DISTRICT ENERGY INTERNATIONAL CONFERENCE LAC 2025

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District Energy Implementation: Experiences & Lessons learnt in Denmark

(Adapted to learnings from other places)

DBDH

Create a Better World where People Companies, and Cities Benefit from Sustainable District Energy

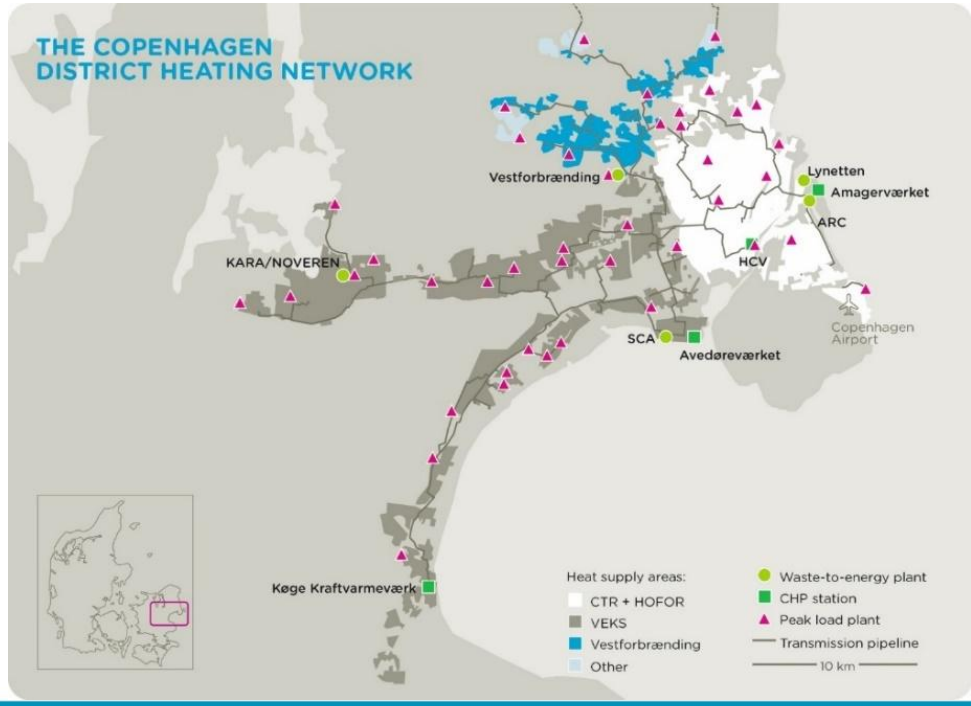
- The Go-to-Partner
- Estab. 1978
- 80+ members
- Magazine HOT|COOL
- Seminars, training, exchanges of know-how, mentoring

District Heating in Denmark

- 70% of all households (1.982.623, 2025)
- 78+% renewable heat (2023)
- All homes in major cities

- ~350 DH companies (Consumer/municipal owned)
- 60.000 km of pipes (30k flow/return)
- 1.000.000.000 l of water

- Prices: Competitive



Why District Heating in Denmark

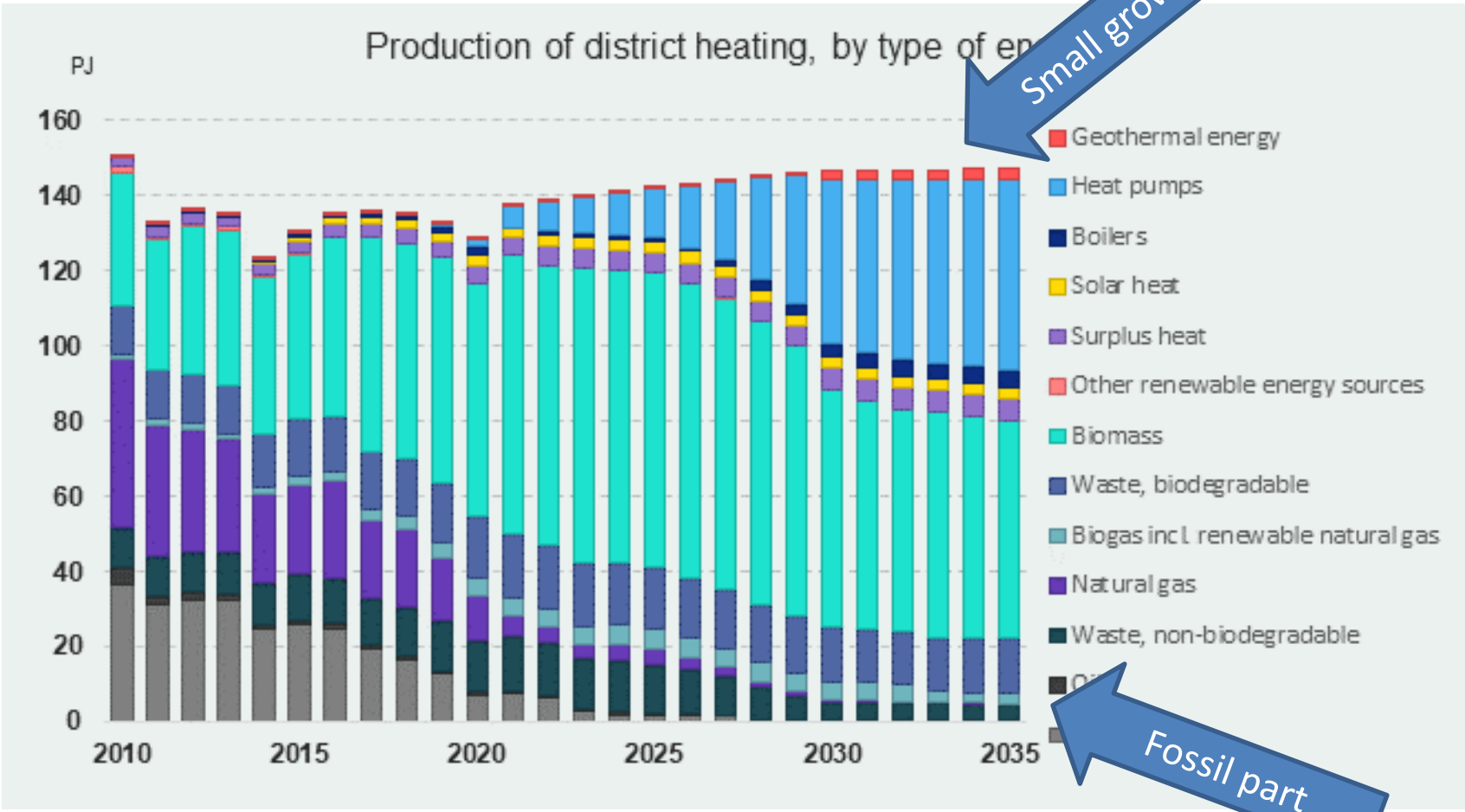
- LOWEST PRICE!!!!
- Renewable!
- Air pollution
- Stable prices
- No import
- Jobs
- Smart Energy
- And many more

LOWEST PRICE!!!!
& renewable!

