Best practice from Denmark in price setting for heat tariffs

Presentation to the Vanguards District Heating Conference

17th July 2015

LE London Economics

Agenda

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About London Economics

- One of UK's and Europe's leading economics consultancies
- We advise clients in both the public and private sectors on economic and financial analysis, policy development and evaluation, business strategy, and regulatory and competition policy.

- Our consultants are highly-qualified economists with experience in applying a wide variety of analytical techniques to assist our work, including cost-benefit analysis, multi-criteria analysis, policy simulation, scenario building, statistical analysis and mathematical modelling.
- We are also experienced in using a wide range of data collection techniques including literature reviews, survey questionnaires, interviews and focus groups.
- Specialist team and expertise in Energy Economics.

Key points on Danish district heating

- Currently 64% of households in Denmark supplied with district heating (April 2015)

- Kicked off in 1979 with the legal requirement that all local authorities produce heat maps by end-1982 at the latest, which was to be used for masterplanning of the local heat supply.

- All Danish district heating must be non-profit either in the sense of the self-supporting principle (hvile-i-sig-selv) or the substitution principle (which is where the consumer pays the lowest of either the cost-based price from the provider or the cost of an alternate form of heating)

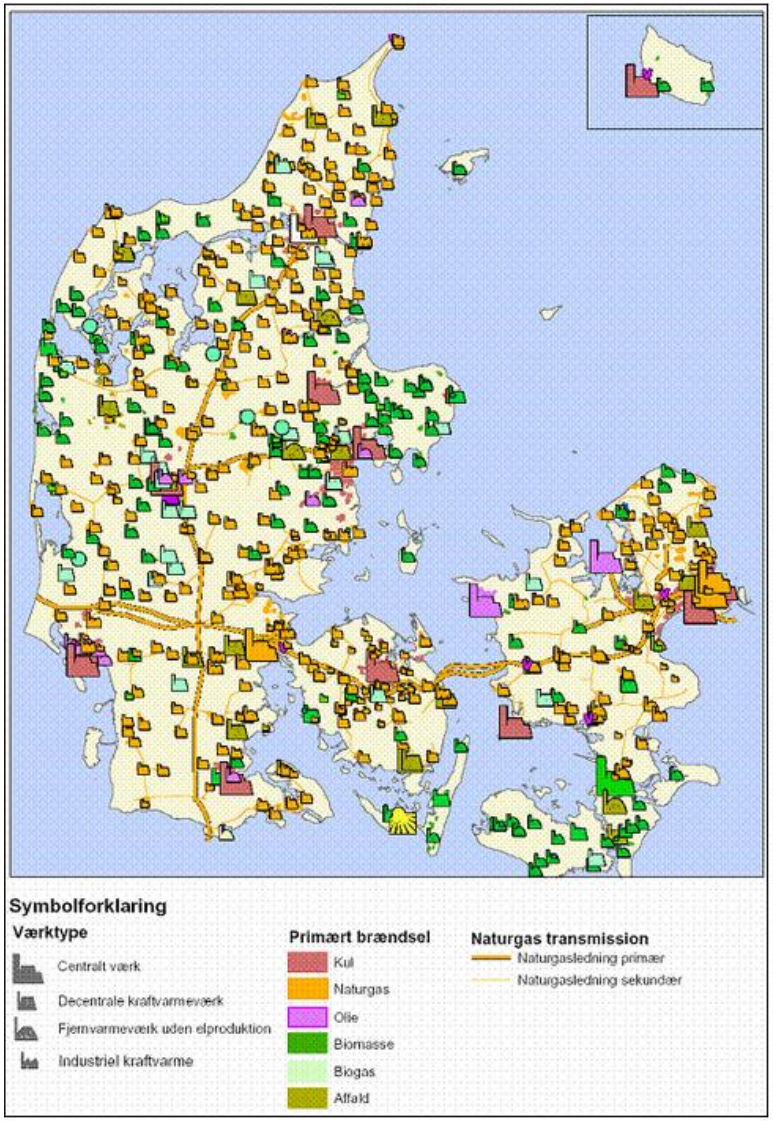


Image source: History of Danish district heating, ens.dk

Danish district heating prices

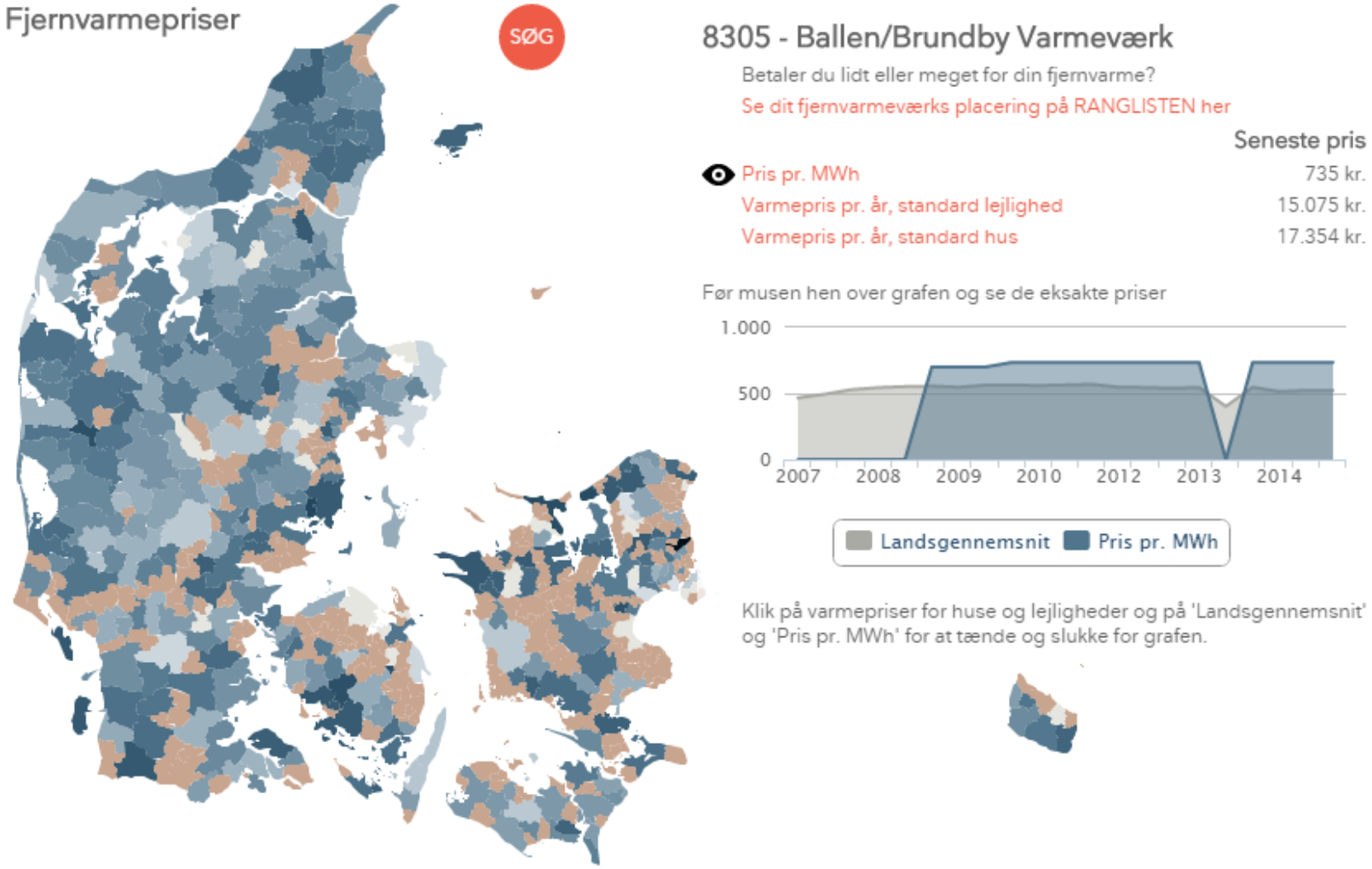


Image source: https://www.bolius.dk/danmarkskort/fjernvarmepriser/

Danish district heating prices - ranking

Fjernvarmepriser

SØG

8305 - Ballen/Brundby Varmeværk

LUK (esc)

Priserne er de seneste. Står der 'n/a' betyder det at der ikke er modtaget tal fra dette fjernvarmeværk.
Klik på kolonnetitlerne - fx Standard enfamiliehus - så kommer priserne i rækkefølge med den laveste først.
Klik igen for at få den højeste pris først.

