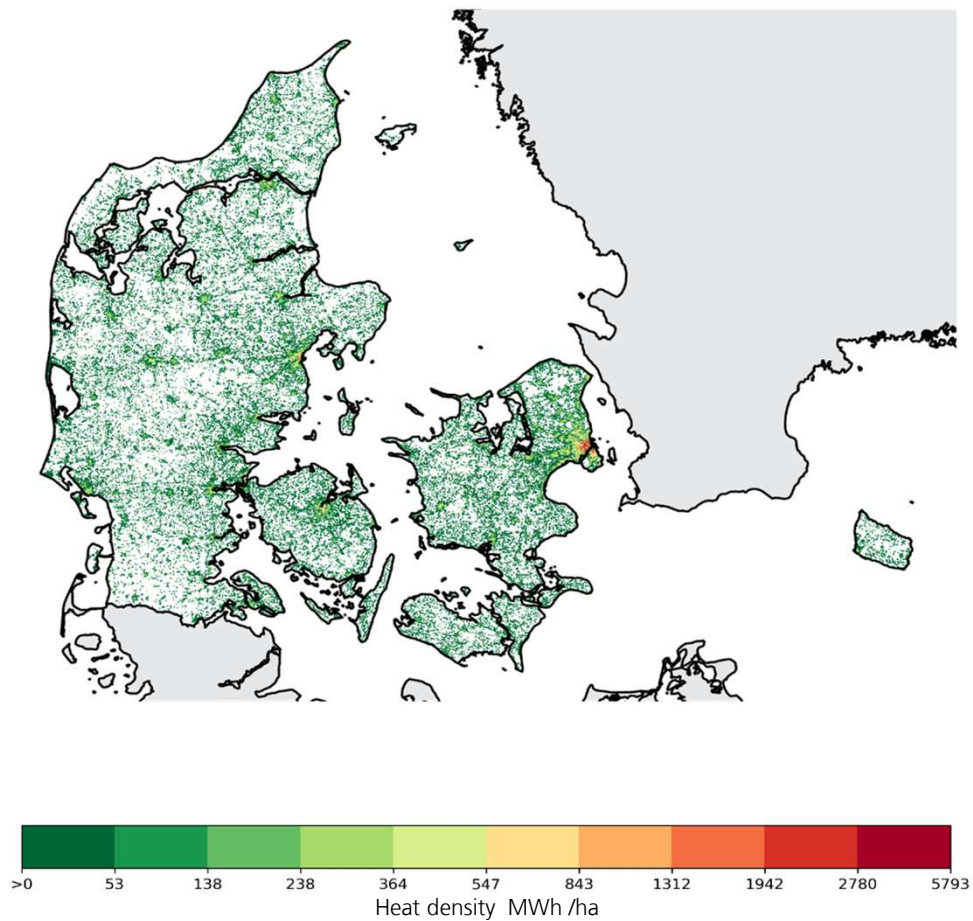


# Space heating market summary

2017

Denmark



Source: <https://www.hotmaps.eu/map>

## **Description of the heat supply sectors of individual EU Member States** ***Space heating market summary 2017- Denmark***

### **Project**

ENER/C 1/2018-494 – Renewable Space Heating under the Revised Renewable Energy Directive

### **Authors**

#### **FRAUNHOFER ISI**

Mahsa Bagheri (mahsa.bagheri@isi.fraunhofer.de)

Tim Mandel

Tobias Fleiter

#### **VIEGAND MAAGOE**

Jan Viegand

Rikke Naeraa

#### **OEKO INSTITUTE**

Sibylle Braungardt

#### **TU WIEN**

Lukas Kranzl

### **Published**

May 2021- Karlsruhe

The information and views set out in this study are those of the author(s) and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this study. Neither the Commission nor any person acting on the Commission's behalf may be held responsible for the use which may be made of the information contained therein. This report has been prepared by the authors to the best of their ability and knowledge. The authors do not assume liability for any damage, material or immaterial, that may arise from the use of the report or the information contained therein.

This country report is prepared as part of the project **Renewable Space Heating under the Revised Renewable Energy Directive-ENER/C1/2018-494**. The report aims to provide a description of today's energy use and supply for space and water heating in the individual EU member states. The country report includes information on the energy consumption for space and water heating supply, the technology distribution, and building structure as well as the regulatory frame in place. Data is shown for the year 2017 if not stated otherwise.