DH development in Denmark

Year	% - DH	New heat sources	Comment
1903	0	Waste incineration	Municipal company
1960'ies	??	Low cost oil	Many co-operatives
1979	30%	Gas, coal	Lowest Price. Planning
1990'ies	50%	Biomass	Many new companies
2025	70%	Electrification	Integration to power
Soon	75%	Everything	Fully renewable (99,?%)

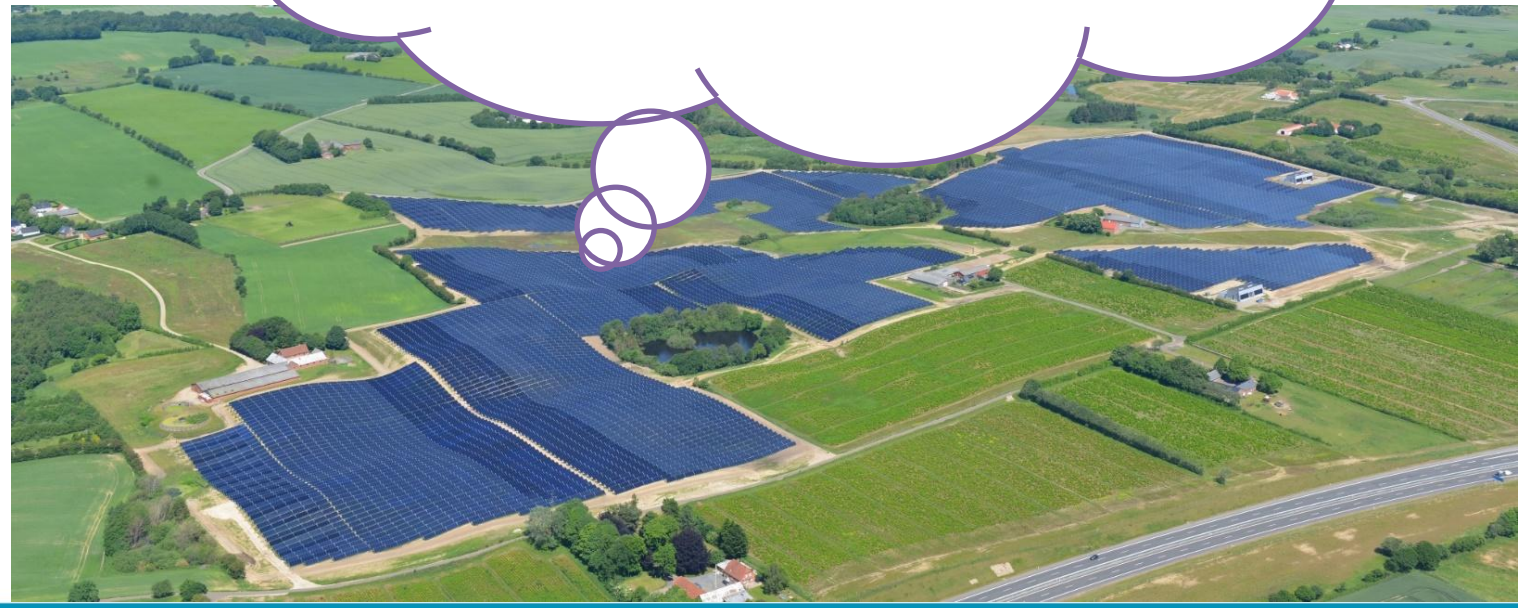
Sustainable Heat Sources



Key Success factors – from DK and Europe

- Municipal leadership
- Capital
- Stable framework conditions
- Consumer protection
- Ownership

"Ultimately, the future of district heating will be shaped by those who own it."



Stable Framework conditions

- LONG TERM!
- Deal with the natural monopoly
- Protect:
  - Investor (in Denmark = the DH company)
  - Consumer
  - Society
- Allows long term perspective and investment
- Financing is essential

Planning

- Everyone know what to do
- Local and municipal leadership
- Zoning
  - Long term perspective
  - Flexible development speed
  - Provide the security needed
- Investor protection and consumer protection

Consumer protection

- Clear stable heat law
- Clear price regulation – cost based
- Transparency – to the extreme
- Functioning complaint system

Cases from Europe

The Netherlands

Germany

Amiens, France

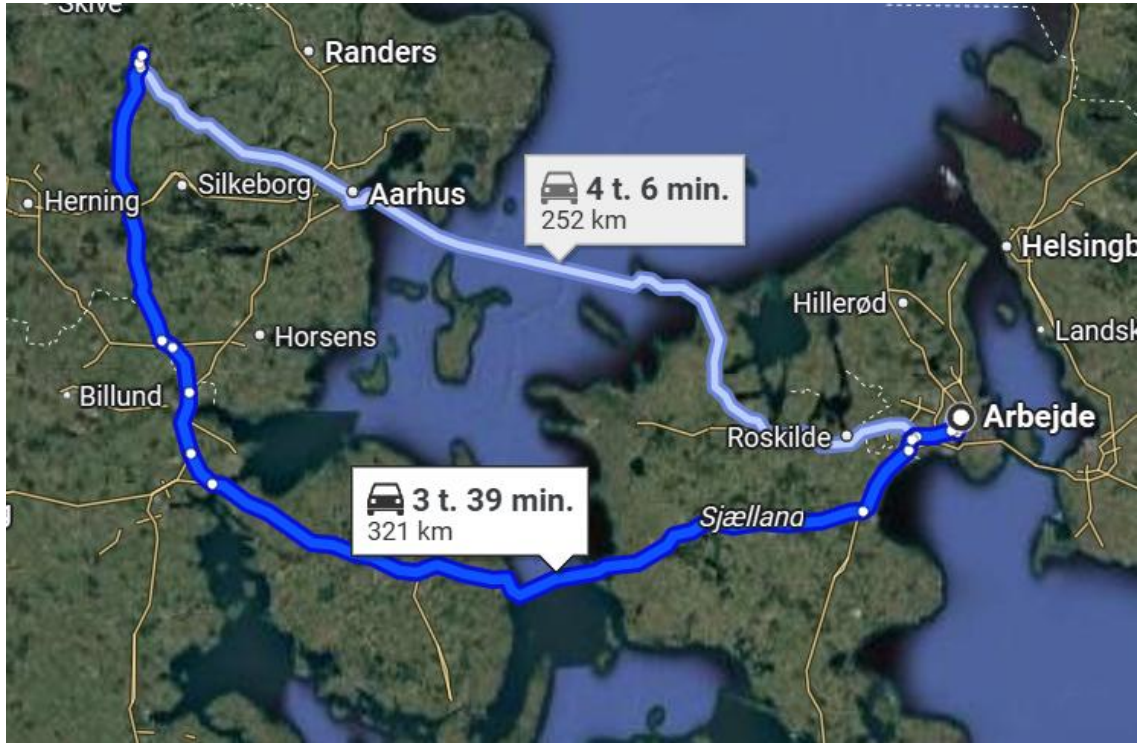
Hamburg, Germany

How to do it right?

