

Demand side Transition to 4th Generation District Heating and Motivation Tariffs



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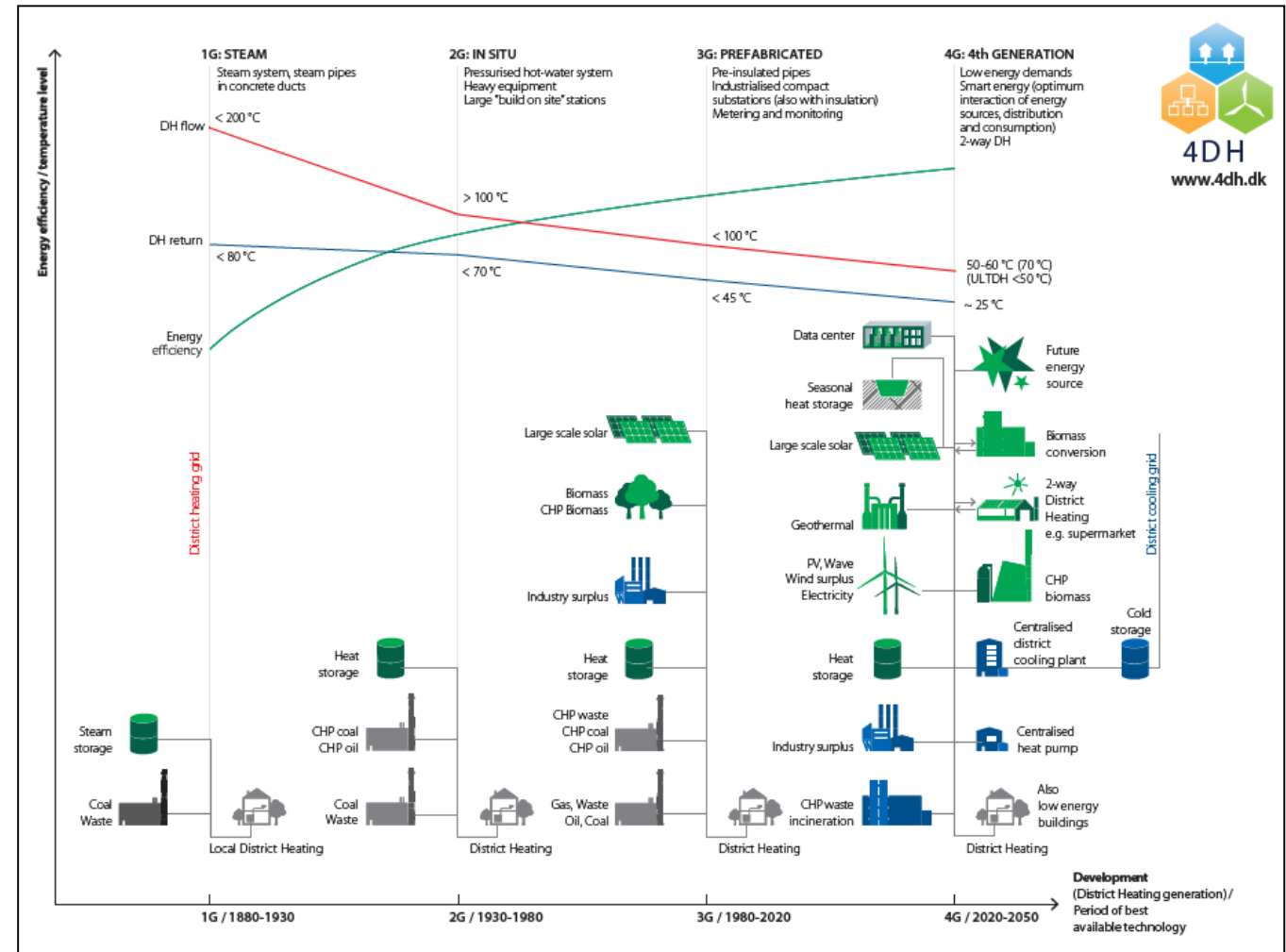
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Innovation Fund Denmark

Context

- Smart Energy Systems
- 4G District Heating
- Demand side implementation of low temperature solutions
- Motivation Tariffs



