Electric Heat Booster in Low Temperature District Heating

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Overview

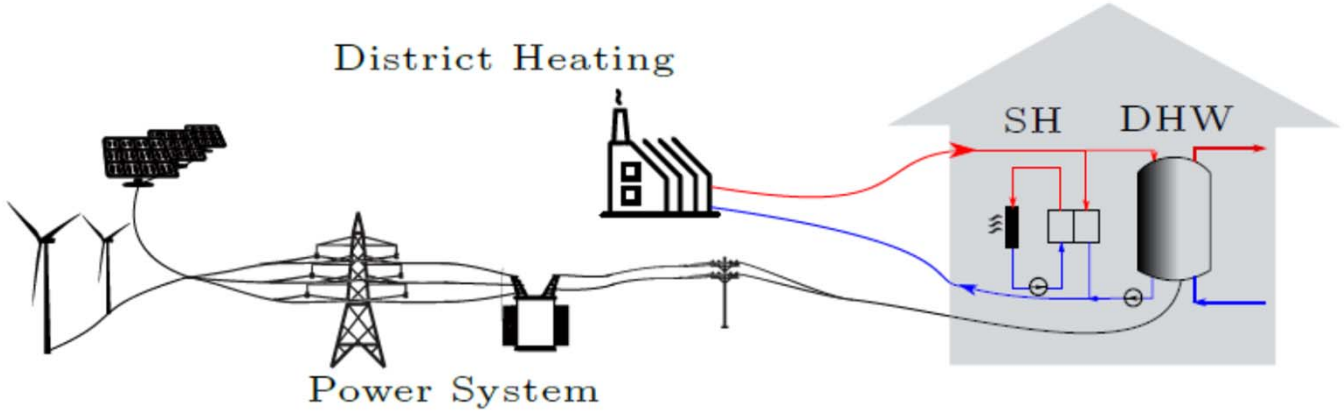
- Background
- System description
- Lab facility
- Water tank modelling
- Network service
- Potential new business

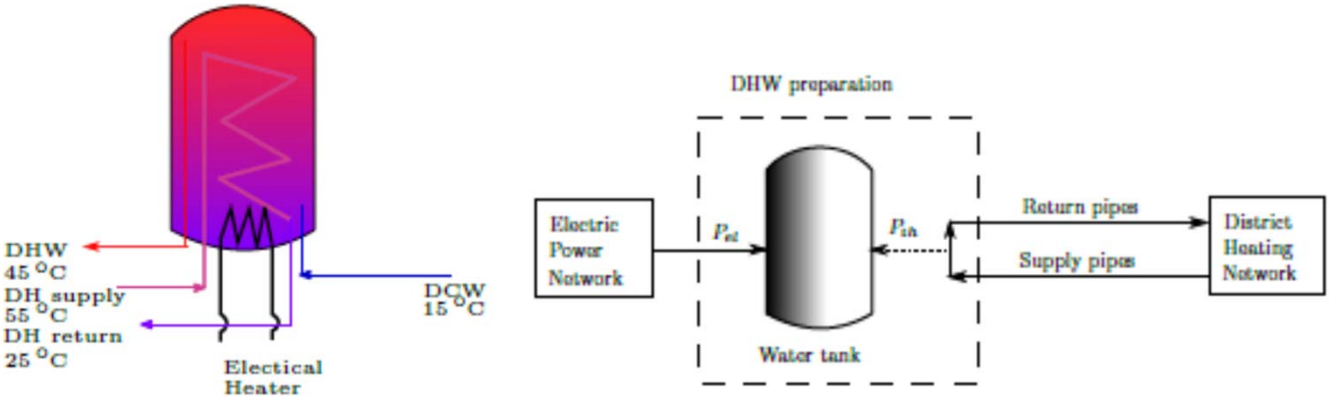
Background

- Increased penetration of renewable energy resources with intermittent power output
- Energy storage capacity needs to be found in other energy sectors
- Integrated energy system is one solution
- Nordhavn as a test bed for integrated energy system research

