

Findings from the operation of a cold grid with multi-source regeneration of the borehole heat exchanger field

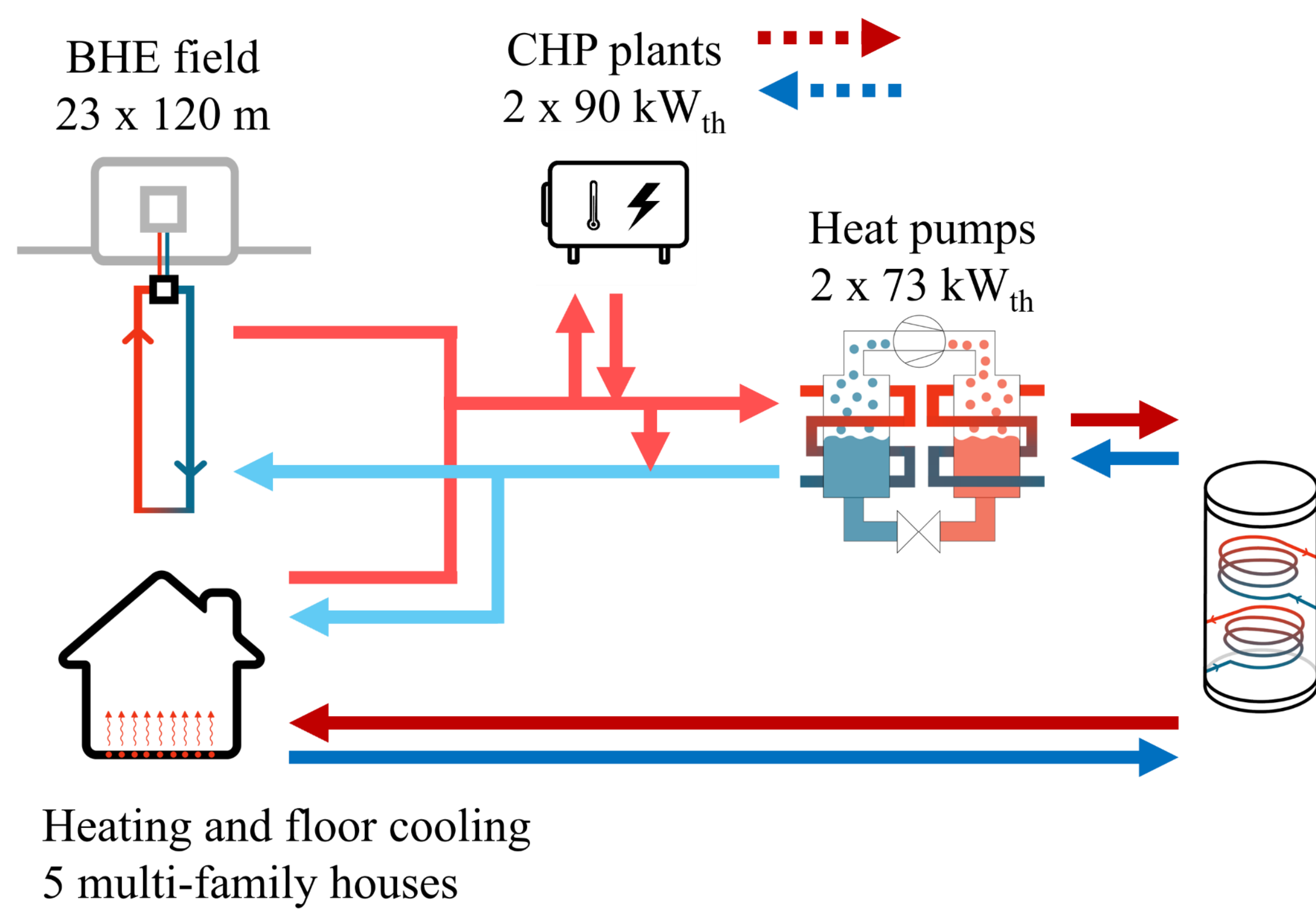
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