Postnr.	Fjernvarmeværk	Placering	Pris pr. MWh	Standard lejlighed	Standard enfamiliehus
7673	Harboøre Varmeværk Amba	1	250 kr.	6.300 kr.	8.155 kr.
6630	Rødding Varmecentral	2	259 kr.	6.194 kr.	8.233 kr.
9550	Mariager Fjernvarmeværk Amba	3	286 kr.	7.799 kr.	9.444 kr.
7770	Vestervig Fjernvarme	4	313 kr.	10.156 kr.	13.235 kr.
8464	Galten Varmeværk	5	319 kr.	8.215 kr.	9.934 kr.
9560	Øster Hurup Kraftvarme	6	325 kr.	11.750 kr.	12.758 kr.
6862	Tistrup Varmeværk	7	338 kr.	9.188 kr.	11.609 kr.
9000	Aalborg Kommune, Fjernvarmeforsyningen	8	341 kr.	6.430 kr.	9.337 kr.
7700	Thisted Varmeforsyning Amba	9	350 kr.	7.188 kr.	9.235 kr.
9400	Nørresundby Fjernvarmeforsyning	10	350 kr.	8.094 kr.	10.348 kr.
8600	Thorsø Fjernvarmeværk Amba	11	356 kr.	9.891 kr.	11.876 kr.
2600	Vestforbrænding Glostrup I/S	12	367 kr.	10.191 kr.	12.297 kr.
4930	Maribo Varmeværk Amba	13	368 kr.	8.149 kr.	10.115 kr.
4930	Maribo Varmeværk Amba	14	368 kr.	8.149 kr.	10.115 kr.
8382	Hinnerup Fjernvarme	15	369 kr.	7.356 kr.	9.655 kr.
9480	Løkken Varmeværk	16	369 kr.	9.365 kr.	11.440 kr.
6870	Ølgod Fjernvarmeselskab Amba	17	370 kr.	9.038 kr.	11.335 kr.
4970	Rødbyhavn Fjernvarme Amba	18	375 kr.	9.164 kr.	10.945 kr.
7280	Sønder Felding Varmeværk	19	375 kr.	8.047 kr.	10.069 kr.
7330	Brande Fjernvarme Amba	20	375 kr.	8.688 kr.	11.500 kr.
7830	Vinderup Varmeværk	21	375 kr.	7.716 kr.	9.999 kr.
8370	Hadsten Varmeværk	22	375 kr.	9.375 kr.	10.538 kr.

BOLIUS Boligejernes Videncenter

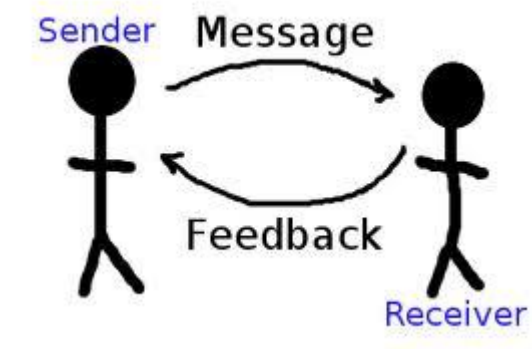
Hvor er fjernvarmen dyrest?
Del kortet med fjernvarmepriser

Image source:
https://www.bolius.dk/danmarkskort/fjernvarmepriser/

District heat tariffs are a communication tool between the provider and the end user

The end goal of district heat tariff setting should be to facilitate a symbiotic relationship between the district heat provider and the end user.

You want to set a tariff that encourages the customers to use heat and to invest in home improvements in a way that is optimal for both themselves and for the district heat provider.



In this sense, a district heat tariff is a communication tool between the provider and the end user.

Optimal price setting for various district heating network characteristics – Danish best practice

- New DHN with excess capacity should price at the marginal cost of production, which is usually slightly higher than the variable cost of production.

- New DHN with no or minimal capacity should price at the long run marginal production cost, which should include the price of increases to boiler capacity and expansion of the heat network. This price will usually lie between the short run marginal cost and the average cost including all capital investments.

- For DHN with fully depreciated heat networks and low cost of production the long run marginal cost may be higher than the average cost but lower than the closest alternative heat source (substitution principle).

- DHN which have capacity constraints or need to upgrade their net should investigate the options for awarding lower return temperatures as it is the volume of water rather than the heat content that impacts the capacity.

Incentives for lowering the return temperature

- There are multiple benefits in getting your end users to provide a lower return temperature, including;
  - Larger optimisation potential (including reducing the flow temperature);
  - Lower production costs for future heat generation sources;
  - Increased capacity in the network;
  - Reduced replacement costs in new pipelines; and
  - Increased pipe lifetime.

- Existing evidence suggests that best practice for incentivising lower return temperatures is:
  - Tariff setting based on the weighted average return temperature;
  - Only positive incentives – no penalities;
  - The lost income provided as a bonus should correspond to the financial gains from lower return temperature such that other users are not penalized.

