Hochschule Reutlingen
Reutlingen University

Heat pump and CHP unit - a win-win combination

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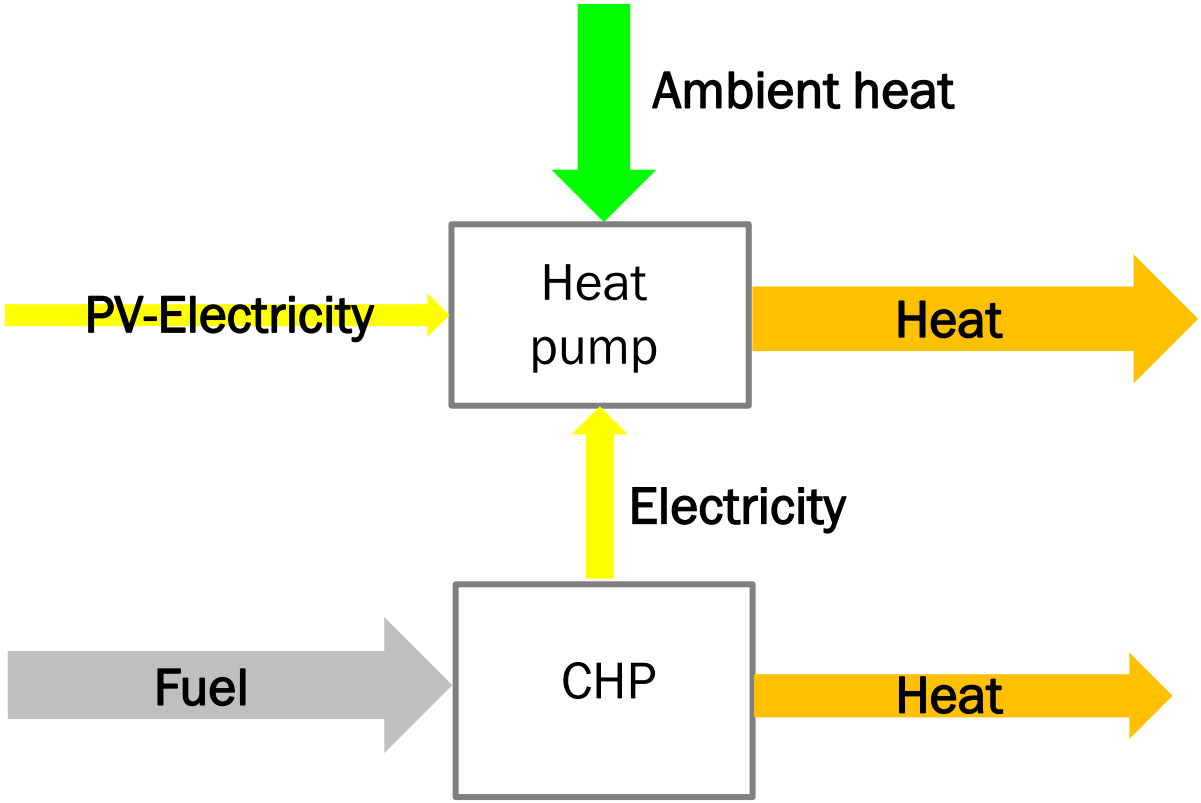
1. The Heat pump-CHP-Hybridsystem



