

Case study

Calculation Tool

Prices and savings in new district heating systems

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Prices and savings in new district heating Calculation tool, used in the case study »Smart Heating System«

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1. Introduction

The purpose of the calculation tool is to be able to present accurate heating prices for building- or dwelling owners, who are considering connection to the new district heating system. The purpose is to be able to present a fairly safe calculation of the heating costs for the individual, if they connect to the district heating system.

The calculation tool is designed in such a way that it *compares* the current cost for the building or dwelling owner with the expected cost of heat delivering from the new district heating system.

The calculation tool is especially intended to present the calculations on citizen *meetings*. The calculation tool thus has - among other things - been used at the citizens' meeting on 18 June 2018.¹

Citizens were asked to bring information about their heat consumption - either in kWh, liters of oil, cubic meters of gas, etc. - or in the form of purchases of fuels over the past year. On this basis, the annual energy consumption for the dwelling or building in question is calculated in the tool. Based on the heat calculated heat consumption, the new heating from the district heating supply is calculated.

As mentioned, the calculation tool is primarily used for citizens' meetings; but it has also been made available to interested parties, etc. It has been used at the mentioned

¹ See the report: Case Study: Smart Heating Systems. Surplus heat for Havdrup and Kirke Skensved. Case study in BEA-APP; Roskilde University 2018, p. 28.

citizens' meeting in June 2018, but the tool also presented at a number of smaller meetings.

The idea is that the tool not only should be used by »experts«, but also by the board of the district heating association's board. At the mentioned citizens' meeting in June 2018, ten computers were set up, where we, as experts together with board members from the district heating association, calculated heating costs for the individual citizen. After the calculations, the individual citizen was offered a printout of the calculations. This involvement of the board members also provided a good opportunity for further discussion and contact between the board members and the citizens.

To help with the calculations, we prepare a guide for board members so that nothing could go wrong. The calculation guide is presented in the next section:

2. Instruction for the user of the calculation tool

(See the spreadsheet in appendix)

1. General

Place: Write address and check the city area (Havdrup, Kirke Skensved, Nauerbjerg)

2. The current energy consumption

Energy consumption: Ask for energy consumption, broken down by the individual energy sources - see the table

Conversion: If the energy consumption is not provided by the units used, the conversion table is used for various possible information. Look at appendix 1.

Heat source: There may be a need to ask for hot water consumption: Always ask if the heating source is either electric heat, air-to-air heat pump, wood-burning stove, wood chip part, and perhaps also with ground heat (pump). Typically, in these cases, electric-heated hot water tank will be used.

If electricity is heated water: If so, and if people cannot tell how much electricity is used for the production of hot water, you should estimate the figure. A good estimate is 10% of a normal heat consumption. Write: 2,800 kWh, which is entered in the category: 'Electric heating / electric water heater' and possibly added to electricity consumption for heating.

Calculation: Now you can calculate annual consumption and annual costs. tell the amount and ask people whether they are likely to spend so many dollars a year.

Correction: If people think the amount is too high or low, ask them how much they pay for their fuels. This is typically the case for the prices of the following fuels: wood, briquettes, wood chips, wood pellets, coke and the like.

3. Savings on the energy bill

Energy bill: The annual savings on the establishment of district heating are evident from the table: partly the annual savings in kroner and ears, and partly in percent. Under very special circumstances, there will be no savings, e.g. natural gas fired hou-

ses of over 160 m². If there is no energy saving, it may be an idea to review the current energy consumption again. If necessary, see the category 'Energy consumption calculated'.

4. If there are no radiators in the house

If radiators are to be installed: If people have electric heat, air-to-air, radiators would typically have to be installed in the house. It is an installation that people themselves have to pay. We expect an expense of DKK 6,000 per. radiator.

You must do the following:

- ask for how many rooms are to be heated. Enter the number in the spreadsheet
- you now get an annual expense if the amount is borrowed on a loan over 15 years with an interest rate of 5% p.a.

3. The use of the tools

In order to use the calculation tools, it is necessary to calculate the total costs. Here are the following steps:

1. Calculation of the *investment costs* for heat source (boiler plant) and district heating network (see the case report)
2. Calculation of *annual operating costs*: annual cost of capital, fuel costs, operation and maintenance, etc.
3. Establish a *tariff system* based on the annual costs. The tariff system can be set up in many ways. Here are the following:
 - Administrative costs (fixed annual amount)
 - Contribution to capacity costs, that is cost which is typically adjusted to the size of the house; number of heated square meters.
 - Heat consumption; payment for the heat consumed.

In this case, the tariff system is arranged so that all costs are covered by the tariffs. People who join the district heating system should not have »money out of their pocket«. The tariff system can of course be arranged in many ways.

The appendix shows two pages from the calculation tool, namely the page that is printed to the citizen and the calculations behind.

Beregning af priser ved fjernvarme

Fjernvarme i Havdrup, Naurbjerg og Kirke Skensved

Fjernvarmeprisen sammenlignet med dagens varmepris

De forventede udgifter til fjernvarme i sammenligning med dine aktuelle varmeudgifter. Der er tre beregninger:

- **For det første** beregnes dine aktuelle omkostning inklusiv brændsel, vedligehold, service, afgifter og moms, men uden anlægsudgifter (du har jo anlægget).
- **For det andet** beregner vi dine omkostninger ved fjernvarme svarende til dit aktuelle varmeforbrug. Beregning dækker alle omkostninger: Anlægsinvesteringer, tilslutning, varmeudgift, afgifter og moms.
- **For det tredje** - Hvis du har el-varme beregnes omkostning ved fjernvarme **inklusiv** opsætning af radiatorer, rørføring mv. i huset.