Motivations Tariffs: Aalborg DH

- Up to 25% penalty on high return temperatures
- Up to 25% discount on low
- Depends on the supply temperature

AALBORG ENERGIKONCERN

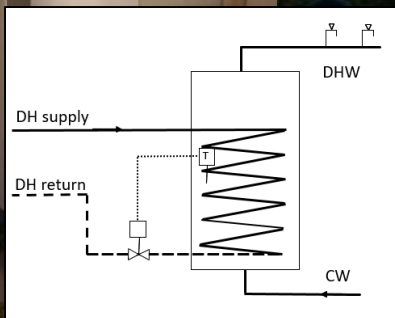
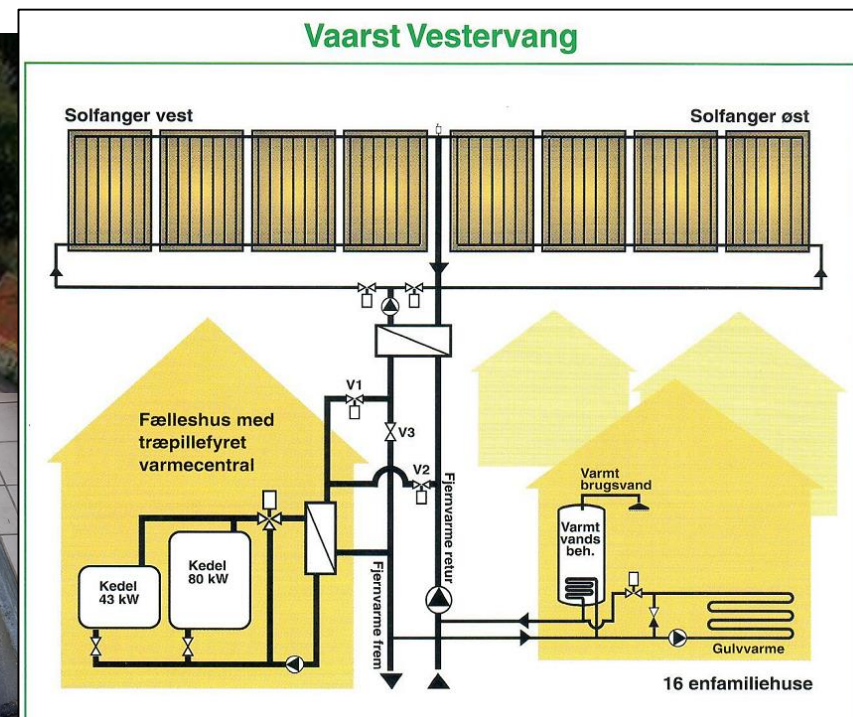
Energifregning med motivationstarif 01.10.2017

Retur i °C																	
Fremløb i °C		60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
20	-25%	-25%	-25%	-25%	-25%	-25%	-25%	-25%	-24%	-24%	-24%	-22%	-22%	-22%	-20%	-20%	-20%
21	-25%	-25%	-25%	-25%	-24%	-24%	-24%	-22%	-22%	-22%	-20%	-20%	-18%	-18%	-16%	-16%	-16%
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Case: Vaarst Vestervang