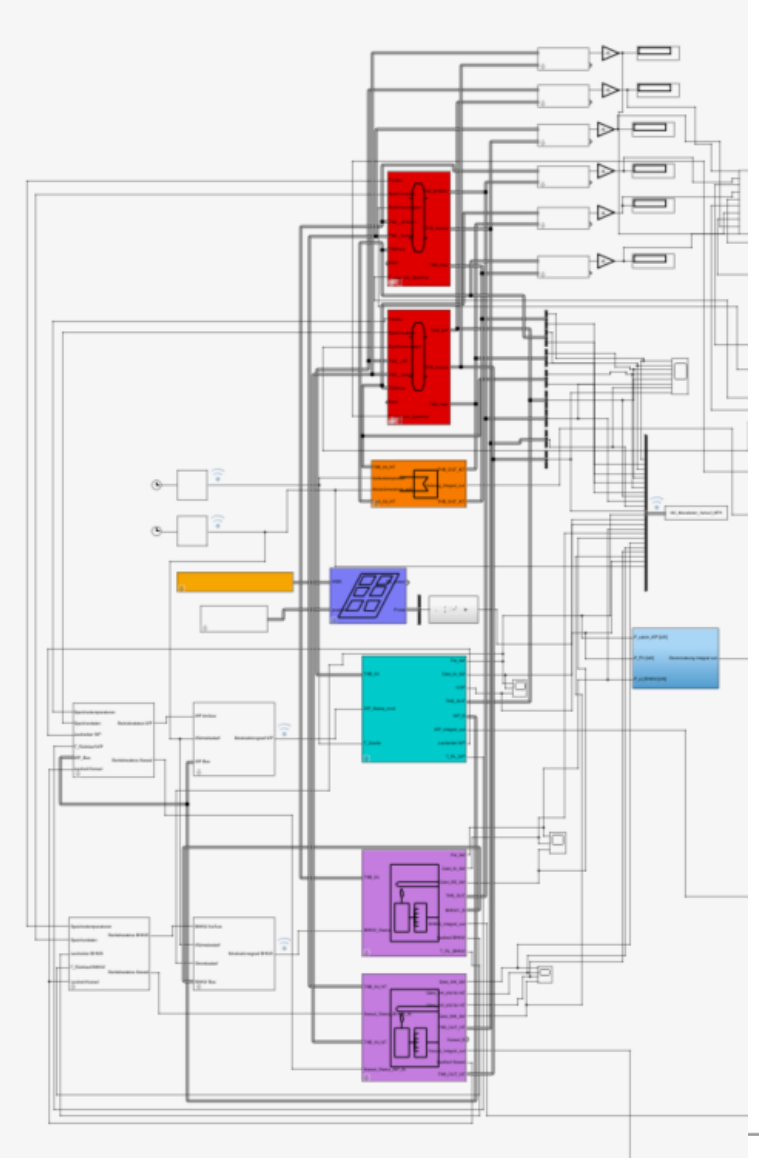
1. Why is it a win-win combination?

1. Heat pumps are an efficient and environmentally friendly technology – if operated by green electricity
2. CHP units efficiently provide electricity in times with no green electricity directly available
3. CHP units help supporting the power grid
4. CHP units provide sufficiently high supply temperatures

2. The Simulink Model

Detailed evaluation of temporal heat rates, mass flow rates and temperatures using Matlab Simulink

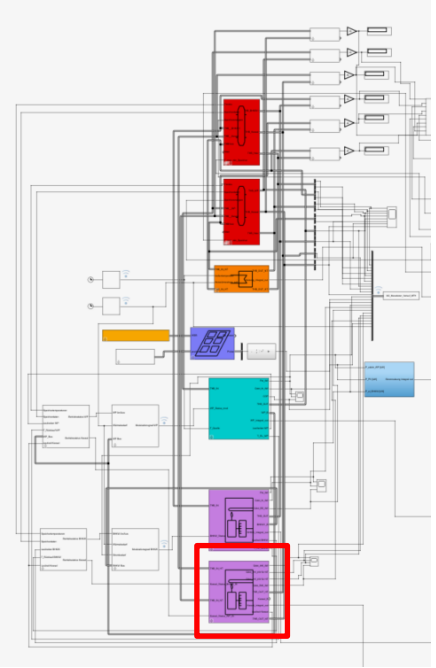
Input data:
Time-resolved annual load profiles for space heating and DHW demand plus time-resolved data of outdoor temperature and solar radiation



2. The Simulink Model – Heat pump

Air-water heat pump

COP and thermal power as a function of outdoor temperature and supply temperature based on correlations from a variety of heat pumps available on the market

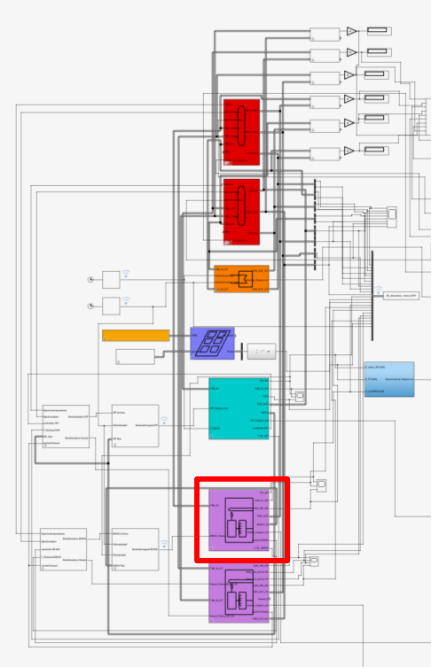


Kemmler, T., Thomas, B.: „Simulation von Wärmepumpensystemen auf der Grundlage von Korrelationsfunktionen für die Leistungsdaten der Wärmepumpe“, Proc. 16. Symposium Energyinnovation, Graz, 12.-14.02.2020