Adresse:

Skriv

Opvarmet areal i m²: m²
 Energiforbrug - beregnet: MWh

Sted: Havdrup
 Kirke Skensved
 Naurbjerg

1. Anvendt varmekilde i dag:

Gasfyr, naturgas	<input type="text" value="0"/>	Nm ³	
Oliefyr, fyringsolie	<input type="text" value="2.100"/>	liter	
Oliefyr, bioolie	<input type="text" value="0"/>	liter	
Elvarme/elvandvarmer	<input type="text" value="0"/>	kWh	
Jordvarme	<input type="text" value="0"/>	kWh	
Luftvarmepumpe	<input type="text" value="0"/>	kWh	
Brændeovn, træ	<input type="text" value="0"/>	kg	
Brændeovn, briketter	<input type="text" value="0"/>	kg	
Træflis kedel	<input type="text" value="0"/>	kg	
Træpillefyr	<input type="text" value="0"/>	kg	
Varmecentral Øresædet	<input type="text" value="0"/>	kWh	<input type="text" value="371"/> m ³ Afgift
Koksforbr.	<input type="text" value="0"/>	kg	

Beregnet omkostninger efter dagens priser: kr om året

Priserne er inklusiv brændsel, vedligehold, service, afgifter og moms på bestående anlæg.

2. Fjernvarme

Beregnet omkostninger efter overslag på anlæg: kr om året

Forventet årlig besparelse: kr om året

Besparelse i procent: kr om året

NB: Kun hvis der er radiatorer og rør (centralvarme anlæg) i forvejen

Priserne er inklusiv **anlægsinvesteringer**, tilslutning, varmeudgift (fast og variabel), afgifter, moms.

3. Fjernvarme, hvis der ikke er radiatorer i huset

Beregnet omkostninger efter overslag på anlæg:

Instal. vandbåren system: antal/rum kr om året

Årlige udgifter i alt: kr om året

Forventet årlig besparelse: kr om året

Besparelse i procent: kr om året

Priserne er inklusiv **anlægsinvesteringer**, tilslutning, varmeudgift (fast og variabel), afgifter, moms.

Antallet af rum er kun udfyldt, hvis du har elvarme og skal have radiatorer. Her er der regnet med en finansiering over 15 år med en rente på 5% for radiatorerne.



Data til beregning omkostninger ved eksisterende forsyning

Omkostninger ved bestående forsyning

De blå tal er baseret på data, som i givet fald kan ændres

Nuværende forsyning Udgifter kr. inkl. moms	Energiforbrug	Energipriser	Varme- udgift	Elforbrug olie/gas	Takst Ørnesd.	Eftersyn service	Diverse	Samlet udgift	Virknings- grad	Brænd- værdi	Varme MWh	kWh pr. m ²
Gasfyr, naturgas	0 Nm ³	7,31 Nm ³	0	0	0	0	0	0	88%	11,00 kWh/Nm ³	0,0	0,0
Oliefyr, fyringsolie	2.100 liter	10,59 kr./liter	22.236	460	-	1.500	-	24.196	85%	10,00 kWh/liter	17,9	148,8
Oliefyr, biodiell	0 liter	8,25 kr./liter	0	0	0	0	-	0	85%	9,00 kWh/liter	0,0	0,0
Elvarme/efvandvarmer	0 kWh	1,72 kr./kWh	0	-	-	0	-	0	100%	1,00 kWh/kWh	0,0	0,0
Jordvarme	0 kWh	1,72 kr./kWh	0	0	0	0	-	0	3,2	1,00 kWh/kWh	0,0	0,0
Luftvarmepumpe	0 kWh	1,72 kr./kWh	0	0	0	0	-	0	2,8	1,00 kWh/kWh	0,0	0,0
Braendevovn, træ	0 kg	1,00 kr./kg	0	-	0	0	-	0	70%	4,00 kWh/kg	0,0	0,0
Braendevovn, briketter	0 kg	2,00 kr./kg	0	-	0	0	-	0	70%	4,65 kWh/kg	0,0	0,0
Træflis kedel	0 kg	1,45 kr./kg	0	0	0	0	-	0	75%	2,90 kWh/kg	0,0	0,0
Træpillefyr	0 kg	2,60 kr./kg	0	0	0	0	-	0	80%	4,90 kWh/kg	0,0	0,0
Varmecentral Øresødet	0 kWh	0,26 kr./kWh	0	0	0	0	-	0	100%	- kWh/kg	0,0	0,0
Koksfor	0 kg	9,00 kr./kg	0	0	0	0	-	0	80%	9,50 kWh/kg	0,0	0,0
Samlede årlige udgifter			22.236	460	0	1.500	0	24.196			17,9	148,8

Beregning af omkostninger ved forsyning med fjernvarme for huse uden radiatorer

	Omkostninger/takster	Årlige omkostninger	Etablering af radiatorer Rente	Pris pr. Radiator Afskrivningsperiode installeret
Etablering af radiatorer	0 kr.	0	5,0%	15 år
Målerleje	313 kr./år	313		
Fast arealafgift	18,50 kr./m ²	2.220		
Forbrugsafgift	661,00 kr./MWh	11.799		
Ialt årlige udgifter - abonnement, areal- & forbrugsafgift:		14.332		7.000

Takstsystemet for den faste arealafgift er indirekter sådan:

Takstsystem
 Areal: **18,50** kr pr. m² op til grænsen
 Grænse: **160** m²
 Over grænsen: 160*18,50 eller 2.960 kr

De blå markerede tal kan ændres