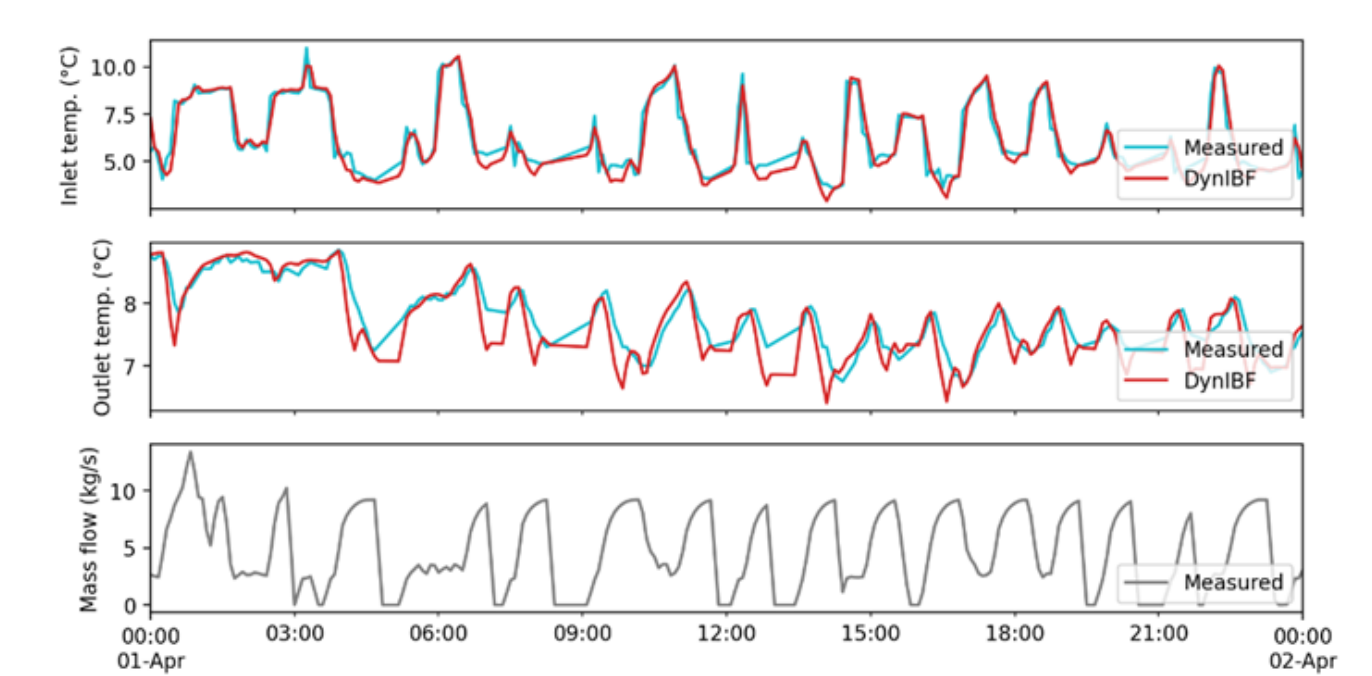
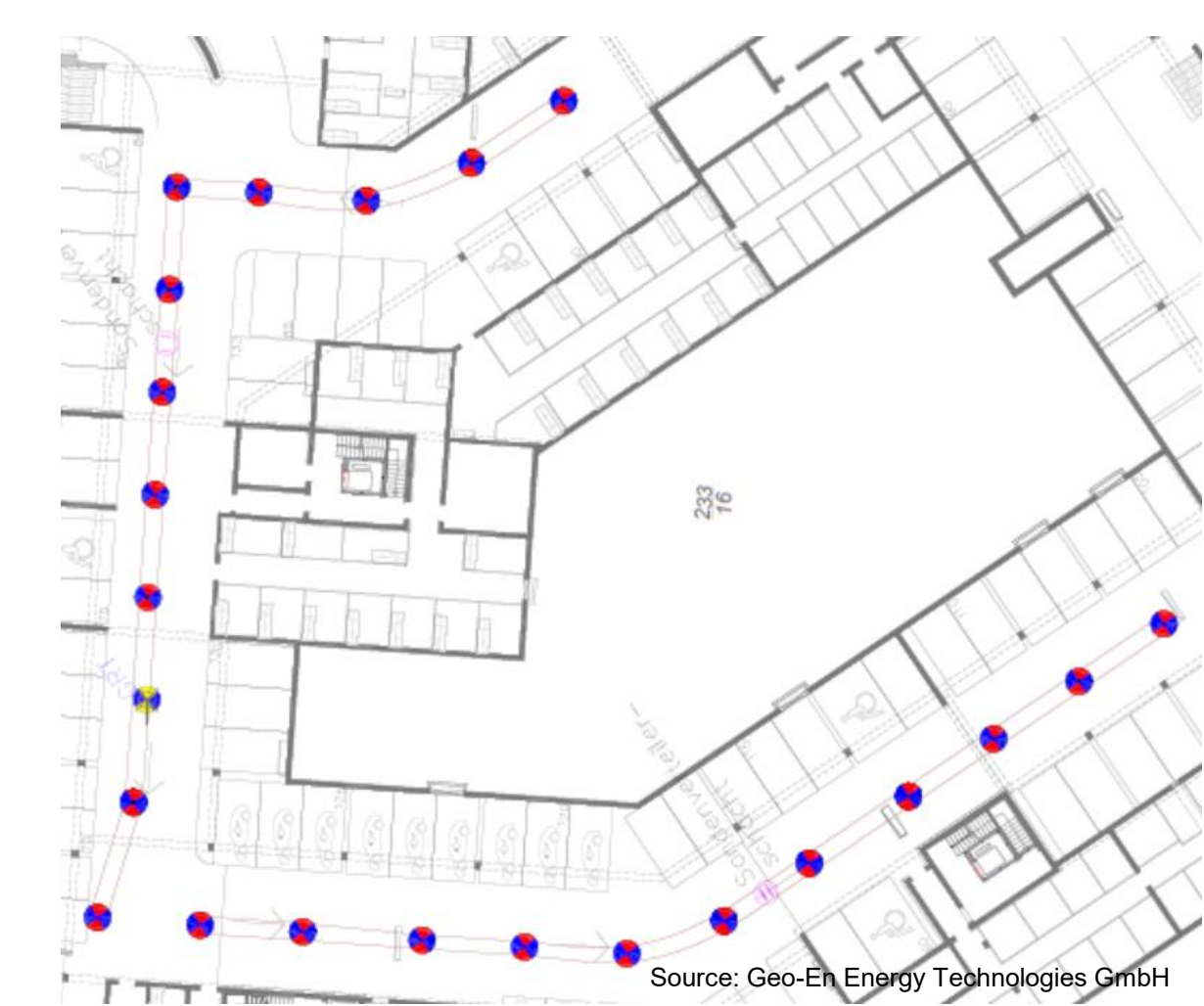
Postsiedlung energy system