2. The Simulink Model – CHP unit

Motor-CHP

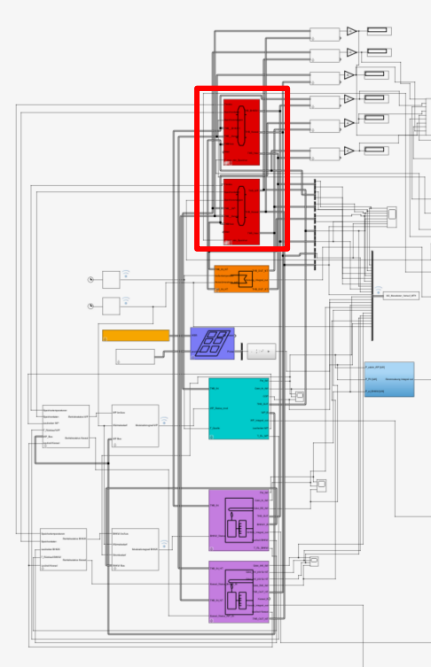
Nominal electric and thermal power taking transients from starting and part load into account



2. The Simulink Model – TES

Two Thermal energy storages from Carnot Toolbox

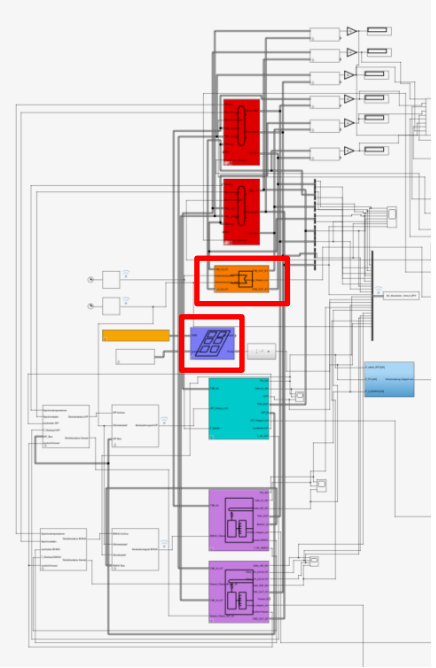
LT-storage for the heat pump
HT-storage for the CHP unit



2. The Simulink Model – Heat demand, PV

Space heating demand and DHW demand can be treated individually

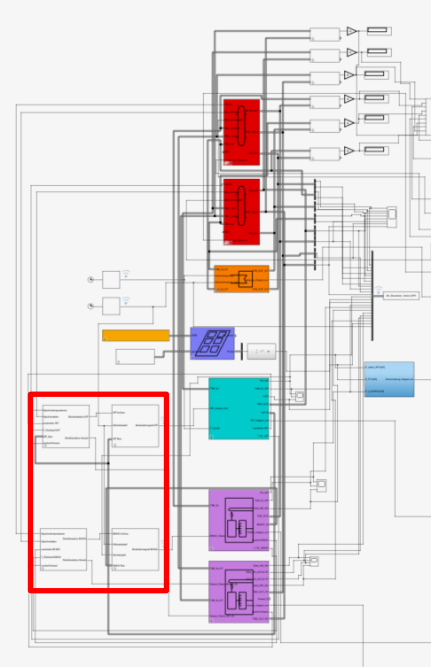
Module for PV-electricity generation from Carnot Toolbox



2. The Simulink Model – Control

Heat led operation of heat pump and CHP unit based on the energy content of the individual thermal energy storage