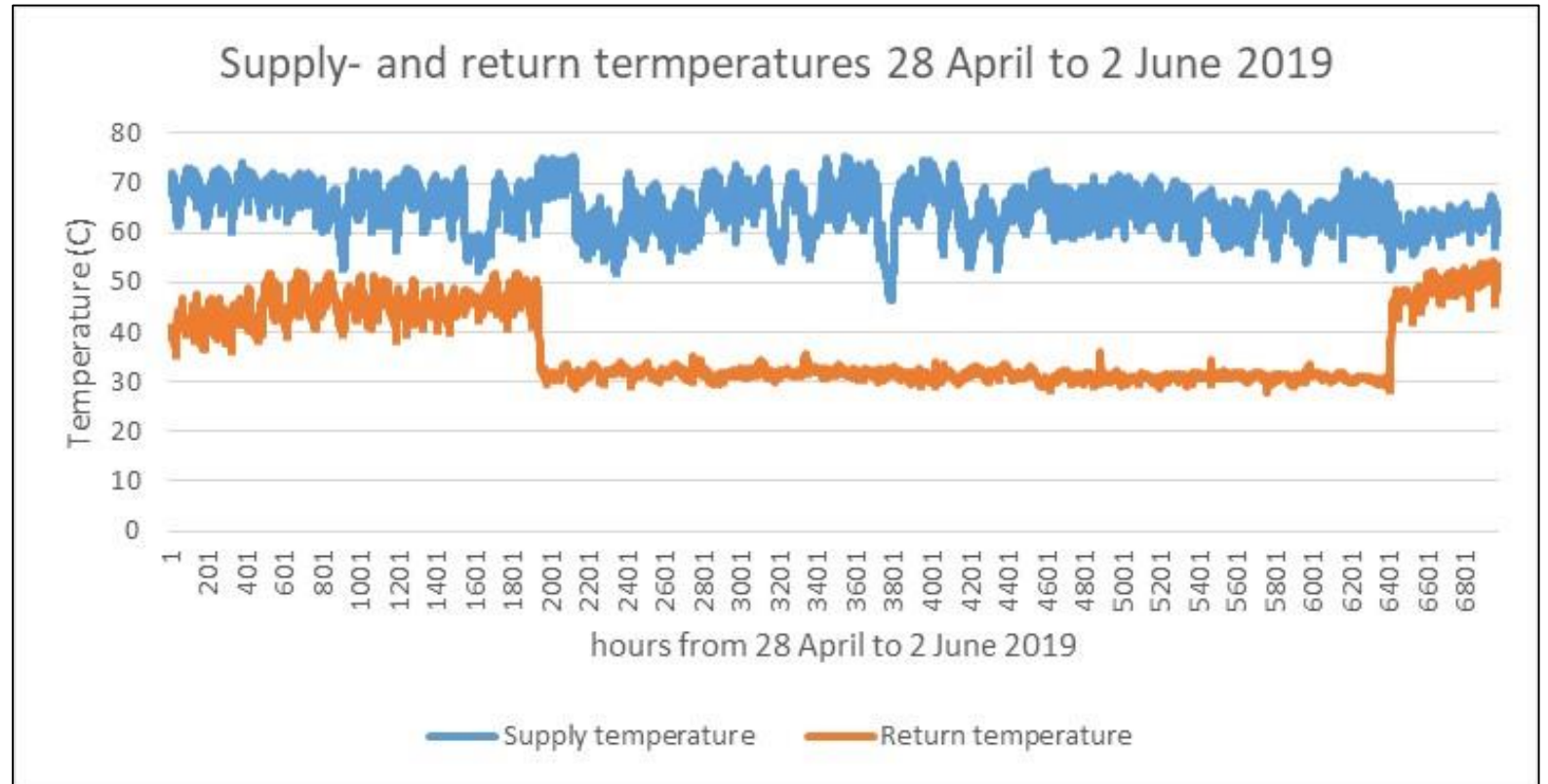
7th International Conference on
Smart Energy Systems

4th Generation District Heating, Electrification,
Electrofuels and Energy Efficiency



Problem: High return on 40-50 C

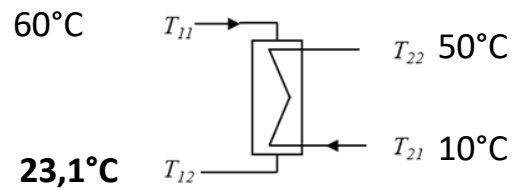
- Return temperature on 40-50 C
- When disconnecting hot water tanks then return is 30 C



