

Written evidence submitted by Robert Bosch UK Holdings Ltd (DHH0015)

Bosch – our contribution to decarbonisation

Bosch is a global company committed to environmental sustainability with an intention to be the first major industrial enterprise to achieve complete carbon neutrality by 2020. In the UK, as well as supplying specialised technology for the UK wind turbine industry, Bosch continues to invest in hydrogen technologies for transport and fuel cells for stationary power. Most notably, Bosch has developed the first prototype domestic boiler to run on pure hydrogen at its R&D site in Worcester. Bosch sees that through partnership between government and private industry, the UK has the potential to establish itself as the world's leading hydrogen economy, and is keen to invest in knowledge, skills and manufacturing in the UK.

The imminent publication of the Government's 'Buildings and Heat Strategy' should be an opportunity for the UK to utilise the latest technology and best practice to lead the world in how to decarbonise heating. This strategy will need to set out clear policies, priorities and timelines to decarbonise heating in residential buildings and help ensure the UK gets on track to deliver Net Zero by 2050.

Our response to the call for evidence focuses on those parts of the terms of reference where Bosch have expertise to bring to bear. We would be delighted to elaborate further and provide oral evidence if this would assist the Committee.

Why our buildings matter

We welcome this Select Committee Inquiry into the issue of decarbonising heat in homes. Domestic heating accounts for 15% of total UK CO₂ emissions and heating overall accounts for a greater percentage of UK carbon emissions than any other sector.

For the UK to meet its net zero commitments by 2050, home emissions need to fall by at least 24% (from 1990 levels) over the next ten years.

Most of the heating in our buildings and industries is delivered by fossil fuels; natural gas remains the predominant source of heating for the vast majority of customers connected to the grid. The prevalence of the gas grid presents a particular challenge to the UK in enabling the necessary shift to low carbon heat.

Achieving the Government's net zero target demands that we move to decarbonise all buildings by 2050. Decarbonising heat in homes will be central to this ambition but the scale, cost and complexity of the challenge is considerable, and it is vital that we begin to map out the steps which will be needed to move away from traditional gas boilers in homes across the country.

There is no silver bullet when it comes to tackling decarbonisation. There has been a focus on electric solutions – in both heating and transport – in recent years but in order to generate enough electricity to meet that demand the UK would have to use sources that produce carbon.

Bosch believe that hydrogen gas, with a by-product simply of water, could be the closest silver bullet we have. But even so, we believe that the best chance we have of hitting our net-zero target is by using integrated technologies, all working together with the same goal. Various technology solutions can effectively heat UK homes. It is important that we educate consumers and provide them with a

choice. The road to net zero carbon in 2050 is a long one and it is important that, when the Government sets out the policy framework, industry works together to find practical solutions that will benefit consumers and create a healthier planet.

Building a UK export potential

The UK is one of the largest heating markets in the world with around 1.6 million boilers installed annually and a thriving manufacturing industry for boilers. The worldwide market for gas boilers is 13.8 million units a year with a value of £6 billion.

It is widely accepted that the route to decarbonisation will be a combination of electric heat pumps in new build properties (technology dominated by Asian suppliers) and boilers developed to run on pure hydrogen for existing buildings.

It is estimated that 145 million domestic boilers are installed worldwide. In the event of a transition to hydrogen, the UK can – if it acts now – be in a world leading position in exporting hydrogen boilers. For instance, in China 3.6 million boilers are sold per year, whilst in South Korea it is 1.2 million.

The success of the H21 project, which examined the potential for the city of Leeds to transition from natural gas to hydrogen by 2025, shows that decarbonisation through hydrogen is practical and economical. The project found that this transition was technically feasible, economically viable and could be accomplished at little cost to the consumer, while also leading to a 73% reduction in CO2 emissions from heating in the city. It provided indicative costings and suggested a series of practical steps for transition, as well as geographical locations for the hydrogen storage required. The project's final report called for Government to make a firm commitment towards this transition and begin the process as quickly as possible.

What technologies are most viable to deliver the decarbonisation of heating?

Hydrogen Boilers

Hydrogen-ready boilers are the key to enabling conversion of the existing gas distribution networks from natural gas (which is mostly methane) to hydrogen. Hydrogen is a carbon free energy carrier and the combustion of hydrogen produces no carbon dioxide or carbon monoxide at the point of use. Hydrogen can be manufactured from water using electricity as a renewable energy source, or from natural gas accompanied by carbon capture and storage. Recent work, such as the H21 Leeds City Gate study, has shown that conversion of UK gas distribution networks is feasible and could help to decarbonise the heating of buildings at rapid scale.

Hydrogen is not a new fuel and historically played a key role heating the UK - making up approximately 50% of town gas before that was phased out a few decades ago.

As a development partner within the BEIS funded Hy4Heat programme, Bosch has developed a fully functional, prototype domestic boiler that runs on 100% hydrogen. The UK has a unique infrastructure for gas, with 85% of homes connected to the gas network. Around 23 million homes in the UK, approximately 80% of the population, use natural gas for heating and cooking.

Hydrogen boilers can therefore play a significant role in rapidly reducing carbon emissions and supporting the Government in reaching its net-zero target.

Hydrogen-Ready boilers are gas-fired heating boilers capable of burning either natural gas or hydrogen. They provide like-for-like replacements for existing natural gas boilers, burning natural gas at the start of their service life. They can be quickly and easily converted to burn hydrogen at the time when the local network switches to hydrogen.

