

## Written evidence submitted by the Embassy of Denmark (DHH0072)

### Dear BEIS Committee

By way of context and introduction, as part of the Danish Government's climate and green energy agenda, Danish embassies work directly with other ambitious countries on the green transition of the energy sector. For decades, Denmark has sought an ambitious green energy policy. This focus has generated policy and technical experiences, which we believe may be of interest to other ambitious nations around the world.

At the embassy in London, we uphold a particular focus on the decarbonisation of the heating and building sector. For around three years, we have been following and supporting policy efforts within this field in the UK. Many of our activities have evolved around supporting the Scottish Government's ambitions to develop their Local Heat and Energy Efficiency Strategy (LHEES) as well as their recent push to introduce regulation of the heat networks sector. For the latter we have, on request, provided evidence to the Economy, Energy and Fair Work Committee's scrutiny of the Heat Networks (Scotland) Bill. We were also developing a programme for a visit to Denmark by the Bill Committee, to see in person some of the solutions discussed in the response, but this has unfortunately been cancelled in response to COVID restrictions.

In London, we are also in close contact with teams in the Department for Business, Energy and Industrial Strategy (BEIS). Our activities have so far included study tours, webinars and bilateral knowledge exchange between policy experts. If the Committee is interested in gaining further knowledge about any aspects of Danish energy policy, we would be very happy to engage and assist.

We believe the Danish case of decarbonisation of the heating and building sector can provide interesting insights for the UK with regard to heat decarbonisation, and in particular this Committee's Inquiry into *Decarbonising heating in homes*. We do not believe that the Danish experience is one that can – or should – be replicated identically; it is not a 'silver bullet' solution. Nonetheless, we hope that we can provide a useful case study in progress on buildings decarbonisation, and some solutions for problems that will be shared by any country seeking to decarbonise a substantial heating sector. Our response is therefore shaped around question 1 (lessons learnt from international comparators), but does also provide input for the remaining part of the inquiry. As indicated above, we would be very happy to provide further information on any areas of potential interest.

Best regards,

Lars Thuesen  
Ambassador of Denmark to the UK

## Introduction to response

*This response introduces Denmark's current progress on decarbonisation, especially around the successful transition within heat and buildings. The response highlights the important role of energy efficiency in lowering consumption and the pivotal role of district heating in enabling fuel and system flexibility, as well as the efficient use of resources. Finally, the response draws out some of the key learnings from the Danish route to decarbonise heat in buildings.*

## Denmark and the UK have shared climate ambitions

Denmark, like the UK, has an ambitious climate agenda. Denmark is required by law to deliver a 70% reduction in greenhouse gas emissions by 2030, and achieve climate neutrality by 2050. By 2016, emissions had already reduced by an estimated 35% on 1990-levels, while at the same time the economy grew by an estimated 51% (see Figure 1). Although there is still much to be done, these achievements underline that it is possible to achieve decarbonisation across a number of sectors, while continuing to grow the economy.

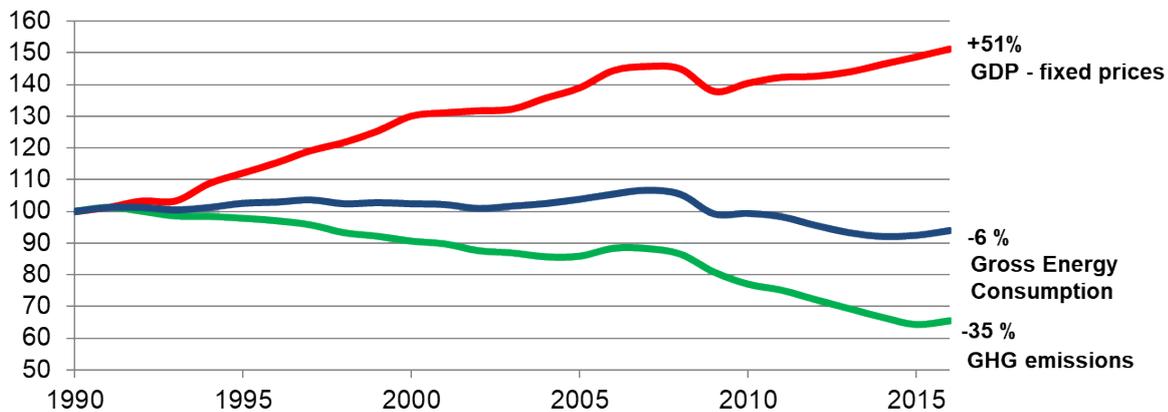


Figure 1 - Decoupling economic growth and GHG-emission in Denmark (Danish Energy Agency)

Like the UK, much of the Danish success in reducing emissions is owed to extensive decarbonisation of the power sector – especially due to impressive developments within wind energy. Another key factor however, is the successful progress towards decarbonisation of the Danish heating sector.