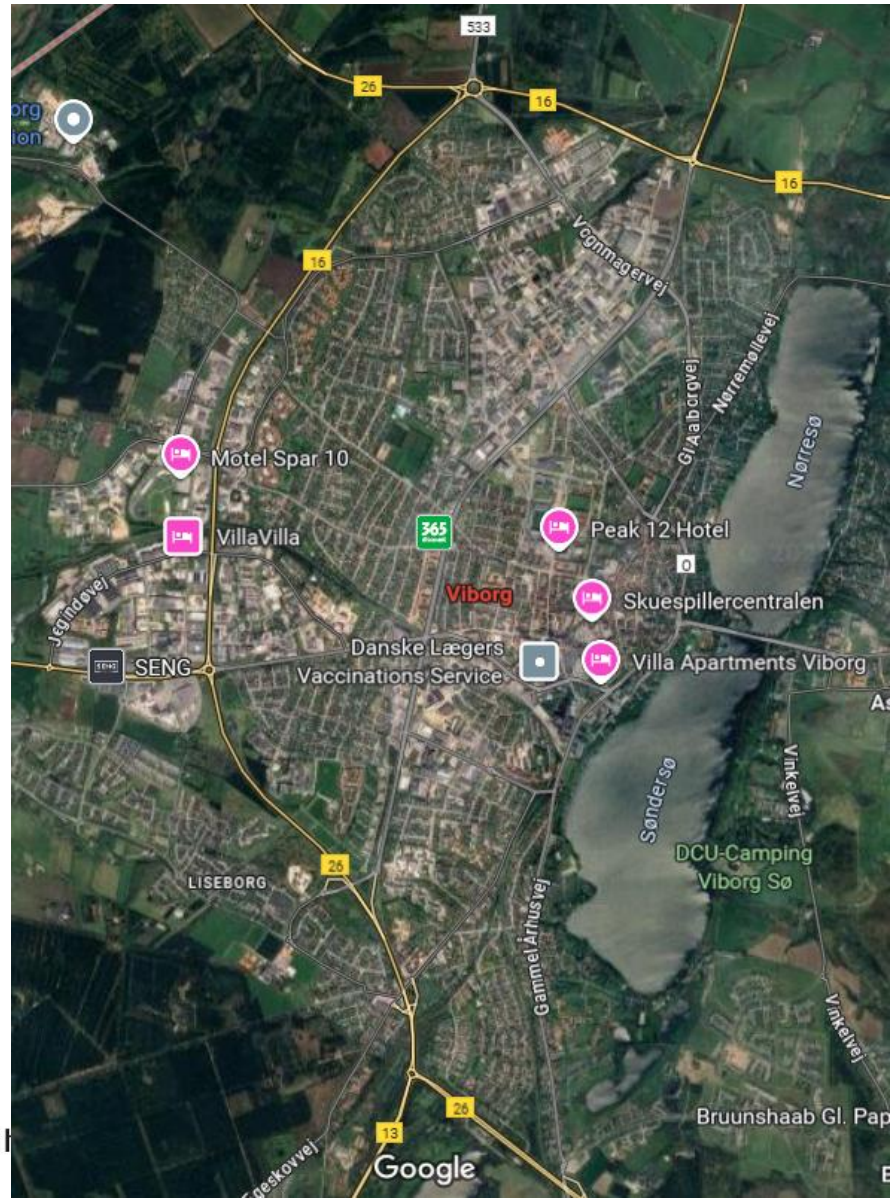
Think very big

- DH should cover and benefit the entire city
- Act big in coordinated phases = planning

Viborg



- 42.000 inhab
- Most has DH
- Some storage
- Several heat sources
- Reserveload not included
- **Peak load: 97,1 MW**