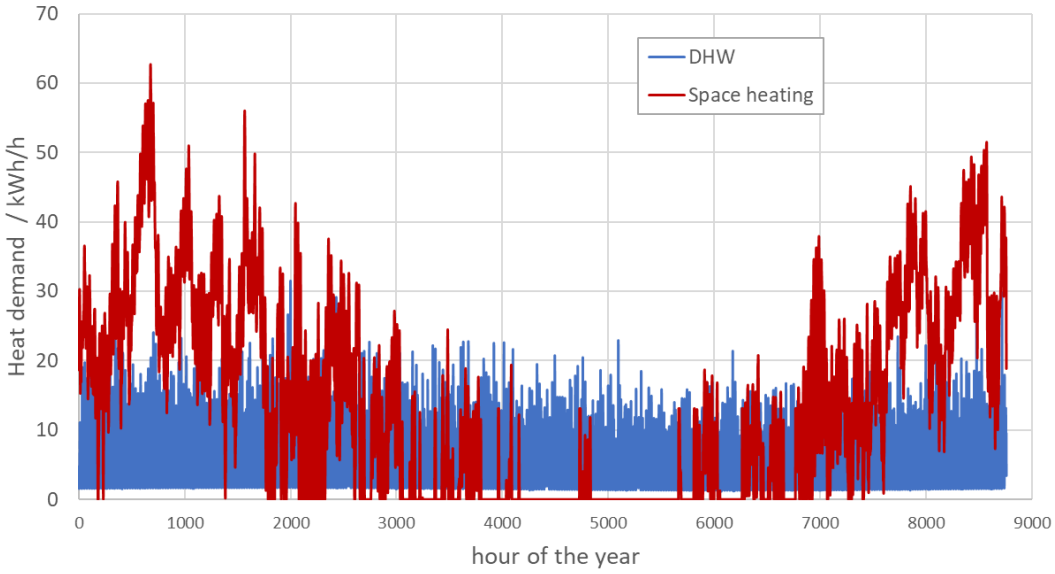
Part load operation for both, heat pump and CHP unit



