Public engagement in Energy solutions - New heating system in the eco-village Munksøgård

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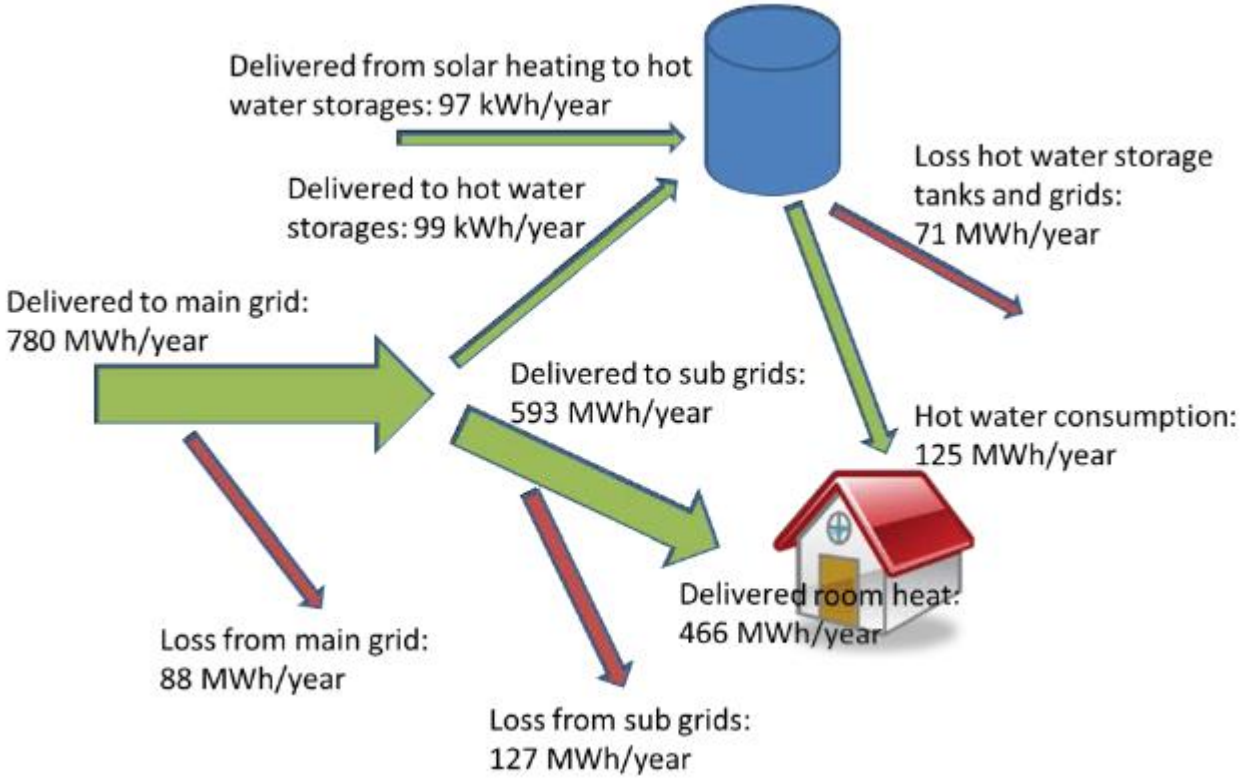
ÆLDRE
FAMILIE
ANDEL
80 - 73
VELKOMMEN
TIL
MUNKSØGÅRD
17 - 20
INDGANG
89 - 94
81 - 88
16 - 7
16 - 1
SENIOR
100 - 95

Some facts….. www.munksoegaard.org

- The house was build in year 2000 - at that time 15% better than the building regulation heat loss wise
- 5 groups of 20 dwellings erected around an old farm building
- Different owner forms and age groups (youth group, senior group and three mixed groups)
- Focus has been on local involvement: local waste water treatment, urine separation toilets and local heating system based on wood pellet boilers and oil back up etc.
- Democratic structure: Common meetings, 2 represents from each group forms the board and a general assembly is the highest authority

Existing heating system



Decision process

1. An “expert” group was established in spring 2014 to describe the different technical solutions, their costs and impacts. Posters have been produced describing each solution. This group was supported by a professional energy consultant.

2. All residents were invited on a meeting in June 2015 where posters and the solutions were presented. The residents were able to ask questions to the “expert group”.

3. The posters were put up in each of the five common houses during the summer of 2015 to encourage people to discuss pros and cons of the different solutions.

4. After summer of 2015 a full day workshop was organized. The workshop ended up with an indication of the preferred solution.
5. Shortly after this workshop the matter was treated on the general assembly meeting and a voting between the solutions was carried out.

6. A detailed feasibility study is then started for the chosen solution.

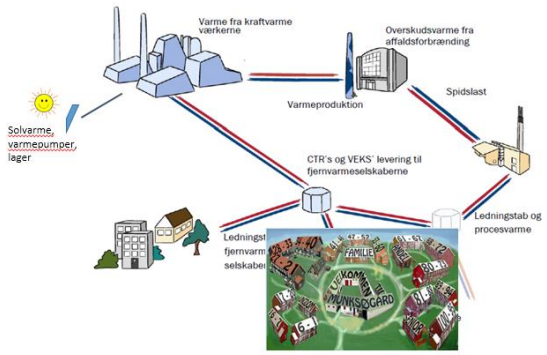
7. The new heating system will be implemented.

Possible solutions

- Improved wood pellet boiler

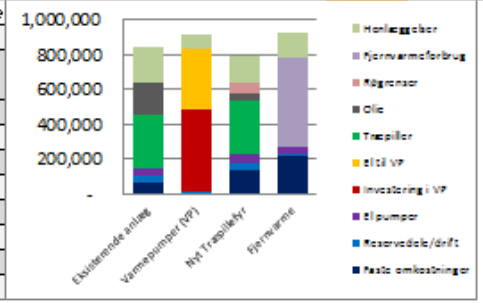
- Local heat pumps

- Connect to district heating



Varmecentral

kr/år	VP	TræOpt.	Fjernvarme
Sparet ifht nuværende syst.	#####	48,518	-80,257
Areal til VP jordslanger m2	17,250	Total omk. kr/år	Varmepris kr/MWh
		Eks.Munk	Varmepris
Lev. ud af varmecentr.(MWh	780	839,038	######
		VP	Varmepris
Lev. ud af varmecentr.(MWh	0	913,213	######
Andel træpiller	95%	TræOpt.	Varmepris
Lev. ud af varmecentr.(MWh	780	790,520	######
		FjernV	Varmepris
Fjernvarme lev. til central	780	919,295	######



Ved at rette i de gule felter kan man lave nye scenarier for Munksøgårds varmesystem.

HUSK kun at rette i de gule felter ellers ødelægges formler eller data.

I arket "Sammenligning" kan resultaterne for scenarierne ses.

