EnergyLab Nordhavn

- A Smart City Energy Lab

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NORDHAVN – THE PERFECT FRAME FOR INNOVATION

Objective of Energylab Nordhavn

To develop

new methods and solutions

for design and operation of the future

cost-effective integrated energy system

based on Nordhavn as a

globally visible real-life laboratory

NORDHAVN – SUSTAINABLE ENERGY AND TRANSPORT

- Over the next 50 years, Nordhavn will develop into a **new district** with 40,000 residents and 40,000 jobs.
- The ambition is to become an **example of a future sustainable city**, supporting Copenhagens 2025 **carbon-neutrality** goal.
- This requires **innovation** in urban design - not least of energy infrastructure

PARTNERS FROM MULTIPLE SECTORS

Authority and city development

Energy Infrastructure

Industry and consulting engineers

University and data infrastructure

2015-2019, Budget 19 M€, Public funding 11 M€ from EUDP

Nordhavn 2007

Nordhavn 2017


2012


2014


2015


2018


Showroom and visualisation
Power grid operation
Flexibility from heat and cooling grids
Integrated markets and
Storage flexibility
Smart network services
Smart charging infrastructure
Measurements and data warehouse
Flexible buildings and users
Photo: By & Havn/Ole Malling

Danfoss led demonstrations of integrated solutions

Havnehuset

- Demonstration of flexible district heating and low temperature district heating
- Q4 2016

Supermarket

- Demonstration of Heat Recovery
- Q3 2018

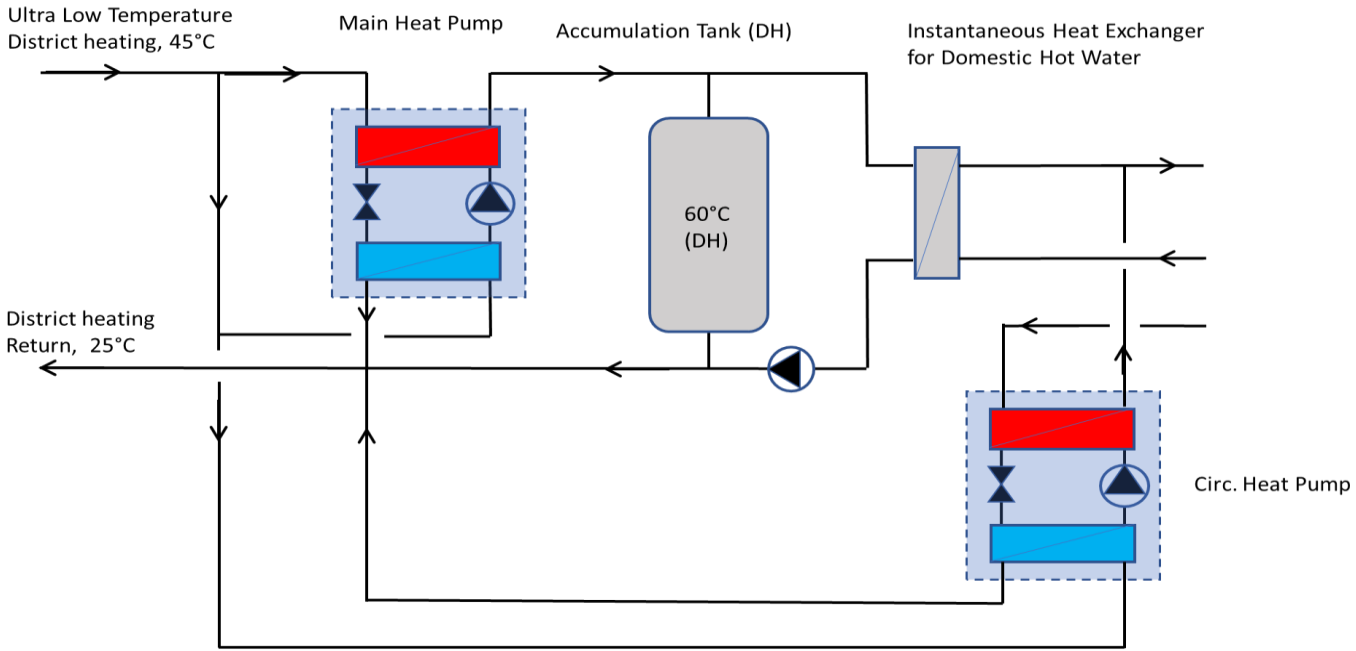
Terra Nova

- 10 appartments with smart control of heating systems
- Measuring of thermal capacity in four apparments
- Q4 2016

