4th International Conference on Smart Energy Systems and 4th Generation District Heating
Aalborg, 13-14 November 2018

Integration of varying flow temperatures in unit commitment models of future district heating systems

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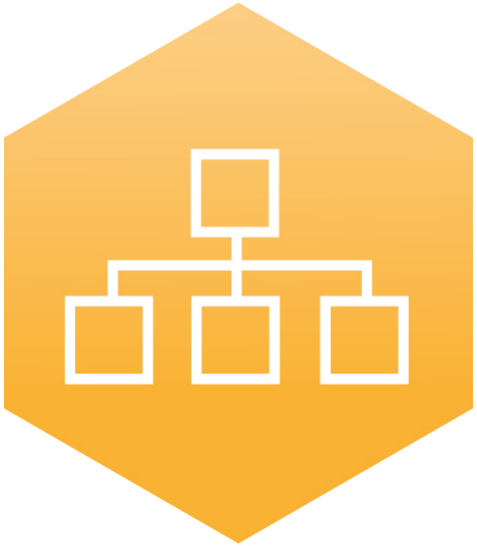

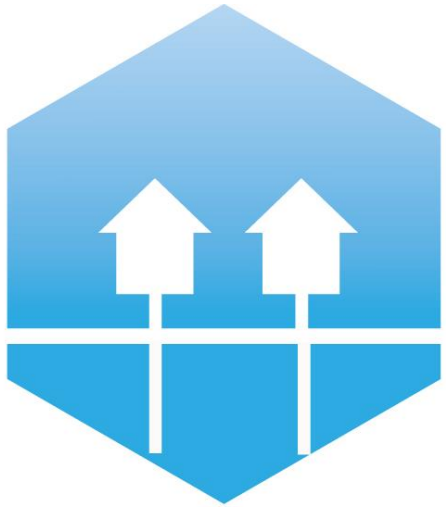

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4th International Conference on Smart Energy Systems and 4th Generation District Heating 2018
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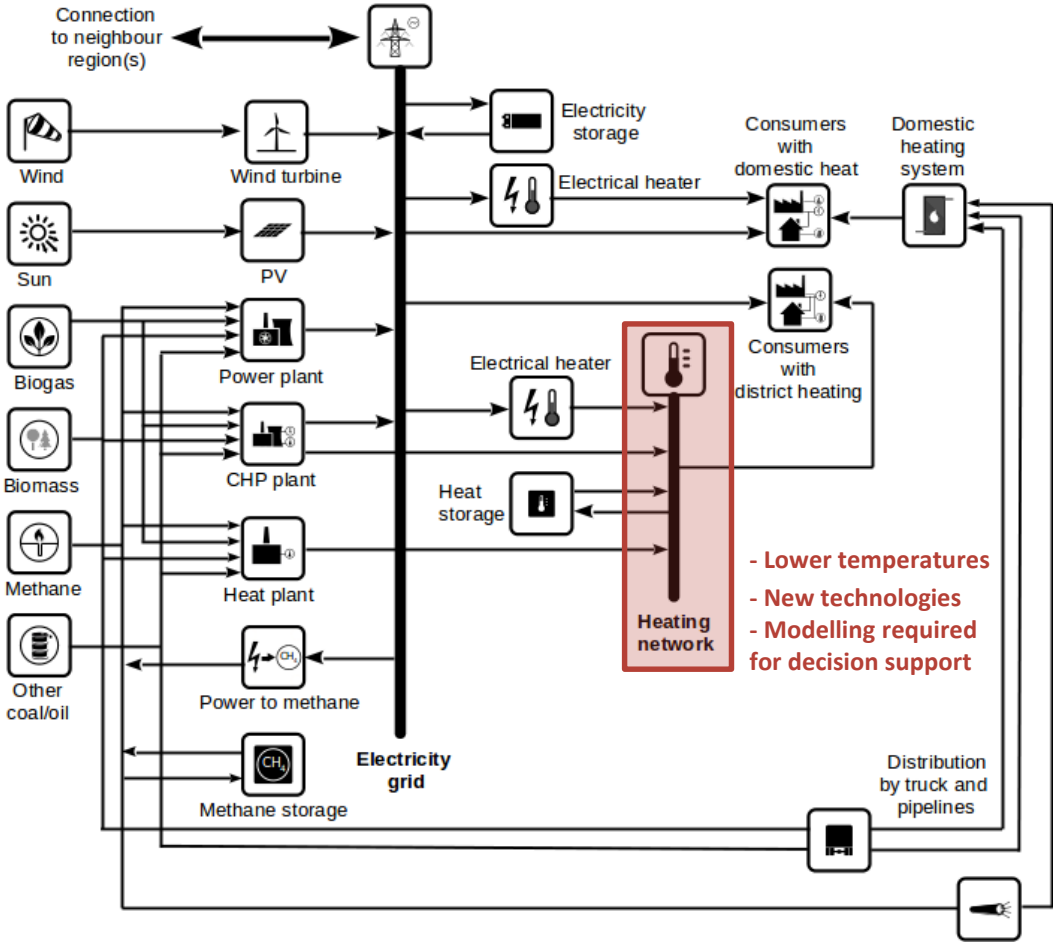
4DH
4th Generation District Heating Technologies and Systems

