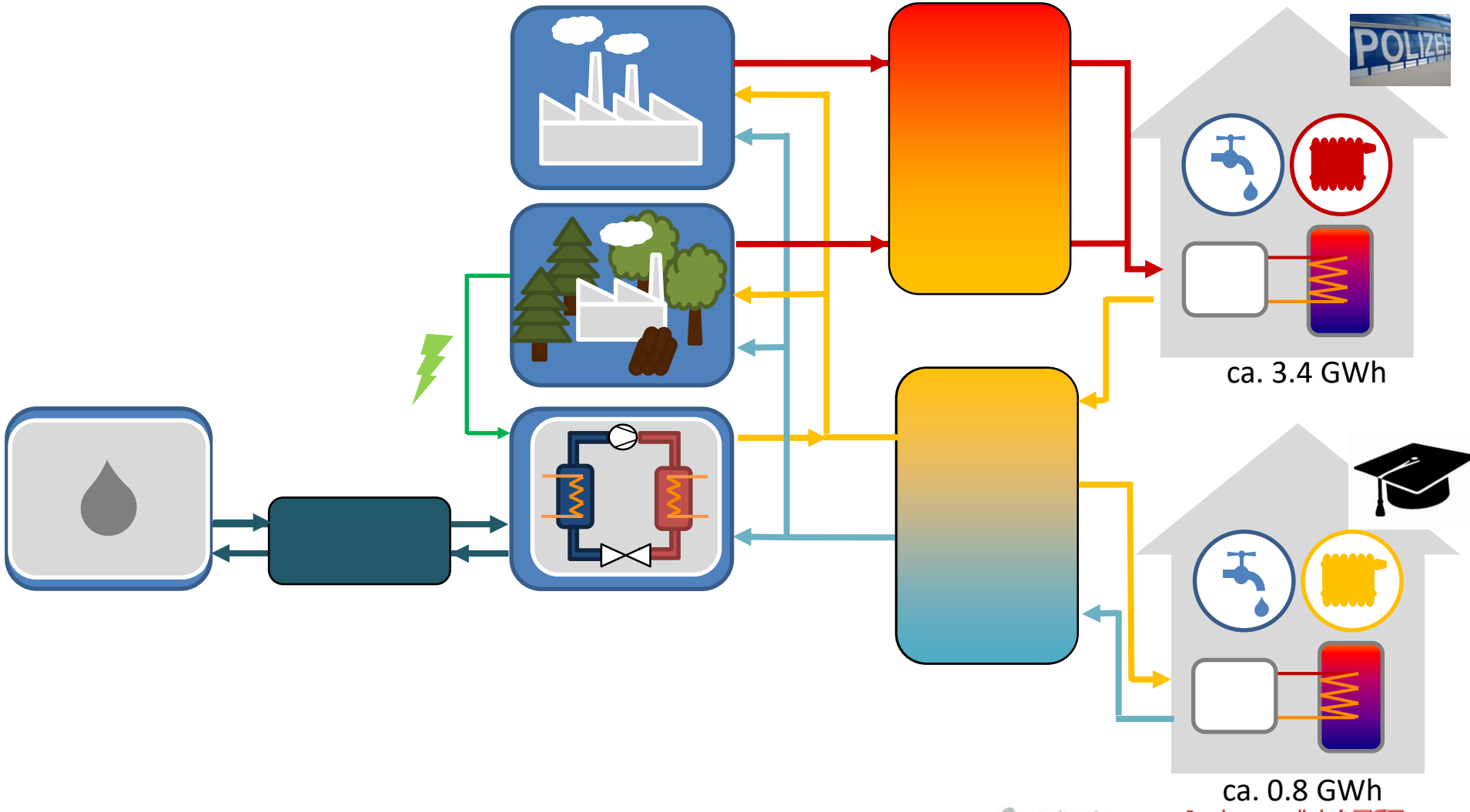
2 Concept of Heat-Dispatch-Center

Interconnection of different heat sources in series as an essential characteristic of the Heat-Dispatch-Center



3 Case study

Interconnection of different heat sources in series as an essential characteristic of the Heat-Dispatch-Center



