2nd International Conference on Smart Energy Systems and 4th Generation District Heating
Aalborg, 27-28 September 2016

Thermal Storage Control of a Local Energy Supply System Acting as District Heating Prosumer

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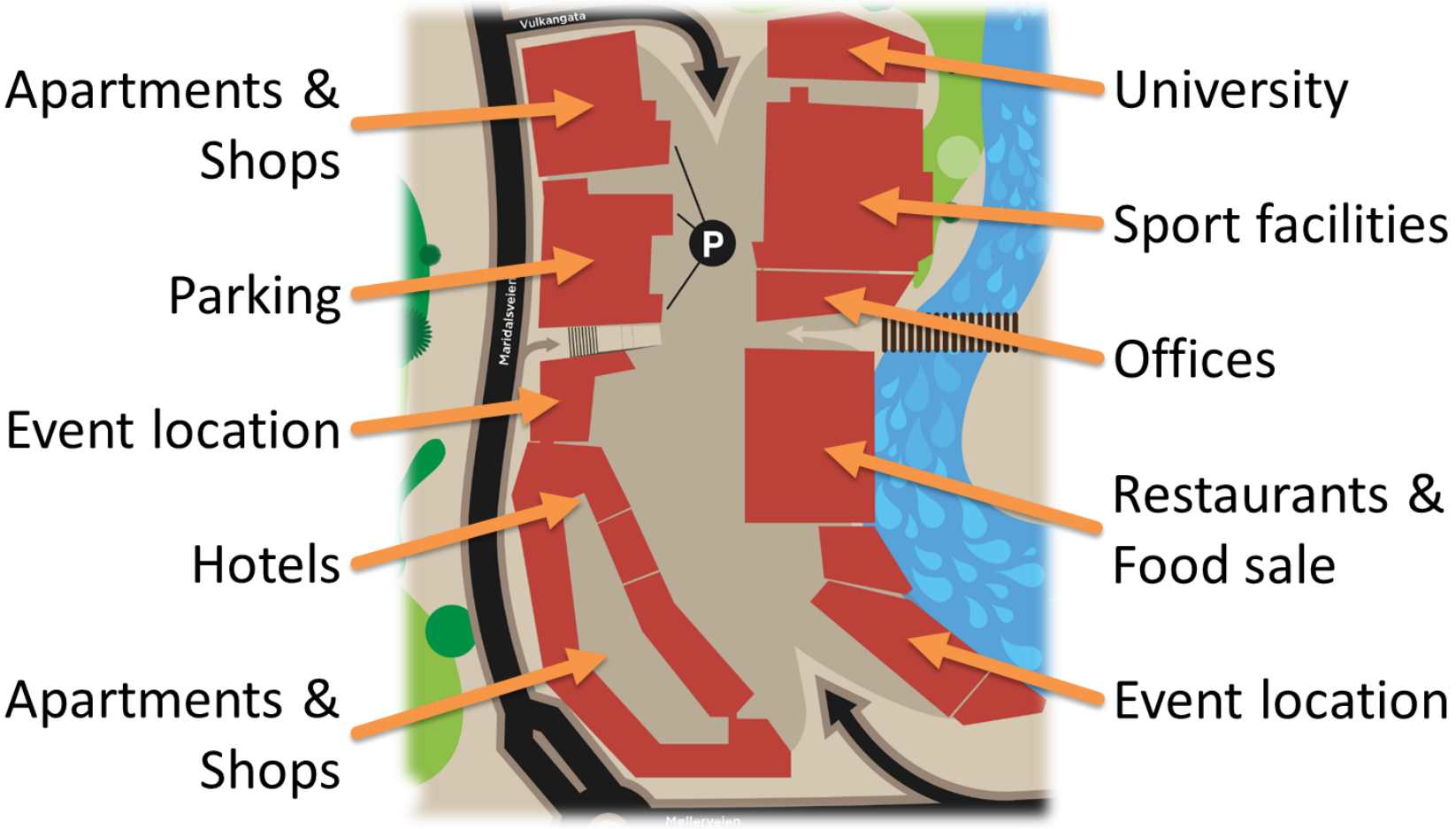
The Buildings

