Written evidence submitted by the Gas Users Organisation (DHH0010)

Technical Director
ANDREW NEWMAN CEng MIET MIGEM

The Gas Users Organisation C.I.C. is a recently formed community interest company established to operate for the benefit of the 24 million households who use domestic gas, and for individual engineers registered with Gas Safe. This submission is based upon three propositions:

1. The net zero target for 2050 is necessary.
2. That the target is achievable through transitioning the gas networks to hydrogen and biomethane.
3. That decarbonisation of heating through green gas is in the best interests of consumers.

Executive Summary (1778 words)

The government's heat strategy must recognise that there is no "off the shelf" solution to decarbonise heating. Both a transition to zero-carbon gas through a hydrogen based gas grid, and a transition to heating through electric powered heat pumps would require equivalent levels of infrastructure transformation and innovation, while heat pumps would also require much higher levels of disruption and cost at a household level.

Green Gas: Hydrogen and Biomethane

On the basis of past experience, we can have high confidence in the prospects of transitioning to a hydrogen based gas grid. The engineering challenges of this approach are actually less, rather than more challenging than a move to electric heating. While a strategic government decision is necessary on the direction of travel, it is also necessary that the decision is the right one.

The UK has successful experience of changing the gas within the grid, as a transition from town gas (which was 50% hydrogen) to Natural Gas, was carried out between 1967 and 1977. Therefore, a strategy of keeping the gas grid, and moving to zero-carbon gas is feasible. There would be a need to make changes to appliances in the home, but this option has the lowest cost and least disruption to consumers.

There can also be high confidence in the building blocks of a future green gas economy. Production and storage of hydrogen at industrial scale is already proven, and while the challenge of the further scale up required is considerable, it is achievable.

The Energy Networks Association predicts that moving to green gas would save at least an estimated £8 billion on power stations alone, compared to a transition to electric heating. There are a number of promising trials currently underway to prove the viability, practicality and safety of a transition to hydrogen. These should be allowed to continue to build an evidence base before any irrevocable decisions are made.

The government should also make a strategic commitment to the production of biomethane from gasification (bioSNG – bio Synthetic Natural Gas). The existing production of biomethane through the process of anaerobic digestion (AD) has a constrained potential for growth due to difficulty of finding capacity in the grid during the low demand summer months. In contrast, bioSNG has the future potential to supply up to 50% of UK demand.

A strategy of green gas in the grid (hydrogen, bioSNG, biomethane from AD), combined with decreasing the requirement for energy use for heating by improving the thermal efficiency of properties, would provide a cost effective and plausible route to decarbonisation.

The recent Climate Assembly UK report showed that a transition to hydrogen was the heating option most favourable to the general public. Also, research into public opinion on the transition to low carbon heating by BEIS found that low disruption at a household level, and a national transition rather than local measures were more favoured by the public, both of which preferences weigh towards using hydrogen in the gas grid over heat pumps.

On the bases of cost, acceptability to consumers, and technical viability, the Energy Networks Association (ENA) propose that by 2050, all gas to end users would "*be supplied with hydrogen and/or biomethane. Hydrogen will be produced by natural gas reforming, creating the basis for hydrogen clusters, and by electrolysis using renewable power (both dedicated and curtailed generation). Biomethane will be produced by anaerobic digestion and thermal gasification*."

The ENA modelled this Balanced Scenario, (where zero-carbon gas is used in conjunction with electricity) and compared it to the Electrified Scenario (where there is an all-electric future and no gas supply). They point out that for the Electrified Scenario, the 2050 electricity system peak is almost double that of the Balanced Scenario.

An urgent step is to agree to the recommendation from the All Party Parliamentary Group on Hydrogen, to mandate the installation of hydrogen ready boilers from 2025, replacing the current government prohibition on new gas connections in new-builds from that date.

Other Complimentary Measures

It goes without saying that there is considerable scope for improvement in energy efficiency measures in homes, such as improved insulation and double glazing. This reduces fuel bills, reduces greenhouse gas emissions, and improves health outcomes. There are greater opportunities for improvement in the private rented and owner-occupied sectors, and government support is necessary to incentivise roll out of thermal efficiency measures to these sectors. National Grid's Future Energy Scenarios document argues that insulation alone can reduce energy demand by 32%, without any change to the method of heating.

It should also be noted that many condensing boilers are currently incorrectly configured with a return temperature of between 70◦C and 80◦C, rather than 60◦C, which inhibits their efficient performance as they will not condense at that temperature. Reducing the return flow temperature on existing installations to 60◦C could provide an immediate efficiency improvement and consequent reduction in greenhouse gas emissions of between 5% and 10%, without any loss of heating function. This is easy, cost free, and could be done right now in large numbers of households. Government public information guidance on this to householders and gas installers would be useful, and could be rapidly achieved.