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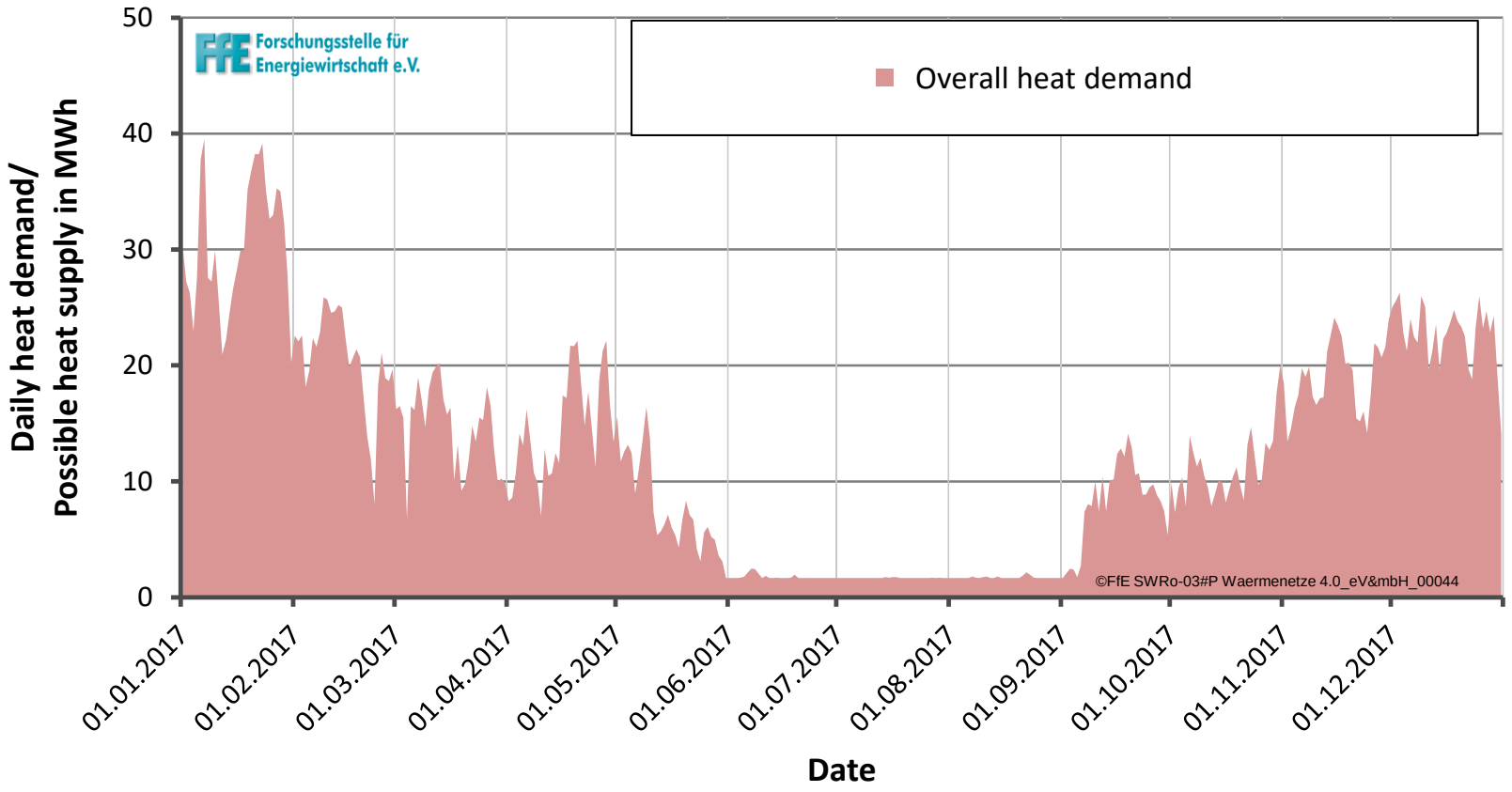
Analysis of heat load profile – Heat demand by temperature level



