Denmark: Strategic Market Outlook

Svend Vinther Pedersen, Danish Technological Institute, Denmark

The number of heat pumps sold per year has doubled since 2016. In new build, a ban on gas and oil boilers is a key driver for heat pumps. In existing buildings, a ban on replacement oil boilers, as well as available subsidies to switch from gas or oil to heat pumps, are driving a shift towards heat pumps. A large number of heat pumps (particularly air/air) are also being sold without subsidies, driven by the running cost savings achievable and the simplicity of the heating system (especially compared to wood/biomass). In relation to consumers' running costs, the price of electricity in relation to other forms of heating such as gas, oil, district heating or biomass (wood/pellets) is critical, and Denmark has had some of the highest electricity prices in Europe. To counteract this, a reduction in the tax on electricity for heating was introduced in 2016, and by 2021, this tax has been reduced almost to zero. In recent years, the drop in gas prices has made it more challenging for electric heating, so hydronic heat pump sales did not increase as much as anticipated, but the gas price rises in 2021 have been positive for heat pumps.

With the massive political focus on phasing out fossil fuels, heat pumps for residential heating are today a popular form of heating among Danish homeowners, and sales have doubled in the last 5 years, where heat pumps have displaced mainly oil boilers. Large heat pumps are also growing fast. The climate goals to reduce CO_2 emissions by 50-54% in 2025 and 70% in 2030 compared to the 1990 level, and the fact that the district heating companies aim to phase out biomass by 2040 to achieve the target, means that it is necessary to implement a large proportion of heat pumps in the district heating network and utilize excess heat in a higher proportion than today.

The heating market in Denmark

There are 2.8 million households in Denmark. Today, the total building area in Denmark is heated by district heating (54.5%), gas (18.1%), oil (10.9%), direct electric heating (6%), biomass boilers or furnaces (6%), and individual heat pumps (4%), see Figure 1. The gas network was greatly expanded from 1980 to utilize the gas from the North Sea, but as the production is declining, there is now a great focus on reducing the use of natural gas and oil and converting to district heating or heat pumps.

Decarbonization objectives at a national level

In 2012, the first political objectives came, which influenced the sale of heat pumps. The main goals are the phasing out of fossil fuels and increased electrification. The objective is that Denmark's energy demand should be covered by renewable energy in 2050, the production of electricity and heat should be renewable by 2035, and 50% of electricity consumption should be covered by wind energy in 2020. At the same time, an

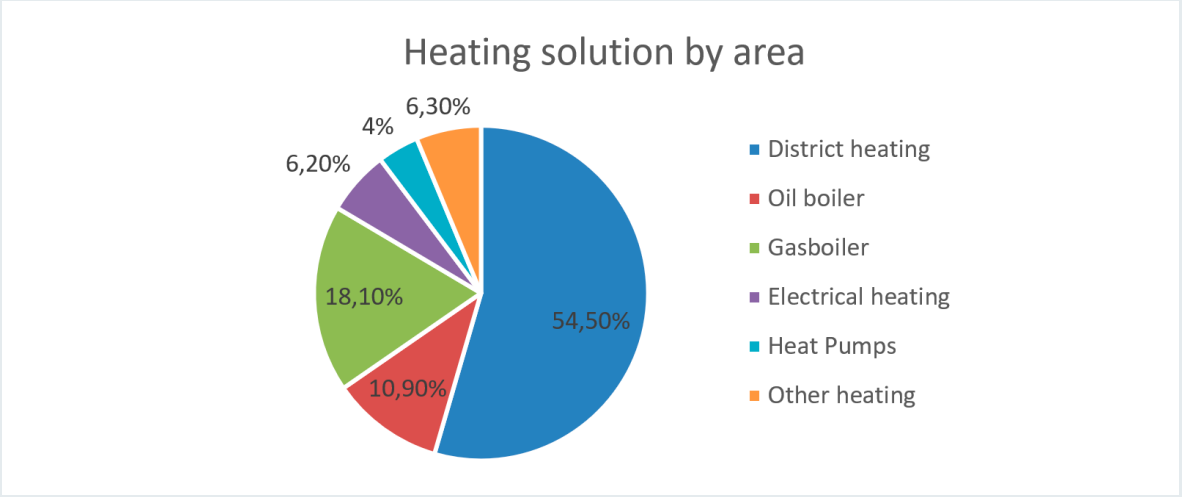

Figure 1: Heating solution by area

energy agreement was made which banned the installation of oil boilers and natural gas in new buildings from 2013 and banned the installation of oil boilers in existing buildings with access to natural gas and district heating from 2016. In addition, the electricity tax for electric used for heating was reduced by 4 euro cents/kWh, which means that the total electricity price decreased by 6.7 euro cents/kWh. In 2018, this tax was further reduced by 2 Euro cents.