## Decarbonisation of the Danish heat sector

In 2019, estimates by the Danish Energy Agency were that without further political intervention, the share of renewables in heating would increase from roughly 45% to 60% by 2030 (Figure 2 – RES-H/C).

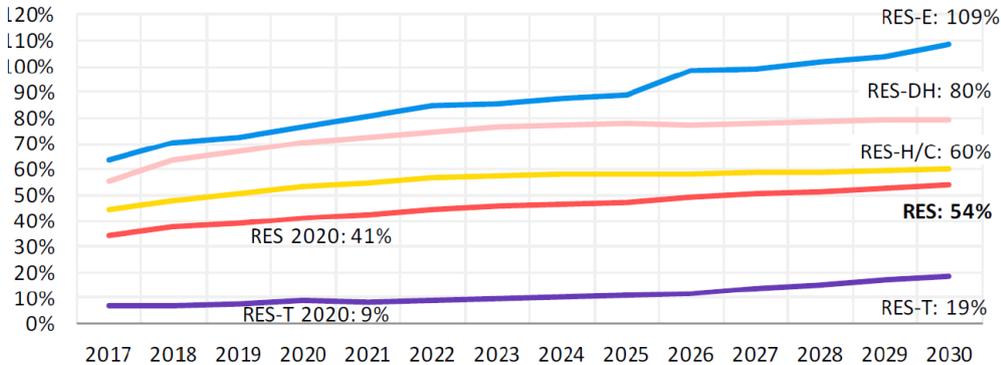


Figure 2 - Estimated developments (2019) in renewable energy within different sectors in Denmark in a BAU/frozen policy scenario (before recent Climate Agreement). Renewable share of electricity (RES-E), district heating (RES-DH), individual heating and cooling (RES-H/C) and transport (RES-T) (Danish Energy Agency, 2019).

Earlier this year, a new Danish Climate Agreement introduced a range of additional measures focused on decarbonising the remaining part of the heating sector (particularly incentivising households to switch from natural gas and oil boilers to district heating and electric heat pumps). New estimates on the expected share of renewables have not yet been released, but there is good reason to expect a significant further increase in heat decarbonisation by 2030.

A key reason for the strong progress on heat decarbonisation in Denmark is the dedicated political effort to promote energy efficiency in buildings and district heating (also known as city-wide heat networks). Today, more than 65% of Danish households are connected to a district heating network. These networks in turn deliver around 50% of Denmark's total heat demand as illustrated in Figure 3.

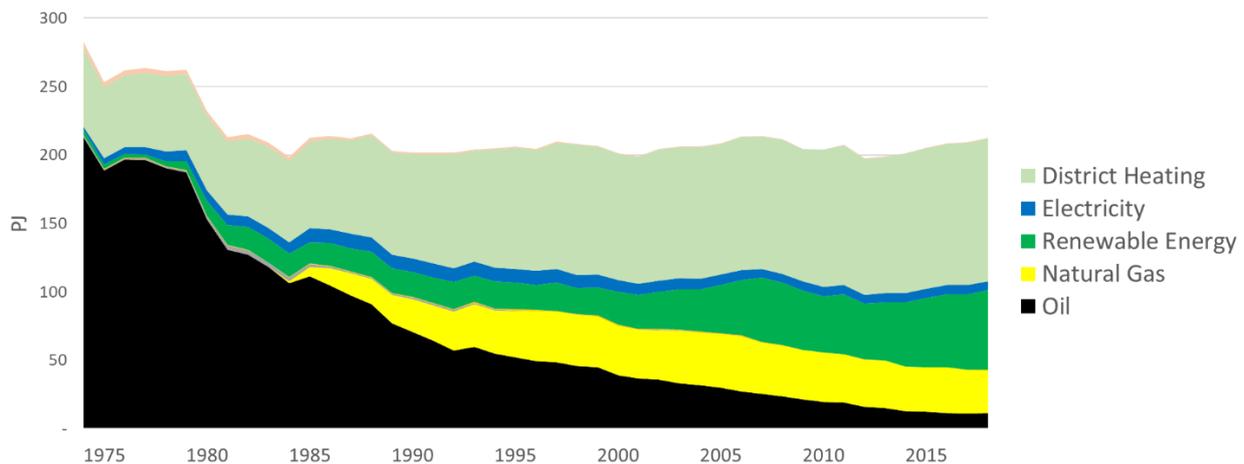


Figure 3 – The source of heat consumed in Denmark between 1972 and 2018 (Danish Energy Agency, 2020).