Cold grid



- Located in Darmstadt, Germany
- In operation since 2023
- Combined energy supply of old and new buildings via heating grids at different temperature levels

Borehole heat exchanger field

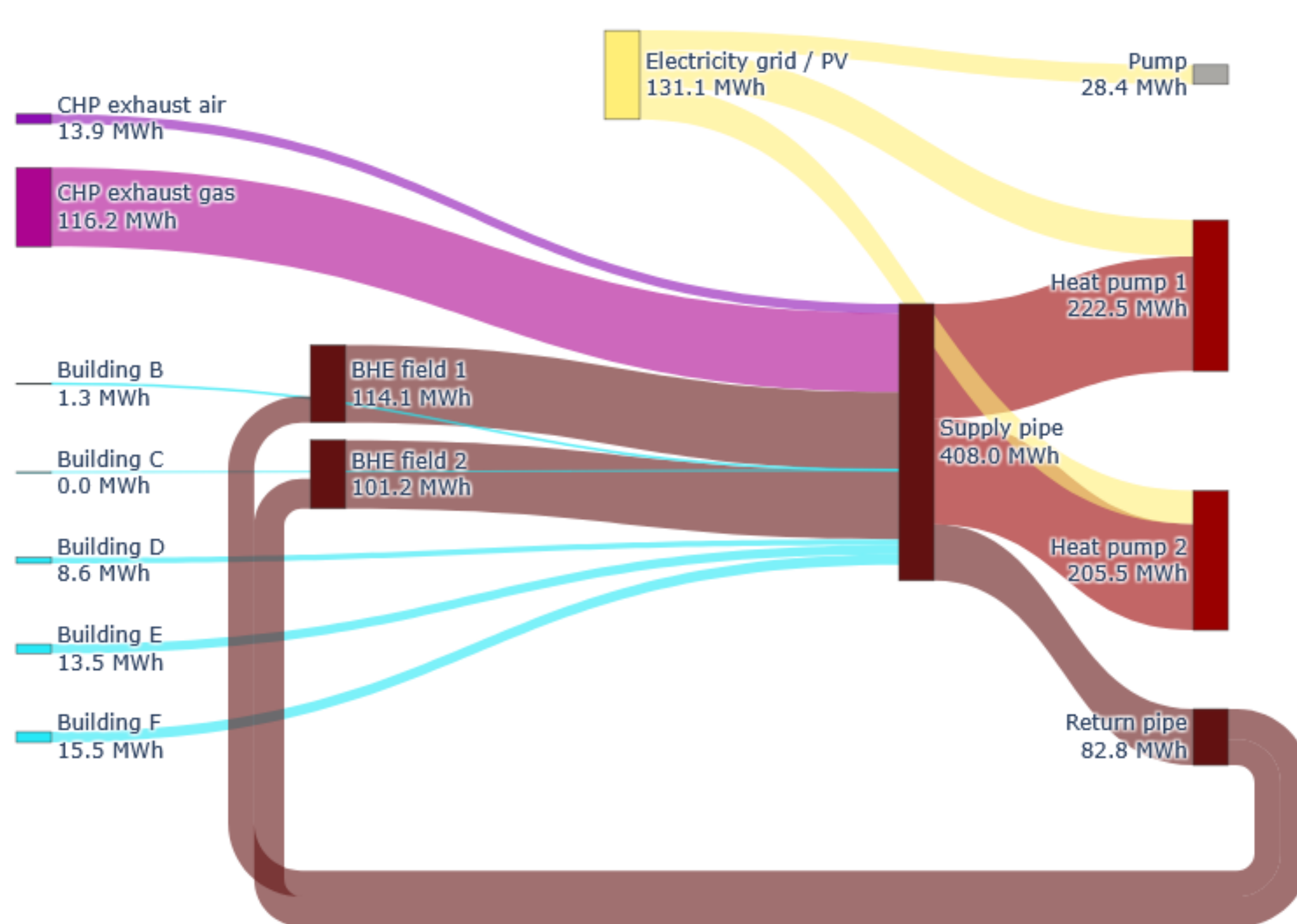


Model: DynIBF (TRNSYS) [1]