The report is divided into three parts, and the content and data sources for each part are explained below. Different methods and sources are used for the various topics, and while some data is directly retrieved from Eurostat statistics, other data is calculated based on additional assumptions and modeling, which implies larger uncertainty.<sup>1</sup>

### Part 1: Heat demand structure and energy use for heat supply

The information shown in part 1 is mainly based on the data collected or calculated in section 2.1 of the project<sup>2</sup> unless otherwise specified. For this part, the following key data is included in the country reports:

**Building stock data:** this data provides an overview of the building stock structure, which is a central determinant of any heating and cooling transition. The data includes the total floor area of the buildings in each sector (Residential, Commercial & public services and Industry). For residential buildings, the data is further detailed for the main building types, single-family house (SFH) and multi-family house (MFH), and by the number of dwellings and total floor area for each type. The age classification of residential buildings is also covered in this part. The main consulted sources are Building Stock Observatory, ODYSSEE database, and the Hotmaps project.

**Climate data:** the climate of a country directly affects heating or cooling needs. We present heating degree days in comparison with the EU-27 average. Data is collected from Eurostat [nrg\_chdd\_a].

**Overview of energy demand:** this includes the final energy demand (FED) for space and water heating in total, by energy carrier, and by sector. It presents relative importance, by comparing the demand for space heating & hot water to the total final energy demand of a country. The final energy demand is depicted via energy commodities e.g. natural gas, electricity or district heating. In addition, the country sheets show the primary energy demand, which includes the primary energy carriers like coal, wind or nuclear energy instead of secondary energy carriers like electricity or district heating. Thus, it allows estimating the overall share of renewable energies used to provide space heating and hot water. Several national and EU sources and statistics have been used to cover the framework data needed for the calculation of the energy balances. The main data sources include Eurostat [nrg\_bal] and [nrg\_chdd\_a], TABULA and ODYSSEE databases,

---

1. Further indication of data sources and methodologies is described in the main report of the project.

2. Task 1: Establish energy consumption for space and water heating for EU

Hotmaps project and Building Stock Observatory. Eurostat energy balances are a major input and frame for the data set. The available figures on primary and final energy carriers in the energy balances are used as the reference for calibrations of the calculated energy demand in different sectors. A detailed summary of the methodology for the calculation of useful, final and primary energy is provided in section 2.1.2 of the project's report.<sup>3</sup>

**Generation mix:** the energy mix used for district heating and electricity generation directly affects the share of renewable energies in space heating and hot water supply. Here, we show the primary fuel mix for electricity and district heating generation by quantities of the type of fuels utilized. The primary data sources for this part are the Eurostat energy balances [nrg\_bal].

**Space and water heating in residential building sector:** the residential sector is presented more in detail, as it is the most relevant demand sector of space and water heating in the EU. The data set shows the final energy demand by end use, final energy demand for space and water heating by energy carrier, and specific final and primary energy demand per building floor area by the main building types (SFH and MFH). The specific energy demand is an indication of the thermal efficiency of the building stock, but is also influenced by other factors like the climate, the characteristics of the building stock (e.g. age class and renovation status), or the user behavior. Data sources are similar to the overview of energy demand and building stock data above.

## Part 2: Technology stock

The input for this part is mainly the output data from section 2.2 of the project's report<sup>4</sup>. The heating technologies are categorized in "district heating supply" and "individual heating systems" and each are shown in different graphs. The following key data is included in the country reports:

**Technology mix:** illustrating the data on heating equipment stock by installed capacities of the technologies and their age. The data is primarily based on the Danish Technology Catalogues and economic parameters are scaled relative to the Danish prices for each country. The investment cost based on the catalogues is the overnight cost. Key assumptions regarding technologies:

### Solar thermal

- The heating efficiency is calculated for the three different climate zones based on irradiance and average temperatures.
- The cost of individual solar thermal is calculated without storage solutions and as only covering a part of the domestic hot water demand.

### Heat pumps

- COP is found from studies for different forward temperatures in an average climate zone (Strasbourg) for an air-to-water heat pump and scaled to the other climate zones.

3. Methodology: Calculation of heating energy balances

4. Task 2: Comparative overview of renewable space and water heating technologies

- Ground-source heat pumps have lower scaling coefficients due to less variance in ground temperature compared to air temperature.
- Ventilation heat pumps have similar COP across climate zones based on an assumption of similar room temperatures.

**Levelised cost of heat:** compares the costs for heat generation for different heating technologies. Levelised cost of heat (LCOH) is calculated for each country, with and without taxes, and distributed into different climate zones and required supply temperatures. The LCOH for district heating describes the cost of supply and does not contain distribution costs. The LCOH is calculated by adding up the discounted investment cost, fuel costs, auxiliary electric costs, O&M costs and dividing by the discounted heat production throughout the technology's lifetime. Revenues from generated electricity are subtracted before division by the discounted heat production. For combined heat and power plants (CHPs), the electricity spot price is used. For individual technologies, the retail electricity price is used.

**Stock for district heating technologies:** stock for district heating technologies, except for electricity generating technologies, is estimated based on the development in gross heat production (GHP) from 2012 to 2018. The stock from Mapping and analyses of the current and future (2020 – 2030) heating/cooling fuel deployment (fossil/renewables) is aggregated into the technology categories used in this analysis, and scaled with the difference in GHP. Geothermal, solar thermal, and heat pump stock is based on recent overviews of large-scale installations.