Tab hovednet 0 MWh

Senior

Solfanger 15
Tab VV cirkulation og tank 7
FV til VV 6
FV til senior 0
VV forbrug 13
FV rum 98
Rumvarme 78
Tab rumvarme 20
104 Varmepumpe

Senior boligareal 1512 m2
Areal jordslanger 2600 m2

Andel

Solfanger 20
Tab VV cirkulation og tank 16
FV til VV 26
FV til andel 1
VV forbrug 30
FV rum 112
Rumvarme 88
Tab rumvarme kreds 23
137 Varmepumpe

Andel boligareal 1848 m2
Areal jordslanger 3425 m2

Ungdom

Solfanger 20
FV til VV 23
FV til ungdom 0
Tab VV cirkulation og tank 15
FV rum 90
VV forbrug 28
Rumvarme 67
Tab rumvarme kred 23
113 Varmepumpe

Ungdom boligareal 1262 m2
Areal jordslanger 2825 m2

Ejer

Solfanger 22
FV til VV 24
FV til ejer 0
Tab VV cirkulation og tank 18
FV rum 174
VV forbrug 28
Rumvarme 135
Tab rumvarme kred 39
197 Varmepumpe

Ejer boligareal 2696 m2
Areal jordslanger 4925 m2

Familie

Solfanger 20
FV til VV 20
FV til lejer 0
Tab VV cirkulation og tank 14
FV rum 103
VV forbrug 26
Rumvarme 82
Tab rumvarme kreds 21
123 Varmepumpe

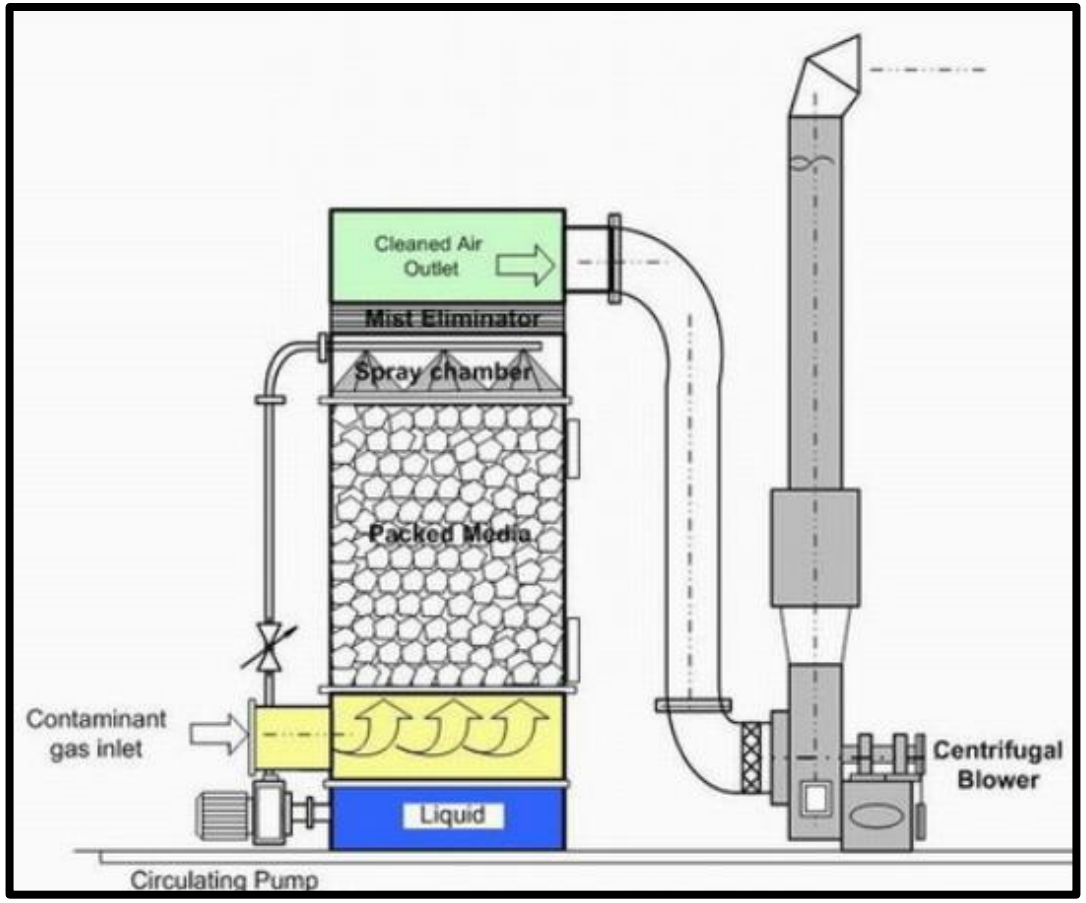
FV til Oline 0
16 Varmepumpe
16 Varmeforbrug Oline
Areal jordslanger 400 m2

		Ungdom	Ejer	Senior	Andel	Familie	
Rumvarmeforbrug pr. m2	kWh/år	52.82	50.01	####	####	####	
Solfanger	MWh/år	20	22	15	20	20	
Lokal varmepumpe	MWh/år	113	197	104	137	123	
Varmepumpe dækning	%	100%	100%	100%	100%	100%	100%
Tab rumvarmenet	%	26%	22%	21%	21%	21%	
Tab varmt vands cirkulation	15%	36%	39%	35%	35%	35%	
Rumtemp ned i grader C	0	0	0	0	0	0	
Varmebesparelse	0%	0%	0%	0%	0%	0%	
Varmtvands forbrug ned	0%	0%	0%	0%	0%	0%	
		Sænkelse af frem og retur temp.					
Mindsket tab hoved FVnet	%	20%	fra 80-55 til 65-40 c			25% red.	
		113	196	103	137	123	
		95	162	84	115	103	

Forkortelser

FV = fjernvarme
VV = varmt vand
Træp = træpiller
VP = varmepumpe
FV rum = fjernvarme til rumvarme

Improved wood pellet boiler



Improved wood pellet boiler

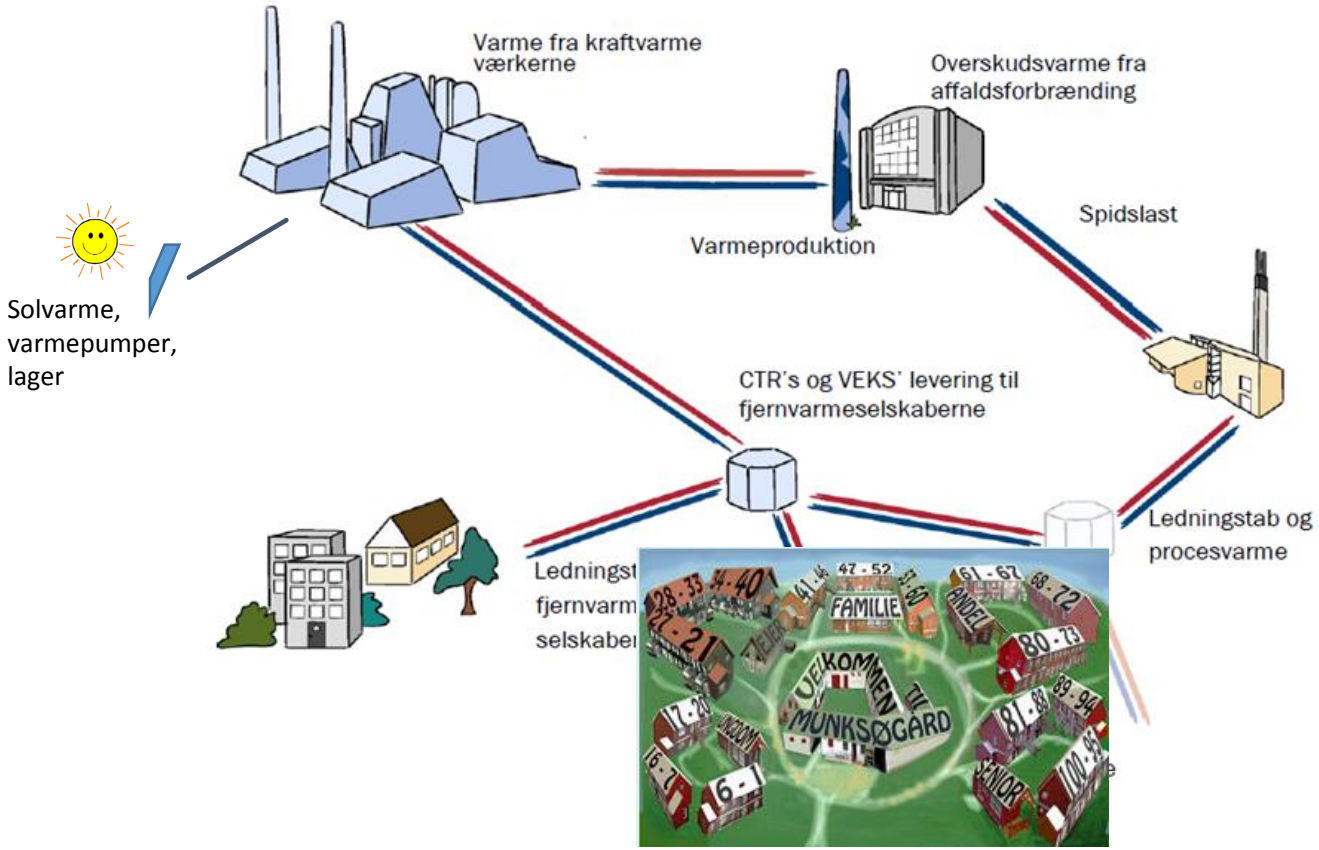
Pros	Cons
Relatively cheap solution	Professionals are needed for repairs and maintenance and regulation
Low emission of CO_2 (only from transport)	Risk of breakdowns mainly due to wood pellet transport system
More stable system	Big trucks with wood pellets arrive once a week in the cold period
Improved local air quality	Depends on limited biomass resources
Locally known technology	Noise problem from flue gas system