In 2020, another political energy agreement was signed, which states that oil and gas boilers must be phased out with green alternatives such as district heating or heat pumps. A scrap-page scheme was established to provide incentives for the scrapping of oil-fired boilers, and the building renovation scheme was also established, which incentivizes energy renovation and conversion to heat pumps or district heating. In addition, it is a requirement that to receive the financial support, the heat pump installer must have passed the course for renewable heat installer for heat pumps (VE-G). As a result, in the last year, almost 1000 installation companies have been certified. In addition, the electric heating tax is reduced to 0.1 Euro cent.

The most recent energy agreement in May 2021 strengthened even further the drive away from fossil fuels in the heating sector. The goal is for CO_2 emissions reductions to 50-54% in 2025 and 70% in 2030 compared to 1990, and to achieve climate neutrality in 2050.

Policy drivers for individual heat pumps

The main drivers in the Danish market have been the bans on the installation of oil and gas boilers in new buildings from 2013 and the ban on installation of oil boilers in natural gas and district heating areas from 2016, as well as the reduction of electricity tax which makes electric heat pumps competitive with gas on running costs. The two subsidies have also been key drivers: firstly, the energy renovation scheme, which provides incentives for energy renovation including heat pumps, worth up to approx. 3000 euros, and attracting 19,000 applicants in 2020; and secondly, the scrap-page scheme for oil-fired boilers established in 2016 (which attracted around 20,000 applications in its first year) for subsidies for the installation of a heat pump.

Another driver has been the availability of alternative ways to buy heat pumps – like leasing and subscription models, which means heat pumps are available to consumers for a low investment cost. In 2013, the Danish Energy Agency launched several demonstration projects to test models for offering heat pumps on subscription and leasing. This has meant that today there are a number of players, including district heating suppliers and energy providers, who sell solutions with individual heat pumps on subscription or leasing.

In addition, it has been key to ensure there are enough qualified installers to meet the growing demand for heat pumps. To receive subsidies for an installation, the installer should be approved as a renewable energy installer (VE-G). It has meant that since July 2020 until today, there have been over 1000 installers on the installation course and that there are approx. 1000 VE-G approved installation companies.

Market development in individual heat pumps

The heat pump sales for individual heat pumps have been steadily increasing since 2016. Air to air heat pumps has a share of 73% of the heat pumps sold, and air to water 2%, see Figure 2. Since 2009, 431000 heat pumps have been sold in Denmark, of which 87,000 are systems for hydronic heating systems. The number has doubled since 2015.

Air to air heat pumps are often used as the primary energy source, especially in houses with electrical heating. Holiday houses (of which there are approximately 228,000) are a big market, but also permanent houses with electrical heating. Air to air heat pumps are also installed for secondary heating in garages and other secondary building areas.

Hydronic heat pumps have primarily been installed instead of oil boilers or in newly built houses, and heat