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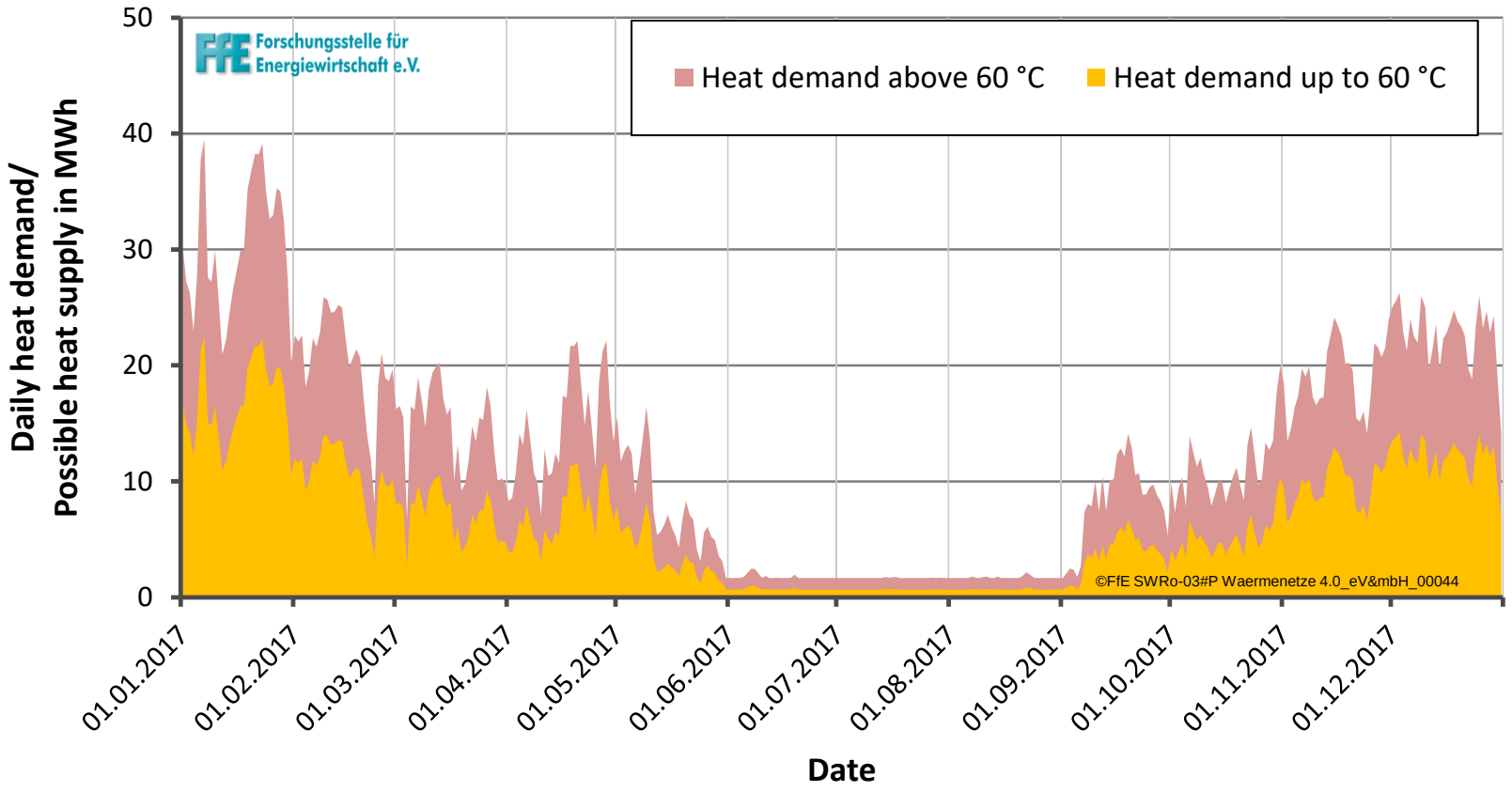