Nordhavn project

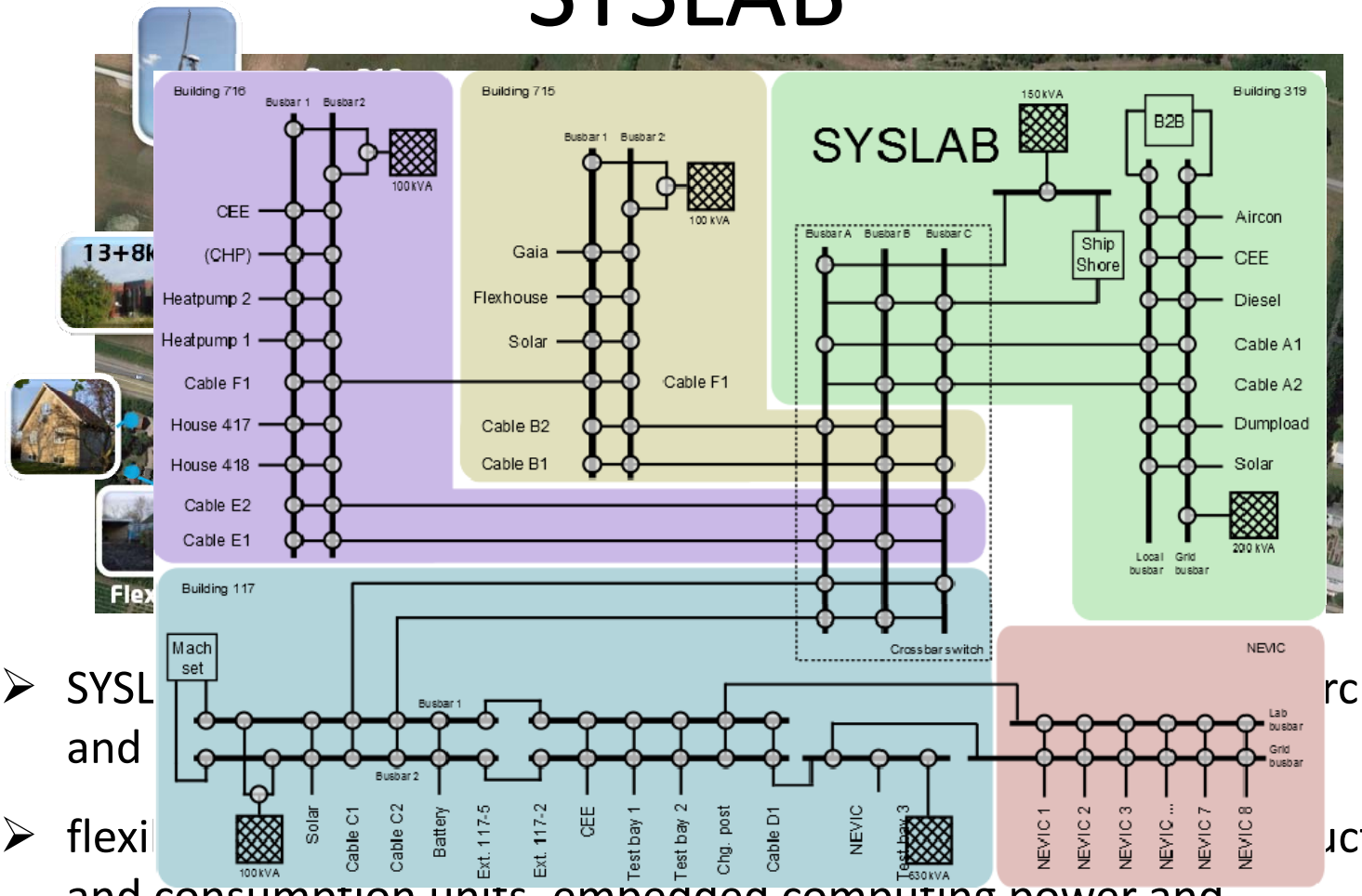
System view





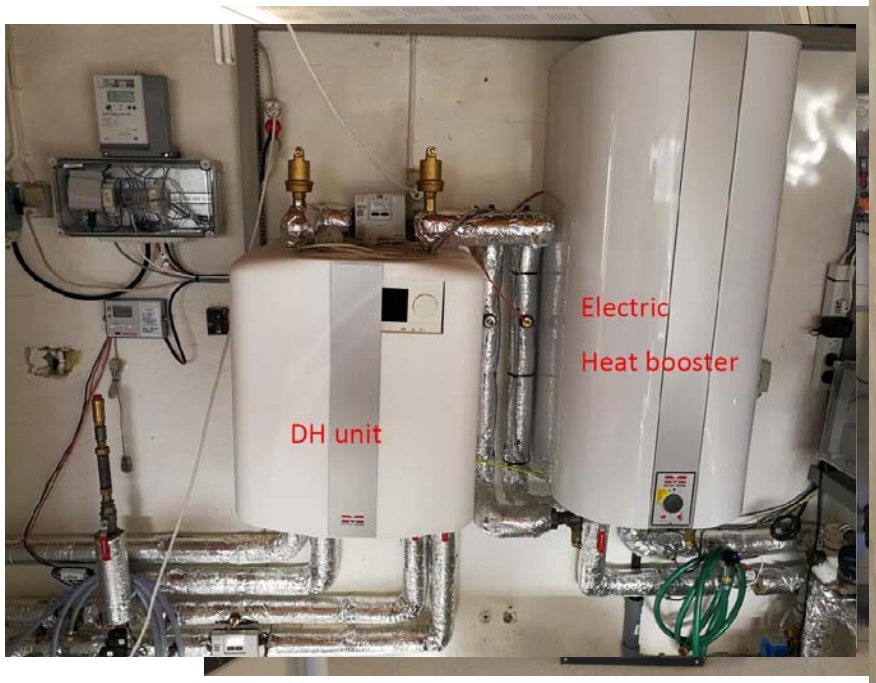
- Boost temperature up to kill legionella
- Heated by both electric and district heating