Motivation



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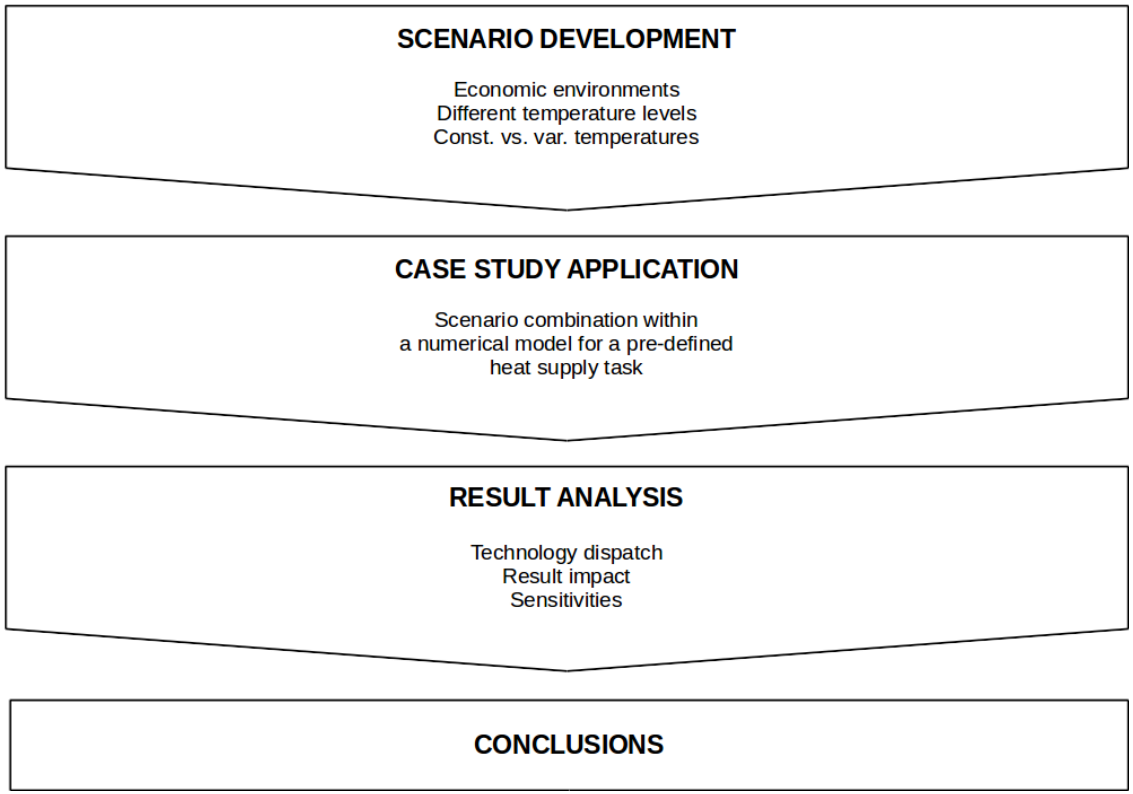
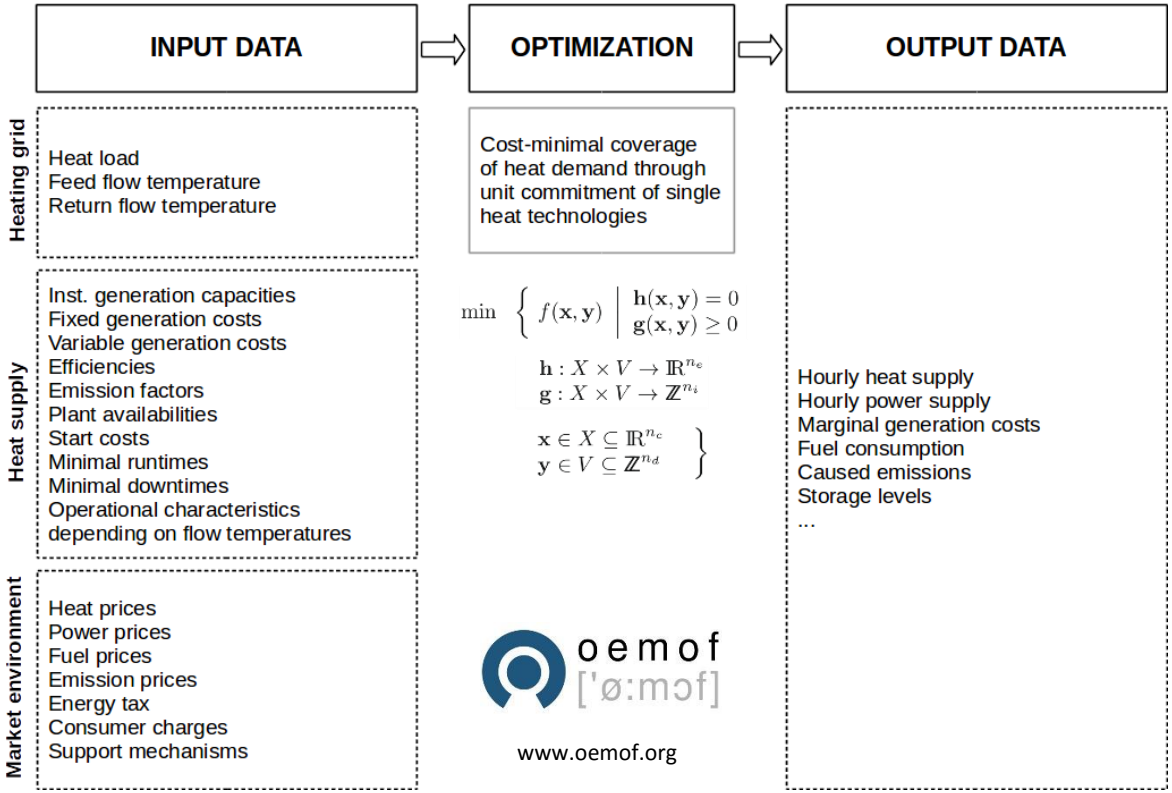
Research questions