533
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Vognmagervej
Gl Aabygvej
Nørremøllevej
Nørresø
Motel Spar 10
VillaVilla
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Peak 12 Hotel
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Viborg
Skuespillercentralen
Jegindovej
Danske Lægers
Vaccinations Service
Villa Apartments Viborg
SENG
Søndersø
Vinkelvej
DCU-Camping
Viborg Sø
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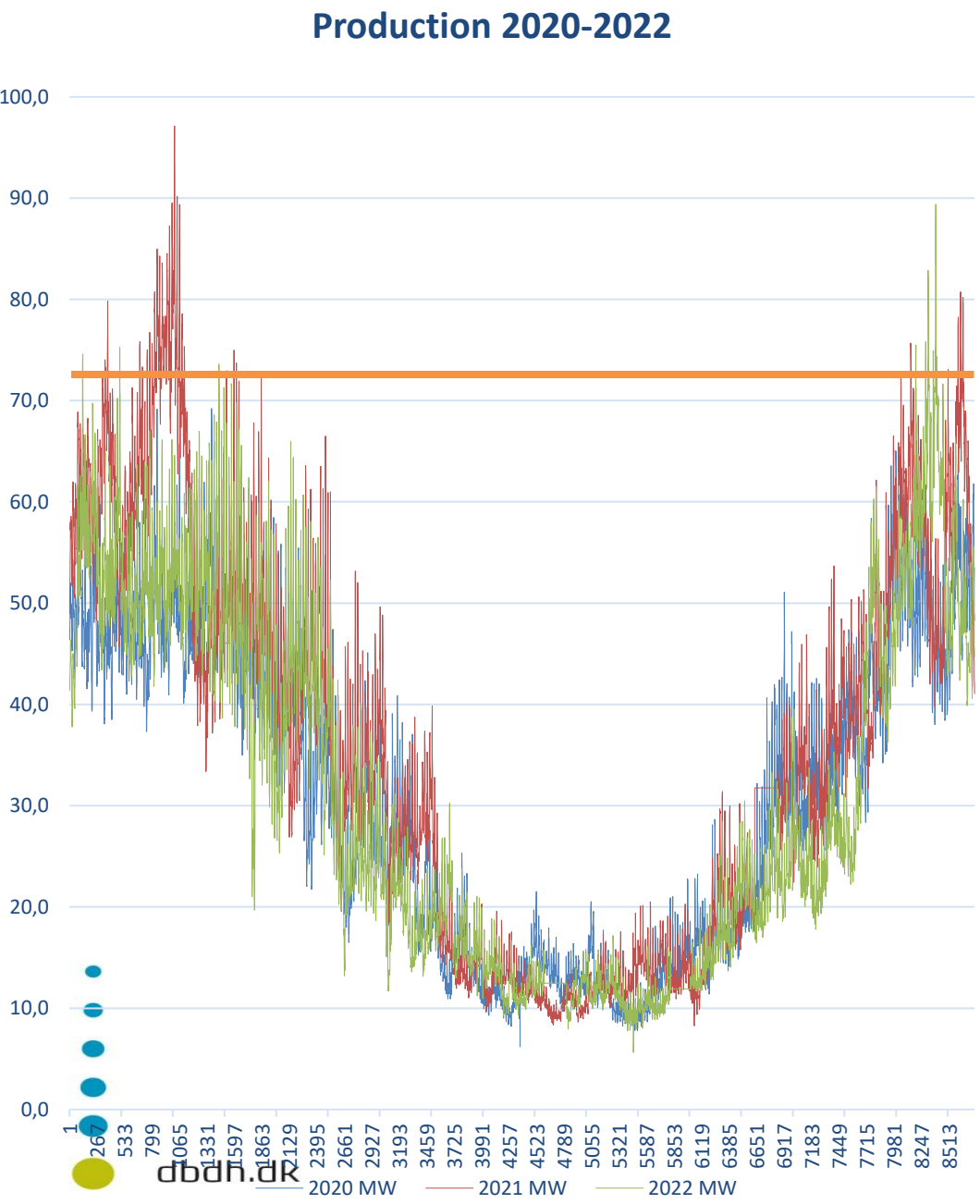
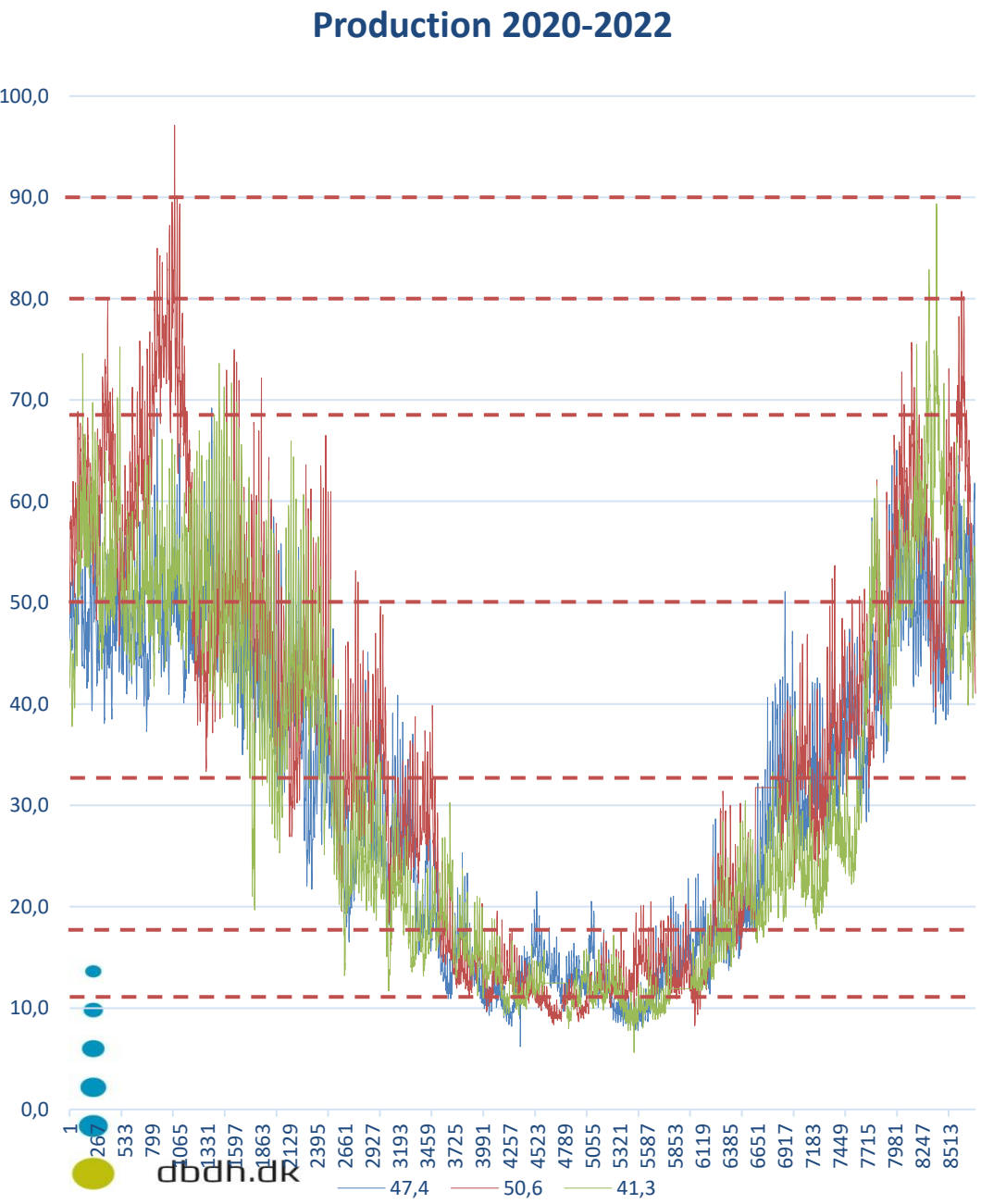
District Heating in Viborg 2020 - 2022



2020 MW	Renewable	Fossil	2021 MW	Renewable	Fossil	2022 MW	Renewable	Fossil
47,3921	47,4	0,0	50,6191	50,6	0,0	41,3345	41,3	0,0
46,3670	46,4	0,0	48,9265	48,9	0,0	41,5905	41,6	0,0
47,3567	47,4	0,0	49,0475	49,0	0,0	41,8964	41,9	0,0
47,1031	47,1	0,0	51,1820	51,2	0,0	42,4805	42,5	0,0
48,9762	49,0	0,0	52,8639	52,9	0,0	43,3920	43,4	0,0
51,4593	51,5	0,0	53,8948	53,9	0,0	44,1120	44,1	0,0
51,4255	51,4	0,0	55,5844	55,6	0,0	44,2623	44,3	0,0
50,8769	50,9	0,0	58,0063	58,0	0,0	45,2146	45,2	0,0
50,2748	50,3	0,0	57,2229	57,2	0,0	45,8942	45,9	0,0
51,3449	51,3	0,0	58,3408	58,3	0,0	46,3288	46,3	0,0
52,0026	52,0	0,0	58,4791	58,5	0,0	46,0513	46,1	0,0
50,8943	50,9	0,0	57,8951	57,9	0,0	45,7654	45,8	0,0
49,1721	49,2	0,0	58,0270	58,0	0,0	45,5635	45,6	0,0



% of total production (2020 – 2022)

Renew capacity	2020	2021	2022	Average
11,2	34,8	30,7	34,9	33,3
18,3	52,5	46,1	52,0	50,0
32,7	79,0	71,1	72,5	75,0
50,0	97,6	90,2	94,5	93,9
68,9	100,0	98,8	99,8	99,5
80,0	100,0	99,848	99,978	99,9
90,0	100,0	99,986	99,9987	99,995
100,0	100,0	100,0	100,0	100,0