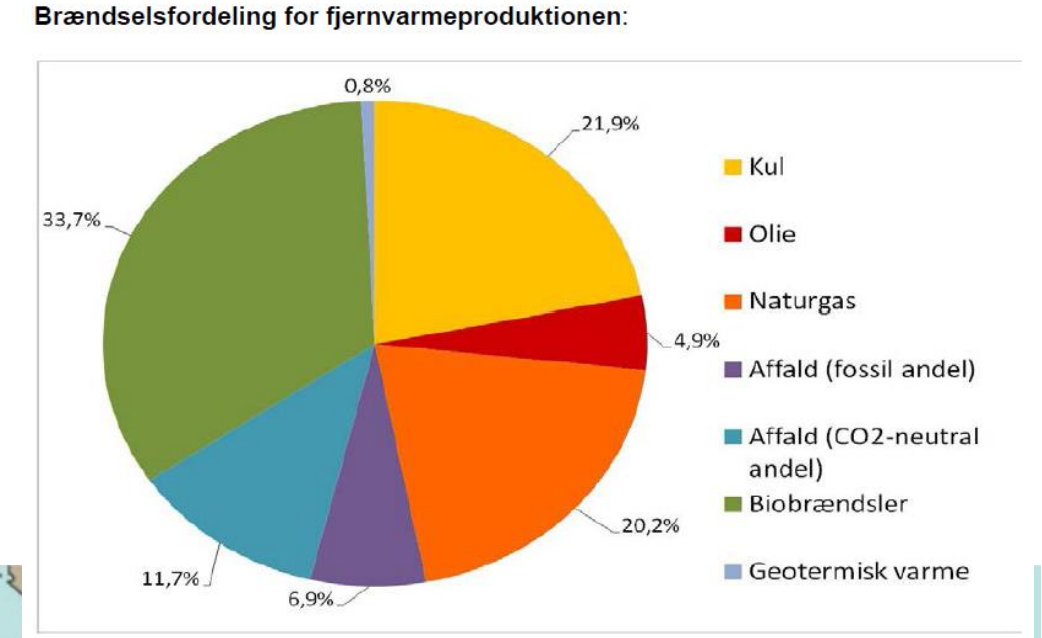
Local heat pumps

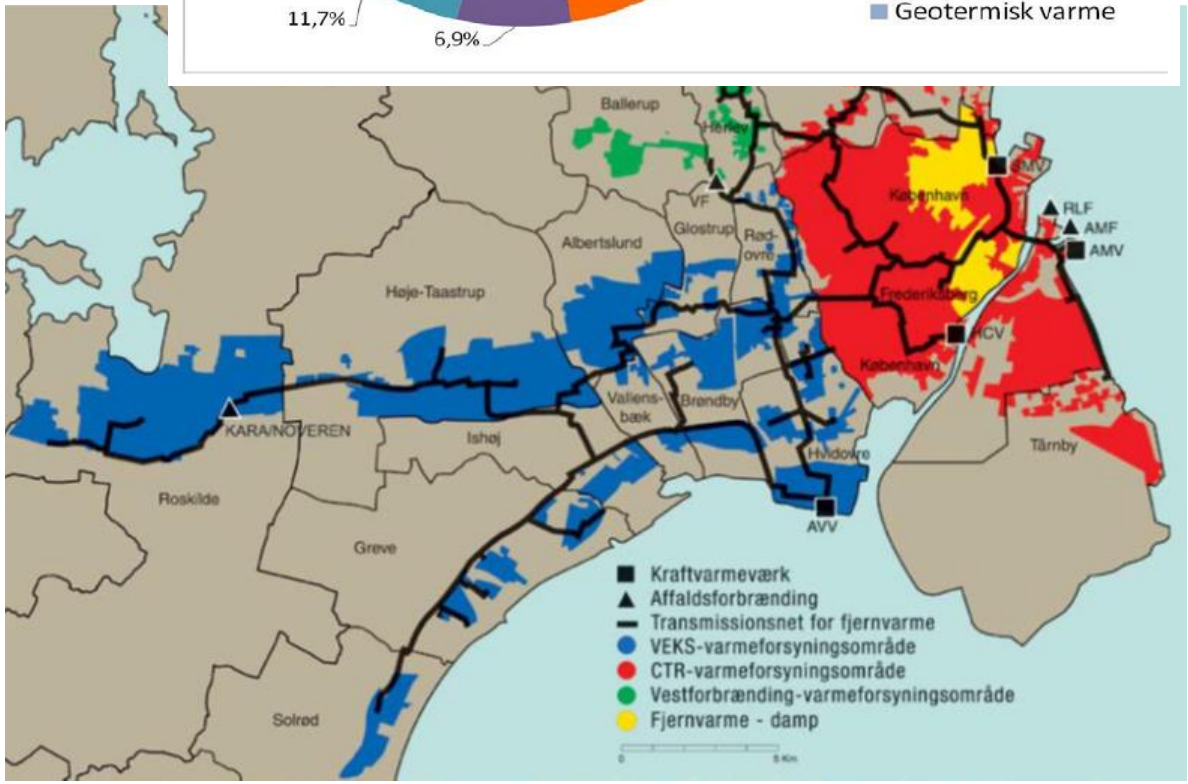
Local heat pumps

Pros	Cons
No noise	Needs thorough monitoring and regulation
Low CO_2 emission (from electricity production)	Will not be able to deliver enough heat in the coldest periods (needs electric supplement)
Less maintenance	Leakage in underground pipes is difficult to find and repair
No local air pollution	A big ground area is needed for the underground pipes
Fits well into the future Danish energy system	

