Written Evidence Submitted by Energy Networks Association

(HNZ0032)

Energy Networks Association represents the companies that operate and maintain the gas and electricity grid network in the UK and Ireland. Serving over 30 million customers, they are responsible for the transmission and distribution network of “wires and pipes” that keep our lights on, our homes warm and our businesses running.

Background

ENA members believe that if our power, heat, transport, waste, and industrial sectors are all interdependent, then so must the solutions for their decarbonisation. Solutions will be driven locally as well as nationally. There are a number of areas in which industry and government can focus on with the right regulatory support to accelerate economic recovery and a carbon neutral future and we are working with Ofgem and the government to support this.

The scale of the challenge ahead is vast. The networks are looking to the future and the ‘difficult to reach’ sectors – including heating - which we need to decarbonise to fulfil our Net Zero obligations. We are ready to provide the digitalised backbone to the national uptake of electric vehicles, a fully flexible energy system and decarbonisation of heating systems.

Through Energy Networks Association’s Gas Goes Green programme, Britain’s gas network companies have made clear their commitment to creating the world’s first zero carbon gas grid, here in the UK, and to delivering the innovation projects needed to tackle the operational and technical challenges associated with the deployment of hydrogen and biomethane.

The UK has the opportunity to create the world’s first zero carbon gas grid. However, other countries (e.g. Germany and Australia) are already pushing ahead, so there is a significant cost of inaction. Establishing a world leading hydrogen economy in the UK could deliver:

- 221,000 Jobs and £176bn of private sector investment across the UK
- A major contribution to our Net Zero targets across power, heat, transport, and industry
- Help deliver the decarbonisation of heat in the least cost way, minimising disruption for consumers and up-front costs
- Create new UK-based green industries and a whole new supply chain

As companies investing in this sector, we are ready to move ahead with c£1bn of investments, including a series of ‘shovel ready’ projects right across the UK to help start to deliver the benefits across the country.

Beyond these more obvious opportunities for hydrogen, there is clear potential for it to provide seasonal or short term, highly local or national storage, and flexibility to the electricity grid. This flexibility is required for a renewable, highly decentralised electricity grid, and hence the two vectors can work together.

As regulated monopolies, which are publicly and directly accountable to the energy regulator Ofgem, Government and Parliament through a price control system, energy networks act as an important lever of public policy. With the right long-term policy and regulatory frameworks, the network companies can continue to perform this important role. Crucially our members have consistently proven themselves capable of operating the networks safely and responsibly. The shift to hydrogen would be handled with the same world-class health and safety policies and frameworks. Our members are already international leaders in adapting these policies and frameworks for a hydrogen future.

ENA would welcome the opportunity to give evidence to the Committee or support the Committee in sourcing expertise from our membership.

- **The suitability of the Government's announced plans for "Driving the Growth of Low Carbon Hydrogen", including:**
    - **the focus, scale and timescales of the proposed measures;**
    - **how the proposed measures—and any other recommended measures—could best be co-ordinated;**
    - **the dependency of the Government's proposed plans on carbon capture and storage, any risks associated with this and how any risks should be mitigated; and**
    - **potential business models that could attract private investment and stimulate widespread adoption of hydrogen as a Net Zero fuel**

1. Different funding models will need to be developed for different emergent technologies such as hydrogen. However, building on the successes of existing models they could all be broadly similar, for example they could adopt CfD variants or could use a Regulated Asset Base (RAB). CfDs are a proven success in the power sector and they may function well for supporting industry CCUS as well as parts of the hydrogen system.

2. We support the approach set out by the Department for Business, Energy and Industrial Strategy in their 2020 consultation on CCUS and hydrogen production models to consider hydrogen production costs only in the first instance.

3. These production costs can be mitigated through the creation of a hydrogen market for heating in the UK by blending hydrogen into the existing gas network. The system as it stands and the appliances which use the gas it carries can support up to 20% hydrogen. Mandating this would not only allow for swifter decarbonisation of the UK's heating, but would also kick-start the growth of domestic hydrogen production.

4. It is critical that the RIIO regulatory framework managed by Ofgem provides an environment in which gas distribution and transmission network companies can continue to innovate and find ways of delivering low-carbon energy at the lowest cost to the public. With policy direction from Government and support from the regulator, there could even be an opportunity to expand such energy network innovation funding into new areas to more directly support the deployment of CCUS and hydrogen at scale. This would build on Ofgem's vision for network innovation which delivers against Energy System Challenges.