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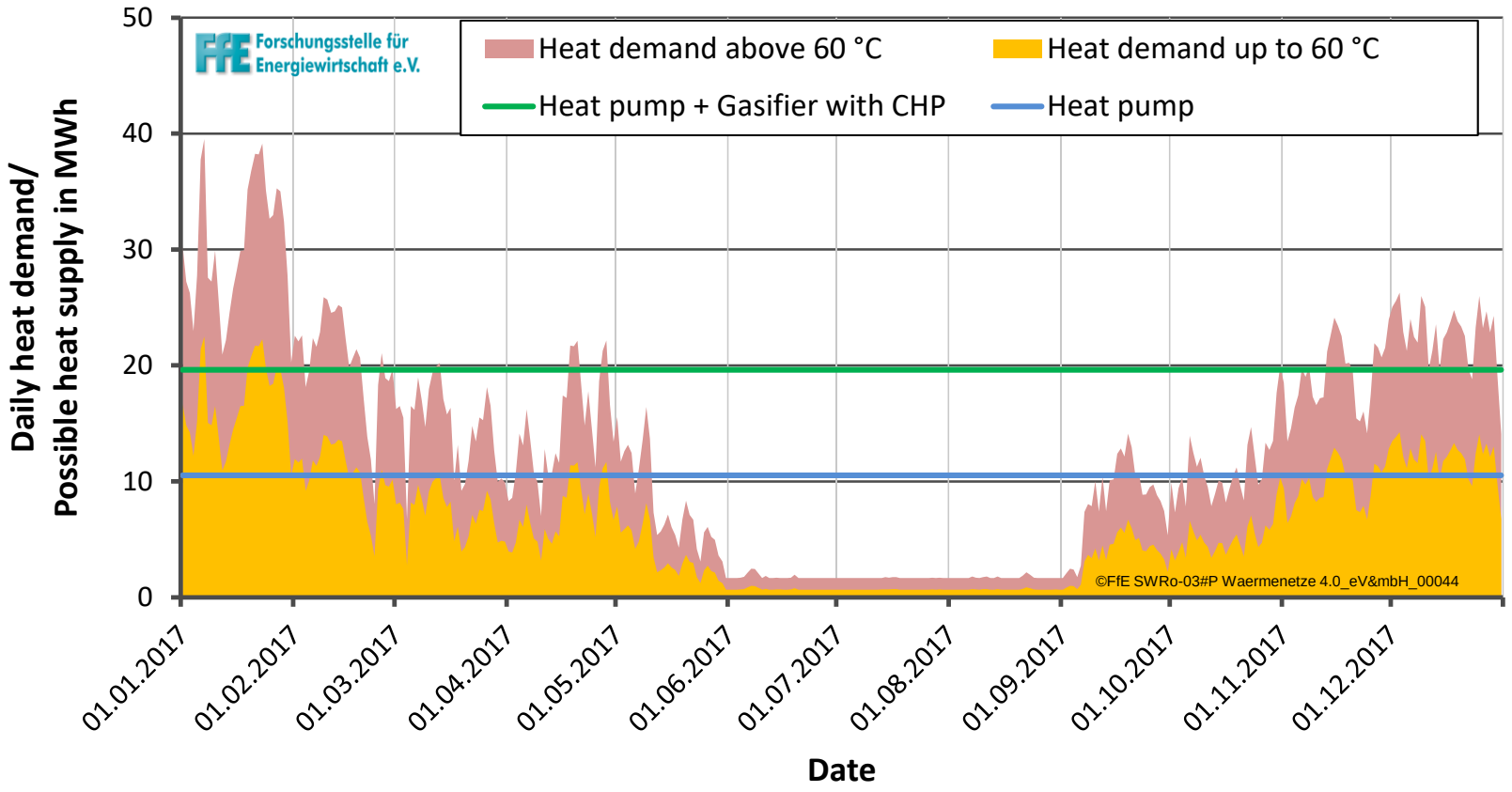
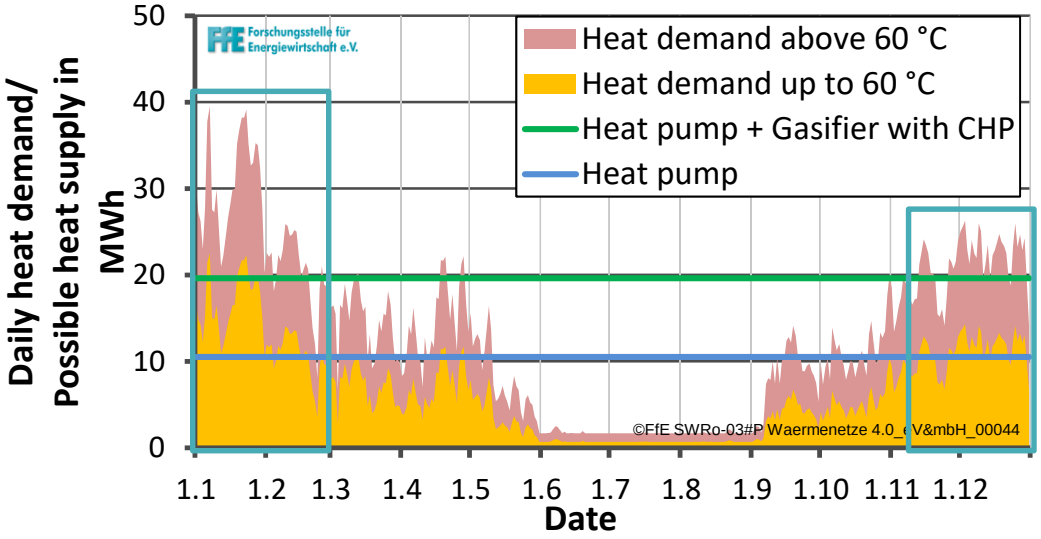
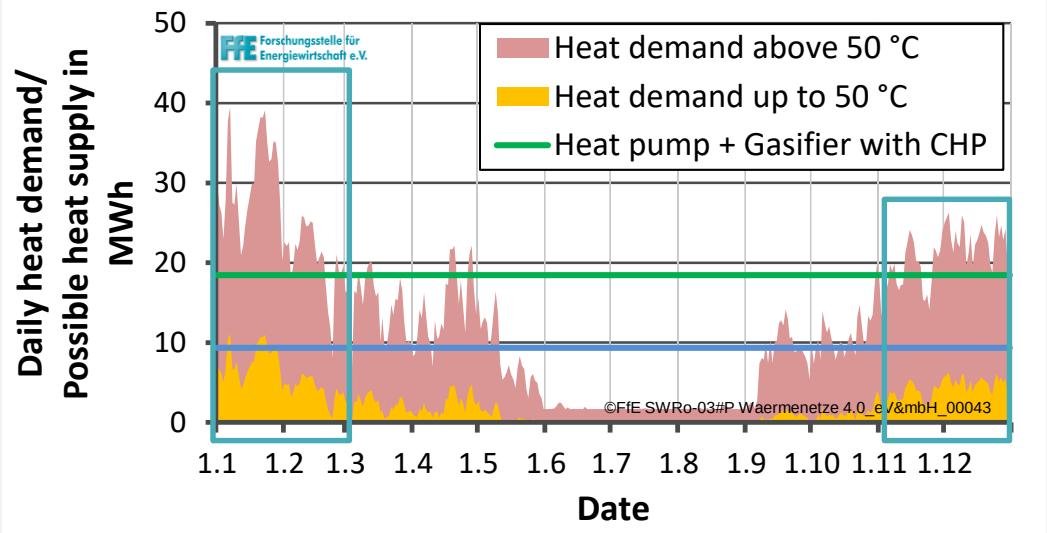
Analysis of heat load profile – Possible heat generation units