Back to Viborg:

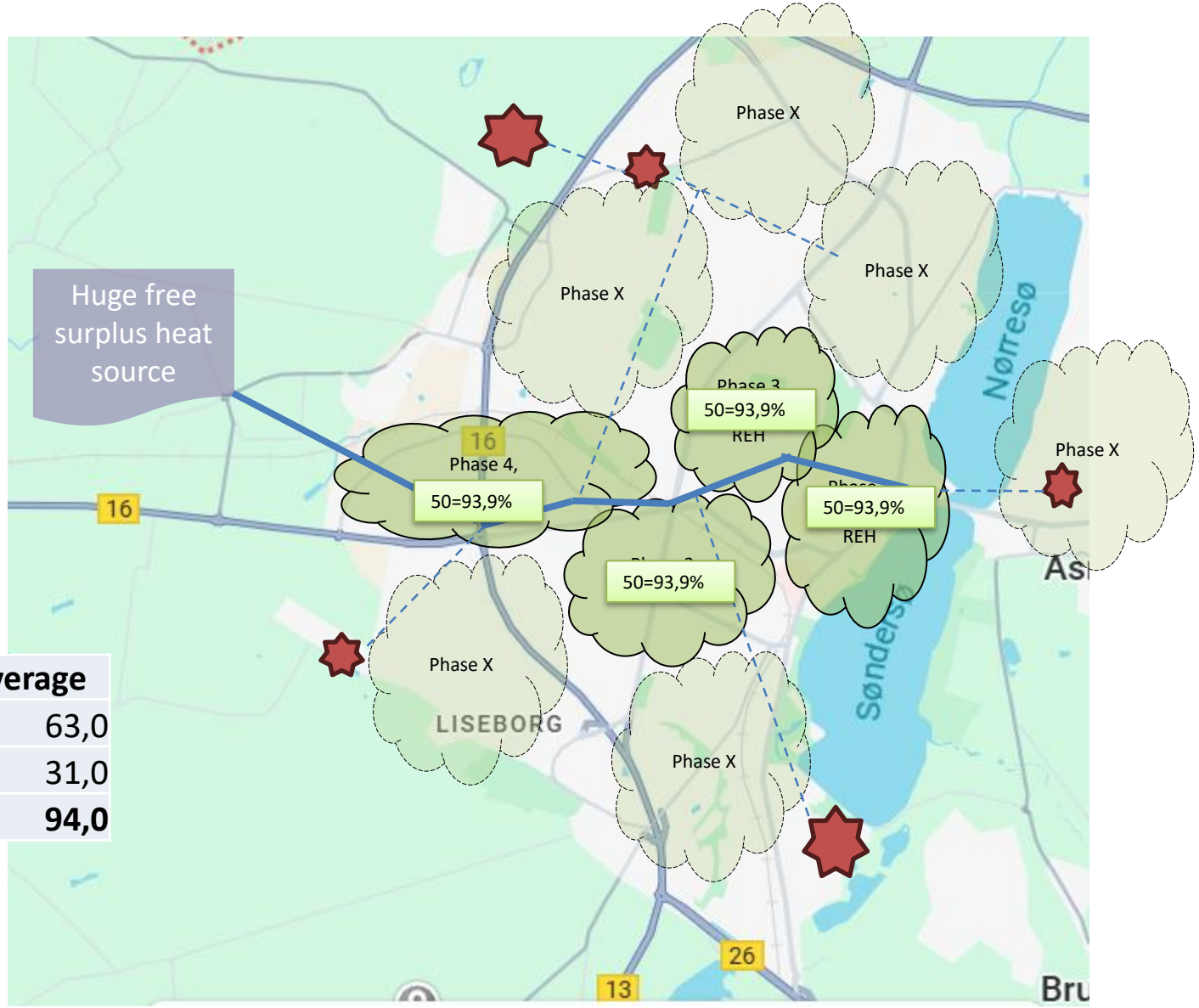
- Phased: 10X10% of the town
- Well plannes and heat mapped
- Start with the easiest
- Plan strategically
- Understand your heat sources

Discussion

- How much over investment in pipe network?
- How much investment in other heat sources?

Sources:

Actual production (hours)	2020	2021	2022	Average
Surplus (25% capacity)	66,0	58,5	64,5	63,0
Heat Pumps (25% capacity)	31,6	31,7	30,0	31,0
Total	**97,6**	**90,2**	**94,5**	**94,0**



How to get the last 50%

- Tell me!

Project evaluation for financing and business development

Danish DH Project Proposals

- Calculates the “value” of a DH project
- Standardised format
  - “a calculation tool”
  - All the numbers, cost, efficiencies
  - Technology Catalogue
  - Published by the Energy Agency

The outcome of project proposals

DH Company	• Business case • Avoid losing money / go bankrupt
Consumer	• Consumer economy • They will complain / not sign up,
Society	• Socio-economic • Include external factor like pollution • Allow for a harder push (mandatory connections back then)

Thank you!

Municipal Leadership

- “It is our village / town / city!”
- Heat Planning is key
- Success depends on local leadership.
- Municipalities must:
  - Lead and take ownership of the planning phase
  - Decide who should benefit and how
  - Decide when and how
  - Control the process

“Ultimately, the future of district heating will be shaped by those who own it.”

Why District Heating?

- Predictable, fair and lowest prices
- Green/sustainable
- For everyone
- Social and other benefits

Back to Denmark

What made DH a succes in Denmark?

Main ingredients

- Stable Framework conditions
- Municipal Leadership – heat planning
- Think very big – act in stages
- Forget the other non-existing solution: H2 etc.
- Allow many heat sources – be agnostic
- DH integrates the energy system
- Consumer protection
- We have no time! And the only thing we have is time.

Trust

- Democratic ownership
- Consumer protection
- Control of the natural monopoly
- Transparency
- Not-for-profit

Clear and relevant objectives

Lowest possible price

Green, job, import, …..