- **The progress of recent and ongoing trials of hydrogen in the UK and abroad, and the next steps to most effectively build on this progress**

5. There are five major UK-led trials underway: H100, HyNet, HyDeploy, H21 and FutureGrid.

6. H100: with funding and regulatory approvals secured, planning applications have been submitted and the engineering design stage well underway and construction due to commence in summer 2021 with delivery of 100% zero carbon green hydrogen scheduled in 2022. This project will construct and demonstrate the world's first end to end production, distribution, and supply of 100% green hydrogen to be used in homes in Fife.

7. HyNet: also going through the engineering design stage, a final investment decision is required by the end of 2022 for it to be delivered during the scheduled window of 2023-2026. This project will demonstrate hydrogen production from natural gas with CCUS and its distribution and use at scale.

8. HyDeploy: currently over halfway through its live pilot which began in January 2020 and will end in October 2021. This is the first project in the UK to inject Hydrogen into a natural gas network. It will demonstrate that a 20% volume blend of hydrogen with natural gas in homes is safe with lower emissions that current natural gas. Doing so will prove that blending hydrogen is not disruptive and costly for customers because they will not need to change their current cooking and heating appliances.

9. H21: currently at the end of its second of three phases is demonstrating the potential of repurposing the gas network to distribute Hydrogen. The technical and economic feasibility to achieve this was proven in 2016 and the safety assurance is being finalised. Phase 3 will demonstrate the use of network on a live existing network without the need for significant new infrastructure. From 2023-2028 the project will produce a strategic report setting out the design requirements for infrastructure to convert the distribution networks to hydrogen between 2028 and 2035.

10. FutureGrid: building on the work of HyNTS which concluded in March 2020 National Grid are building a facility – separate from the main network - from a range of decommissioned transmission assets to create a representative whole-network which will be used to trial hydrogen and will allow for accurate results to be analysed. Blends of hydrogen up to 100% will then be tested at transmission pressures, to assess how the assets perform. The aim is to start construction in 2021 with testing beginning in 2022.

- **The engineering and commercial challenges associated with using hydrogen as a fuel, including production, storage, distribution and metrology, and how the Government could best address these;**

11. Through Britain's Hydrogen Network Plan, ENA has identified four 'tenets' that are underpinning our work to deliver a 100% hydrogen network. These are:

    a. Ensuring people's safety: Working closely with the Health & Safety Executive, our innovation projects are making great progress and results have shown that using hydrogen in the natural gas grid is fundamentally safe. Our safety work is developing the right technology and procedures across the GB system, including:
        i. End-user appliances, such as domestic boilers and industrial burners.
        ii. The low-pressure distribution network.
        iii. The high-pressure transmission network, whether repurposed or new.

    b. Maintaining security of supply: We will deliver a hydrogen network that meets the same high levels of supply security as today, with very rare unplanned interruptions. This includes ensuring:
        i. Sufficient physical network capacity and resilience to meet peak demand.
        ii. Effective System Operation.
        iii. Linkages to sufficient hydrogen production and storage capacity.
        iv. Flexibility to connect new sources at more entry points.

    c. Focussing on people's needs: Our hydrogen network will have a strong customer focus, supporting consumers to decarbonise in a convenient and cost-effective way

Compared to other alternative such as full electrification, with as minimal disruption as possible. There will be interim steps to enable rapid decarbonisation, covering:

i. Domestic convenience and utility.
ii. Transport sector convenience and utility.
iii. Industrial sector convenience and utility.
iv. Interim steps to reduce emissions rapidly and early, including blending and hybrid heating systems.
v. Energy-content billing.

d. Delivering jobs and investment: We will deliver the supply chain to construct and convert the network needed to allow 100% hydrogen to be introduced on time, which includes:
    i. Equipment, including appliances and long-lead items.
    ii. Skilled people.

12. Alongside the preparation of gas networks for hydrogen conversion, a set of wider actions are needed for hydrogen to be adopted at scale. These are outside of the networks' control, although projects are being supported by the gas network operators. Building on the Ten Point Plan, the Government's Hydrogen Strategy needs to support work in several areas, to enable Britain's Hydrogen Network Plan – the wider actions are spelt out in detail in the main report, and the key areas include:

    a. Hydrogen production: There must be sufficient hydrogen production for a widespread gas network conversion to take place from 2030, which means that production must be expanded beyond the level that is needed for use within clusters. As explained above, this requires GW-scale capacity additions each year, together with the required low carbon electricity generation and/or natural gas and CCS capacity. While the Ten Point Plan targets 5GW of low-carbon hydrogen production capacity by 2030 this needs to be increased to 10GW to enable this Plan. It is worth noting that if the UK does not produce enough hydrogen indigenously, then it is likely we will have to import it from other nations who are investing heavily i.e. Germany, Japan and Australia.