Connect to district heating



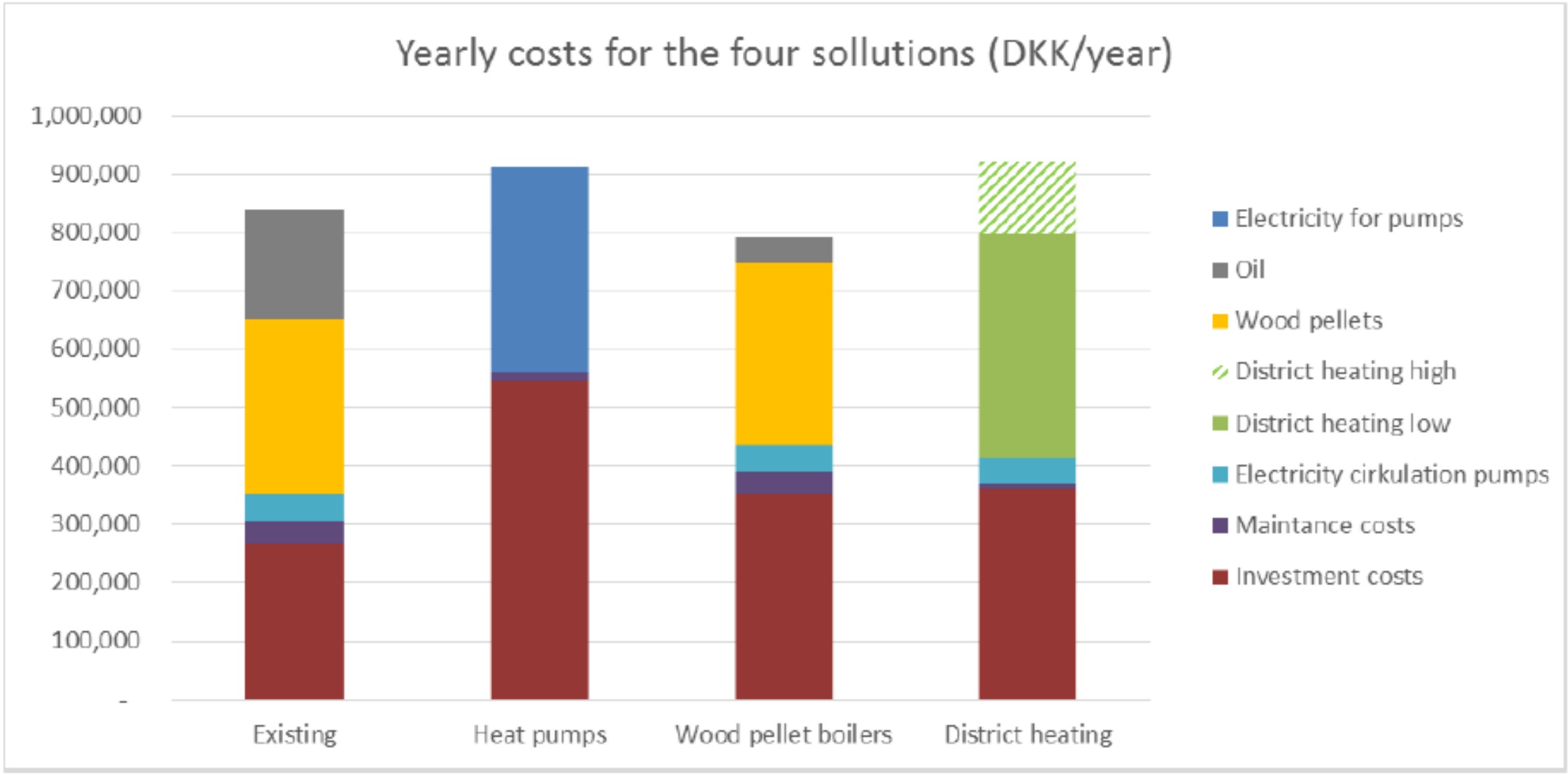




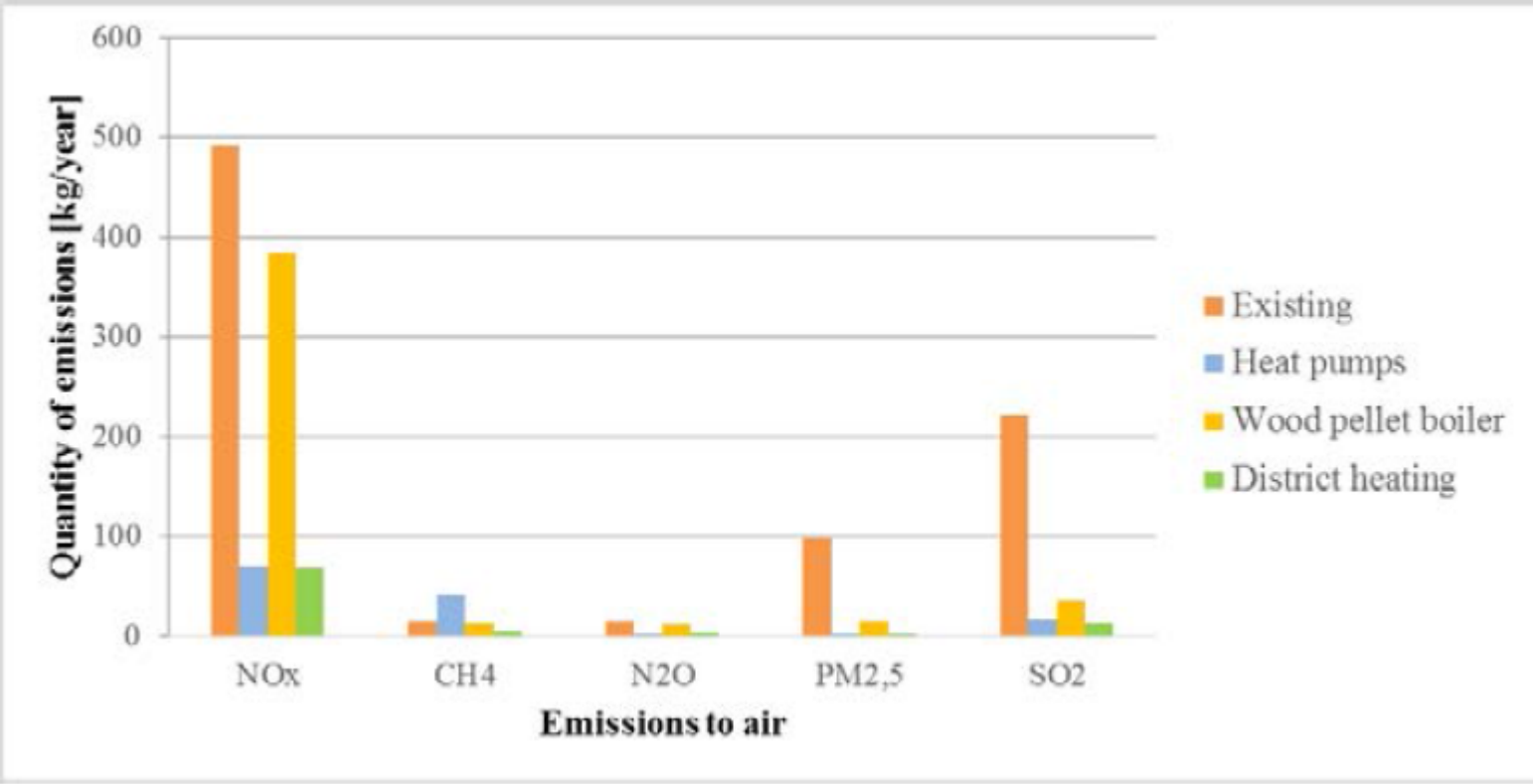
Connect to district heating

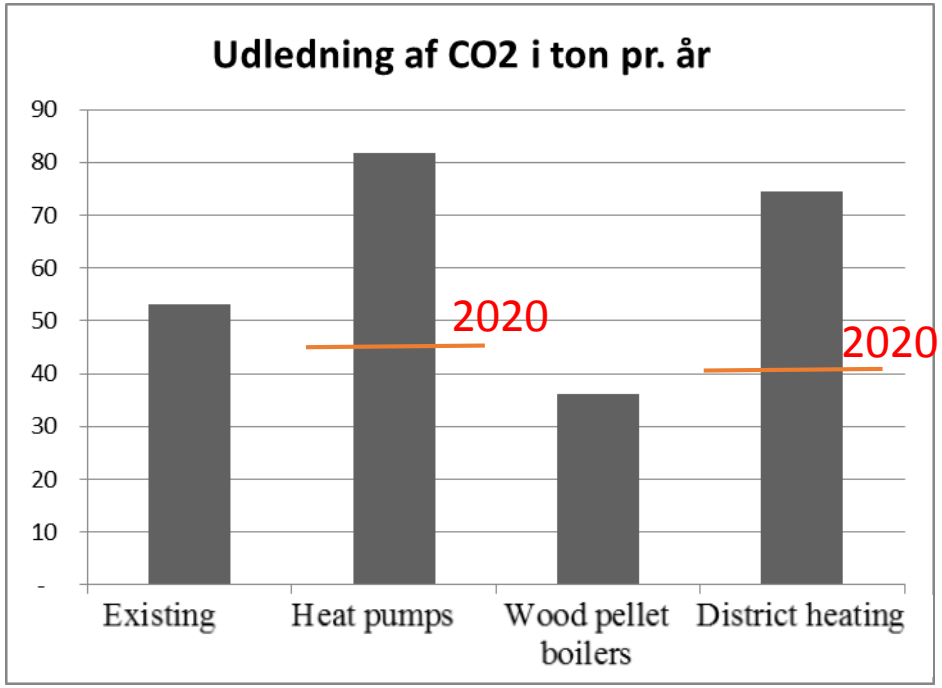
Pros	Cons
No noise	Heat price is set by Roskilde Forsyning (the local distribution company)
No local air pollution	Breakdown on main district heating grid will influence heat supply at Munksøgård
Very little maintenance Minimum need for monitoring and regulation	
Fits well into the future Danish energy system	