- How can varying temperatures be integrated in linear optimization models of future DH systems?
- How does the overall temperature level influence the operational results?
- How significant are the result deviations between modelling with varying/constant temperatures?

Analytic procedure



Model overview



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Heat supply task

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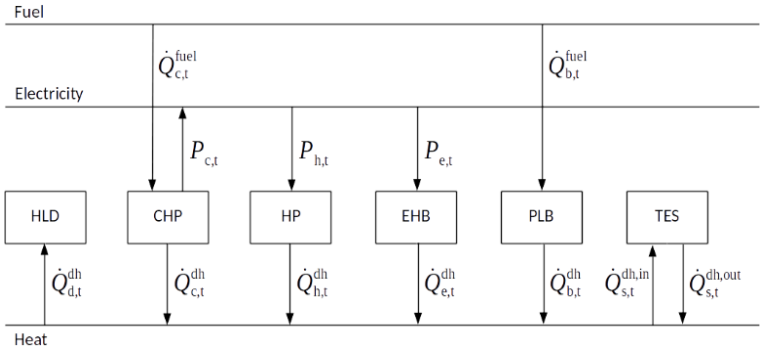
Assumptions for DH system

- Municipal heat supply task for the city of Flensburg in northern Germany
- Artifical dimensioning of broad technology spectrum on supply side
- No discrimination of single technologies



Nominal heat output related to maximum heat load		
Back pressure turbine	BPT	0.25
Combined cycle extraction turbine	CET	0.25
Internal combustion engine	ICE	0.25
Electric heating boiler	EHB	0.25
Compression heat pump	HP	0.25
Peak load boiler	PLB	0.25
		1.5
Thermal energy storage capacity in h of maximum heat load	TES	2

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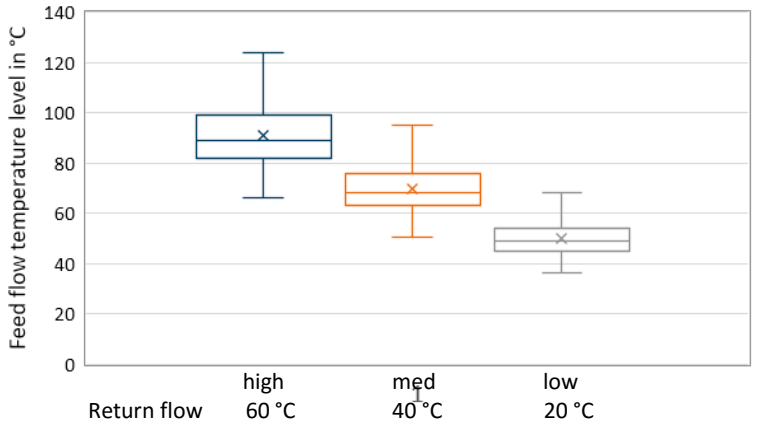
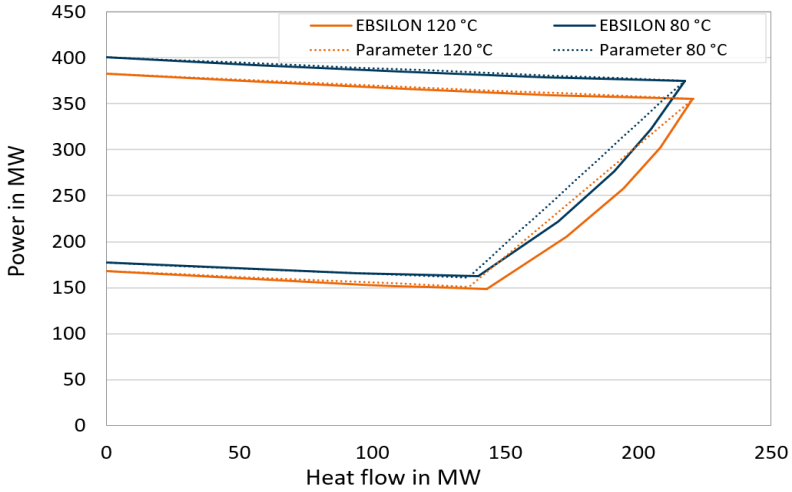
Temperature integration

Representation within model

- Three different temperature levels represent different DH system generations
- Pre-processed component characteristics and thus exogenous temperatures
- Parallel circuit of components arround DH network