Optimal division between fixed and variable tariffs

- Overall, best practice is to set the variable tariff at the long run marginal costs of the district heating network. Most DHN will set a variable tariff at a price higher than the short run marginal cost and keep it at a constant level throughout the year.

- Historically, fixed tariffs in Denmark correspond to around 31% of costs. The Danish Energy Regulatory Authority recommends that the fixed tariff is set at least at 20% of the costs.

- Variable tariffs should at minimum cover variable costs.

- This promotes investment in viable energy saving measures, including allowing for investment in domestic heat production (e.g. from solar thermal panels or heat pumps).

Examples of fixed tariffs

- Best practice has been to set fixed tariffs relative to the registered living area (heated area) of the home. The fixed tariff consists of:
  - A suitable subscription tariff; and
  - A step-wise decreasing cost per m2 to ensure equal competitiveness for larger and smaller customers.

- An alternative is to set the fixed tariff relative to expected annual capacity demand
  - e.g. if a domestic user has an expected heat demand of 2,000 MWh over 2,000 hours = 1MW capacity.
  - This may cause issues depending on customer acceptance of the method of calculating the expected annual demand.

- Other options include
  - Fixed tariff based on flow capacity, with a focus on delivered flow temperature; and
  - Fixed tariff based on the last 3 years of heat demand (normalized for annual temperature).

Examples of tariffs to increase the customer base

- Connection and installation fees included in the price. This approach is very similar to the ESCO approach but best practice in Denmark recommends that the DHN directly deals with customers rather than going through an ESCO.

- Conversely, experiences from Sweden and Denmark suggest that for larger users who are comparing an alternate investment (such as a large heat pump) it will be more attractive to provide a fixed upfront investment covering all CAPEX and installation fees, with a long-term variable fee covering OPEX costs.

- For DHN where attracting additional users is a necessity, but where the tariffs are higher than their preferred option, the DHN can provide a discount:
  - In the form of a percentage reduction on the fixed tariff; or
  - In the form of taking over the block central heating system and providing lower heating costs for each individual user (in the case of building societies).

- Given the increasing amount of low-energy new build, it is also becoming common to offer up to a 50% discount on e.g. a fixed tariff calculated on the basis of heated household area.

Adjusting for customer size

- The size of the user plays a significant role in tariff-setting;
  - Larger customers typically have cheaper alternatives for heating than households, partially due to savings on bulk purchasing of natural gas and partially due to economies of scale on CAPEX investments.
  - This price differential for larger customers is in line with the lower costs of providing heat to a larger customer (e.g. only one heat meter needs to be installed).
  - The variable tariff should be the same across all customer sizes on any given day (adjusted for return temperatures).
  - Price differentiation between large and small users should be applied only to the fixed tariff, and should reflect the opportunity costs of both the large user and for the DHN.
  - For example, the fixed tariff can contain both a flat fee and an incremental inverse fee

Seasonally adjusted heat tariffs

- Danish best practice borrows from Sweden, who have been using seasonally adjusted heat tariffs for 25 years.

- District heating networks have noted an increasing interest in domestic production of heat during the summer;

- In principle seasonal tariffs can be implemented even with older heat meters, although this might mean increasing the number of meter readings from once a year to 3-4 times a year:
  - Highest price for the 4 coldest winter months;
  - Lowest prices for the 4 warmest months; and
  - Medium prices for the remaining 4 months.

- Advantages for the customers include:
  - Able to adjust heat consumption for the most expensive period of the year;
  - Able to avoid heat consumption for the most expensive period of the year by using household heat sources, such as heat pumps.

Dynamic district heating tariffs – the future

- Should be implemented over time in conjunction with;
  - Increasing use of remotely monitored heat meters;
  - Marginal heat production costs become increasingly volatile; and
  - As heat end users increasingly wish to produce their own heat (domestic heat generation).

- Dynamic tariffs are expected to become a necessity alongside increasingly fluctuating electricity production in Denmark (wind – such as last week, where the Danish electricity system produced 140% of their electricity consumption from wind alone). Average annual contribution is currently at 40% of electricity; as this increases to 60% over the coming years, the Danish district heating system is needed increasingly to balance the load.

- Heat production for the district heating network will therefore come from a variety of sources including excess industrial heat (waste heat), CHP, heat pumps, large solar, etc.