Comparison of solutions - private costs

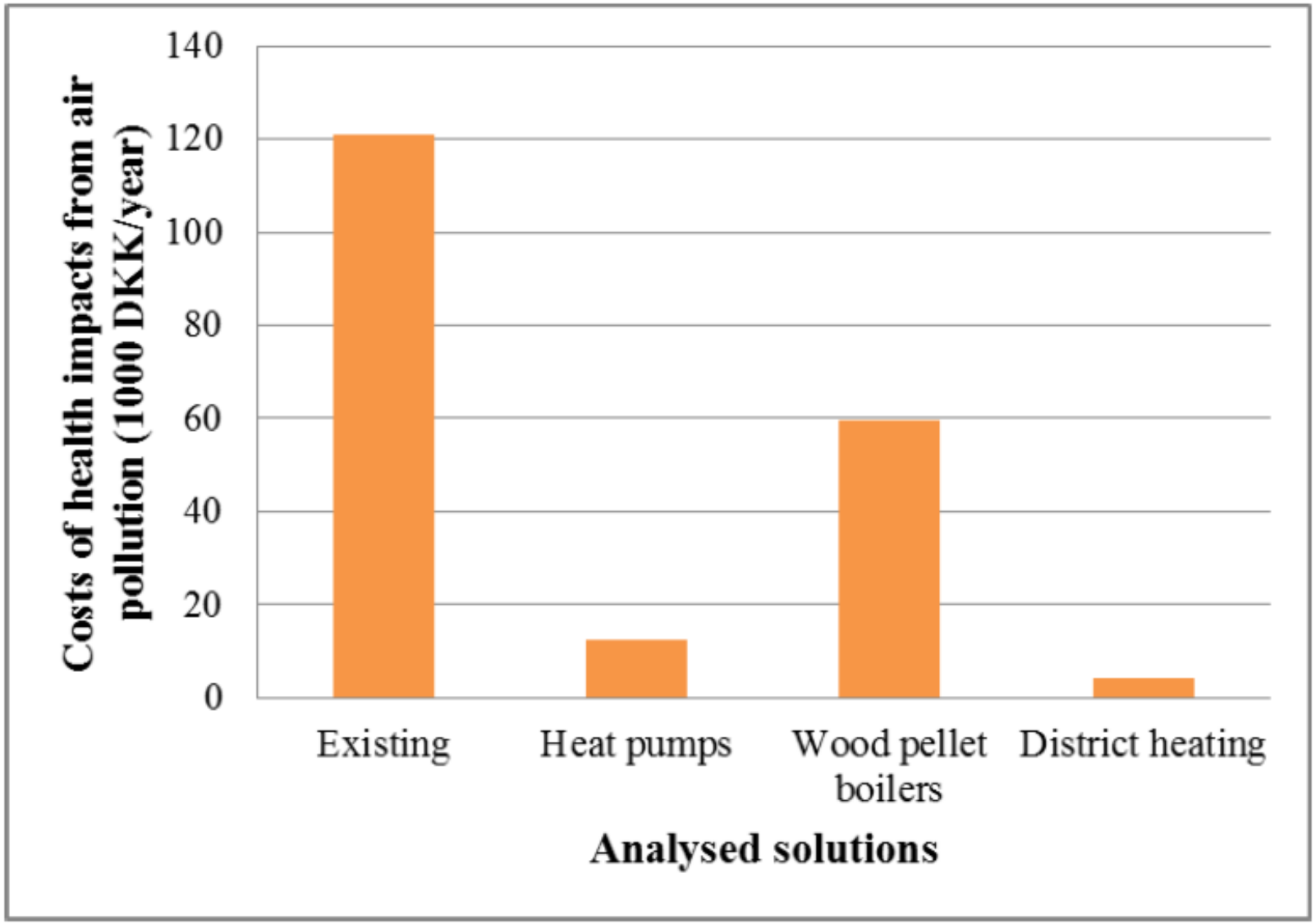


Comparison - emissions



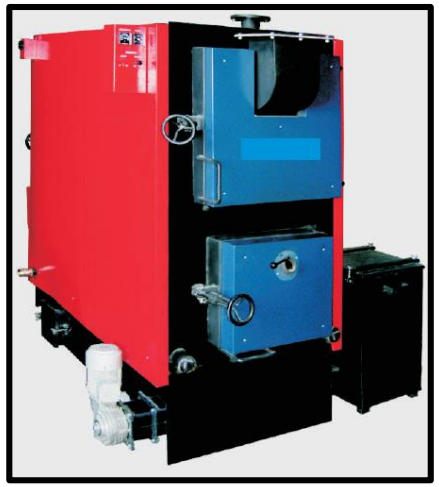


Comparison - Socio-economic health costs



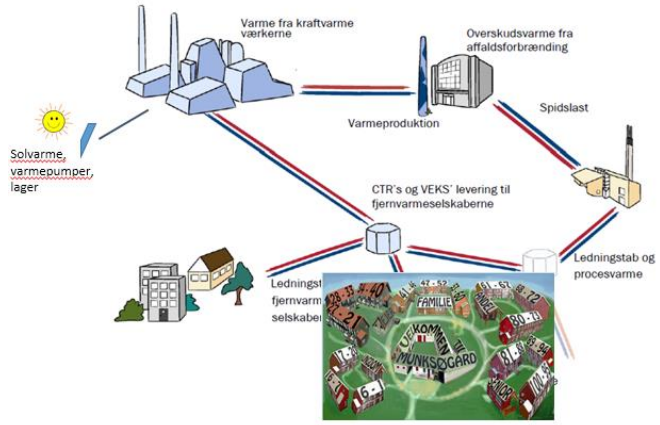
Now you vote ☺

Voting result from Munksøgård General Assemply



Wood Pellet Boiler