- Electric heating may have a different role in future energy system

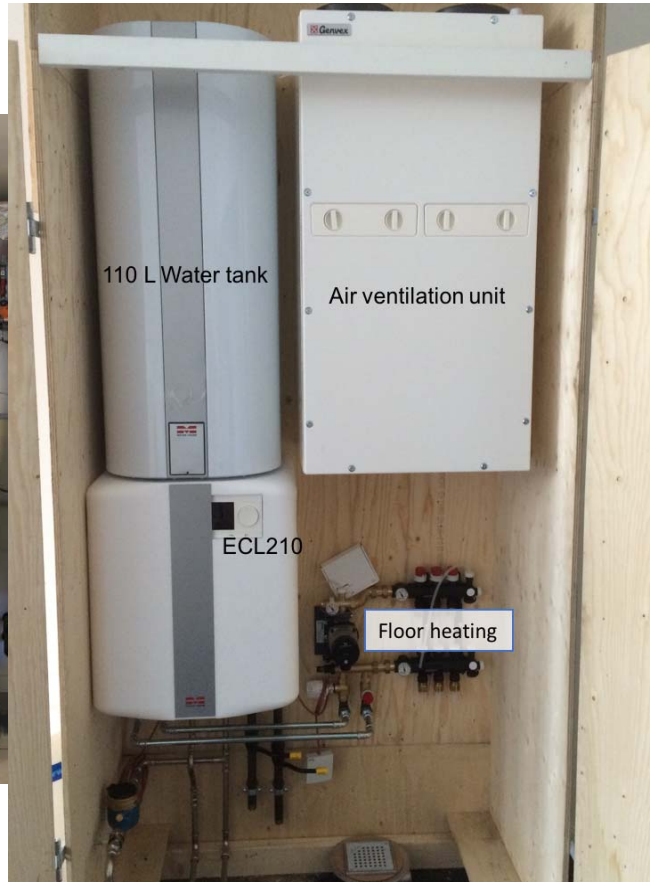
SYSLAB



- SYSL rch and
- flexi uction and consumption units, embedded computing power and communication