ULTDH HEAT BOOSTER SUBSTATION

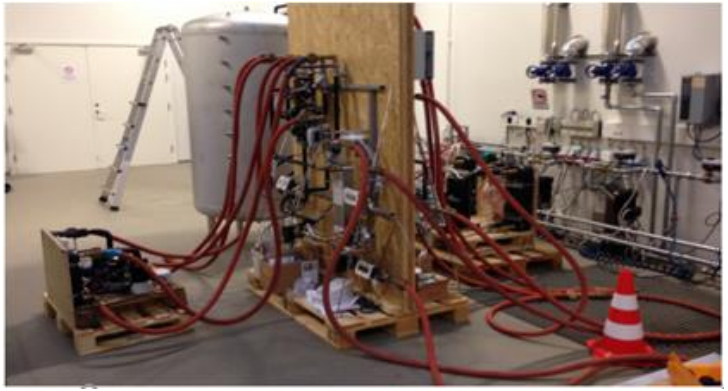
Example on heat and power integration

- Utilization of low temperature heat sources
- Flexibility on power and heat side
- Storage capability



ULTDH HEAT BOOSTER SUBSTATION

Example on heat and power integration



22 Flats
8 Risers

ULTDH HEAT BOOSTER SUBSTATION

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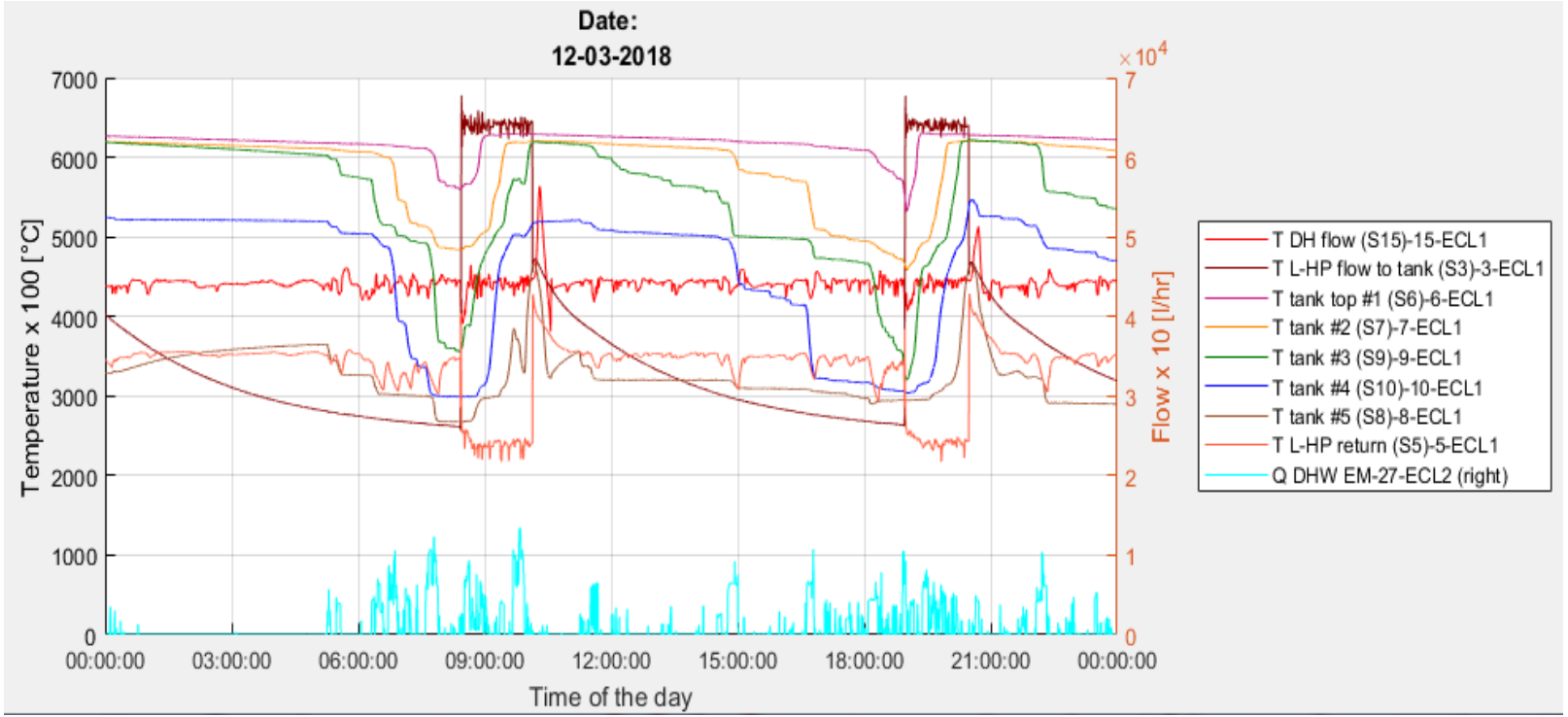