**Stock for individual technologies:** it is based on sales data from ecodesign studies, market statistics, previous heating and cooling studies, and the FED from part 1. Stock of heat pumps is taken from the annual report of 2019 from the European Heat Pump Association. Stock of non-solid fuel boilers, oil and gas, are based on an ecodesign study for Space and combination heaters that provided recent stock numbers and sales data for the European Union. Stock for solid fuel boilers is largely based on the FED in the residential sector, along with climate zone specific full load hours, average capacities to determine total installed capacity, and the stock. To determine the distribution of FED of biomass, the stock for individual biomass stoves from Mapping and analyses of the current and future (2020 – 2030) heating/cooling fuel deployment (fossil/renewables) was used to remove their share from the FED, and it is then assumed that the rest of the FED is covered by biomass boilers.

The stock was not available in the same technology categories as employed here, and thus assumptions have been made regarding distribution, i.e. distribution of gas boilers into condensing and non-condensing. Similarly, the distribution into different age categories are the same across countries due to the data being on EU-wide basis.

### Part 3: Policies and historical trends

For this part, the following key data is included in the country reports:

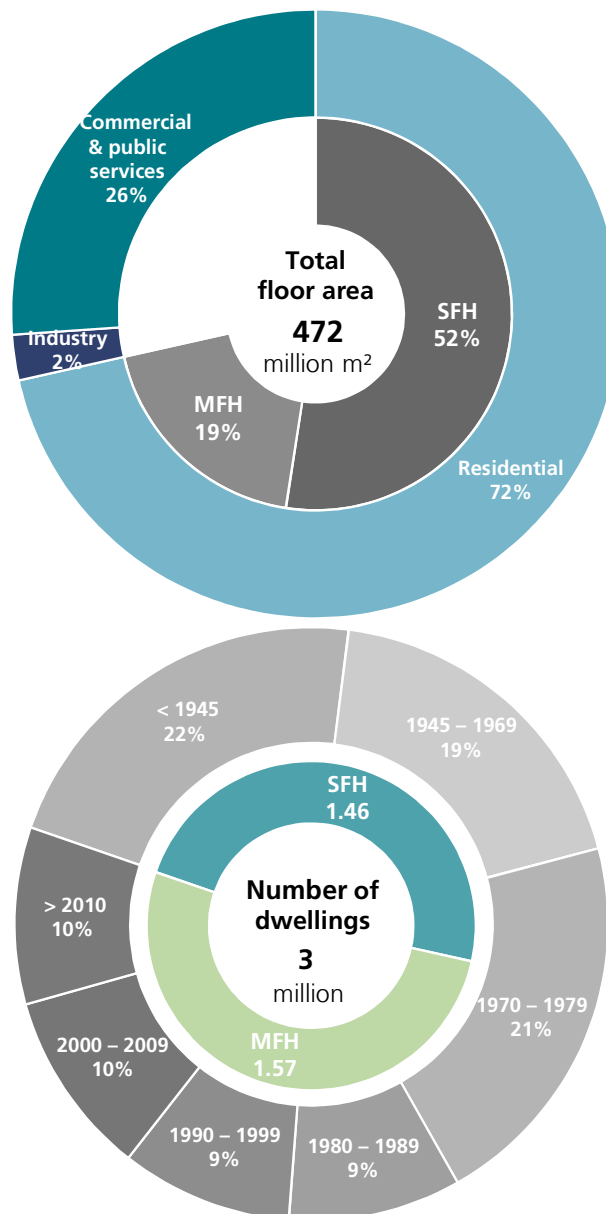
**Overview of policies:** covering existing policies for heating, renewable heating, and the decarbonisation of heat. This includes regulatory (e.g. zoning, building regulation), fuel taxes and other fiscal and financial measures (e.g. as carbon taxes), support measures, the distribution of regulatory and policy responsibilities at national, regional and local levels. The overview is based on literature review, desk research, and the following key databases: RES-Legal database, MURE database, IEA/IRENA Global Renewable Energy Policies and Measures Database, IEA Energy Efficiency Policies and Measures Database, Comprehensive assessments of the potential for efficient heating and cooling, National energy and climate plans (NECPs).

**Historical trends:** following indicators are selected to show the historical developments of the heat sector. Data for this part is extracted from Eurostat.