The share of renewables in district heating has rapidly increased in recent years, and is expected to increase to roughly 80% by 2030 (Figure 2). Combined with the latest initiatives from Climate Agreement (2020), it is expected that the only non-renewable contribution to the district energy mix by 2030 will be the non-renewable share of waste incineration.

Like the UK, Denmark also has a natural gas grid that covers most of the country, which has been providing heat to households since the 1980s. In the near future, many of these households are expected to switch to either electric heat pumps or district heating. This does not mean that the main gas grid will be decommissioned. But by moving households away from gas heating, the remaining gas decarbonisation challenge is reduced and high value green gases are effectively reserved for “hard to abate” sectors such as industries and heavy transport.

The following map on Figure 4 shows the geographical coverage of the district heating networks and the natural gas grid. District heating dominates the major cities and many towns, while the natural gas network covers many towns and some suburban areas, for example around Copenhagen.

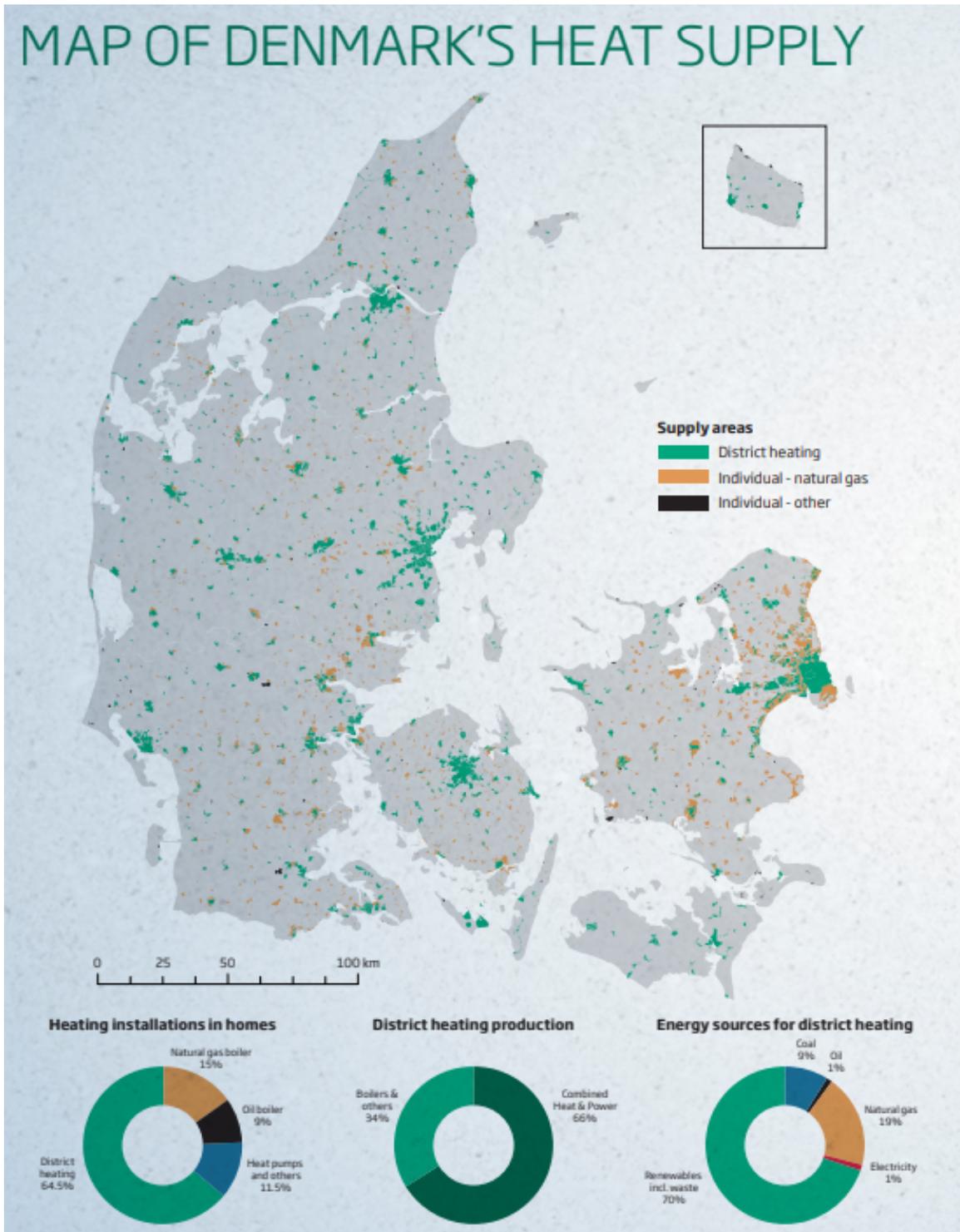


Figure 4 - Map of Denmark's heat supply (State of Green, 2020)

Finally, energy efficiency is sometimes forgotten, but has been an equally important part of Danish success in decarbonising homes. Efficient use of energy is essential to cost-effective decarbonisation, regardless of the source of heating. In Denmark, the

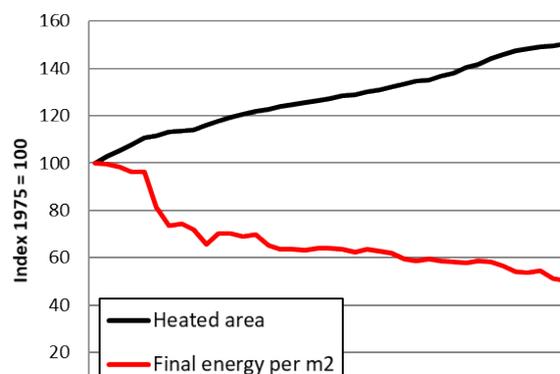


Figure 5 - Energy consumed for heating by Danish households since 1975 (Danish Energy Agency)

average final energy consumed per heated m<sup>2</sup> is today less than 50% of what it was in 1975 – seen in Figure 5. This achievement is the result of a number of initiatives, including ambitious building regulations, information campaigns, energy savings obligations – and district heating. Energy efficient buildings, new as well as old, not only reduce the energy needed for heating, but also increase the system efficiency of district heating and make heat pumps a competitive option. District heating is also in itself an energy efficiency measure, as it allows for recovery and utilization of otherwise wasted sources of energy.

## Why has district heating been so pivotal to the success of heat decarbonisation in Denmark?

In this part, we wanted to explain why district heating has been such a pivotal part of the success of heat decarbonisation in Denmark and why we are suggesting that the Committee pays special attention to its possible application in a UK context.