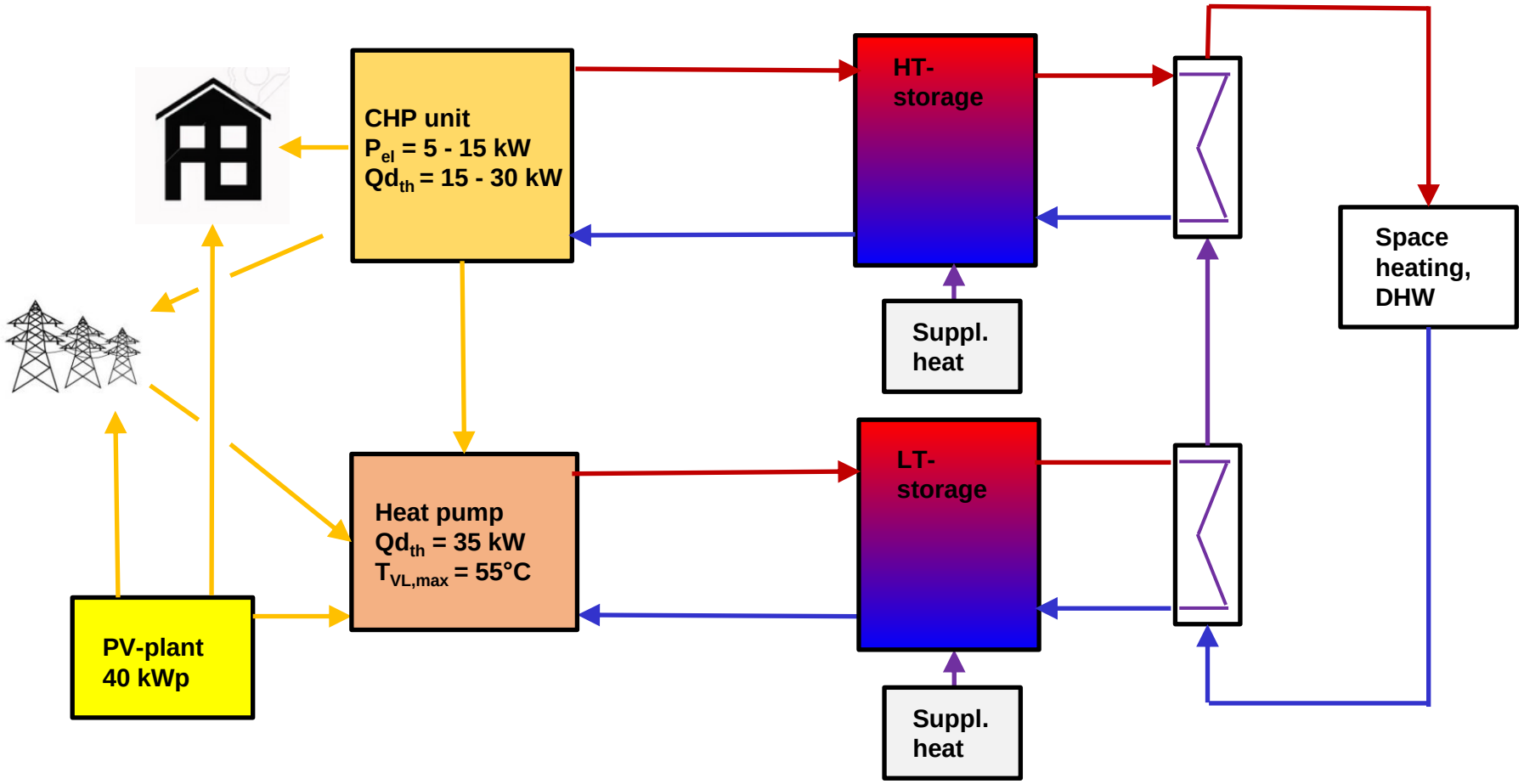
3. The use case – Multi-family house

- **25 apartments**, 62 residents,
  year of constr. 1978, location: Rainau (BW)

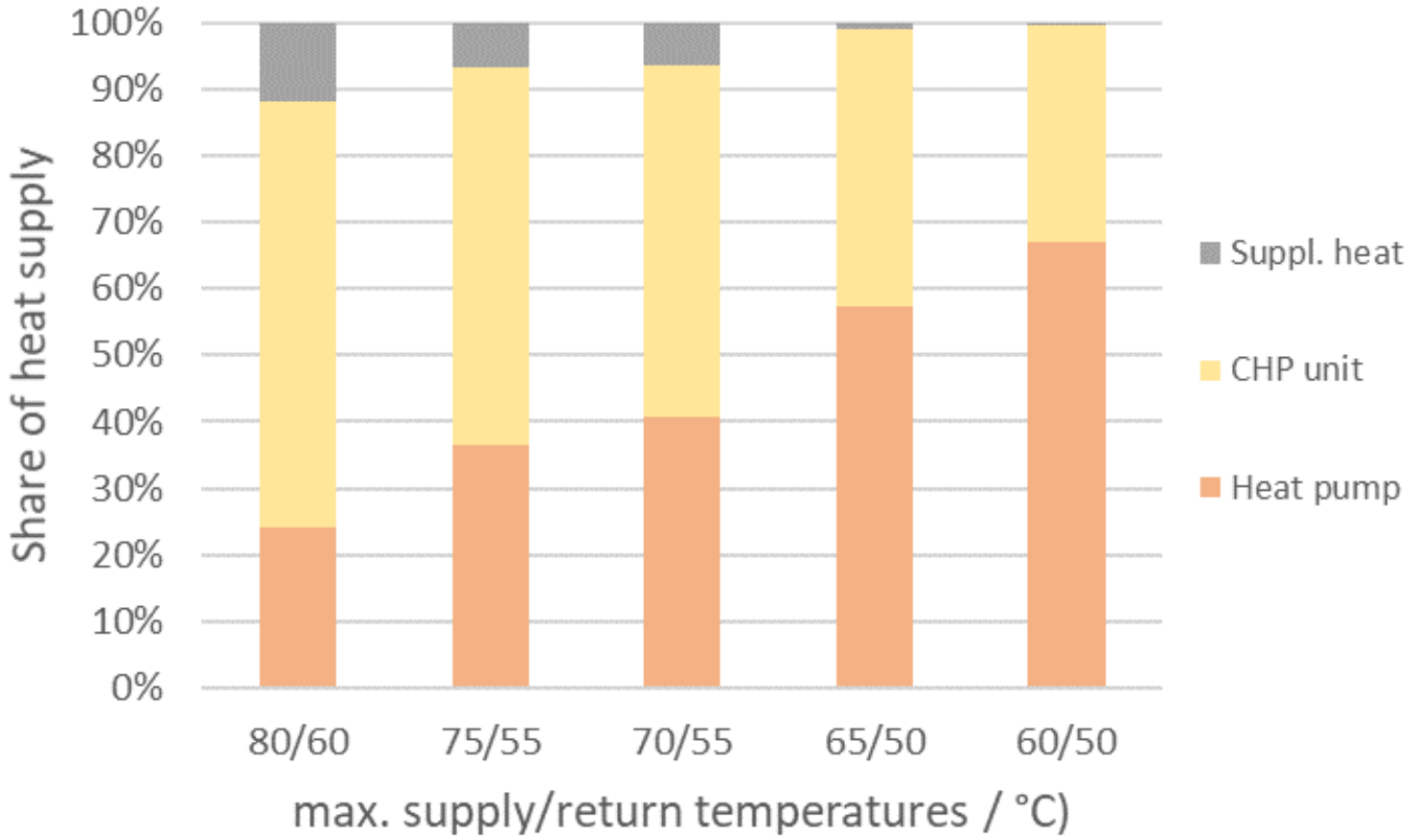
- **Synthetic load profiles**
  yearly energy demands:
  space heat 119.226 kWh/a
  DHW 50.558 kWh/a
  Electricity 91.973 kWh/a