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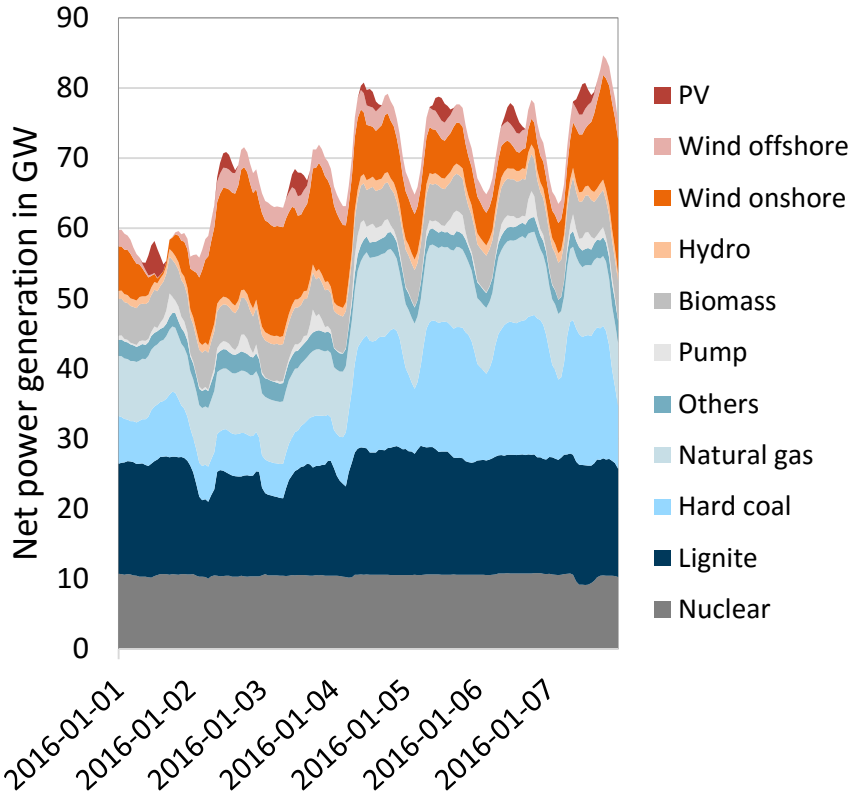