Load profile and effect on generation composition – Winter



- Heat demand at 60°C higher than heat pump load



- Heat pump target temperature is decreased to 50 °C
- Efficiency of heat supply increases

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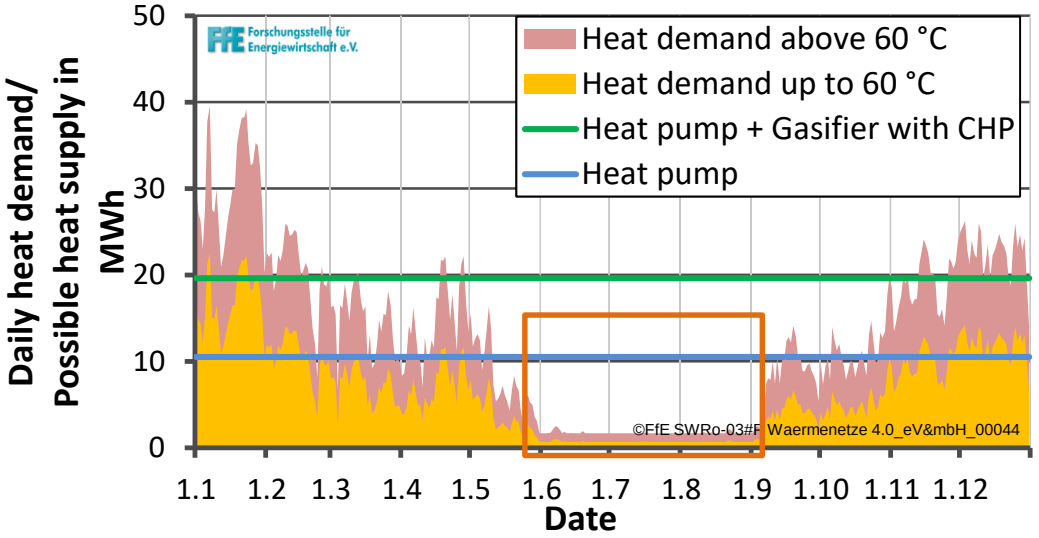
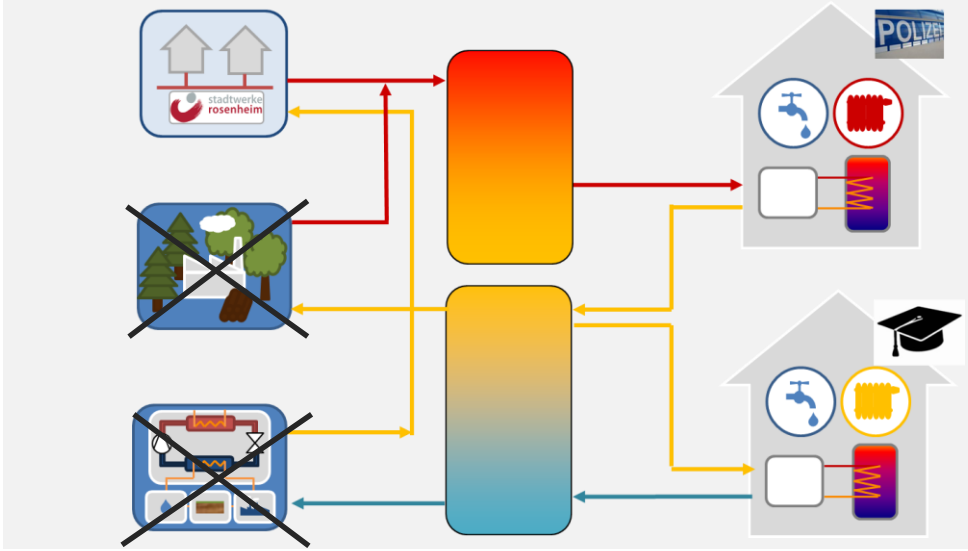
Load profile and effect on generation composition – Summer