3. The use case – Hydraulics and electricity



3. The use case - results



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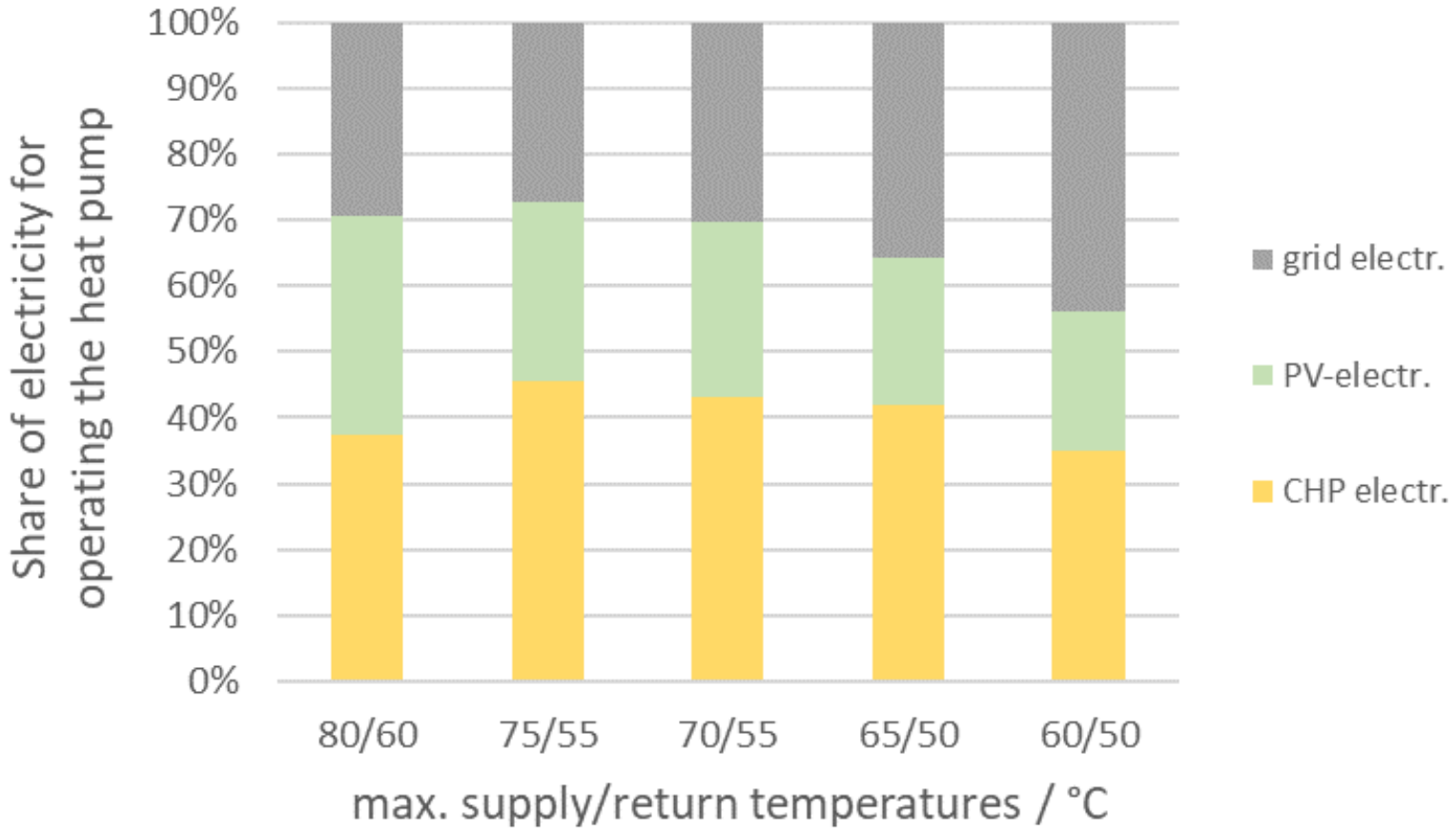

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