1. *District heating enables wider decarbonisation of the energy systems and increased efficiency of the whole energy sector – if planned appropriately*

Since the oil crisis in the 1970s, district heating has been a core component of Danish energy policy. The technology has proven itself in changing political climates and helped deliver on both trade, fiscal and security policy agendas. While security and cost concerns are still applicable today, the main agenda in focus is undoubtedly decarbonisation – not only of heating, but also of power, gas and transport. All these sectors benefit hugely from the existence of an infrastructure that allows for the flexible and efficient utilisation of heat: heat that would otherwise be lost can be used, thereby reducing the need for additional generation elsewhere.

Examples of energy system functions that can benefit from district heating include: the production of power via CHP, production of green gases or fuels (hydrogen/power-to-X), balancing of the power grid (electric boilers and heat storages), and extraction of surplus heat from data centres and industries. The opportunity to sell heat to a network also adds an additional revenue stream or can reduce the cost of cooling for these larger energy consumers. In 2018, roughly 70% of heat generated from power plants and basically all heat from waste incineration facilities was utilized in district heating in Denmark. District heating also allows for possible utilization of other “free” sources of low-grade heating. This could, for example, be heat produced from the cooling of office spaces, waste water, underground transport, or flooded mines, as well as ambient heat from rivers, oceans and the air. Utilizing these cost-effective and abundantly available sources of heat through large-scale heat pumps is only possible with district heating.

As with any large-scale infrastructure project, implementing district heating grids requires planning. Unlike a power grid, district heating is inherently local in regards to both supply and demand. On the

### **Planning for district heating**

Both national and local authorities play a vital role in the development and maintenance of district heating in Denmark. Mandating local authority ownership of the planning process and providing local authorities with the appropriate tools and resources has been pivotal in ensuring the success of district heating. Local authorities not only hold crucial local knowledge and bargaining power, but also the democratic mandate and drive for decarbonisation of heating.