- Load is significantly smaller than possible heat generation



- Heat generation units are turned of to prevent partial load
- Storages are only used as bypass to prevent storage losses

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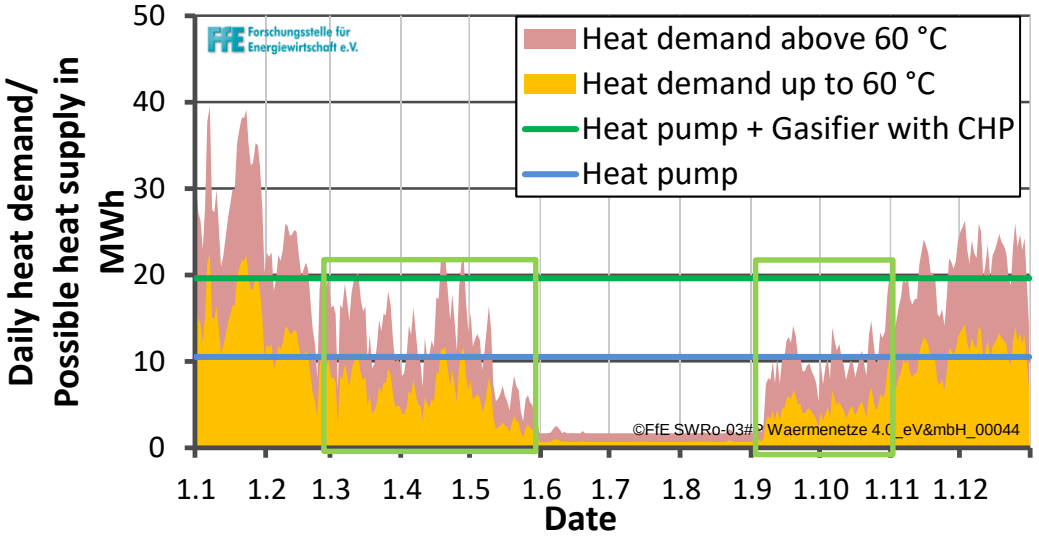
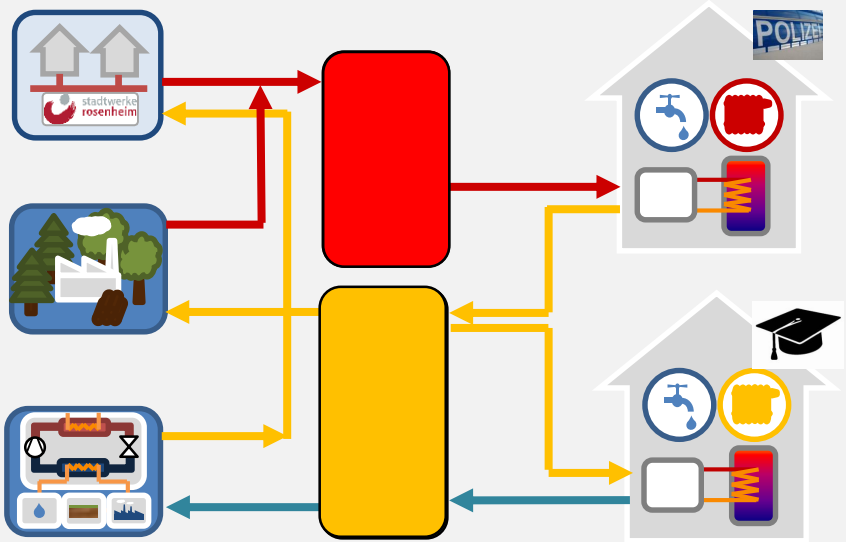
Load profile and effect on generation composition – Transition period