Measured data

Annual energy balance

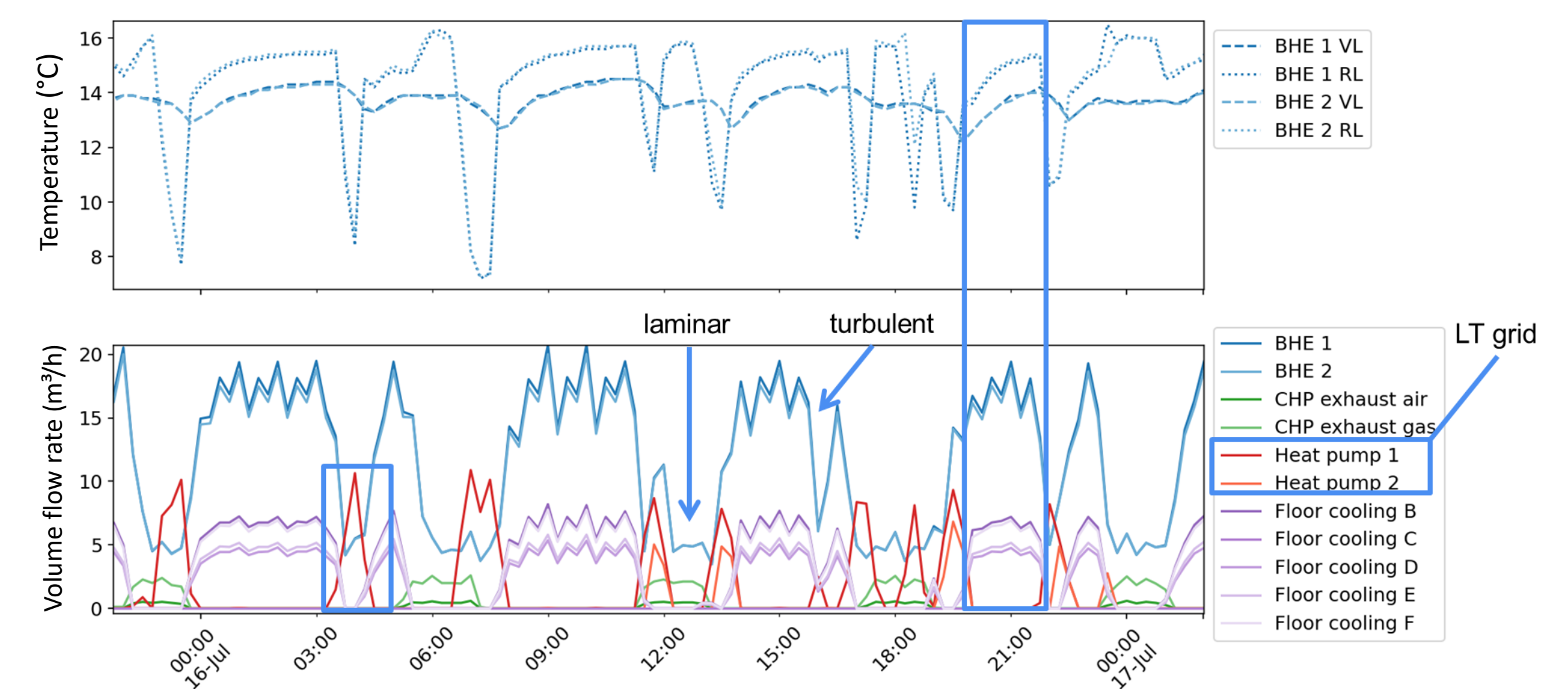


Findings:

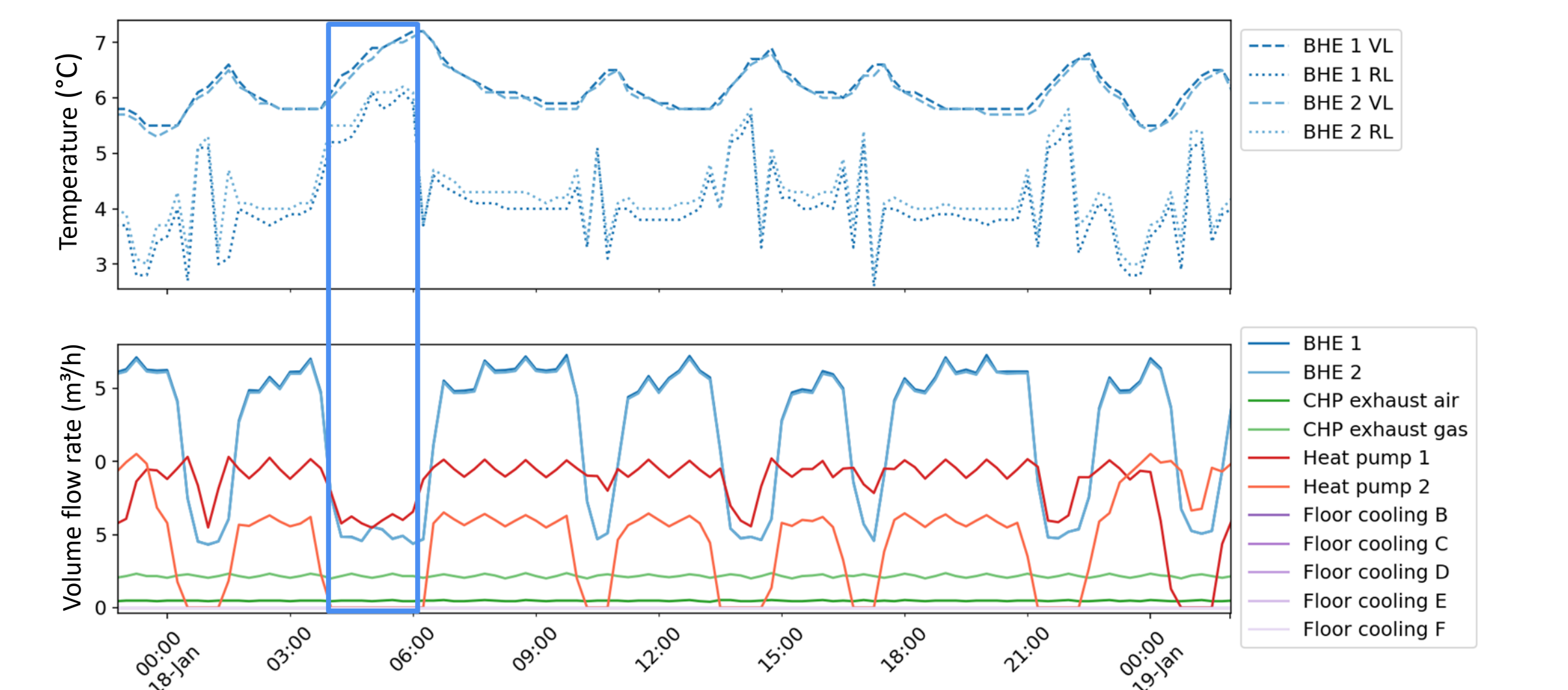
- High electricity consumption of the circulation pump
- Laminar flow in boreholes in partial load operation
- Low temperature difference supply/return