    b. Hydrogen storage: Alongside sufficient natural gas storage, hydrogen storage capacity needs to be expanded at the level of several hundred GWh per year from 2025. Existing natural gas storage will not provide the full solution – inevitably some existing storage facilities will be converted to hydrogen, but other facilities must be newly built, to ensure that the methane network maintains its very high reliability.

    c. CCUS: Ensuring that CCUS is developed at scale in several clusters by 2030 is critical to network conversion to hydrogen, as it can deliver more hydrogen more quickly than relying on green hydrogen alone. Over time, green will become the production method of choice, as costs decline rapidly, but in the interim, blue hydrogen can deliver the required scale.

13. Policy support and decisions from government are required for hydrogen development in all sectors. Significant progress is being made, including ongoing work to develop business models for low carbon hydrogen production, but there are several gaps in policy. These gaps need to be addressed in the forthcoming Hydrogen Strategy to deliver on the commitments made in the Ten Point Plan and to deliver this Network Plan – these are set out in more detail in the main report, and the key points include:

a. Hydrogen-ready appliances: There is no timetable for mandating hydrogen-ready appliances, which are necessary to facilitate a network conversion. The earlier hydrogen-ready appliances are rolled out, the smoother the conversion will be. A mandate needs to be in force by no later than 2025, which would mean that most homes would have hydrogen-ready appliances by 2040.

b. Hybrids: Hybrid heating systems should be supported now, for roll-out at scale.

c. Hydrogen production volumes: The main risk is that insufficient volumes of hydrogen production are supported. As we set out above, GW-scale production capacity needs to be added each year, and business models need to support this scale. While the Ten Point Plan targets 5 GW of low-carbon hydrogen production capacity by 2030 this needs to be increased to 10 GW to enable this Plan.

d. Storage and conversion support: There are no business models for hydrogen storage or for network conversion, both of which could be funded through the regulated asset base (RAB) framework. Such a solution for hydrogen storage should be in place from 2025, and for domestic conversion from 2030.

e. Flexibility: The RIIO2 framework needs to be managed in a sufficiently supportive and flexible way to enable the range of innovation projects and trials to be carried out in a timely way.

f. Planning: The planning system will need to be able to accommodate a large volume of applications for hydrogen production, storage, pipeline, and other facilities. It is not clear whether the planning system will be able to manage this in a timely manner. Planning applications should be prioritised, and decisions expedited.

- **The infrastructure that hydrogen as a Net Zero fuel will require in the short- and longer-term, and any associated risks and opportunities;**

14. Much of the infrastructure we already have in place will be hydrogen-ready by the end of the 2020s thanks to the Iron Mains Replacement Programme. This is being demonstrated through the aforementioned H21 project.

15. The programme has been running for 20 years and is due to conclude by 2032, replacing the UK's old iron network with hydrogen and biomethane-ready piping made from plastic. By the end of 2020, 62.3% of local gas distribution network piping was replaced. Subject to funding decisions made by the energy regulator, Ofgem, 100% of this piping will be installed by 2032.

16. By switching away from leakier iron pipes, the programme has already reduced emissions by more than a fifth since beginning, the equivalent of taking 179,123 cars off the road. By 2032, if the corresponding investment plans are approved by Ofgem, emissions will drop again by more than half, the equivalent to taking an additional 506,993 cars off the road since 2020.

17. Under the RIIO-2 price control for gas network companies (running from 2021-26), the regulator will take a more active intra-price control role on funding decisions, compared to previous price controls. Rather than major funding decisions being made and set at the beginning of the price control period, the regulator will make funding decisions during the period through a series of ‘reopeners’.

18. This includes funding decisions on the £904m of innovation funding proposed by gas network companies in July 2020 as part of their Zero Carbon Commitment, to support projects across four strategic areas:

    a. New hydrogen networks - developing the infrastructure needed for the industrial use of hydrogen, as well as the world's first 100% hydrogen domestic consumer pilot.
    b. Hydrogen blends – to blend an increasing amount of hydrogen with the natural gas currently used in our gas networks, to gradually replace it.
    c. Repurposing the network for hydrogen – ensuring that both the existing gas network and appliances are ready for the use of hydrogen.
    d. Cross-cutting projects – projects where investment will deliver the wider changes needed for decarbonising our gas system.