Trend for thermal length of Heat Exchangers for DHW preparation towards 4GDH

Year ~2005

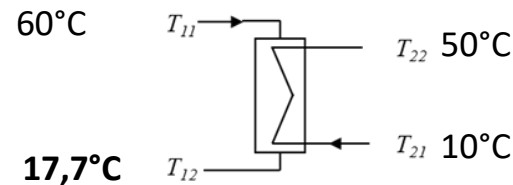
Thermal length: **NTU = 3,2**



XB06 H Type - 30 plates

Year ~2013

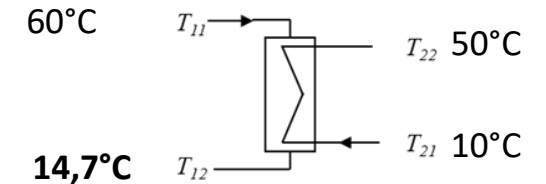
Thermal length: **NTU = 4,8**



XB06 H+ type - 40 plates

Year ~2021

Thermal length: **NTU = 6,5**



XB06 HU Type - 50 plates



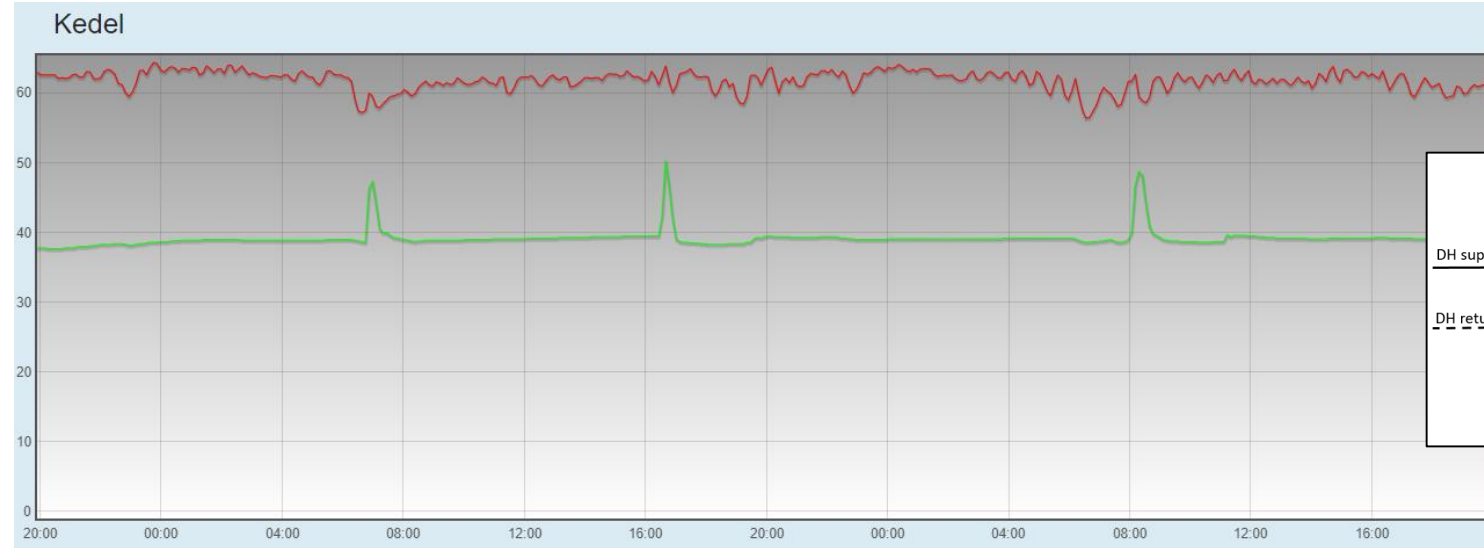
32,3 kW DHW capacity (DK Norm)
dP in the range of 6 to 10 kPa
Same platform, different plate
corrugations