The planning process in Denmark has also been used as a tool to ensure active participation and ownership from the local community. This has become an integrated consumer protection measure, which is critical when dealing with a possible monopoly infrastructure.

other hand, district heating still benefits greatly from scale, meaning that small local schemes connecting a few

buildings do not really reap the benefits and reduced cost per unit of energy, that can be achieved through larger city-wide networks. In Denmark, the key to unlocking these greater benefits was in planning – both on the supply and demand side – combined with policies that helped promote uptake of district heating by both consumers and suppliers.

## *2. District heating is agnostic to the source of heating*

District heating does not concern itself with the origin of the heat it transports and can therefore be regarded as technology agnostic. For this reason, district heating networks have been able to adapt to, and even enable, changing political priorities in Denmark. In the 1970s, when security was a key concern, the aim in Denmark was to diversify from oil by introducing coal and waste incineration. Later, natural gas and biomass were added to the mix. Today oil and coal have been almost almost fully replaced by low-carbon alternatives, and natural gas is also being phased out.

These transitions took place largely without affecting consumers and households: no new boilers or additional pipework was needed. In the near future, a similar transition away from biomass could easily happen, as large scale heat pumps and excess heat from hydrogen/power-to-X become more widely available. In Denmark, large-scale heat pumps (for example drawing heat from the air or the sea) are already becoming the primary technology choice for replacing older district heating boilers.

In the UK, where the heat strategy discussion often centres on hydrogen or heat pumps, district heating can act as a low-risk enabler for both pathways. Experience in Denmark has found that large-scale heat pumps are both cheaper and more efficient, when installed as part of a district heating system. Similarly, if hydrogen becomes cost-competitive, it could be an ideal heat source for district heating, with the potential to use heat recovered from hydrogen production facilities, as well as with larger hydrogen CHP facilities (rather than “hydrogen boilers” on an individual household basis). These examples show how district heating can be considered a “no-regrets” policy option and one that can help keep pathways open with the long-term net-zero goal in mind.

## *3. It is popular among consumers*

A critical reason why district heating has expanded so successfully in Denmark is because it is generally the preferred heating solution for households. Some of the reasons that district heating is preferred by households in Denmark include:

- It is cheap. District heating is generally the cheapest heat source available across Denmark.<sup>1</sup>
- It is reliable. The supply company handles maintenance and if a boiler breaks down at the district heating plant, the backup kicks in immediately.
- It is convenient. There is no need to find room for an in-house boiler or be concerned about possible noise from a heat pump.
- It is safe. There is no risk of gas leakages.

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<sup>1</sup> *Heat prices vary from network to network, but district heating has on average been the cheapest heating option for many years. In 2019, district heating was estimated to be 5% cheaper than an electric heat pump and 14% cheaper than natural gas. The comparison is based on yearly costs incl. investment and maintenance for a “standard” single family house. Source: Price comparison statistics (2019), Danish Association of District Heating.*

In addition, concerns about the need for behaviour change, which are sometimes expressed in the UK, do not generally align with the experiences of Danish households who have switched away from gas or oil boilers. The main down-side of installing district heating is the disruption and cost of installing it the first time around – although this can be somewhat mitigated through consumer engagement and innovative business models.

#### ***Consumer engagement in Denmark***

The Danish Government recognises that consumers must be actively engaged for successful decarbonisation of the buildings sector, and of homes in particular. In addition to awareness-raising campaigns over the years, there are a number of tools available to households to help them decarbonise and improve the energy efficiency of their homes.

The Danish website SparEnergi is, for example, a central source of useful information for households looking to make energy upgrades to their home. Consumers can use the website to find their energy performance certificate, locate an approved installer or renewable heating technology, or calculate how much they could save by installing various measures. Alongside this, courses are made available for households considering renovation of their homes.

Consumers are supported to take action by a skilled supply chain, who also have resources and training available through a central *Knowledge Centre for Energy Saving in Buildings*.

**In sum**, the roll-out of district heating in Denmark required ambitious policy making and planning at several levels of government. The result of this effort has been a strategically useful, low-regrets tool for decarbonisation of the heating sector and beyond. We are aware that not all of the learnings and approaches taken in Denmark will be fully transferable to the UK context, but we hope that some of the opportunities resonate.

Our key message is not that the Danish approach is necessarily the right approach. Our Scandinavian neighbours have for example, chosen somewhat different pathways, but have also demonstrated strong progress on decarbonisation. Our main ambition in responding is to provide some direct information on the Danish experiences. District heating has provided an invaluable tool in Denmark's decarbonisation of the energy sector, but a comprehensive strategy and policy framework was needed to get there.

*November 2020*