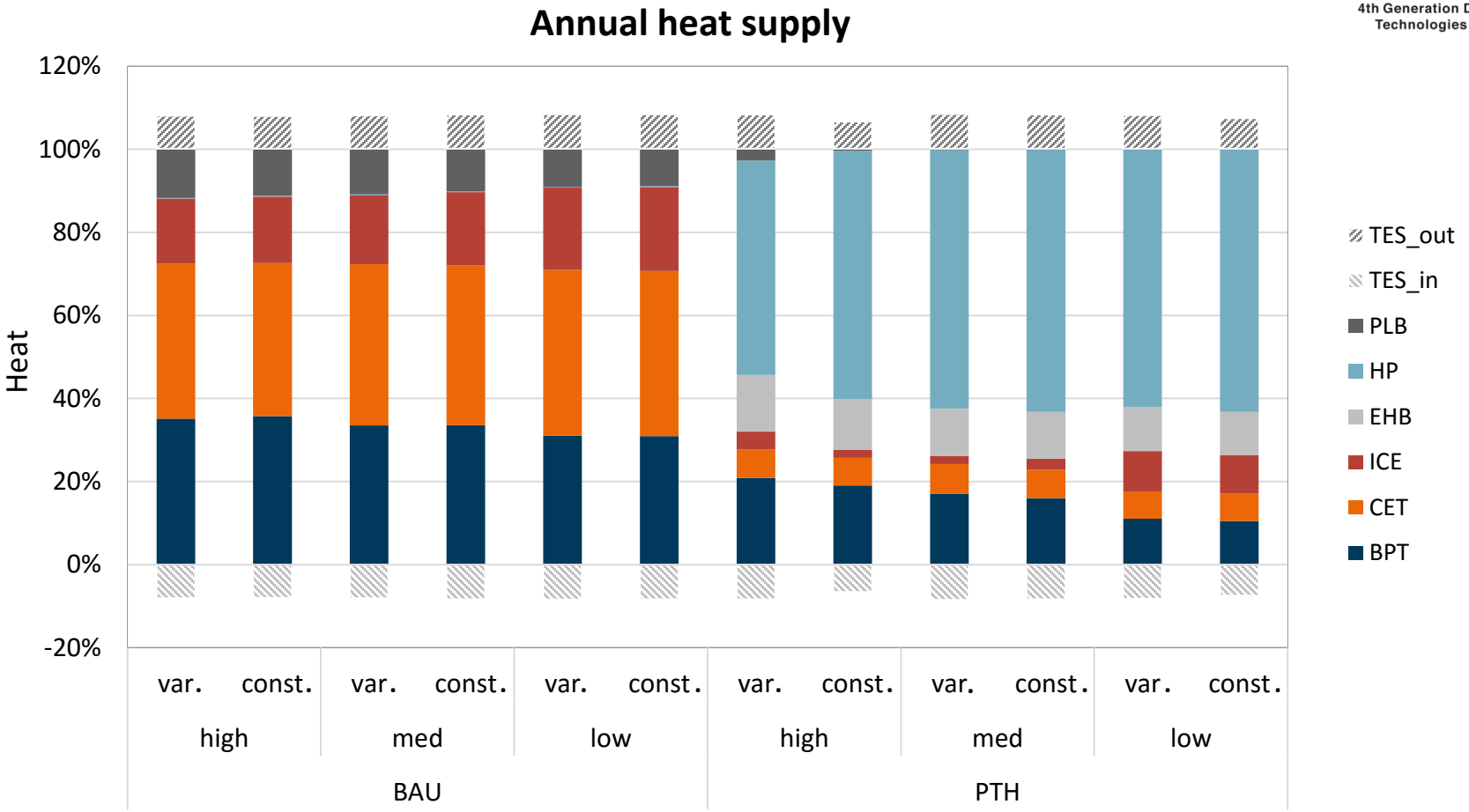
Economic environment