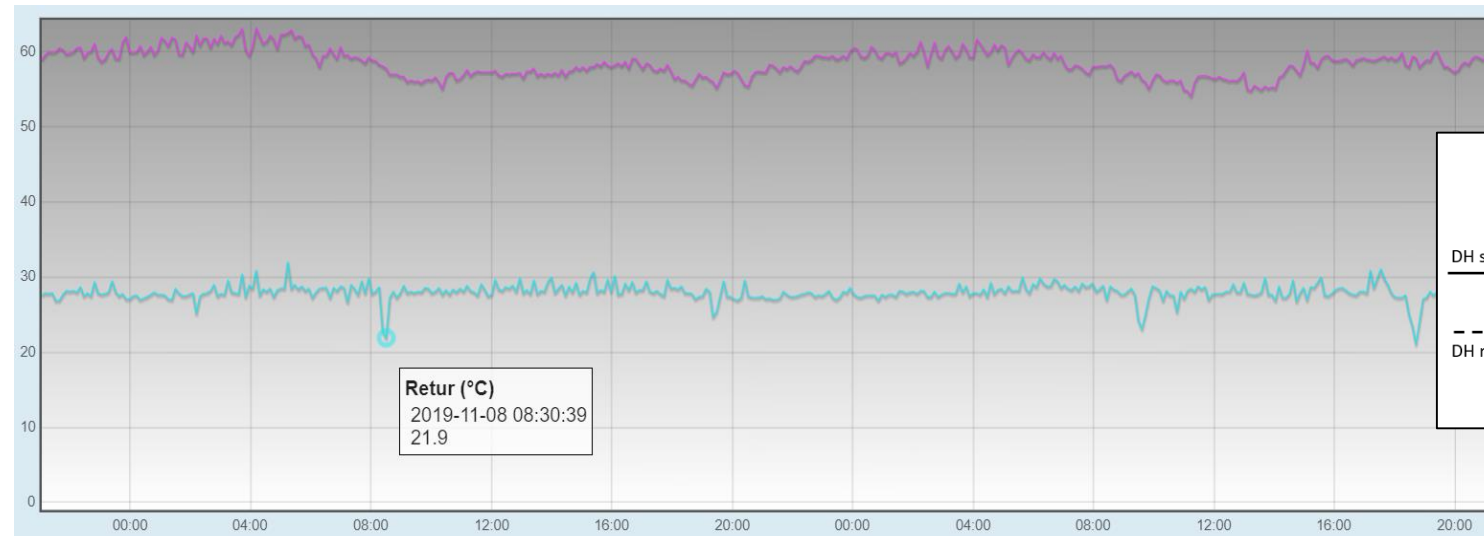
As installed in Vaarst Vestervang

Solution: Instantaneous heat exchangers

- 40 C with and increase to 50 C when water is used

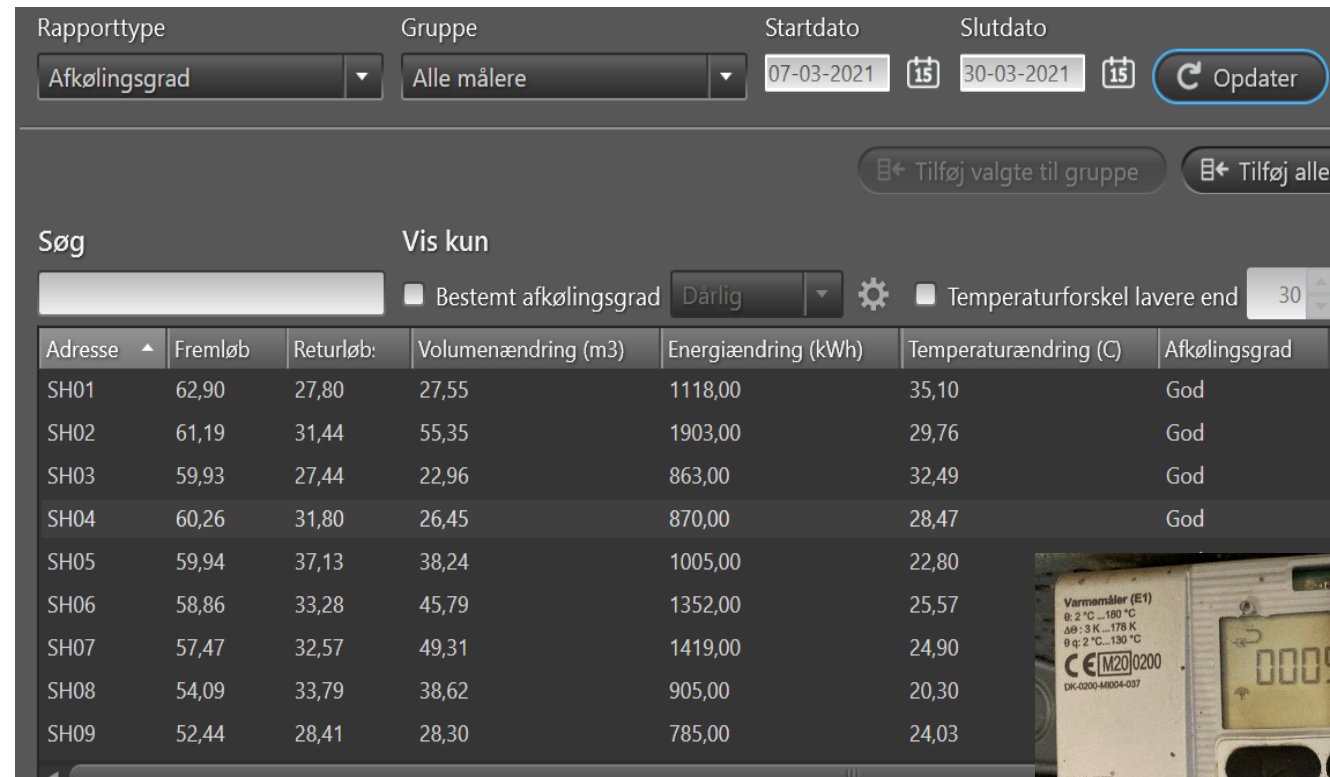


- 30 C with and decrease to 20 C when water is used



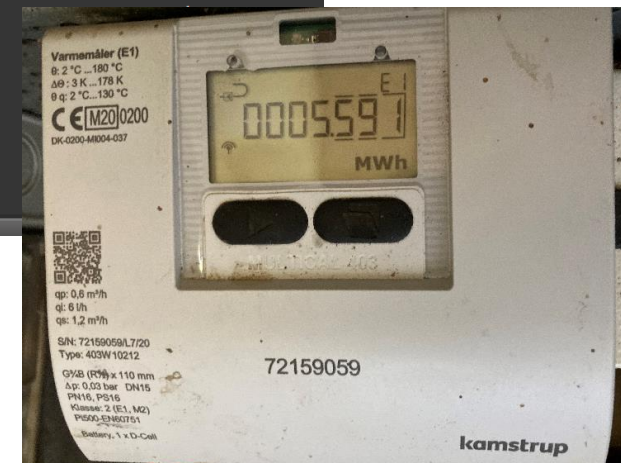
Next Step: Smart meters