System Transformation Required for Electric Heating

There is a misconception that moving to Heat Pumps could be achieved easily within the current technological and engineering infrastructure endowment; this is not the case. While moving a relatively marginal number of households to an electric heat pump (currently about 30k per year) can be achieved without a transformation and reinforcement of the electricity generation and supply networks, the wholesale replacement of gas with electricity for millions of homes would face three major challenges: firstly, that much more generating capacity needs to be created; secondly that renewable generation is decoupled from demand cycles, while electrical energy is hard to store

until it is needed; and thirdly that the transmission network needs to be reinforced to carry the additional load.

Overall, National Grid estimates that electricity generation power capacity would need to increase by 2.8 times to achieve decarbonisation.

Use of electricity for domestic heating would require significant demand for energy storage. Under the current gas central heating endowment, peak winter demand is straightforwardly met by drawing more gas from underground storage. However, using electricity, an estimated additional supply side capacity for grid-connected electricity storage of 200 GW is required, by for example, pumped hydro storage, or underground storage of compressed air or liquified air, all of which are major infrastructure projects. Energy Storage is a complex engineering challenge, and both the costs and feasibility of the technology at the required scale are unproven. To put this level of requirement in perspective, there are currently just 4 GW of storage projects in planning, in addition to the just 1 GW of battery storage already in operation, and 2.7 GW of existing pumped storage capacity.

The amount of electricity required would also depend upon the proportion of homes which install demand side measures to mitigate the call for peak electricity, although these would not necessarily be cheap. Based on assumptions that 40% of homes have a thermal store (a hot water tank, or the new technology of phase change storage), and that there is 30 GW of electricity storage in consumers' homes (for example batteries on the consumer side of the electricity meter), then National Grid estimates an additional electrical power peak demand for heating alone of 30 GW, by 2050.

Costs to Consumers of Heat Pumps

A report by Element Energy for BEIS modelled different assumptions for system installation costs of heat pumps in three scenarios,

i) where installation costs fall by 30% by 2030 due to increased volume,
ii) where installation costs fall by 30% by 2050 due to less increased volume,
iii) where installation remain static due to very modest increased volume

They concluded that "*gas heating remains lower in cost than electrical heating using the HP over the whole time period 2017-2050 and in all scenarios considered*"

Replacing the radiators involves both cost and disruption. The recent report by Delta-EE Energy for BEIS indicates that, using one of the lower end examples, that the installation of an 8kW Air Source Heat Pump (ASHP) including fittings, small buffer tank and cylinder, controls and heat distribution system would cost £14750. This does not include the cost of first improving the thermal efficiency.

In contrast, for a household with an existing gas central heating system, to install a new 24kW combi for combi direct swap using a local installer/plumber (including labour and fittings but excluding controls and heat distribution system) would be just £2250. Moving to hydrogen ready boilers would not be expected to add significant additional costs.

Furthermore, low income families are the most likely to be those unable to sustain continuous operation of a heat pump, forcing them onto the most expensive operational cycles.

Heat Networks

Research by the Competition and Markets Authority (CMA), by the consumer advocacy organisation, Which?, and by Citizens' Advice all reveal that the current experience of heat networks is poor. A significant minority of heat network customers face higher heating bills compared to domestic gas consumers; there are more interruptions of supply; and inferior customer service. In the Netherlands, where there is a high market

penetration for heat networks, customer prices are capped at the reference price of domestic gas heating.

Although district heating is common in countries like the Netherlands, Denmark and Finland, the penetration of heat networks has been less pronounced in countries like the UK who have a liberalised energy market, such that domestic heating is seen as a commodity that is purchased by a consumer who exercises choice, rather than a service that is provided to a citizen.

General points

The best approach to fund the decarbonisation of heat is for the cost of zero-carbon energy to be paid for through general taxation, which is linked to ability to pay.

If decarbonisation is achieved through a transition to green gas, this preserves the principle of consumer choice, as those households who wish to install a heat pump as an alternative would still be able to do so.

With regard to engagement with the public, attention should be paid to the investigation into public perceptions of hydrogen that has been conducted by academics from Leeds Beckett University as part of the H21 project, which is a project to support a transition to a hydrogen network in the North of England. This research, undertaken using the sortition or people's jury method, found that the public are more likely to be engaged with decarbonisation based upon a narrative of what can practically be done to reduce carbon emissions, rather than being engaged with the 2020 zero carbon target.

November 2020