The business model

- End-user/Customer owned
  - Co-operative
  - Municipal
- In *charge* of the whole value chain
- Provide heat at lowest prices
- Professional, *commercially acting* organisation

Developments today

- Gas is out!
- Supports integrations with the power market
- Surplus heat – all kinds
  - Large heat pumps (data centres, industry, any kind of water….)
  - Hydrogen, PtX, CCS/U
- Storage
- Smart energy / digitalisation

Composition of DH companies

Type	#	Size	Comment
Municipal	70	Large	Often ”arm-length SPV”, but fully owned. consumer owned (indirectly).
Cooperative	275	Smaller	Private co-operative, consumer owned. 7th or 8th largest DH is the largest co-op. Many established in 60’ies and 80’ies. From 70 houses to 75.000 persons.
Commercial	4	Micro	Private-commercial (EON)

* Approximate numbers

Use all/many heat sources

- Use what you have (also biomass, gas, CHP)
- Build big storage – keeps prices low and support the entire energy system
- Sector integration to Power, PtX, HS, WtE
- Ability to always choose the cheapest source
  - with respect to investments allready made
- Focus on fossil-free, but remember - there is still time

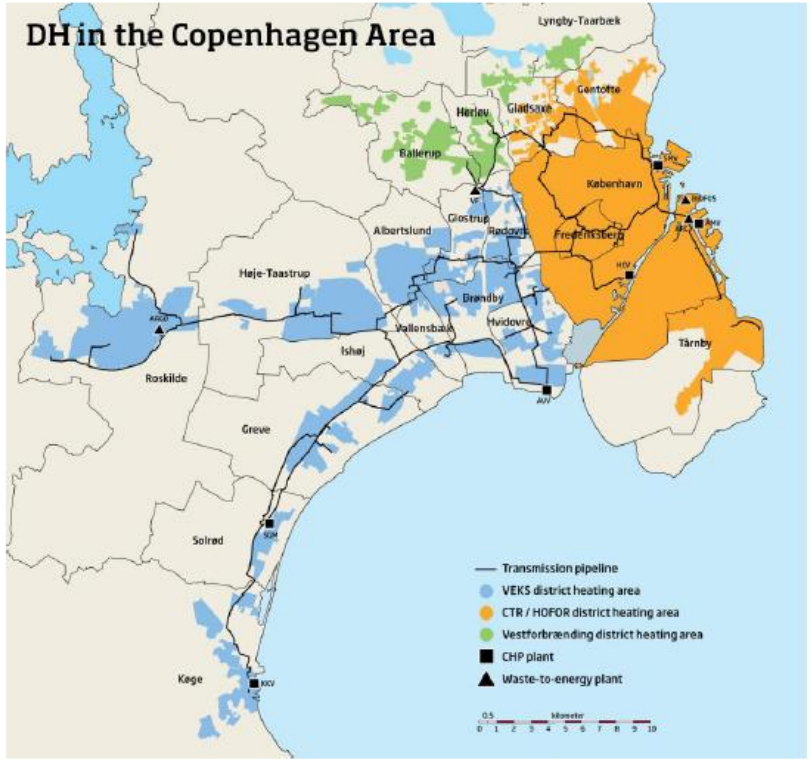
DH is the integrater!

- There are so much heat out there – let's use that (first)
- Integrate to the electricity system and make cheap heat. How?
  - High electricity prices – DH companies produce power (and heat)
  - Low electricity prices – DH companies use power (and produce heat)
  - Balancing
- Heat can be stored for short or long

Greater Copenhagen

DH in Greater Copenhagen

VEKS, CTR and HOFOR



VEKS

- Partnership between 12 municipalities
- 350,000 tax-payers
- 170,000 end – users
- 9,000 TJ (2,500 GWh)

DH in Greater Copenhagen

- 19 municipalities
- 4 integrated systems
- 500,000 end – users
- 34,500 TJ (9,600 GWh)

40 km

Grøn fjernvarme til dig

The future is district heating!

- Carbon agenda: 70% reduction by 2030……
- Heating: de facto 0% carbon or less
- 400.000 more homes connected to DH

The DH Company

It is not-for-profit!

Who owns what in Denmark?

- ”Customers”: DH Company always
- Pipes: DH company – always
- Heat sources:
  - Often the DH company – control is important
  - Surplus heat from industry – many variants and contracts
  - Electricity producers – more and more the DH companies
  - WtE – external, but always municipal