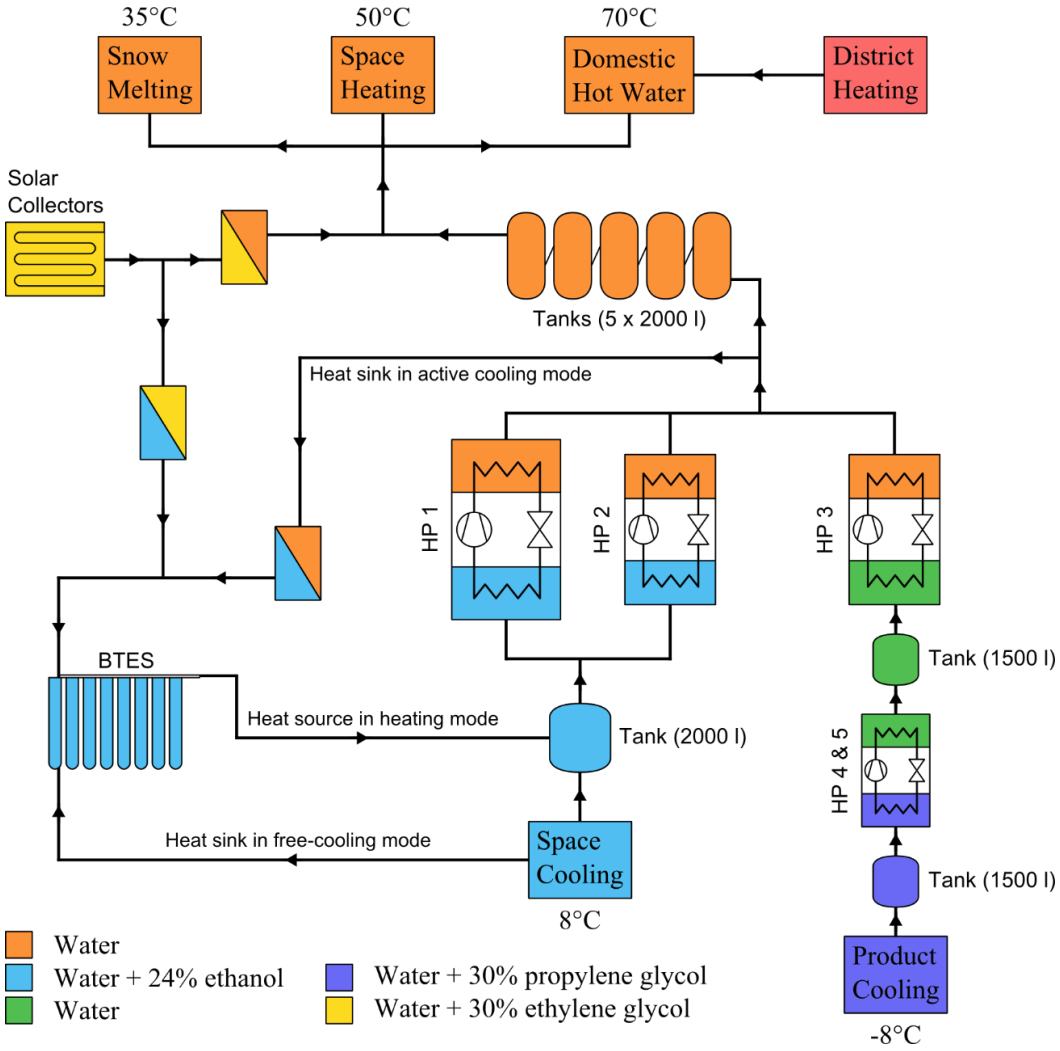


Picture from www.vulkanoslo.no

The Energy Supply System

- Covers product cooling, space cooling, space heating and DHW preheating
- District heating used for DHW temperature lift and space heating backup
- Main components
  - Heat pumps
  - Water tanks for short term storage/buffering
  - Boreholes for long term thermal storage
  - Solar collectors