ULTDH HEAT BOOSTER SUBSTATION

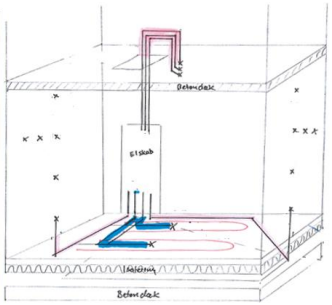
Example on heat and power integration

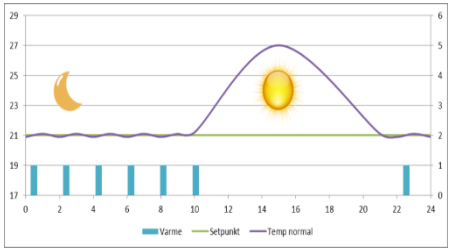
Essential Performance, based on two days:

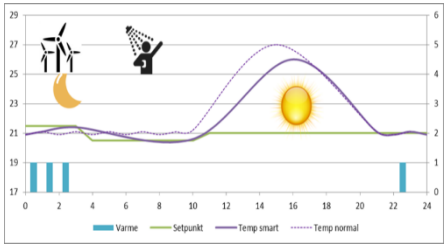
	Monday 12.03.2018		Sunday 18.03.2018
V DHW [L]	2.540		2.905
DHW Energy [kWh]	133	← Load Shift potential →	152
DHW circ. Energy [kWh]	78		77
MHP elec. Energy [kWh]	9.3	← Load Shift potential →	11,7
SHP elec. Energy [kWh]	14.2		14,2
Electric share [%]	11,1		11,3
DH flow [°C]	44,0		44,0
T DH ret [°C]	30,5		29,1
Energy DH [kWh]	181		204

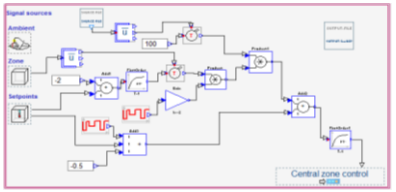
Smart Control of Heating System

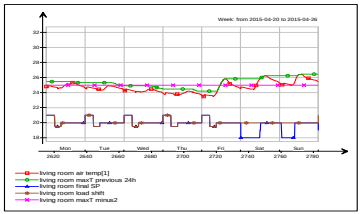
Example on heat flexibility



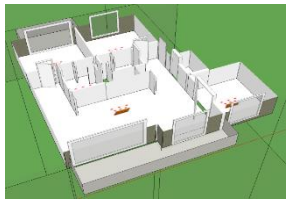








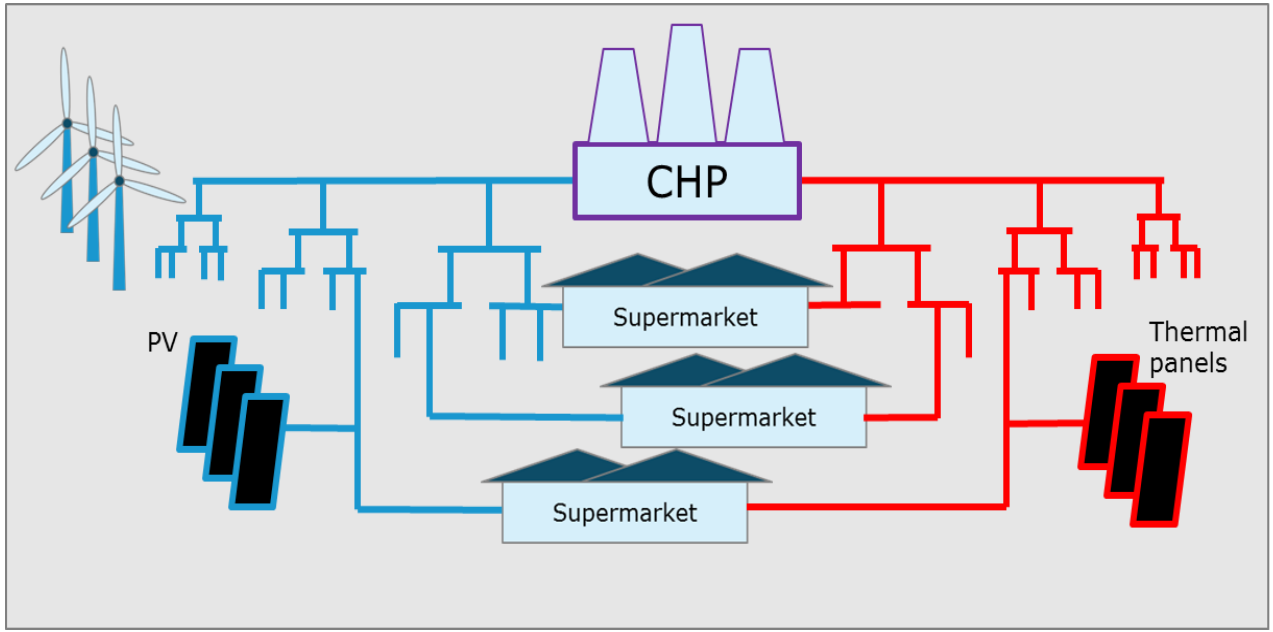
Load Shift Potential in average 100 kwh/day