- **RES-H shares in heating and cooling 2004-2017:** They show the evolution of renewables in total heating and cooling energy demand. Note that by including process heating, this indicator goes beyond space heating. However, as space heating has the highest share in total heating, the trends give an important indication for space heating. Data is collected from Eurostat [nrg\_ind\_ren].
- **Energy carrier shares in residential sector 2000-2017:** The evolution of energy carrier shares in the household sector shows important structural shifts, like market share gains of natural gas or renewable energies. Note that this indicator has a broader scope than only space heating, as it also includes electricity consumption (mostly for non-heating end-uses), and gas use for stoves. However, space heating accounts for the major share of most energy carriers, and results show robust trends for space heating. This indicator can also be used to explain changes observed in the above RES-H indicator. Eurostat [nrg\_bal\_c] is used as the data source.
- **Energy carrier shares in gross heat production of district heating 2000-2017:** As district heating is mainly used for space heating, this indicator provides a good overview of structural changes in the upstream heat supply, ultimately affecting primary energy and embodied CO<sup>2</sup> emissions in space heating. Data source for this part is Eurostat [nrg\_bal\_peh].

## Building Stock Data

SFH: Single family house  
MFH: Multi-family house



Denmark 2017

5

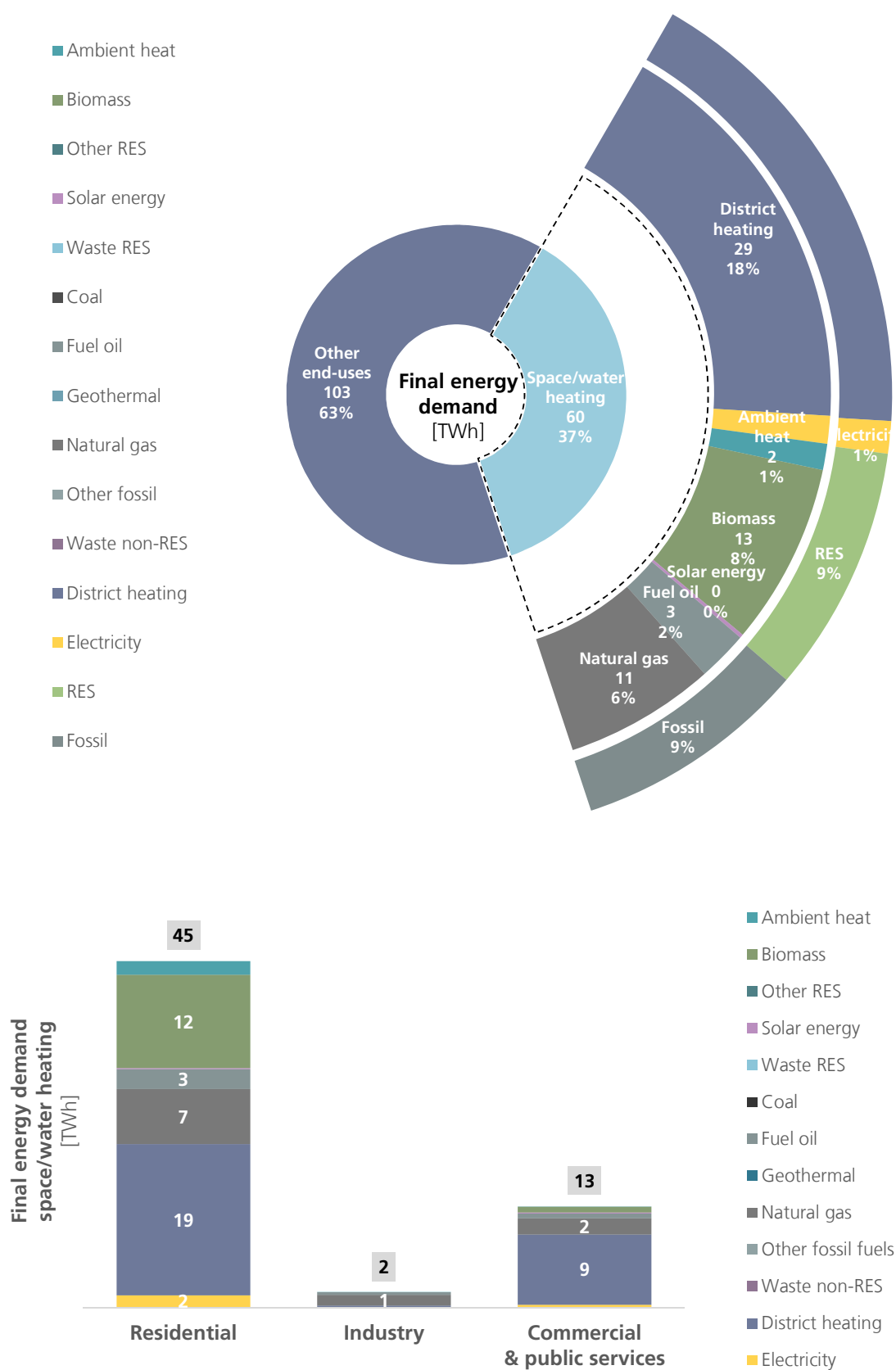
## Climate Data

Heating degree days	Denmark	EU-27
Average value 2000-2017	3232	3098

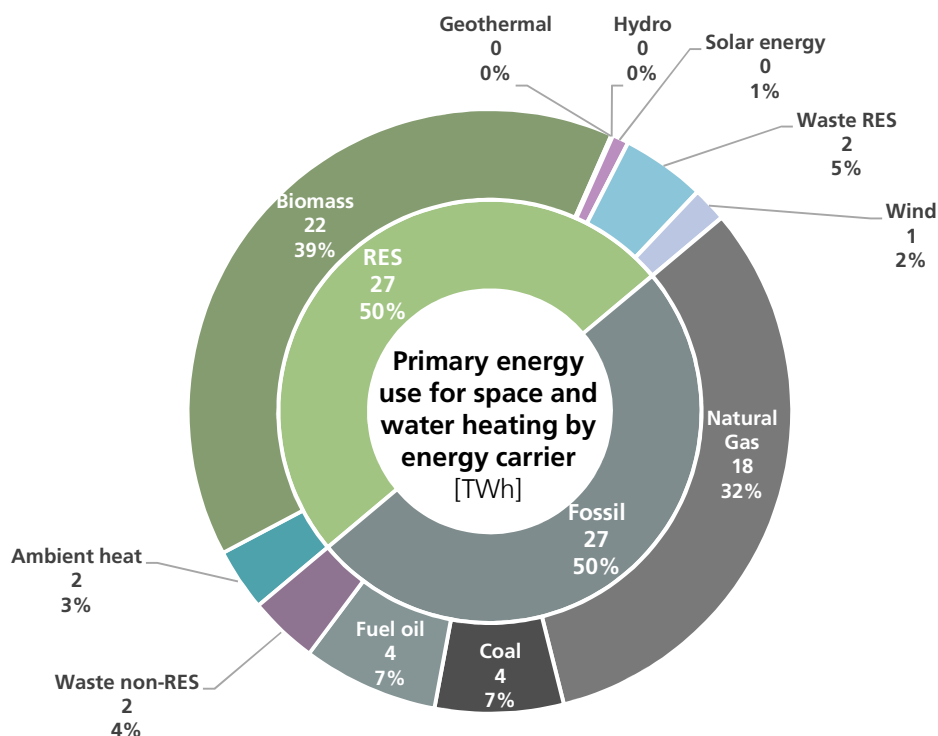
## Overview of energy demand

Denmark 2017

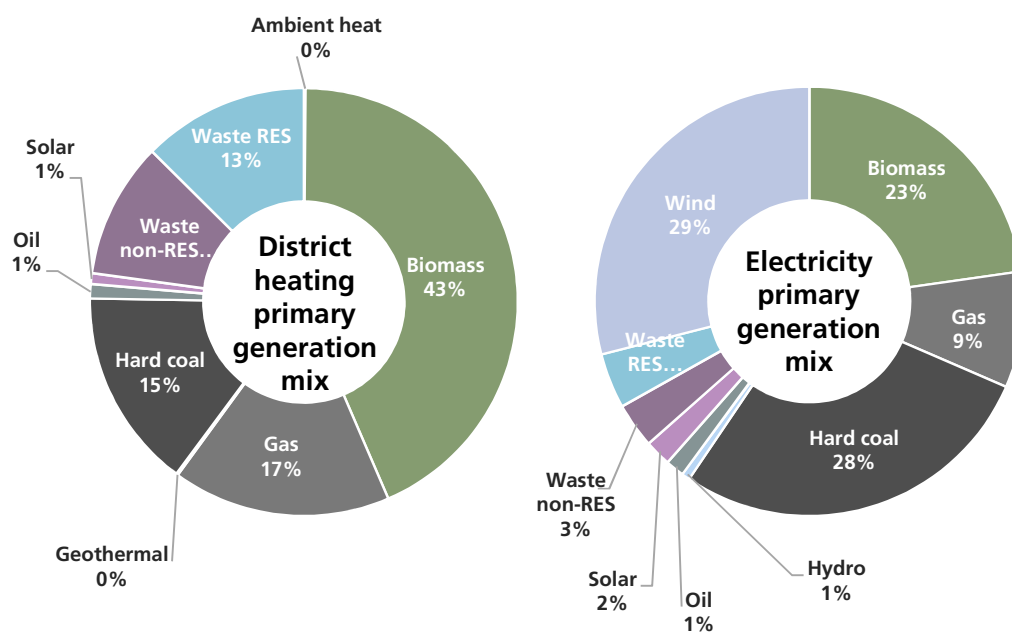
6







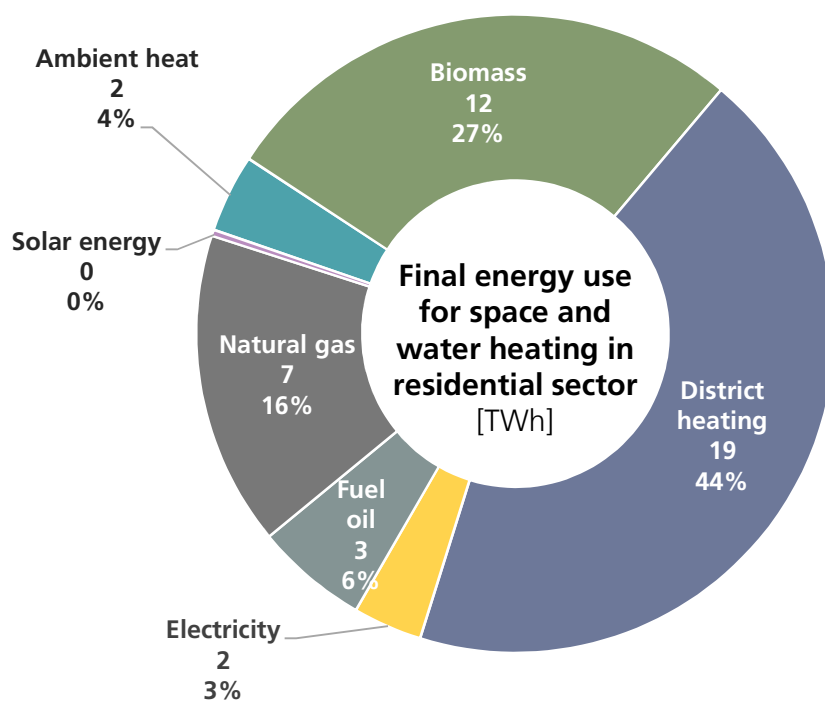
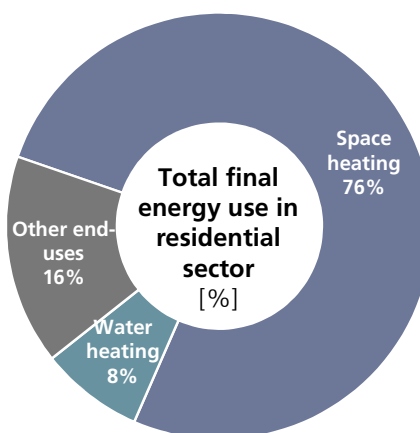
## Generation mix