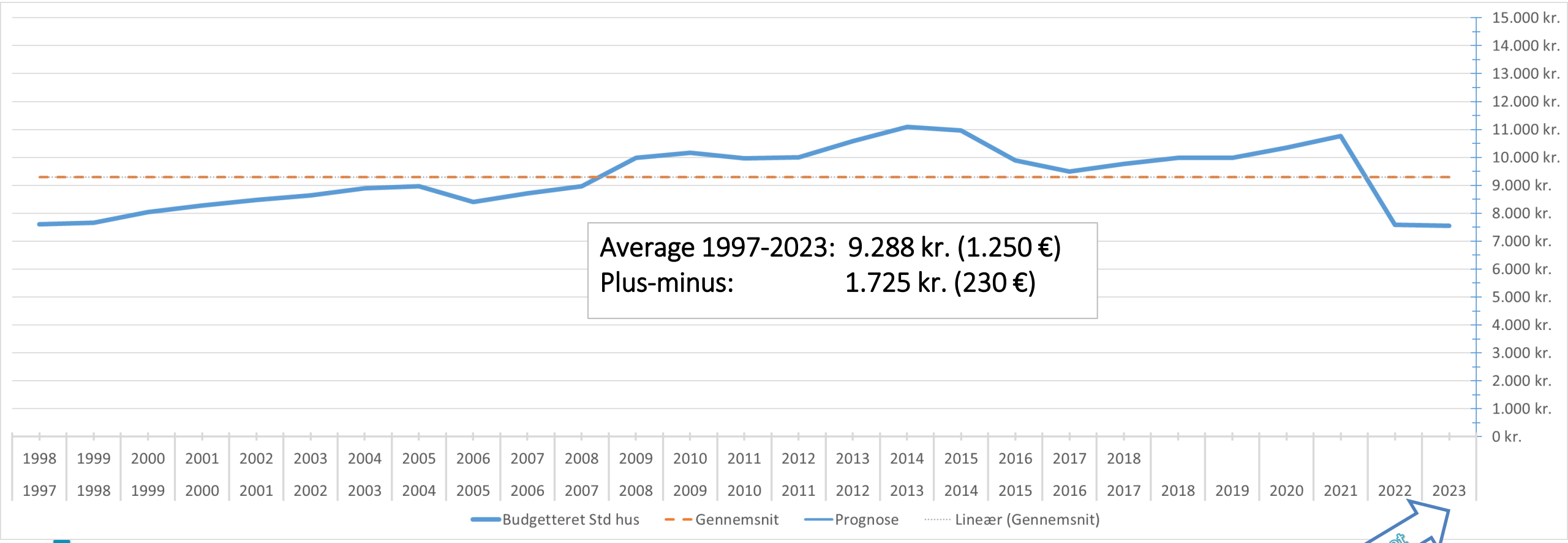
Case Assens

About Assens Fjernvarme

- Established in 1960
- 3.400 DH customers/owners

25 years with a low and stable heatprice

Standard house: 130m^2, 18,1 MWh

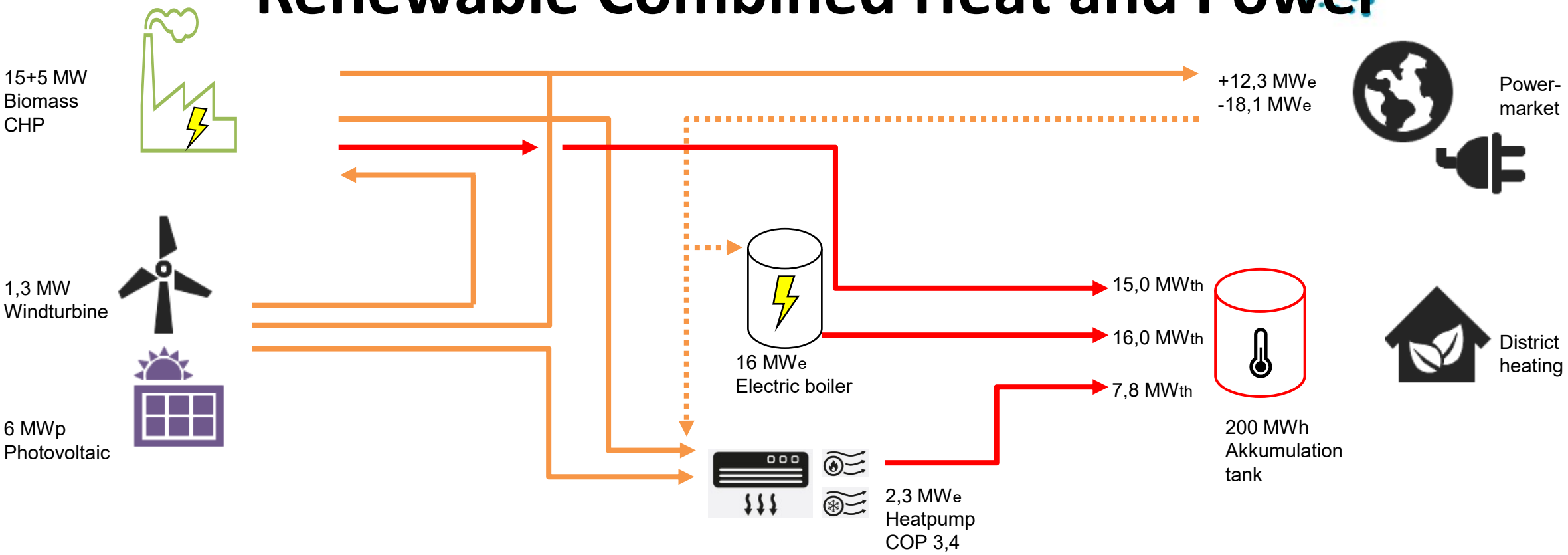


Average 1997-2023: 9.288 kr. (1.250 €)
Plus-minus: 1.725 kr. (230 €)

Budget

dbdh.dk

Renewable Combined Heat and Power



Renewable "*Combined Heat and Power*" makes it possible to:

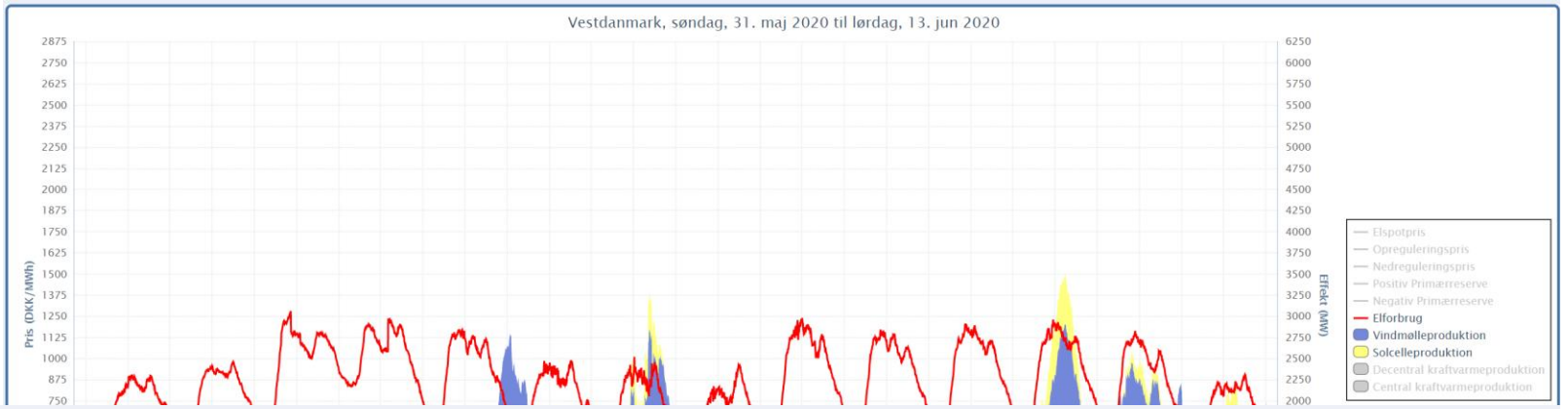
- Produce big amounts of sustainable energy
- Sell sustainable power when the price is high – **stabilize the market!!!**
- Purchase sustainable power when the price is low – **stabilize the market!!!**
- Use own power when the price is middle – "**stabilize" the market!!!**

Sector coupling

dbdh.dk

Assens works with the electricity market

Sustainable electricity production causes very big fluctuations in the market.



dbdh.dk

Assens and the power market

- Active on
  - Day-to-day market
  - Intra-day marked
- Not on very short term markets
  - Maybe at a later stage - with more experience

ASSENS IS ONE OUT OF MANY!

Case Sdr. Felding

750 houses – plus a few larger customer

Max demand 5MW – on the coldest day

Heat sources

Large storage: 3.000 m3

~2,8 MW heat pump

10 MW e-boiler

Bjæverskov DH

- Established 2 years ago
- 1.000 houses
- Non very renewable – but will be soon. (Who cares)
- Later heat pump, surplus heat, e-boiler