36%

Local Heat Pumps
35%

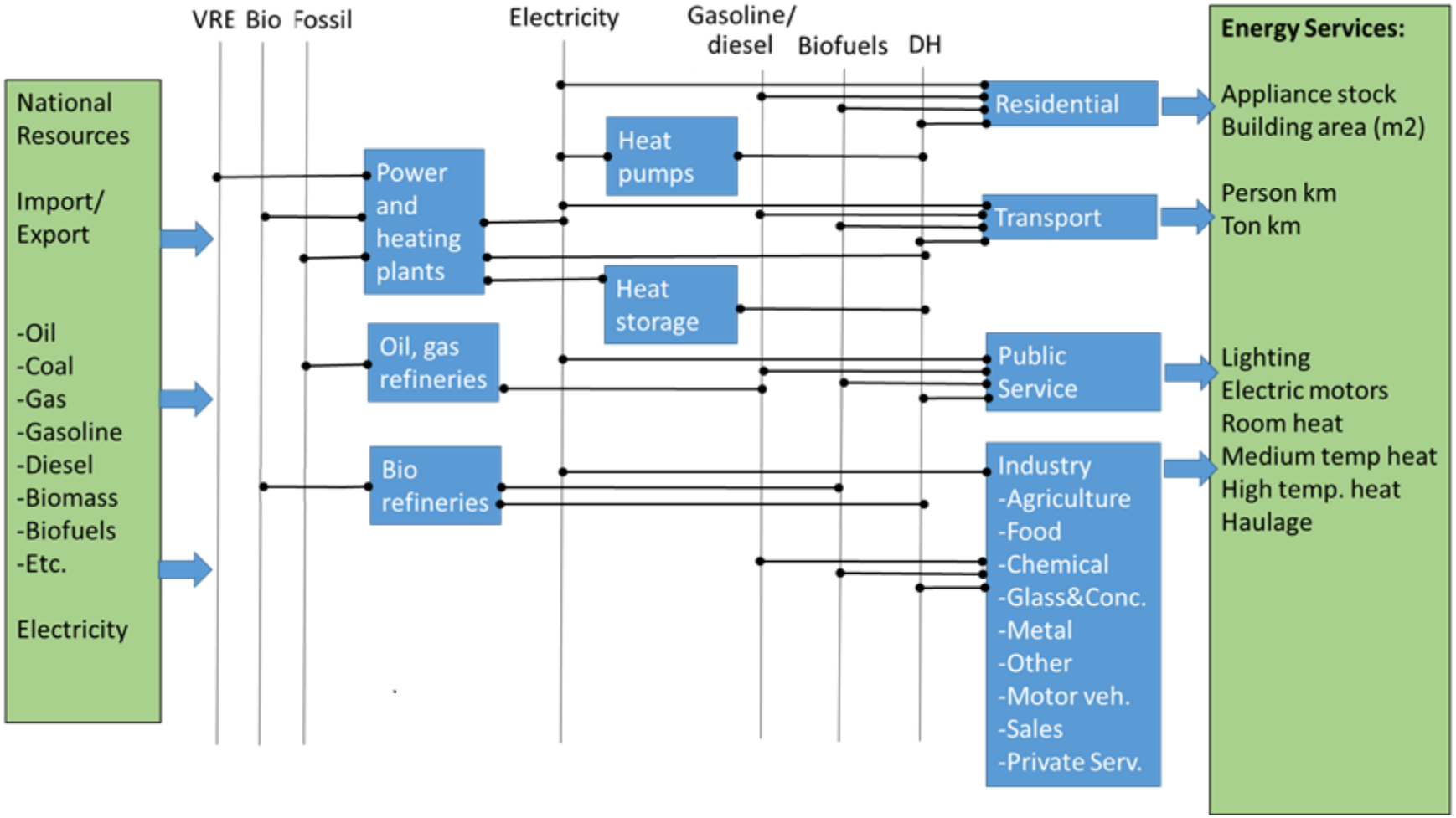


District Heating
29%

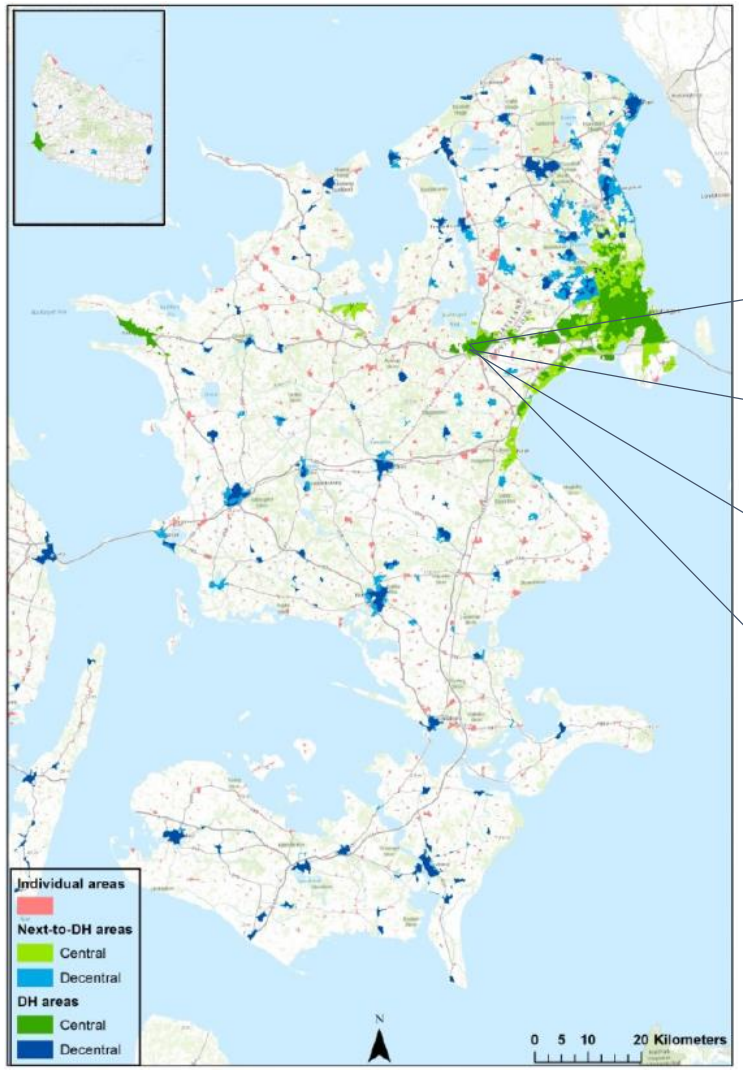
What would be the socio-economic optimal solution?

TIMES-DK is an energy system optimization model developed by DTU and DEA. It includes all sectors and al energy carriers.