Hydrogen-Ready allows technology change to happen within the normal asset lifecycle, meaning boilers are replaced as they reach their natural end of life. This offers a minimal-pain option to home owners, faced with potentially unplanned expenditure when a boiler finally fails and needs to be replaced. While Hydrogen-Ready does not negate the need to insulate buildings, it provides a new default heating technology, which ensures that all properties can be switched to low-carbon heating as and when gas networks are converted.

A hydrogen-ready boiler has in-built advantages including:

- providing a like-for-like replacement for an existing natural gas boiler allowing the appliance to be replaced with a hydrogen-ready variant when it reaches the end of its natural life.
- quickly and easily converted to burn hydrogen at the time when the local network switches over.
- being capable of accommodating and supporting an existing high temperature heating system in a hard-to-heat building. Where costs are highly constrained, a hydrogen-ready boiler (and conversion of the local gas network) provides an accessible way to deeply decarbonise heat.
- The cost of a hydrogen-ready boiler installation will be very similar to that for a condensing boiler today. The ancillary components, accessories and controls will be identical to those for natural gas boilers

Hydrogen also offers benefits for the energy system as a whole. In order to use a high proportion of renewable energy generation, electricity systems need large quantities of flexible energy storage. Hydrogen offers one of the most attractive means of providing very large-scale energy storage and can integrate the energy systems through electrolyzers and hydrogen-fuelled electrical generation.

Heat is a very large energy demand which varies very rapidly at key points in the day. Currently, this demand is satisfied by the distributed energy storage intrinsic to the gas networks; the continuous use of a form of gas for heating will relieve stress on future electricity systems, as well as offering overall energy flexibility and resilience.

Creating a national hydrogen infrastructure may also open the door to more wide-scale use of hydrogen for transport – assisting the UK's decarbonisation efforts yet further. Hydrogen fuel cells are seen as an attractive technology for commercial transport applications.

Heat Pumps

A heat pump is a relatively new technology in the UK although they are widely used in Scandinavia and many parts of Europe where there is an abundance of renewably sourced electricity. A heat pump takes energy from outside and transfers it into heat to be circulated around a heating and hot water system. A heat pump uses electricity to run the components of a heat pump, principally a fan, compressor and circulating pumps to transfer the energy from the heat source into the heat sink or heating system.

For use in a domestic heating system application, there are basically two forms of heat pump; Ground Source or Air Source.

A Ground Source heat pump has a collection pipe filled with a Heat Transference fluid and collects heat from the ground. The collection pipework is normally a continuous, unjointed length of pipe buried in the ground either horizontally or vertically in a borehole. For an average sized domestic property, if the collection system was sited horizontally, it would require the pipe to be buried around one metre in depth and would occupy an area of ground similar in size to a tennis court. If the collection system is to be sited vertically then either one or more boreholes equivalent to around 150 metres deep would be needed.

An Air Source heat pump takes the outside air as its heat source and is consequently easier and less expensive to install as there is no collection pipework to install into the ground. The outside unit contains a fan that draws into the unit outside air and transfers this into the refrigerant circuit which is then compressed to a high temperature and then transferred into the water within the heating system via a heat exchanger.

What incentives should put in place to help the public uptake of new net zero heating technologies.

The Social Market Foundation has recently published a report setting out that a majority of the public do not have a good understanding of the need to decarbonise home heating or know about the alternatives to gas heating. This shows the level of education required to reassure and explain why change is required.

Evidence also indicates that UK consumers are generally very satisfied with their existing heating systems and it will likely take a strong consumer proposition to increase public readiness to accept a transition to low carbon heating. Research in 2013 found that for 90% of people, a gas boiler would be their preference for a future heating option and 70% of the public would not change their existing system until their current one fails.

There is general recognition that no one technology can provide the best solution for everyone. A mix of technologies and customer options will need to be available to cater for, amongst other things, consumers' different requirements, the variety of building types and conditions, and different local infrastructure provision and constraints.

The upcoming Hydrogen Strategy should explicitly reference the role of hydrogen boilers in decarbonising heat and mandate hydrogen ready boilers by 2025. The Government should also review building regulations to ensure they promote and encourage zero carbon technology.

Impact of past and current policies for low carbon heat both in UK, and internationally

The operation of the Renewable Heat Incentive has provided a wide range of evidence which can inform future policy. There is evidence that building regulations and local planning guidance can be used effectively to incentivise district and electric heating in new developments in urban areas.

The conversion of significant parts of the gas grid to hydrogen would require an extremely high degree of planning and co-ordination across many sections of society including the energy infrastructure operators, industry supply chains, product markets, government, regulators and the public.

The transition from town to natural gas transition between 1966 and 1977 provides a good model for this process. There are clearly important parallels and there is much to be learnt from how this conversion was rolled out.

Where should responsibility lie for the governance, coordination and delivery of low carbon heating.

BEIS will shortly publish the Government's Buildings and Heat Strategy and should be set out as part of the long-awaited Energy White Paper – the last Energy White Paper was published in 2007. This White Paper should set out a coherent national framework for the future energy system including a clear roadmap for how low carbon heating should be rolled out. The White Paper should also be the definitive statement of the UK Government's energy policy and include measures to support innovation and the development of commercially viable new technologies.

BEIS should work closely with MHCLG and local authorities to ensure that all house builders develop new homes that are fitted with the right technology to be zero carbon. This should include social housing.

The Government should also consider converting government office buildings to use hydrogen boilers and incentivise other parts of the public sector – especially the NHS – to follow suit.

November 2020