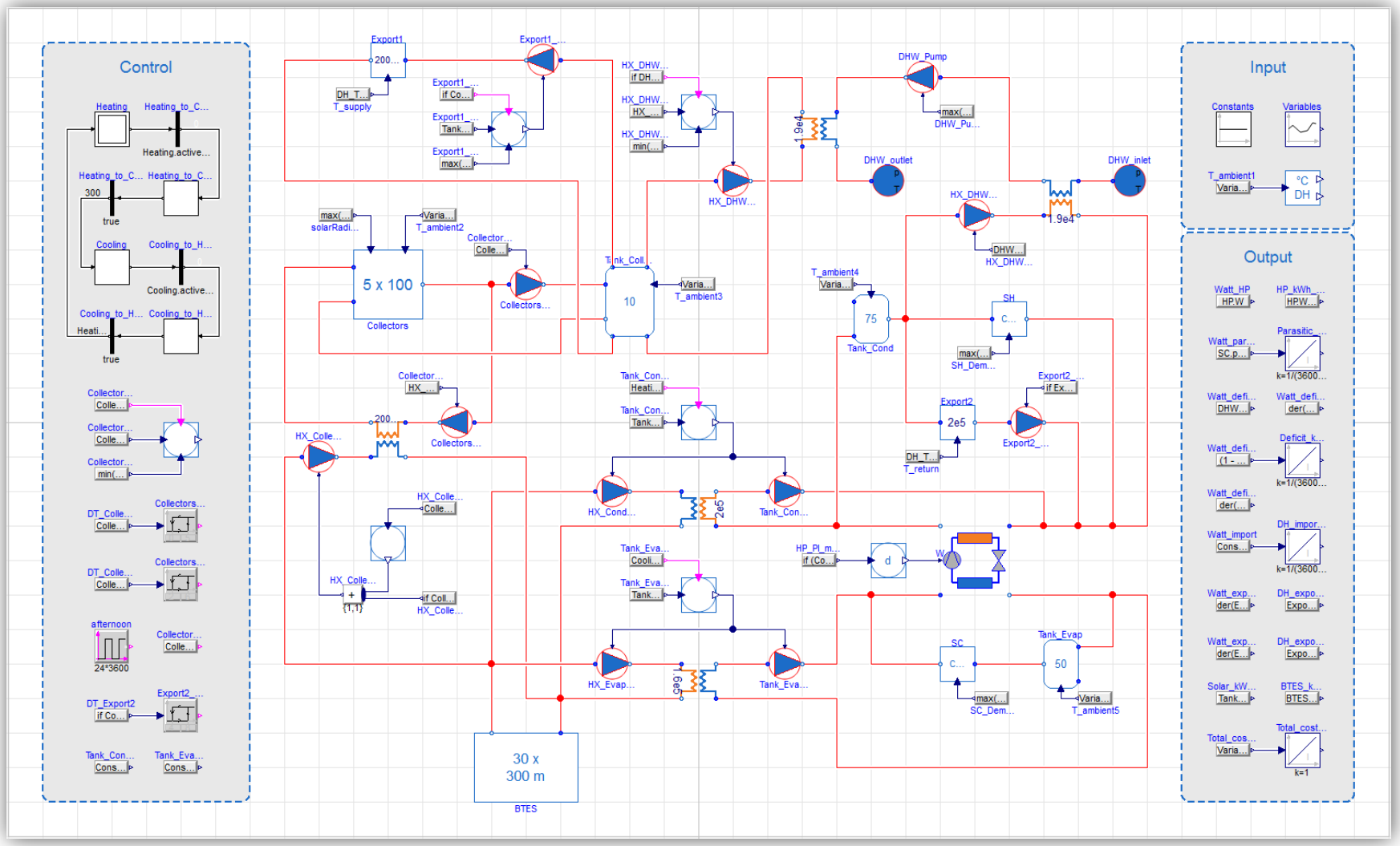
The Energy Supply System



The System Model

- Modelled with Dymola/Modelica
- Goal: Analyze system performance for one year period
- Component models built based on “Thermal” library
- Inputs
  - Measured demand data
  - Ambient temperature and radiation
  - Variable prices for electricity and district heating