Example of a dynamic daily district heating tariff

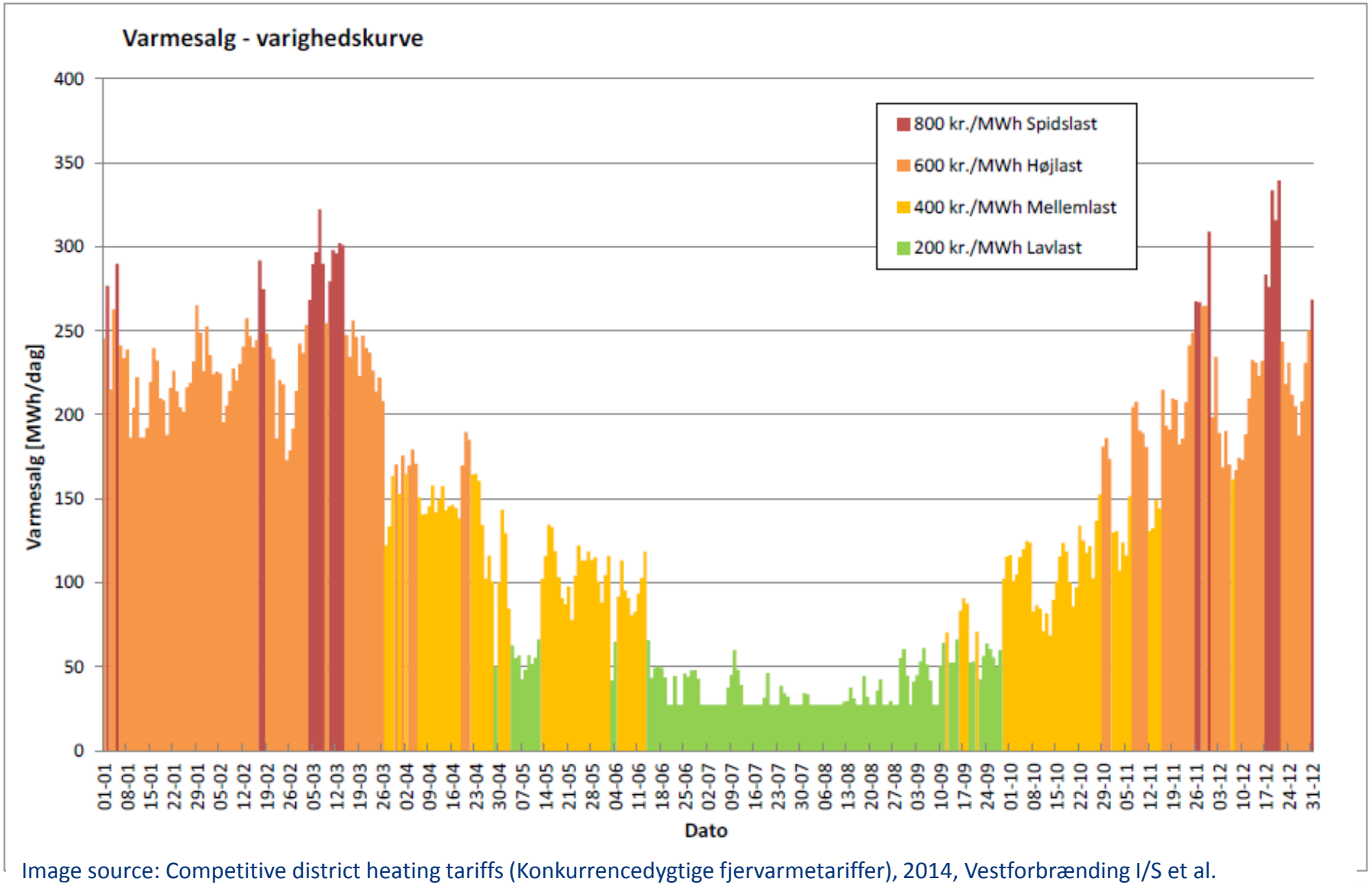


Image source: Competitive district heating tariffs (Konkurrencedygtige fjervarmetariffer), 2014, Vestforbrænding I/S et al.

Sources

- Competitive district heating tariffs (January 2014), published by
  - Vestforbrænding I/S
  - Rambøll Danmark A/S
  - Lystrup Fjernvarme A.m.b.A.
  - VEKS I/S
  - Rødovre Kommunale Fjernvarmeforsyning
  - With financial support from the Danish District Heating Association

- History of Danish district heating in Market Conditions for District Heating, ens.dk, archive folder: http://www.statensnet.dk/pligtarkiv/fremvis.pl?vaerkid=34601&reprid=0&filid=9&iarkiv=1

- Historical tariff information from Vedvarende Energi – de lovgivningsmaessige rammebetingelser, Ellen Margrethe Basse, 2011 (book).

Thank you for listening

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