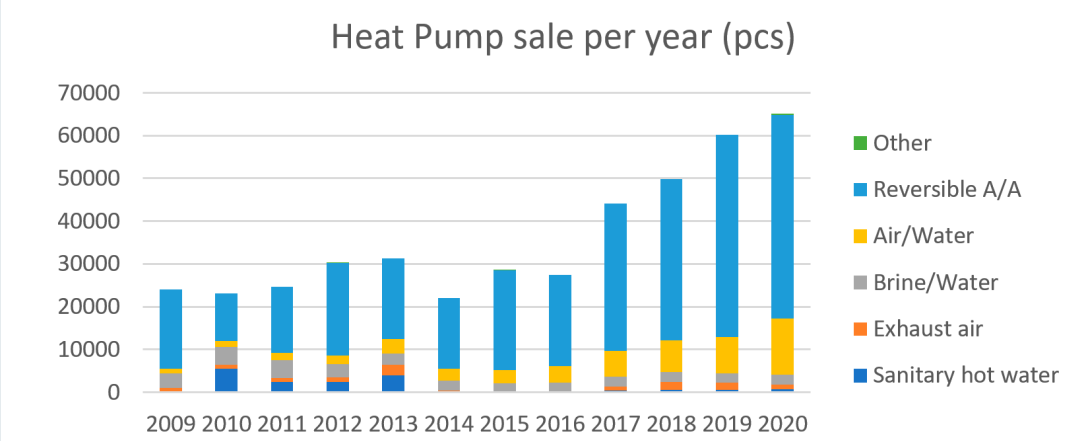

Figure 2: Heat Pump sale per year

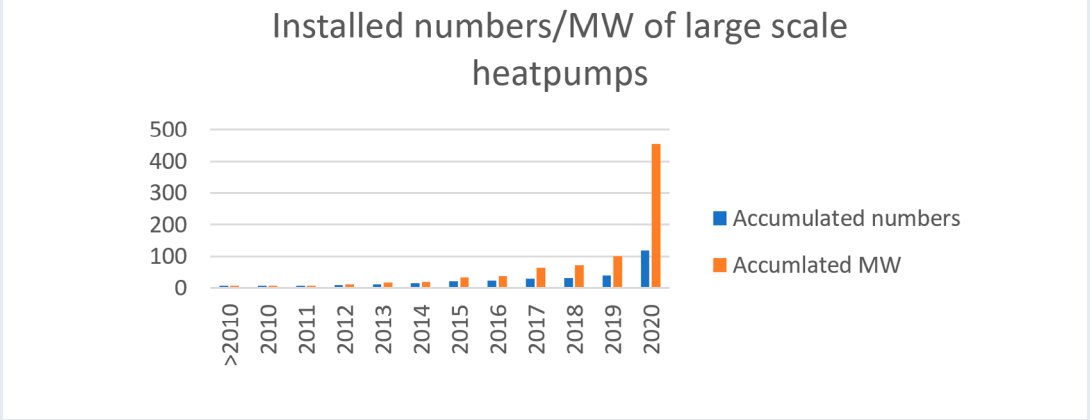

Figure 3: Heat Pump sale per year

pumps have been chosen in 29% of all new buildings (compared with 53% district heating). As gas prices in the period from 2015 have generally been low, it has been difficult for heat pumps to compete in the replacement market for gas boilers, but this currently seems to be changing with the current increases in oil and gas prices, which are to the advantage of heat pumps, also supported by the reduction in tax for electricity used for electricity for heating.

Focus on large scale heat pumps

Today, district heating heats 54% of the heated area in Denmark. Most of the district heating comes from burning biomass CHP (31%), waste incineration (22%), gas (17%), biomass boilers (15%), heat pumps & solar panels (8%) and other sources make the remaining (8%). In recent years, there has been a conversion from coal-burning to biomass at the CHP plants, and the transition is now underway from biomass to heat pumps and other renewables.

Policy drivers for large heat pumps

Policy began to drive large heat pumps following 2018's energy policy agreement, which aimed to drive more renewable energy and greater electrification. In May 2021, this drive was strengthened further with the agreement on emissions reductions to 50-54 % in 2025 and 70% in 2030 compared to 1990, and to achieve climate neutrality in 2050. The pressure to convert from gas and oil to district heating with heat pumps is high.

To achieve the shift away from gas CHP, several measures have been introduced. District heating plants in Denmark have traditionally been incentivized to connect to the natural gas networks and operate co-generation plants to produce both heat and electricity. District heating plants have been released from their requirement to use co-generation and natural gas, so they are no longer required to produce electricity and are more free to consider alternatives like heat pumps and solar thermal as heat source. In addition, the obligation on consumers to connect and remain connected to the district heating system has been removed. This increases competition in the heating market and incentivizes district heating providers to offer the lowest running cost solutions; this is increasingly driving a shift to heat pumps and other sources like solar thermal in district heating, which are becoming the cheapest options.

Since 2020, start-up support has been available for collective electric heat pumps to drive the shift away from fossil fuels in large buildings. In addition, district heating plants have been able to apply for subsidies for the establishment of heat pumps. Business subsidies are given for energy efficiency projects for companies, and the companies can get subsidies for replacing boilers with heat pumps.

A further factor driving the large heat pump market is a projected increase in electricity consumption for data centers (of which there are many in Denmark). This is expected to correspond to 8.5 TWh in 2030, which corresponds to the electrical use in 2.1 million households (almost all of the Danish homes). This means that there is a great need to be able to utilize the waste heat in these data centers and from the industry if the CO_2 reduction goals should be achieved. The taxes on the use of waste heat are reduced to 3.33 euro/GJ, and in some cases, it can be removed completely; this will help promote the utilization of excess heat from industry and other industries, including supermarkets.

Market development in large heat pumps

The measures introduced over the last years, described above, have kick-started the implementation of large heat pumps in the district heating network. Therefore, it is seen that the number of plants with heat pumps is increasing sharply. In 2020 alone, 77 large scale heat pumps were installed with a total power of 353 MW, see Figure 3.

SVEND VINTHER PEDERSEN
Danish Technological Institute
Denmark
svp@teknologisk.dk
https://doi.org/10.23697/09cv-p209