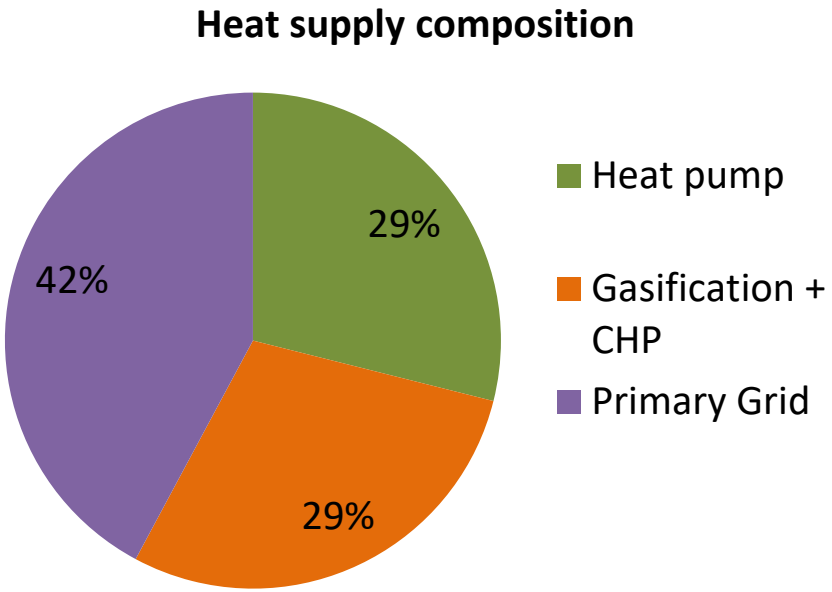
- High variation in ratio between heat supply and demand

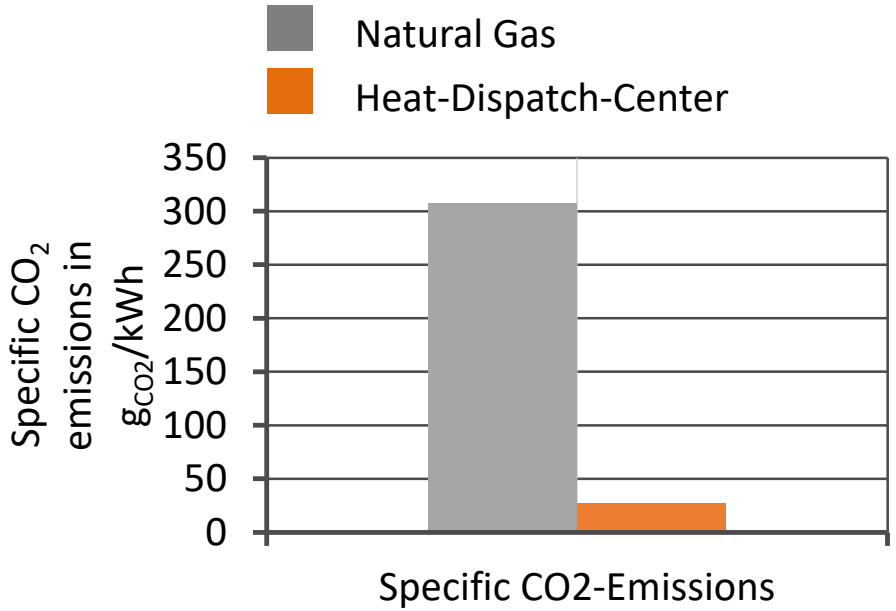


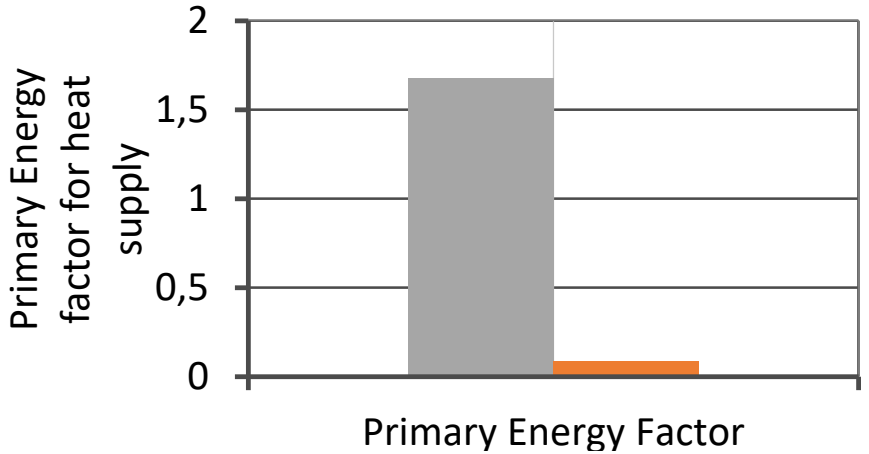
- Heat generation units have to vary their load
- Storage capacities are fully used