- Installations of 17 smart meters for heat and water
- Central supervision of flows and temperatures



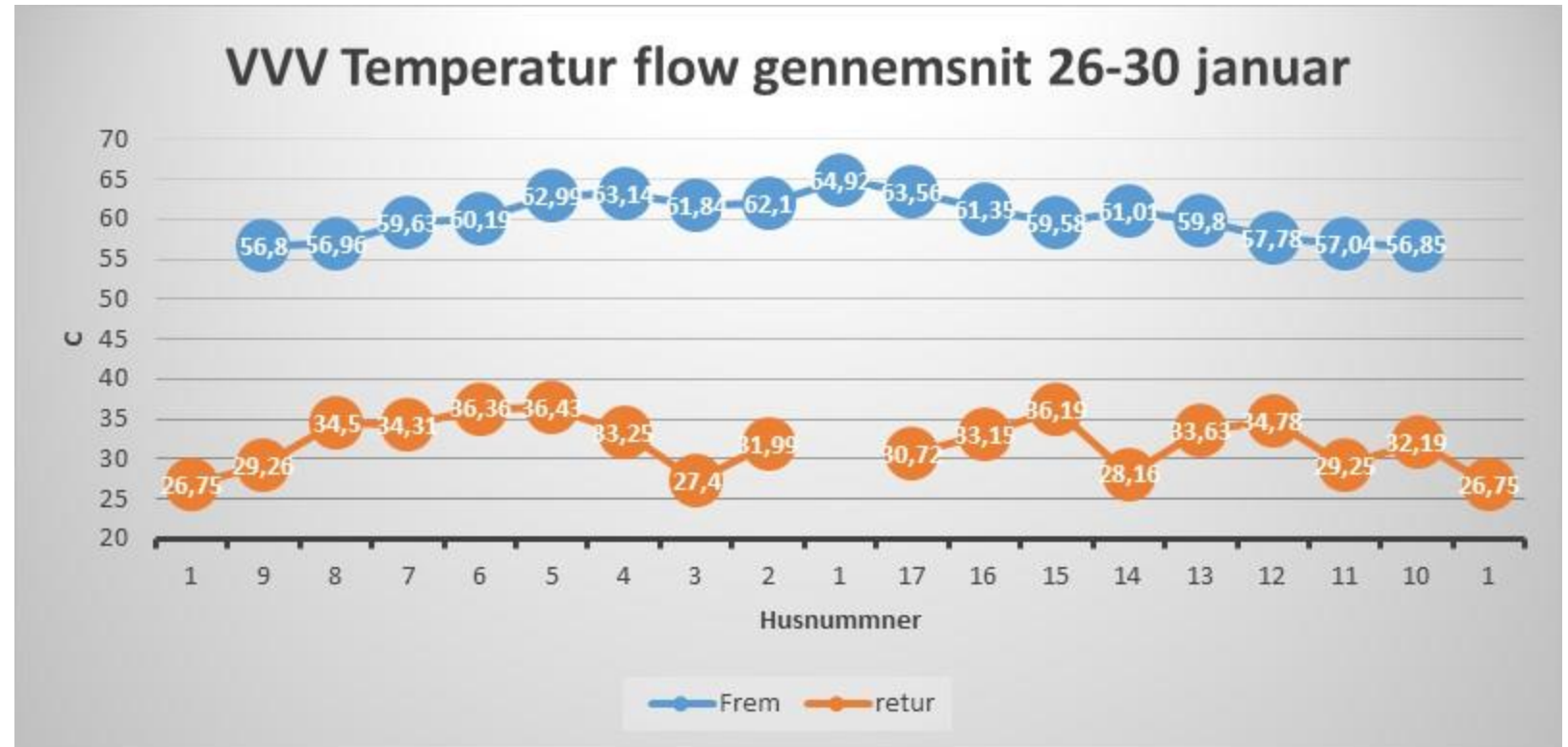
The screenshot shows a web-based interface for managing smart meters. At the top, there are filters for 'Rapporttype' (Afkølingsgrad), 'Gruppe' (Alle målere), 'Startdato' (07-03-2021), and 'Slutdato' (30-03-2021). There is an 'Opdater' button. Below the filters, there are buttons for 'Tilføj valgte til gruppe' and 'Tilføj alle'. A search bar labeled 'Søg' and a 'Vis kun' section with checkboxes for 'Bestemt afkølingsgrad' (Dårlig) and 'Temperaturforskel lavere end' (30) are also visible. The main part of the interface is a table with the following data:

Adresse	Fremløb	Returløb	Volumenændring (m3)	Energiændring (kWh)	Temperaturændring (C)	Afkølingsgrad
SH01	62,90	27,80	27,55	1118,00	35,10	God
SH02	61,19	31,44	55,35	1903,00	29,76	God
SH03	59,93	27,44	22,96	863,00	32,49	God
SH04	60,26	31,80	26,45	870,00	28,47	God
SH05	59,94	37,13	38,24	1005,00	22,80	
SH06	58,86	33,28	45,79	1352,00	25,57	
SH07	57,47	32,57	49,31	1419,00	24,90	
SH08	54,09	33,79	38,62	905,00	20,30	
SH09	52,44	28,41	28,30	785,00	24,03	



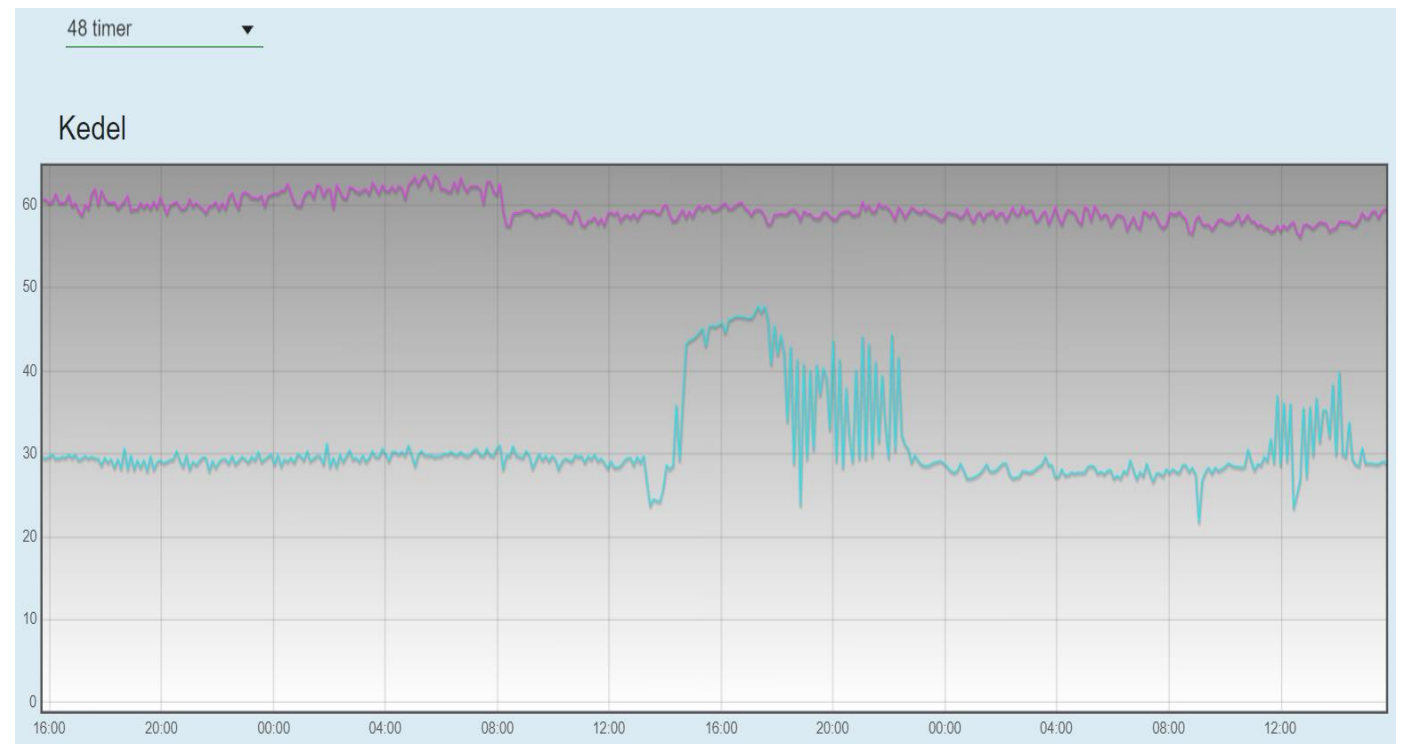
Smart Meters: temp. monitoring

- Used to identify and correct faults in measurement of supply temperatures



Example: Fault in a shunt thermostat

- Measurements from smart meters have been used to identify and correct faults in the floor heating systems of the buildings



Results and problem in motivation

- Motivation has been successful (green arrow)
- But is it fair... (blue arrow)



Energiafregning med motivationstarf 01.10.2017

Retur i °C		Fremløb i °C															
		60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
20		-25%	-25%	-25%	-25%	-25%	-25%	-25%	-24%	-24%	-24%	-22%	-22%	-22%	-20%	-20%	-20%
21		-25%	-25%	-25%	-25%	-24%	-24%	-24%	-22%	-22%	-22%	-20%	-20%	-20%	-18%	-18%	-18%
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26		-18%	-16%	-16%	-16%	-14%	-14%	-14%	-12%	-12%	-12%	-10%	-10%	-10%	-8%	-8%	-8%
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33		-4%	-2%	-2%	-2%	0	0	0	0	0	0	0	0	0	0	0	0
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35		0	0	0	0	0	0	0	0	0	0	0	0	0	+2%	+2%	+2%
36		0	0	0	0	0	0	0	0	0	0	0	0	+2%	+2%	+2%	+2%
37		0	0	0	0	0	0	0	+2%	+2%	+2%	+4%	+4%	+4%	+6%	+6%	+6%
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Conclusions and discussion

- Use of **instantaneous heat exchangers and smart meters** has been successful to decrease return temperature to 30 C and maintain decrease also with low supply temperatures (60-65 C).
- Case has proven near **4G District Heating possible** with 60-65 C supply and 30 C return
- **Motivation tariffs has been successful:** Return temperature has been decreased from 40 to 30 C
- **But is the motivation tariff fair:** Benefits are not available to consumers because the supply system is not yet ready for the 60 C...?!



Thank You...



Henrik Lund, Aalborg University and Vaarst Vestervang.

Jan Eric Thorsen, Danfoss.

Steen Schelle Jensen, Kamstrup.

Flemming Pentz Madsen, Vaarst Vestervang



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Vestas

LOGSTOR

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