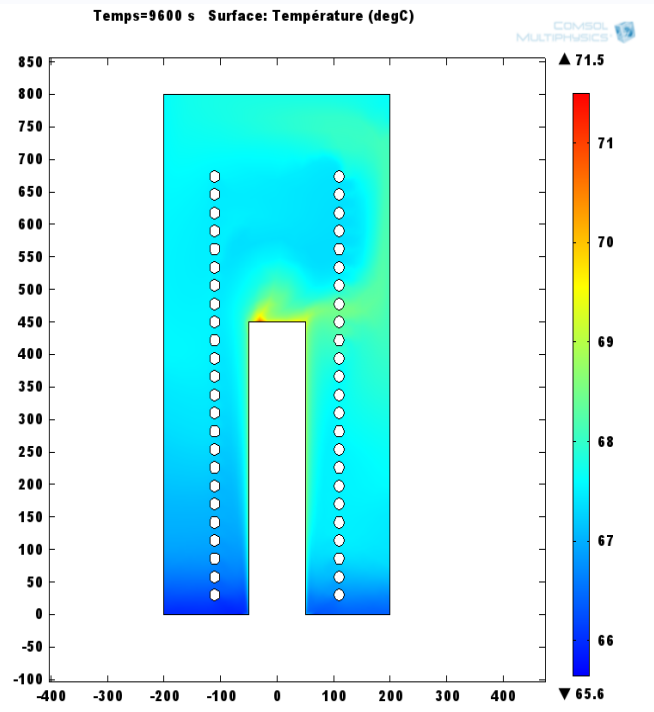
Lab facility



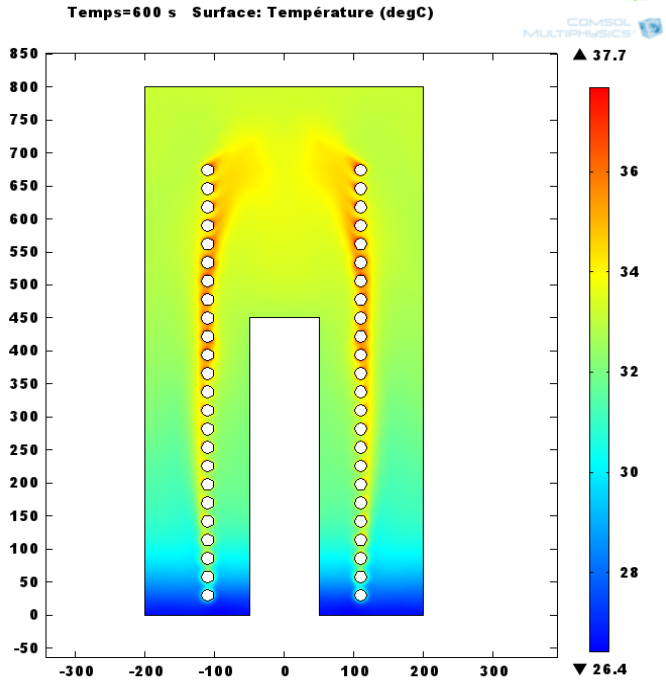


24 apartments participate in experiment

Water tank model - Comsol



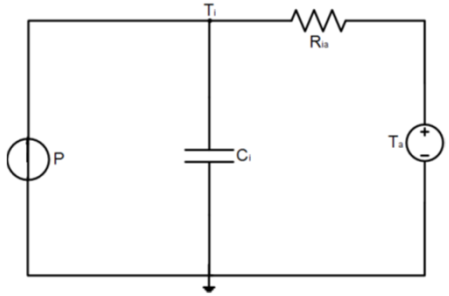
Using electric heating

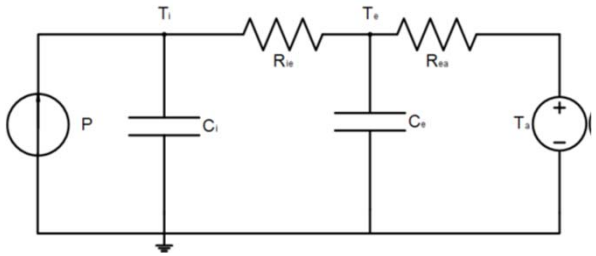


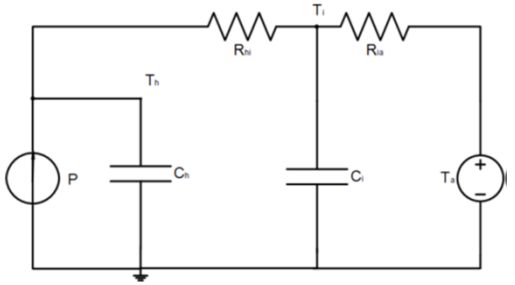
Using district heating

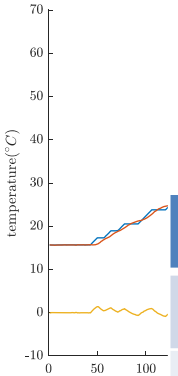
- Different dynamics using electric and district heating
- Simulate dynamics inside tank when only limited number of sensors available
- However, model is too complicated from the perspective of control