It has two regions DK-E and DK-W which are sub-divided into Urban, Suburban and Rural areas. Within each of these areas it describe 12 building types.



Categorizing the Munksøgård buildings



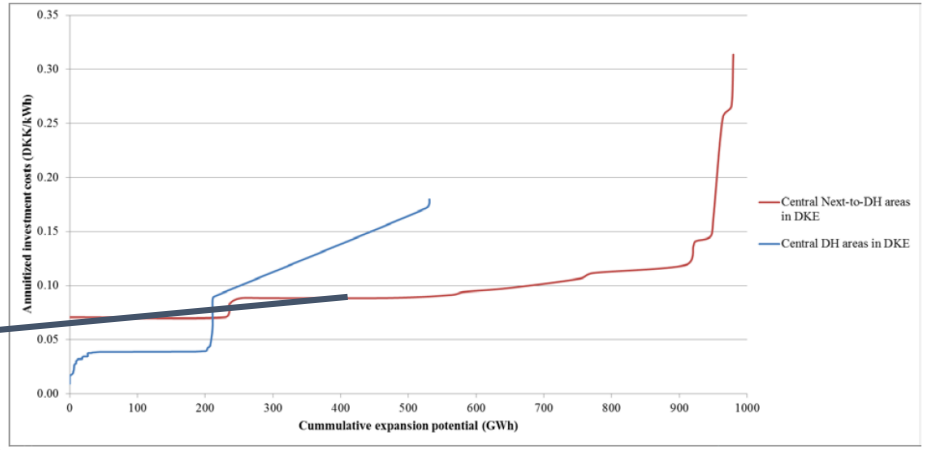
Detached buildings before 1972

Detached buildings after 1972

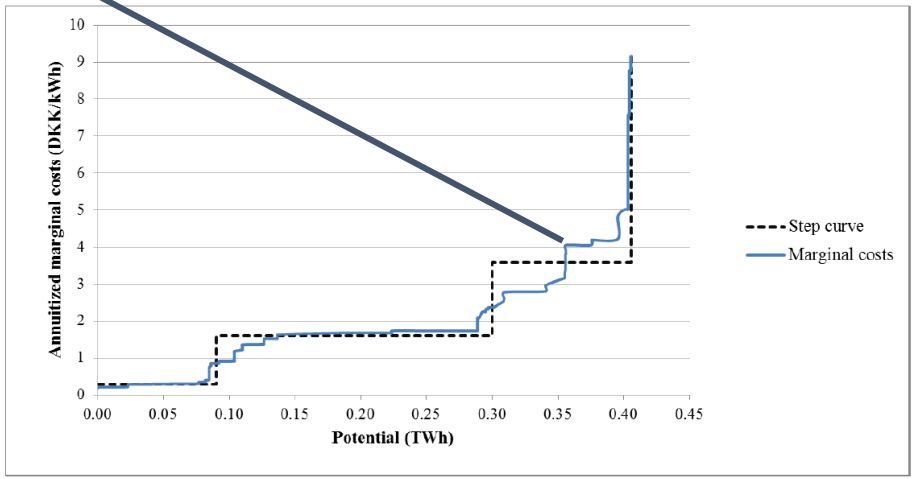
Multi-story buildings before 1972

Multi-story buildings after 1972