2 perspectives

Which DH networks or heat sources do we build

- Project proposal
  - Society
  - Company
  - Consumer

The daily operation of the networks – how to secure lowest possible prices

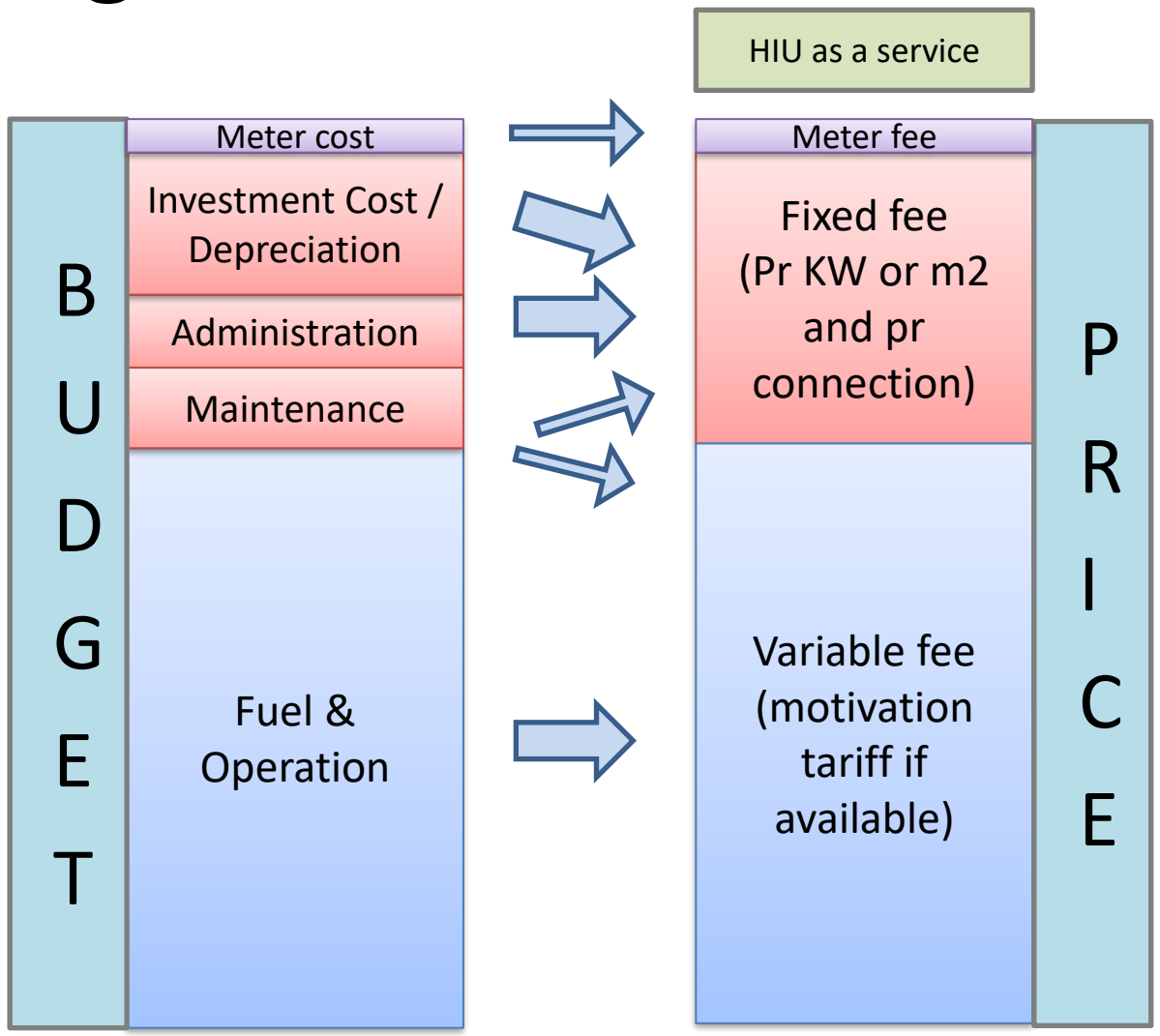
- Price regulation
- Transparency
- Aligned interest via ownership
- Complaint-system

Main ingredients for a sound heat transition based on Danish experiences

Forget the other non-existing solution
– for heating buildings

- Biogas: To industry
  - DK: <18% gas for heating, >40% biogas in network
- H2: Cost, PtX, transport, industry, export
- Individual / small heat pumps: Noisy, electricity grid, costly, one energy source – great out side urban areas ☺

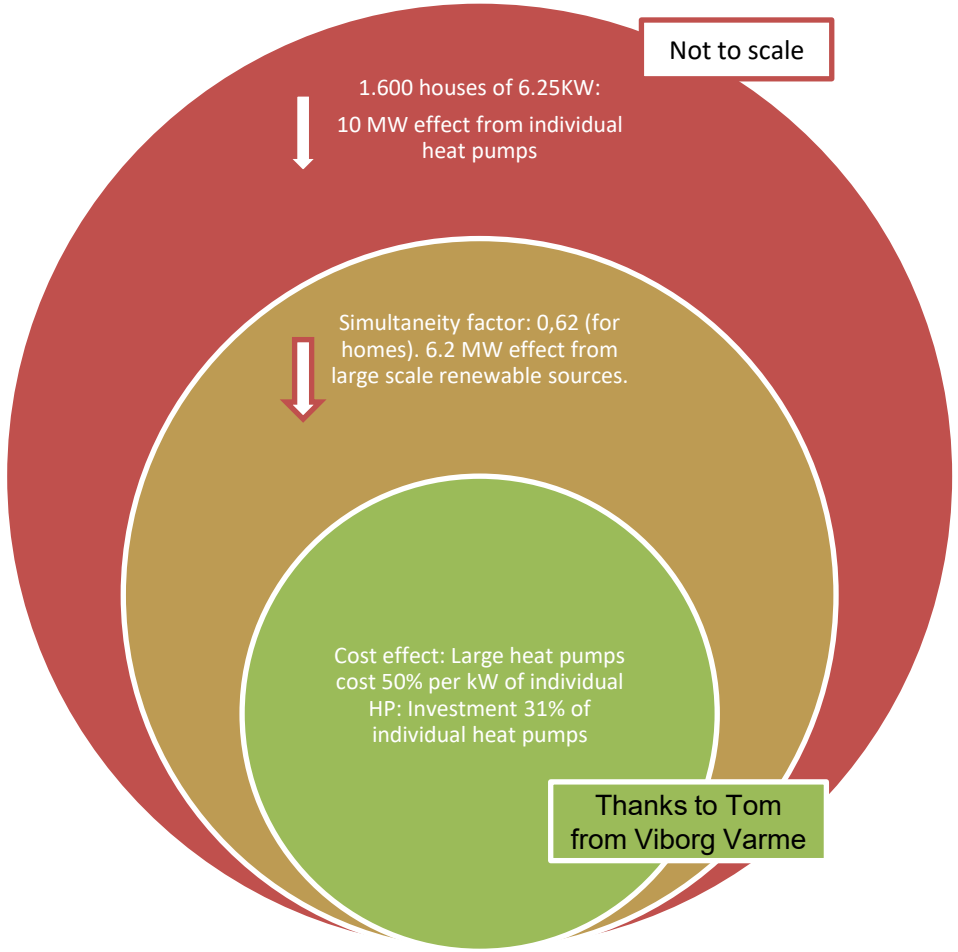
Budget and Prices in Denmark



Individual solution or district heating

Simultaneity effect /factor:

- The effect of things happening at the same time
- The fact that:
  - Peak demand happens at different times
  - The same installed effect can be used to heat more buildings
- About the needed installed effect (MW and peak demand), not about consumption (MWh)



A Danish DH company act as / is a 100% commercial company!

Owned and directed by shareholders

With the aim to make 0,00% profit!

= Provide the lowest possible heat prices

Price challenge

- Do not compare prices to natural gas
- Natural gas is an obsolete technology and heavily subsidised
- The gas network will be a stranded asset for heating buildings