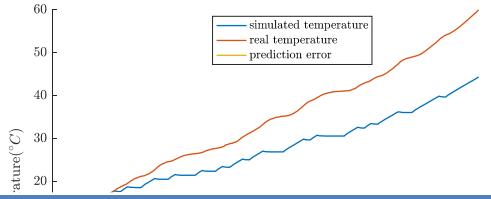
Water tank model - simplified

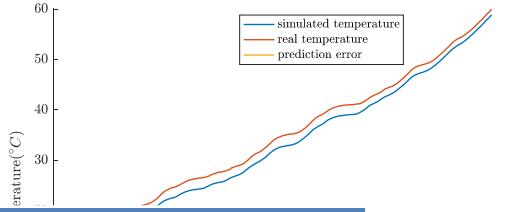




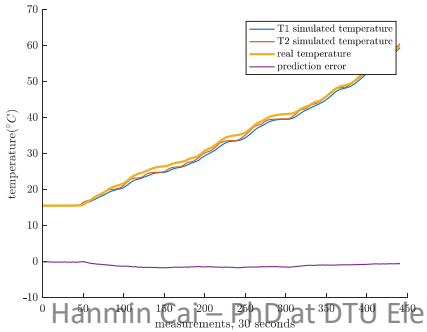


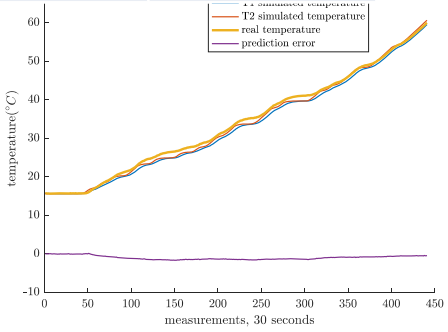




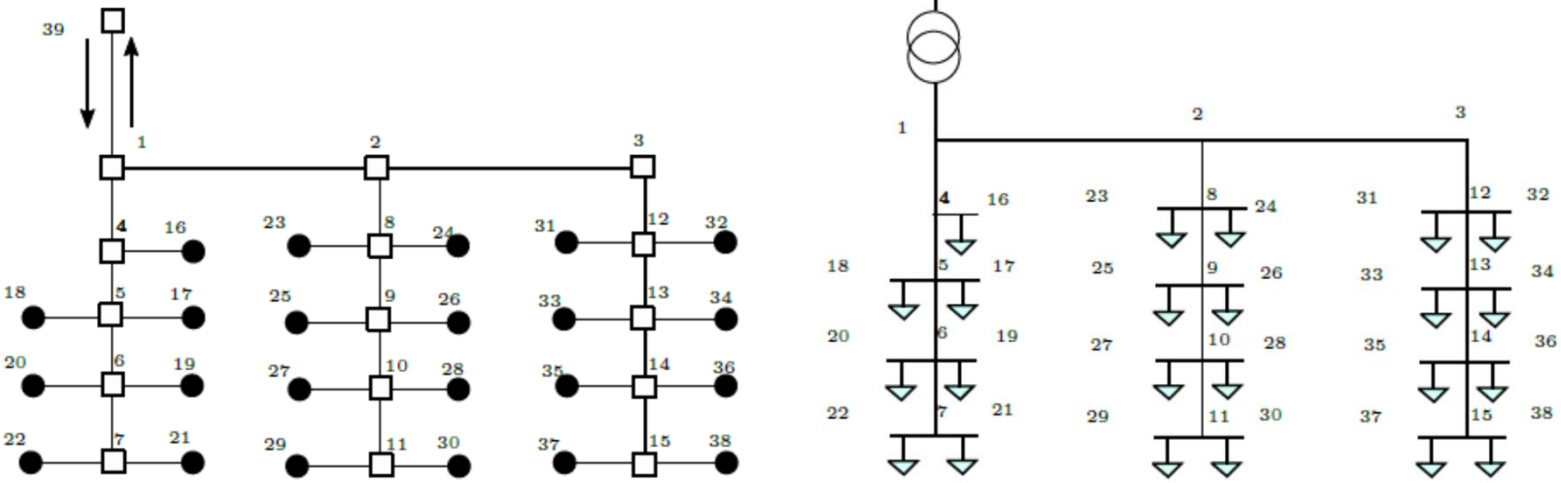


1-layer				2-layer	
Ti	Ti Te	Ti Th	Ti Th Te	Ti Th Te	Ti Th
1.36	8.29	1.58	0.92	1.77	1.11