## Space & water heating in residential sector

Denmark 2017

8



### Specific energy demand

**132 kWh/m²yr**  
Final energy demand

**123 kWh/m²yr**  
Primary energy demand

**149 kWh/m²yr**  
Single-family dwellings

**139 kWh/m²yr**  
Single-family dwellings

**86 kWh/m²yr**  
Multi-family dwellings

**80 kWh/m²yr**  
Multi-family dwellings

## Technology mix

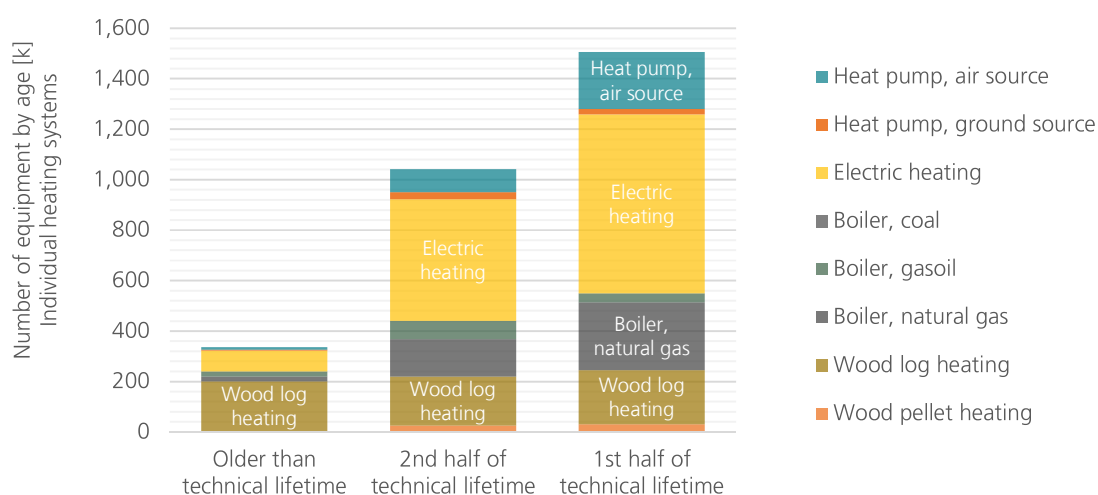
Denmark 2017

Technology		Total number of equipment [k]	Older than technical lifetime (%)	2nd half of technical lifetime (%)	1st half of technical lifetime (%)	Technology efficiency [%]	Installed capacity [GWth]
Individual heating systems	Heat pump air source	329	3%	28%	69%	3.8	2.0
	Heat pump ground source	53	6%	53%	41%	3.7	0.5
	Solar thermal	227*	3%	27%	70%	0.5	0.2
	Electric heating	1,275	7%	38%	56%	1.0	1.3
	Boiler, coal	-	-	-	-	0.8	-
	Boiler, gasoil	128	16%	57%	27%	0.9	1.9
	Boiler, natural gas	436	4%	34%	62%	1.0	4.5
	Wood log heating	604	32%	32%	35%	0.7	7.1
	Wood pellet heating	61	8%	41%	51%	0.8	0.7