Supermarkets, Source of waste heat and flexibility

Example on heat and power integration

- Waste heat from refrigeration is exported to district energy networks
- Supermarkets can add flexibility and become storage enablers for heating and cooling
- Coupling of power and heat infrastructures
- Typical 60 kW in summer
- Typical 40 kW in winther



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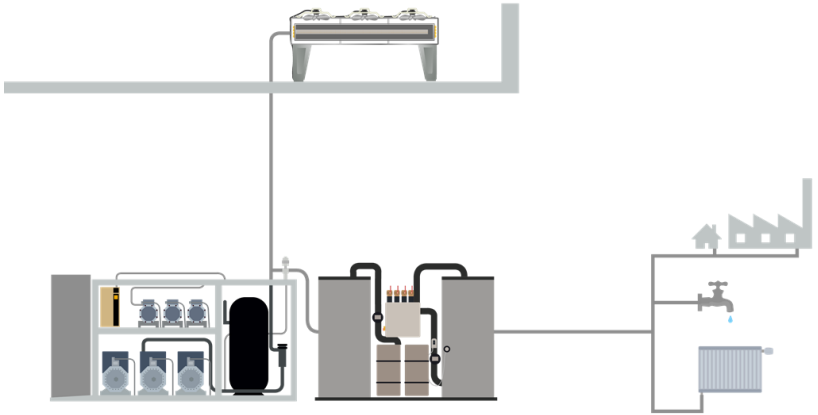
Example on heat and power integration

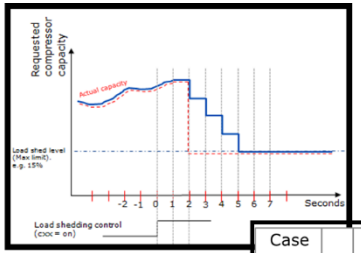


Supermarkets, Source of waste heat and flexibility

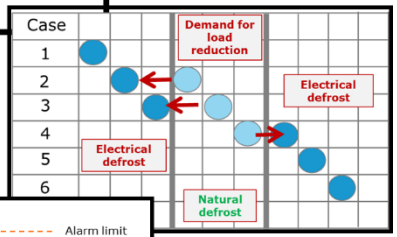
Example on heat and power integration

Flexibility in supermarkets

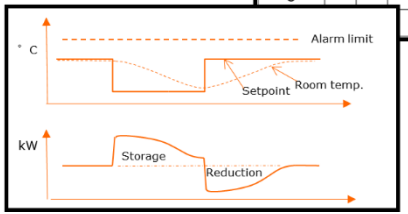
1. Load shedding / FFR (compressors)



2. Defrost shifting



3. Thermal storage



Parameter	Value	Comment
Thermal storage of a typical supermarket	25 KWh	5°C temp. change in 20 cabinets of 500 kg food, C_p=1,7 KJ/(KG °C)
Compressor cooling capacity to maintain normal operation	100 KW	Full capacity is 250 KW
Compressor power with a COP of 2,5	40 KW	COP will vary during the year
Time with 100 % - 60% reduced power	15-25 min	
Time without Defrost	90 min	Defrost event is not dependent on the cooling capacity event
Defrost power flexibility	13 KW	
Total power flexibility	53 KW	For 500 stores adds up to 26,5 MW

EnergyLab Nordhavn – Showroom & EHUB at pakhus 47, Sundmolen

Thank You for the Attention

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