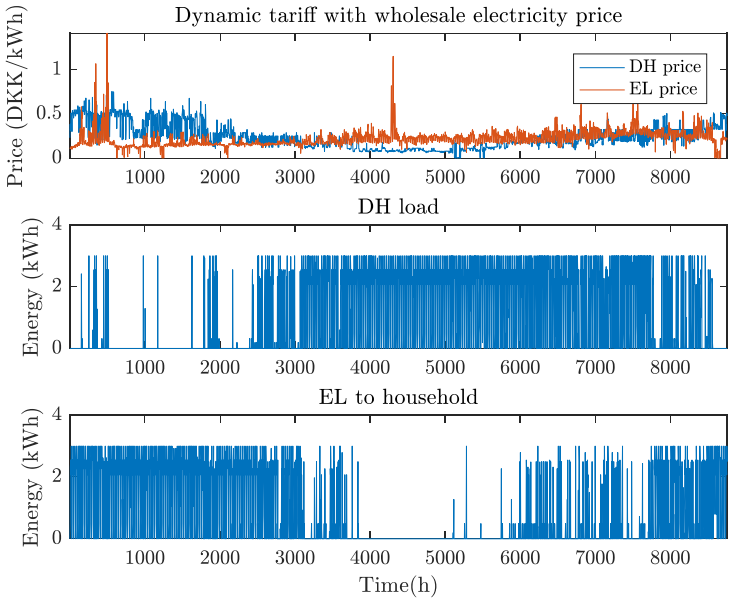
Interaction across networks

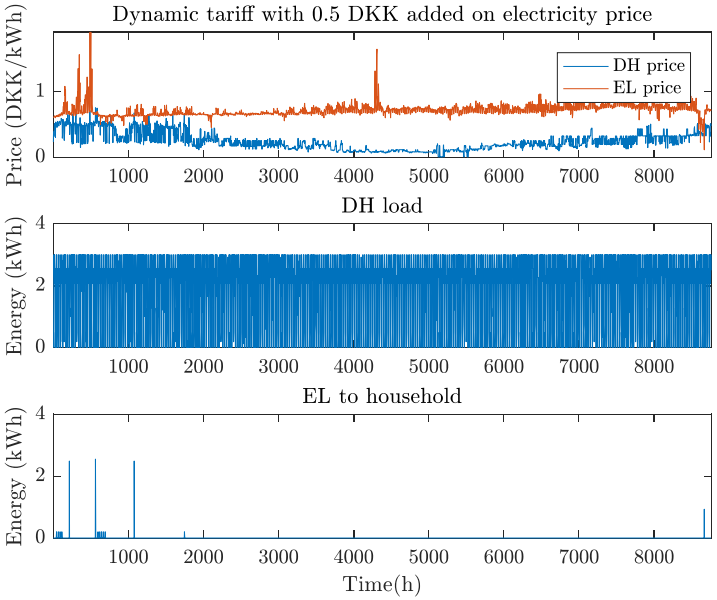


Network service

- Services
  - For district heating : peak shaving
  - For power system: balance fluctuating wind power production
- Demonstration:
  - Real time energy price
  - Explicit control signal