9

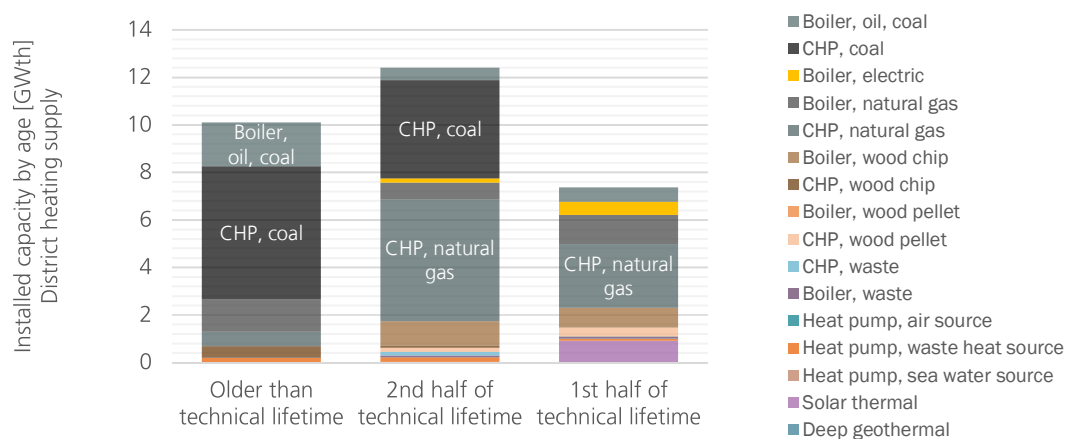
\* unit 1000 m<sup>2</sup>

- no data

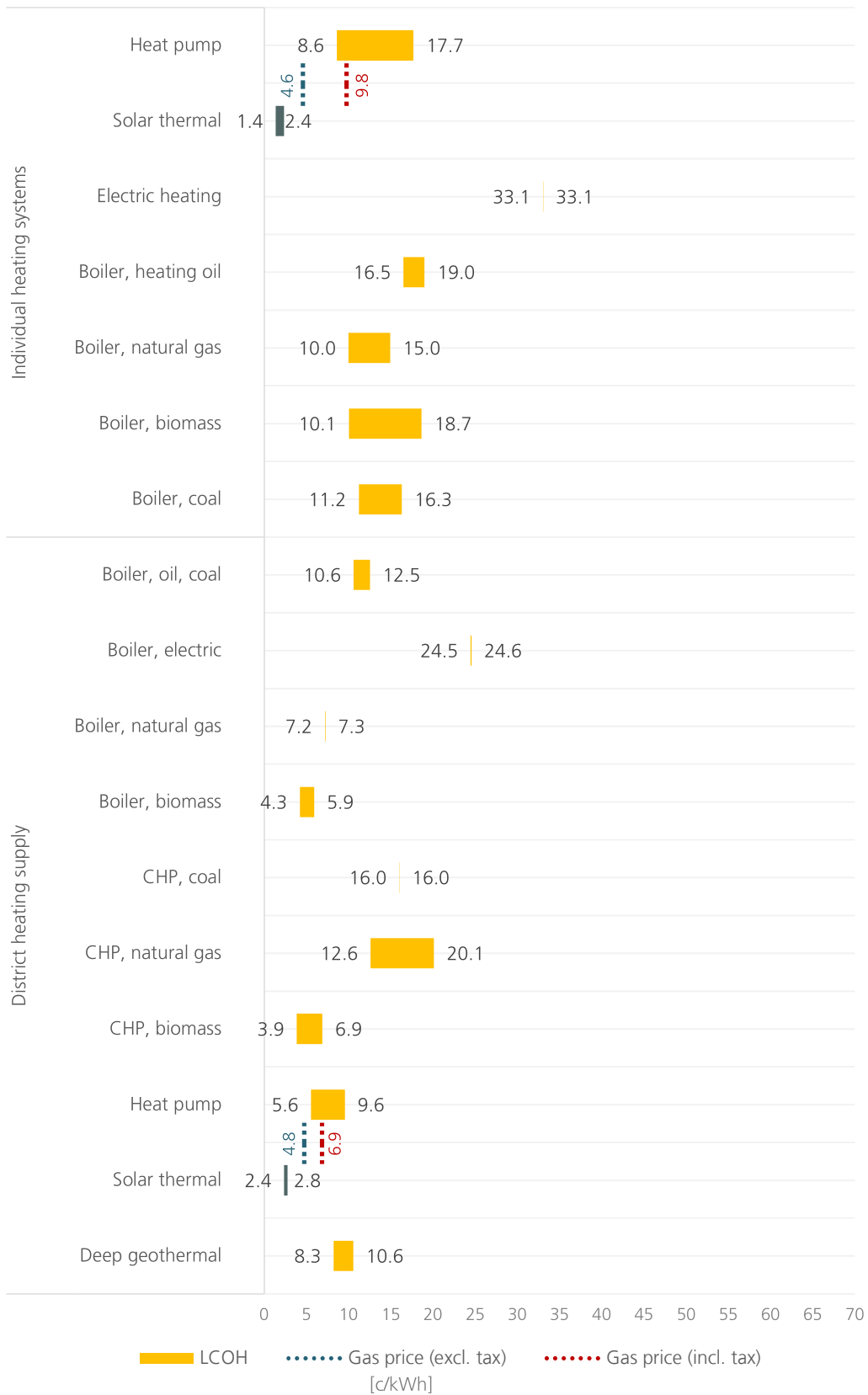


Technology		Total number of equipment	Older than technical lifetime	2nd half of technical lifetime	1st half of technical lifetime	Technology efficiency [%]	Installed capacity [GWth]
District heating supply	Boiler, oil, coal	227	48%	29%	24%	0.9	3.0
	CHP, coal	9	56%	44%	0%	0.5	9.7
	Boiler, electric	49	0%	3%	97%	1.0	0.7
	Boiler, natural gas	295	33%	26%	40%	1.1	3.3
	CHP, natural gas	720	4%	80%	15%	0.4	8.4
	Boiler, wood chip	338	0%	53%	47%	1.1	1.9
	CHP, wood chip	8	50%	50%	0%	0.9	0.6
	Boiler, wood pellet	-	-	-	-	1.0	-
	CHP, wood pellet	8	0%	50%	50%	0.7	0.6
	CHP, waste	7	0%	86%	14%	0.8	0.1
	Boiler, waste	5	6%	33%	61%	1.1	0.2
	Heat pump air source	12	17%	0%	83%	3.4	0.0
	Heat pump waste heat source	29	33%	33%	33%	5.0	0.5
	Heat pump sea water source	-	-	-	-	3.3	-
	Solar thermal	109	3%	4%	94%	0.5	0.9
	Deep geothermal	-	-	-	-	6.5	-

- no data





## Levelised cost of heat (incl. tax)



## Overview of policies

<b>Financial support schemes</b>		
<b>Financial support for RES-H investments</b>		
	Financial support specifically addressing low-income households	
	Financial support specifically addressing public buildings	
	Scrapping schemes for heating equipment based on fossil fuels	
<b>Financial support for energy efficiency investments</b>		
	Financial support specifically addressing low-income households	
	Financial support specifically addressing public buildings	