Techno-ecological boundary conditions and results for heat supply

- 50 % of generation has to come from renewables, max. 50 % of this from biomass

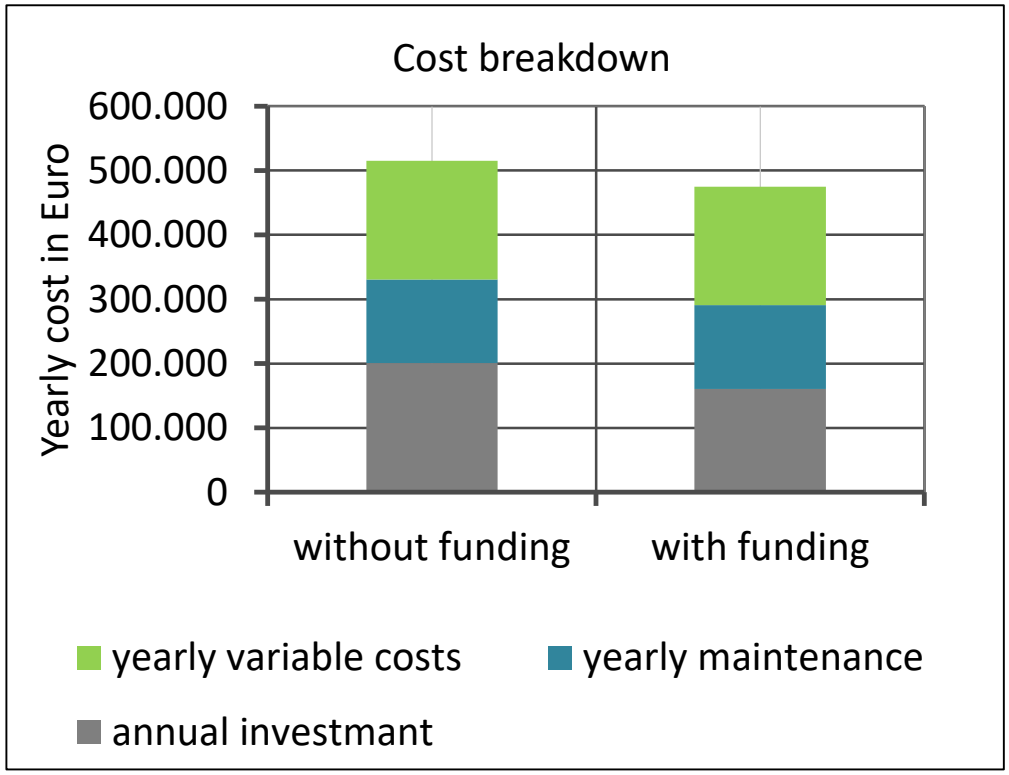






Economic boundary conditions and results – Funding according to BAFA fund „District heating 4.0“

- Electricity overproduction from CHP is sold as green electricity (5 €ct/kWh$_{el}$)
- Funding is 20 % on all investments

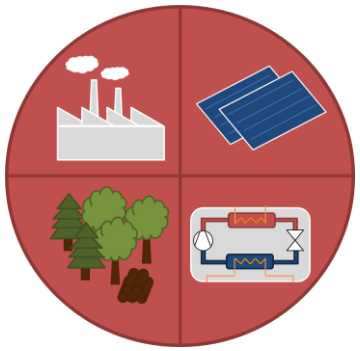


- Specific heat generation cost excluding uncertainty margin
  - 11,4 €ct/kWh$_{therm}$ including funding
  - 12,4 €ct/kWh$_{therm}$ excluding funding
- Cost Benchmark:
  - District heating 4.0 – 12 ct/kWh
  - Rosenheim 7 ct/kWh

4 Conclusion and Outlook

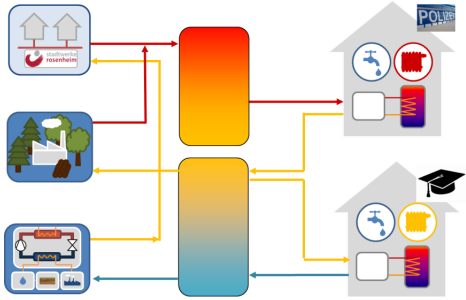
Conclusion and Outlook

1. Future heat supply will rely on a **composition of different heat sources**



2. Heat generation units should be **combined** in temperature cascades

3. **Unit control is key** as frequent adaptations are required



4. **Higher costs for invest, maintenance and operating material** render system uneconomical, further **income** e.g. from electricity trading/load reserve required

→ To increase flexibility further investigation of the hydraulic connection, load control and storage limitations are needed

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