Example: response to real time price



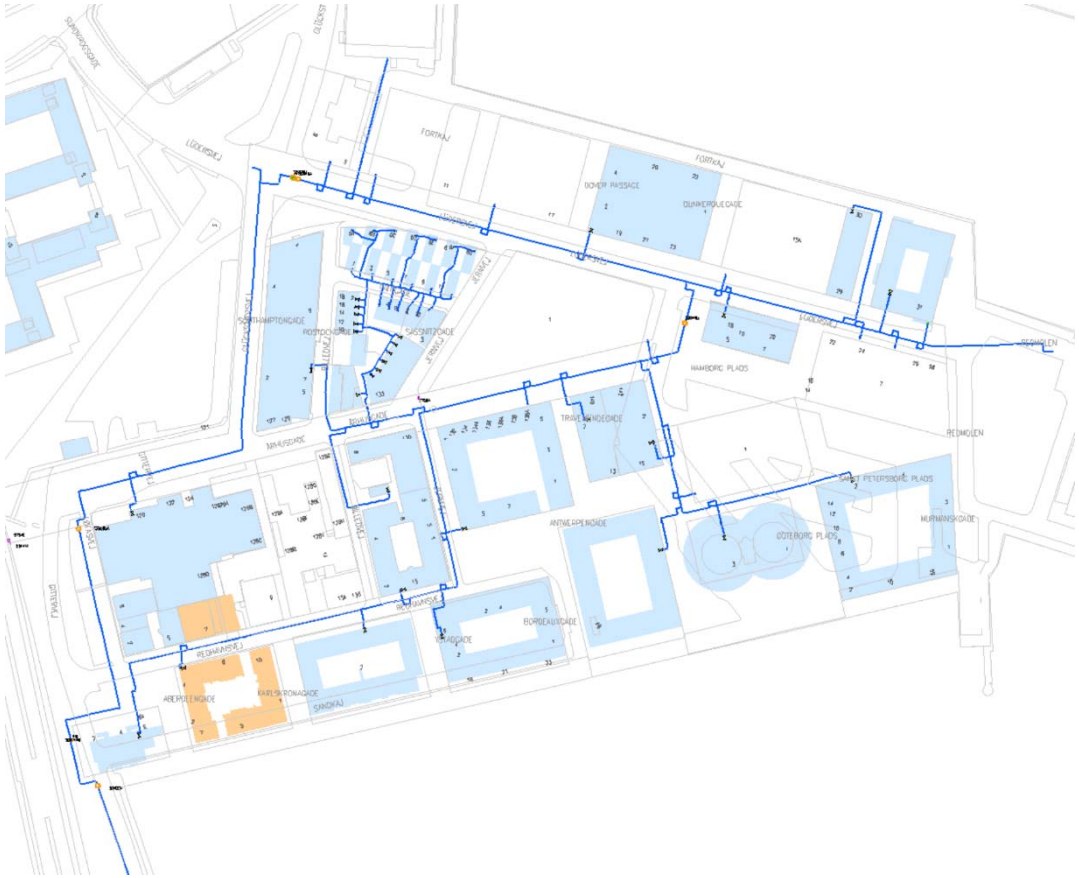


Electricity tax eliminates interactions

Potential new business

- Heat subscription
  - benefit from fluctuating electricity price
  - economic evaluation of ownership
- Flexible heat loads give
  - more flexibility to CHP operation
  - potential to reduce network loss

Case study of Nordhavn area



Remarks

- Heat booster as a solution to LTDH bottleneck is a source of flexibility in future energy system
- Demonstration of integrated operation in Nordhavn

Questions?