Scenarios for surrounding system

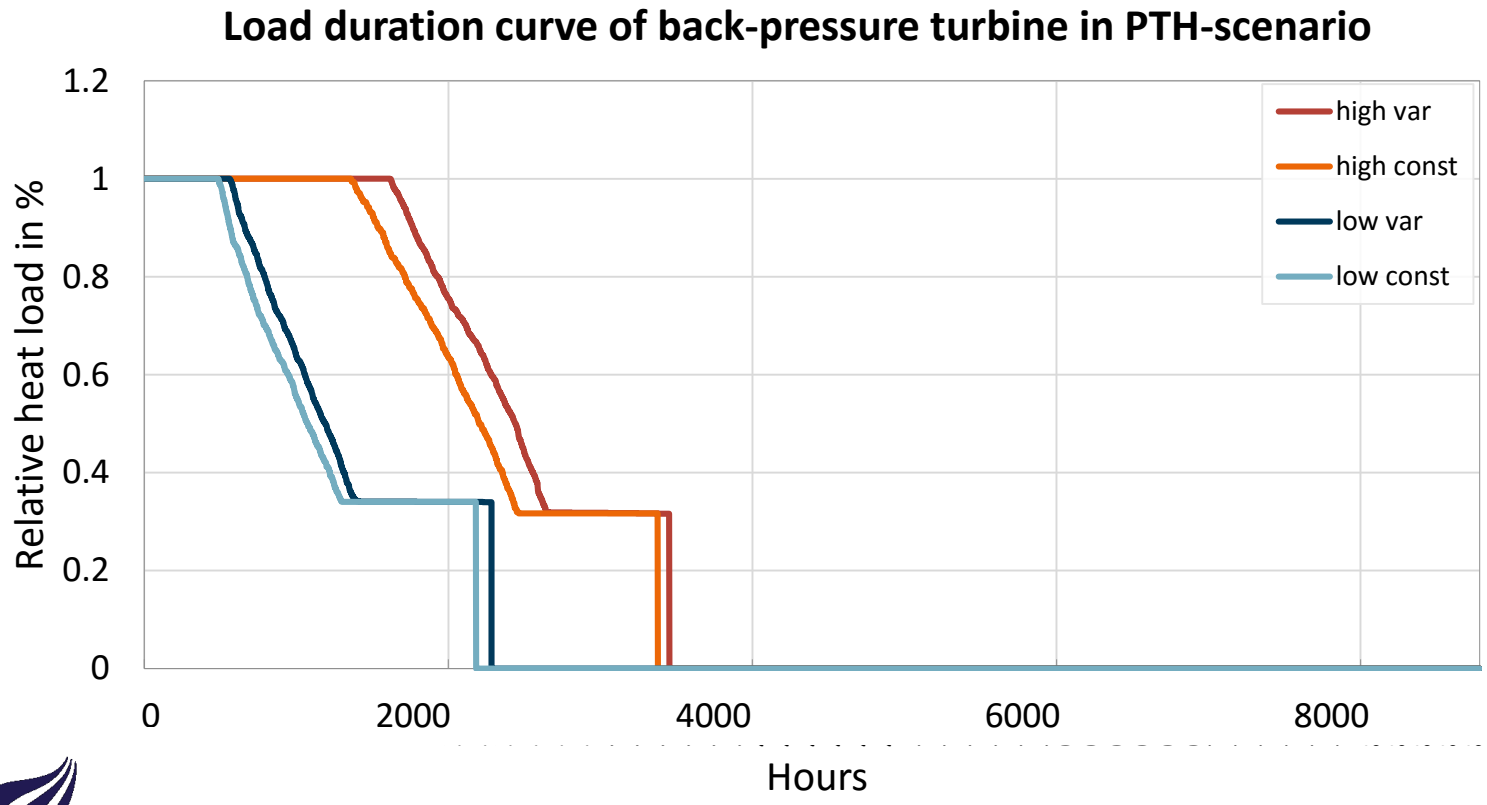
- Business-as-usual (BAU) scenario supports CHP and is based on historic data for 2016
- Power-to-heat (PTH) scenario supports PTH and is based on power market model data for 2026