Cold grid

Summer

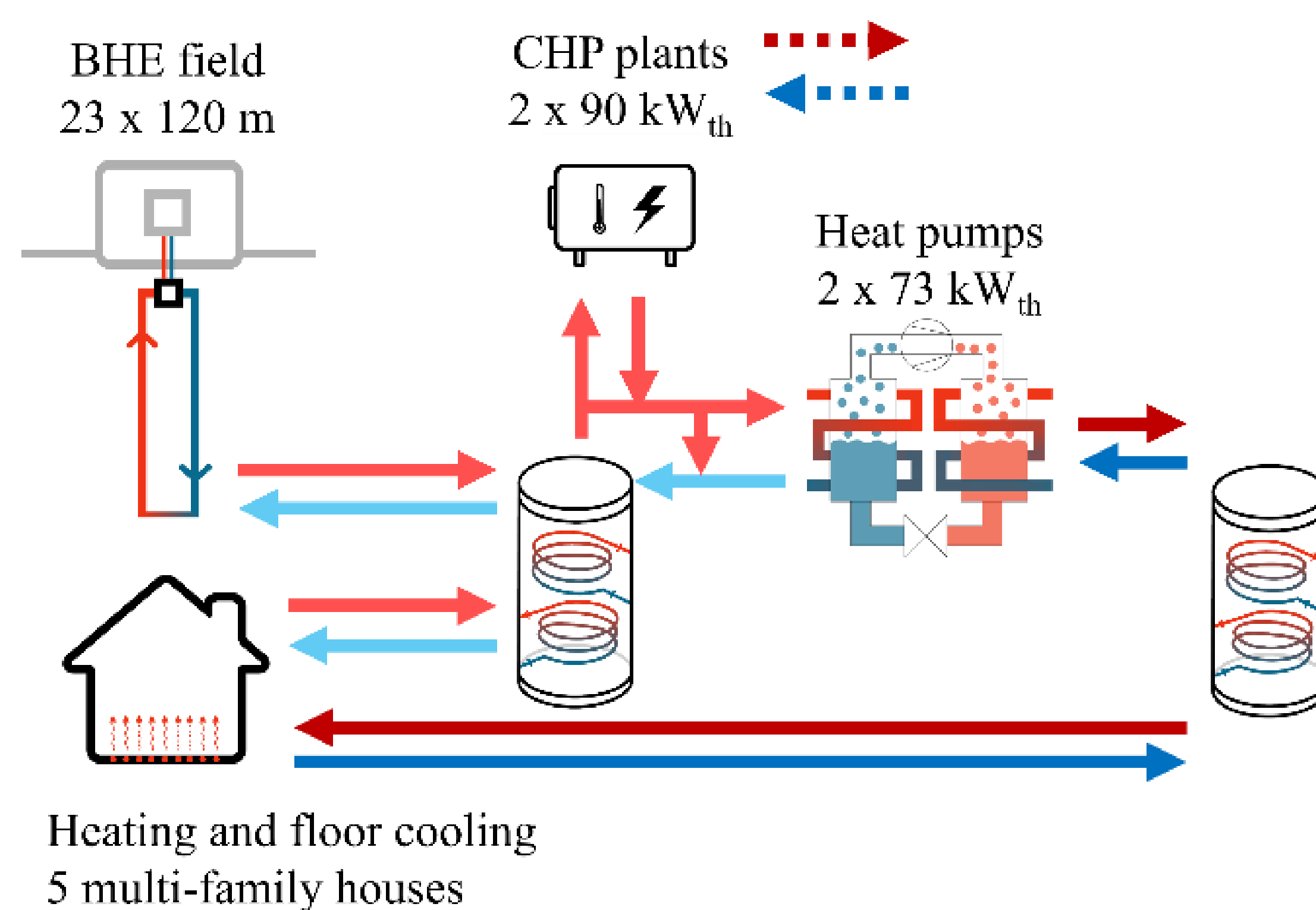


Winter



Optimisation potential

- Decoupling of the volume flow rates using a buffer storage
- Simulation results for first operational year: decreased pumping energy can increase system performance
- Further potential: implement simultaneous operation of heat pumps and floor cooling; reduced volume flow during floor cooling



Conclusions & outlook

- Monitoring at least during the adjustment phase of complex multi-source energy systems is crucial to ensure functionality as planned.
- Long-term simulations are needed to determine the optimum trade-off between pumping energy and regeneration, and the added value of a more complex operational strategy.

References

[1] X. Kirschstein, M. Ohagen, J. Reber, C. Hübler, Development and validation of a new model for system-integrated shallow borehole heat exchanger fields with irregular geometry, Geothermics 134196 (2026) 103481. doi:10.1016/j.geothermics.2025.103481