The System Model



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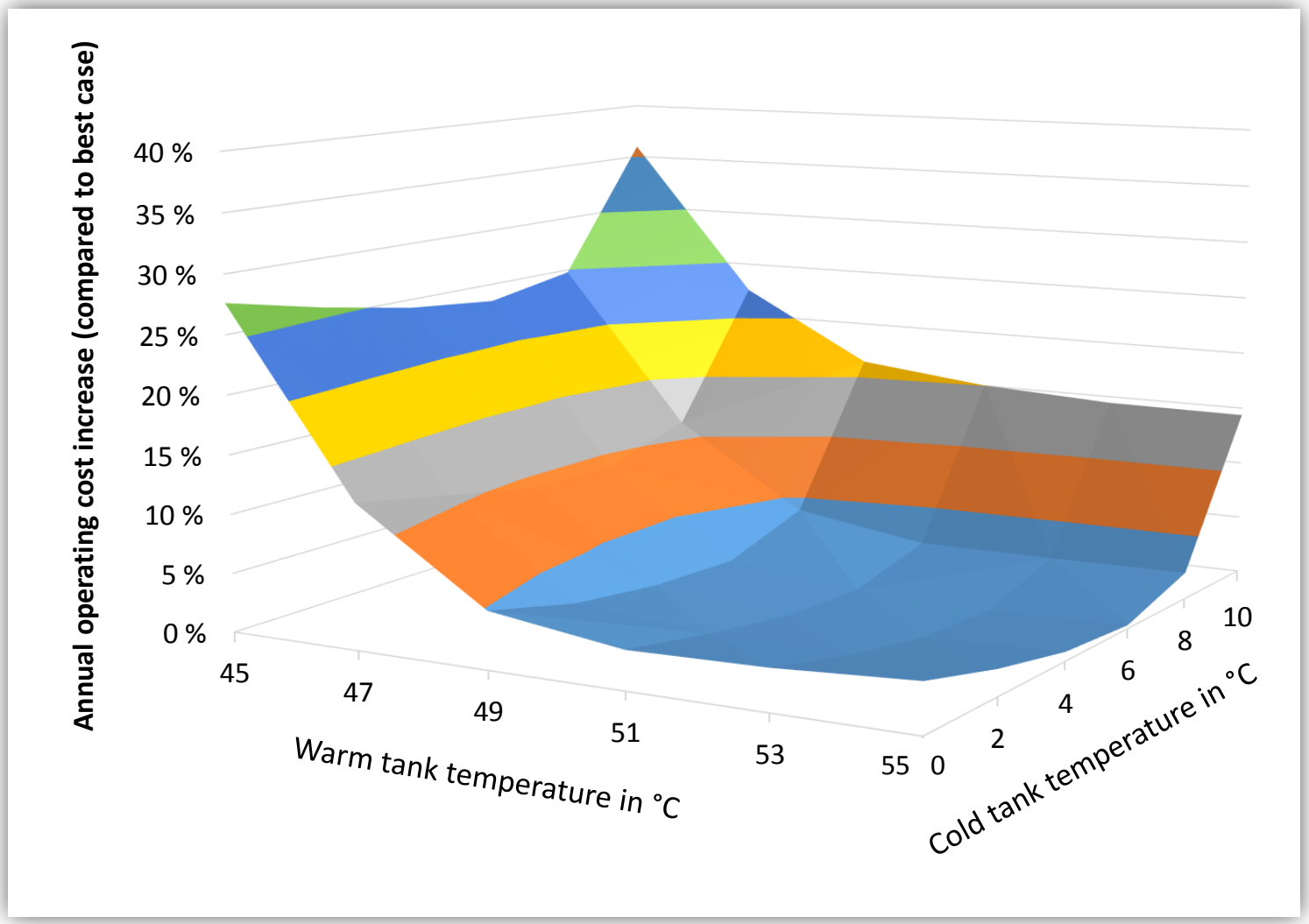
Case Study

- Export to district heating grid possible
- Larger solar collector area
  - 1000 m² instead of 290 m²
- Bigger water storage tanks
- Less boreholes

Control strategy

- Heating/cooling mode based on demand forecast for next day (perfect forecast in model)
- Rule-based control for solar collectors
  - Different rules before and after solar radiation peak
- Buffer tank temperatures kept constant at first
- Parameter study
  - Warm side: 45…55°C
  - Cold side: 0...10°C

Results



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Future Work

- Make control “smarter”
  - Many degrees of freedom due to storages and grid interaction
  - Adjust tank temperatures for operation mode
  - Use tanks for peak shaving (demand and price peaks)
- Optimization of component sizes with “smart” control
  - Avoid over-dimensioning
  - Flat optimum important (sensitivity)

Thank you for your attention!

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The authors gratefully acknowledge the support from the Research Council of Norway (INTERACT 228656 / E20) and the partners Aspelin Ramm Eiendom AS, Statkraft Varme AS, Rema 1000 Norge AS, COWI AS, Asplan Viak AS and SWECO.