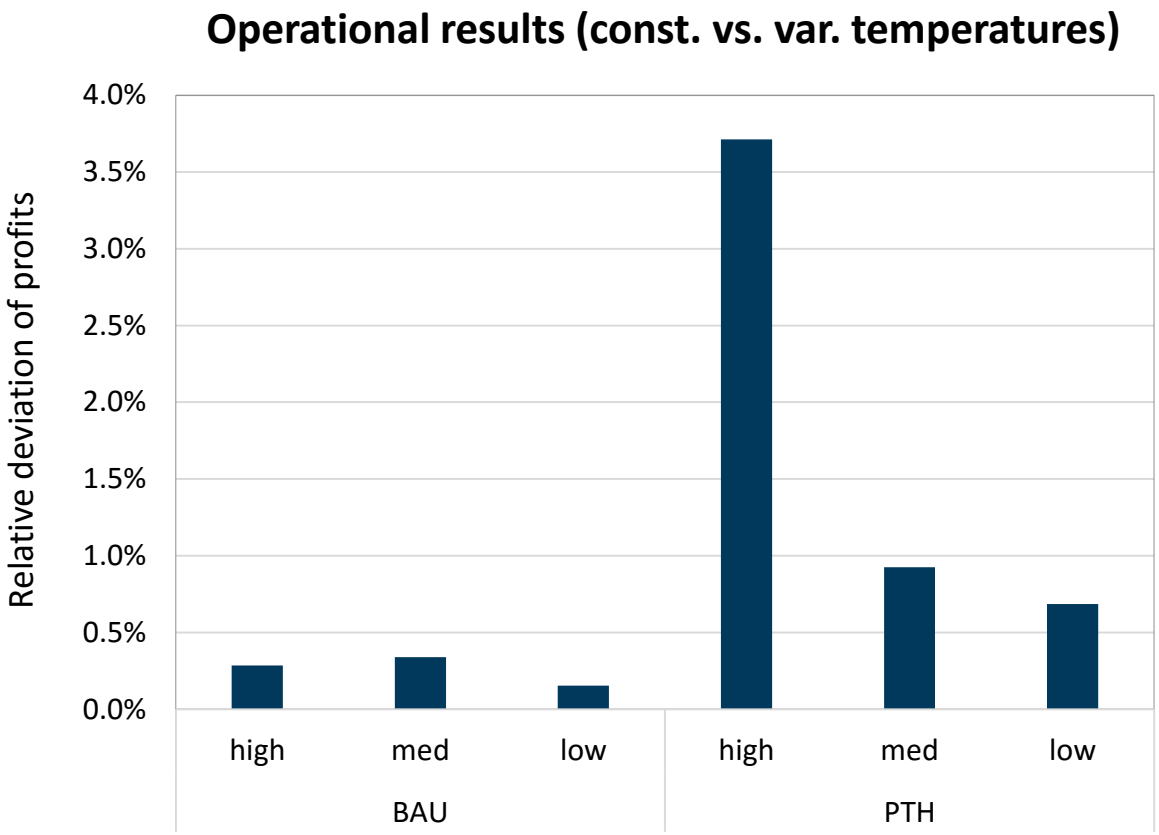
Operational results



Partial load behaviour



Result impact



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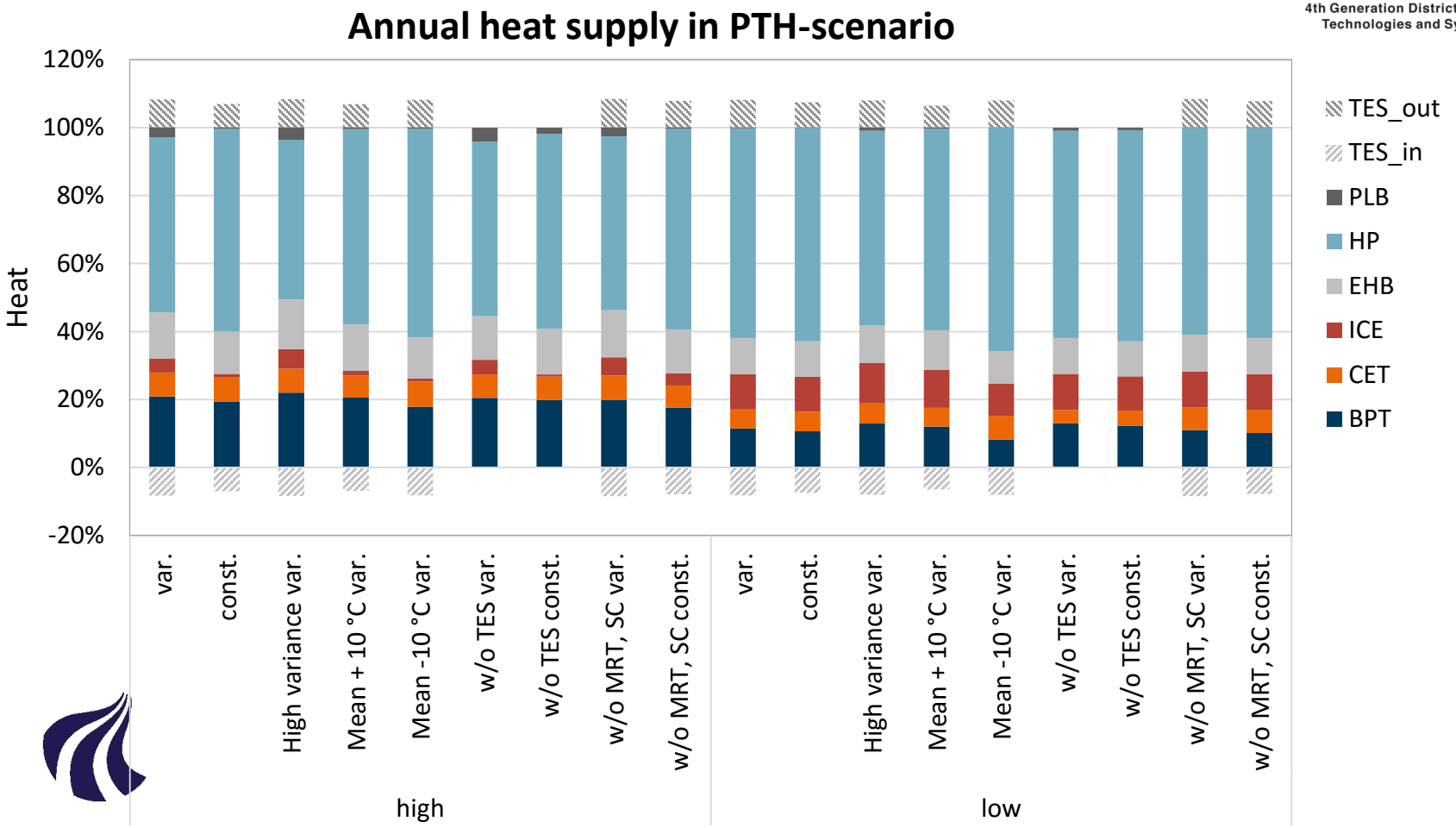
Considered sensitivities



Conclusions

- Varying temperatures can be integrated via flow-dependent operational parameters
- Operational results are influenced when temperature levels affect operating ranges
- Result deviations between constant and varying temperatures are low with good assumptions

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