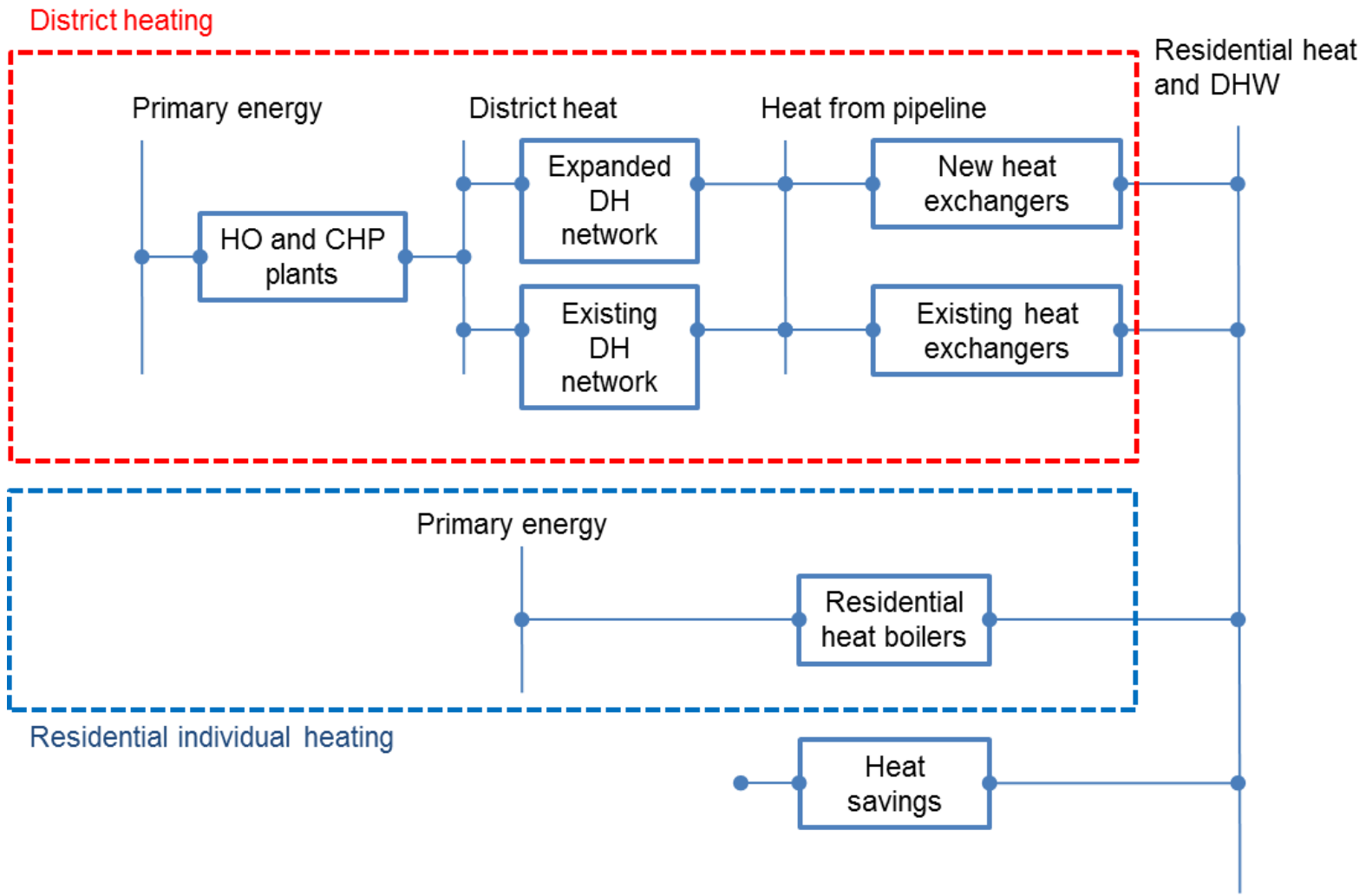
Costs of connecting to district heating



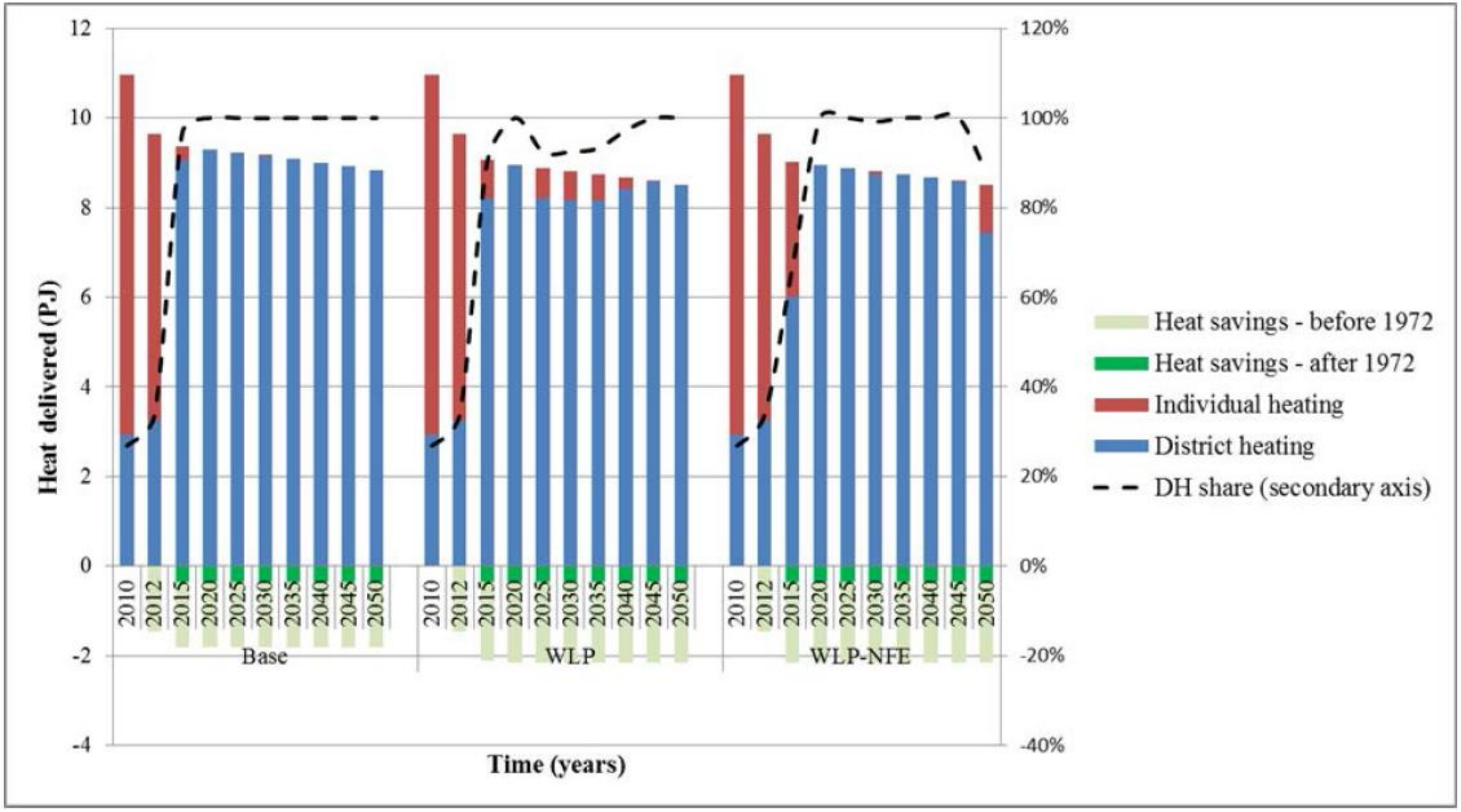
Costs of heat savings



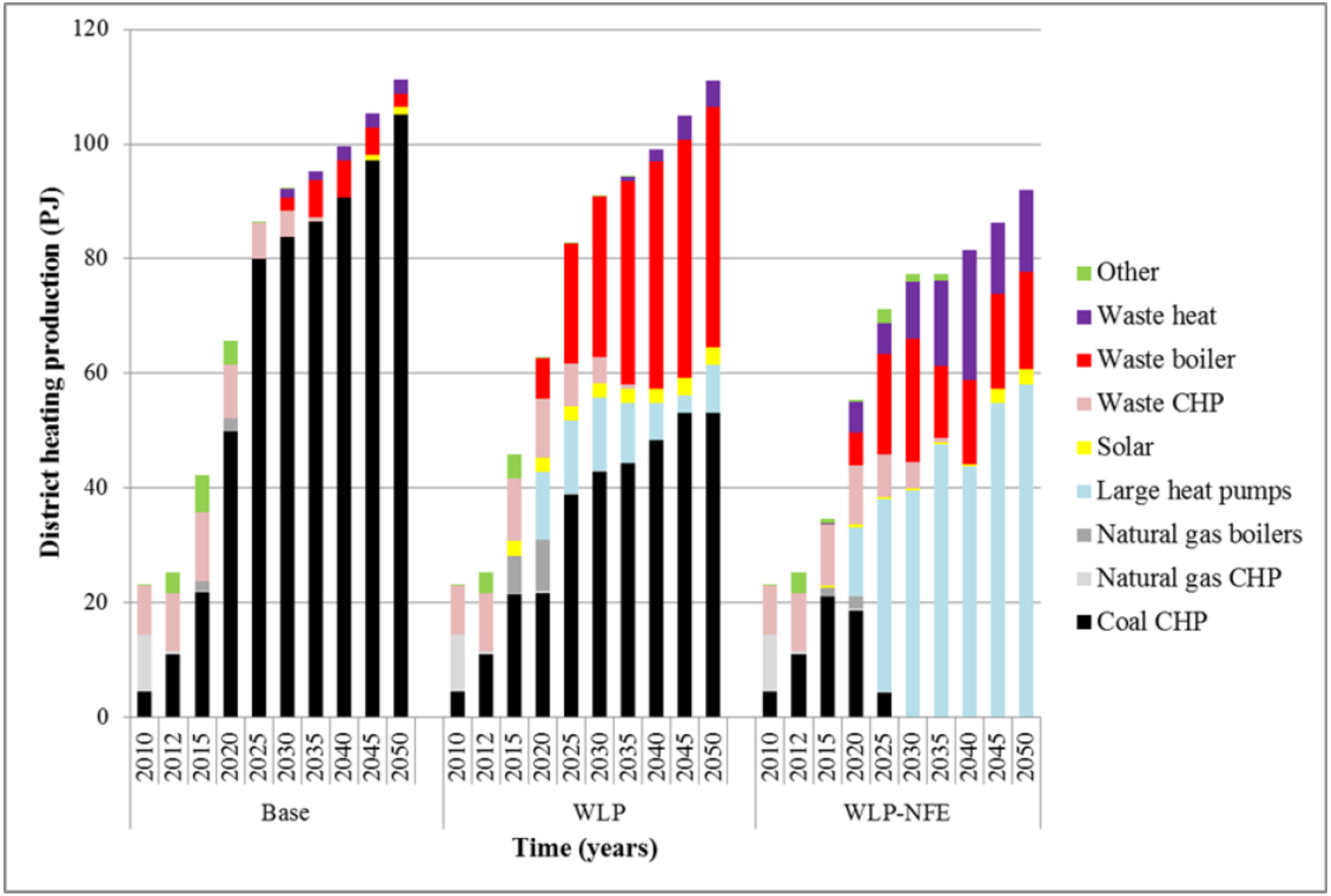
Modelling of heat supply to the buildings



Heat supply to Munksøgård building categori



District heating production in central area DK-E

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