<b>Financial support for RES-H infrastructure investments</b>		
<b>Price-based mechanisms (renewable heat incentives)</b>		
	Heat incentives for central heating systems	
	Heat incentives for decentral heating systems	
<b>Energy- and CO<sub>2</sub> pricing</b>		
	CO <sub>2</sub> pricing	
	Tax exemptions for electricity for heat pumps	
<b>Regulatory measures</b>		
<b>RES-H obligations</b>		
	RES-H obligation for new buildings	
	RES-H obligation for existing buildings	
	Trigger point: Major renovation	
	Trigger point: Exchange of heating system	
<b>RES-quota for district heating</b>		
<b>Priority access for RES and/or waste heat in district heating</b>		
<b>Energy efficiency requirements for new buildings</b>		
<b>Energy efficiency requirements for existing buildings</b>		
	Trigger point: Major renovation	
	Trigger point: Transfer of ownership or new tenancy	
	Trigger point: Efficiency class below certain level	
<b>Ban on fossil fuel heating technologies (oil and/or gas)</b>		
	New installations in new buildings	
	New installations in existing buildings	
	Use of fossil fuel heating technologies	
	Phase-out for certain building segments (e.g. public buildings)	
<b>Energy efficiency obligations (including buildings)</b>		
<b>Zoning regulations for DH and/or Gas</b>		
<b>Information and planning</b>		
<b>National Database for EPC</b>		
<b>National requirements for urban heat planning</b>		

 No measure

 Measures in development

 Measures in place