19. The regulator will make decisions through 'reopeners' on £721m of the £904m funding proposed by gas network companies. It is essential that these decisions are made in-line with wider Government decarbonisation policy, and not in isolation from it. Otherwise, we will risk failing to tackle the technical and operational challenges ahead of us, as well as failing to exploit those opportunities that arise.

- **Cost-benefit analysis of using hydrogen to meet Net Zero as well as the potential environmental impact of technologies required for its widespread use**

20. A balanced scenario of low carbon gases and electricity is the optimal way to decarbonise Great Britain's energy system and reach net-zero emissions.

21. Analysis in the gas network members of ENA report Pathways to Net Zero[1] shows that the Balanced Scenario is lower cost than the Electrified Scenario by £13bn/year, equivalent to 12% of total energy system cost in 2050

- **The relative advantages and disadvantages of hydrogen compared to other low-carbon options (such as electrification or heat networks), the applications for which hydrogen should be prioritised and why, and how any uncertainty in the optimal technology should be managed**

22. ENA does not advocate for a specific technology. The future of heat will be much more diverse than it is now, with heat networks, hydrogen, and heat-pumps as well as hybrid solutions working alongside one-another.

23. We believe that it is essential that the Government enshrines the principle of delivering technology-choice for end-users at the heart of decarbonisation policy. This is necessary to ensure policy moves forward with public support and so that different types of homes and businesses, operating in a variety of different settings, can access low carbon technologies that are both practical and realistic in their installation and use.

24. Given hydrogen's potential to accelerate decarbonisation across multiple sectors, a cross-cutting vision and strategy for a hydrogen economy will be required from the government, with production and use starting from the early 2020s.

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[1] ENA (2019) Pathways to Net-Zero: Decarbonising the Gas Networks in Great Britain, https://www.energynetworks.org/assets/images/Resource%20library/ENA%20Gas%20decarbonisation%20Pathways%202050%20FINAL.pdf

25. Hydrogen can have a significant impact across multiple sectors, transport, industry, power generation and domestic heat. Creating greater support for hydrogen in the UK, such as implementing a hydrogen strategy and by mandating hydrogen replacements for old gas boilers, will help establish a world-leading hydrogen economy which could deliver several hundred thousand jobs and around £176bn of private sector investment right across the country.

26. There are also benefits to hydrogen with regards to security of supply. Five times as much energy is carried by the gas networks than the electricity networks at peak.

27. Likewise, heat pumps provide a viable option for decarbonising heat provided that the underlying electricity that is powering the heat pump is decarbonised. BEIS' *Clean Growth – Transforming Heating, Overview of Current Evidence* document recognised that electricity presented the greatest opportunity in decarbonising properties off the gas grid. This makes it clear that there is no single answer for decarbonising heat, and the associated costs need careful consideration.

28. If paired with thermal or electrical storage, including hot water tanks, heat pumps can provide a significant amount of flexibility, which in turn could be used by local DNOs or National Grid ESO. In turn this could help reduce the socialised costs of electricity networks and facilitate alignment of heating usage requirements with the availability of zero carbon electricity generation. This local storage could also help reduce the need for system-wide electrical storage or the over-provision of generation capacity.

29. The partial electrification of heat is anticipated to be one of the main reasons for a forecast doubling of peak electricity consumption by 2050. Electricity networks are primed to deliver a smart-charging system which, based on the National Grid Future Energy Scenarios from 2018, with 20% of flexibility could reduce the new investment in electricity generation by 20% and with 40% of flexibility could reduce the cost of reinforcing the network by 36% - around £6bn.

30. Further details can be found in Annex A.

(January 2021)

Annex A

1. Hybrid heating systems are vital from an overall system cost perspective and support for them should continue. This view is shared by CCC who say, “Hybrid heat pumps should be eligible under future schemes (unlike proposals in the recent BEIS consultation)[2].” In our Pathways to Net Zero report, which sets out a viable and optimal pathway to deliver net zero for buildings, industry, transport and power, hybrid heat systems become the dominant option for heating buildings[3].

2. Specifically, heat pumps do provide a viable option for decarbonising heat in certain scenarios, provided that the underlying electricity that is powering the heat pump is decarbonised. The electricity networks in the UK have played a significant role is this decarbonisation of electricity, with approximately 53% of all electricity generated in 2018 from low carbon sources (nuclear and renewables) and over 30GW of distributed generation being connected to the distribution networks, the vast majority of which is wind and solar PV.

3. If paired with thermal or electrical storage, including hot water tanks, heat pumps can provide a significant amount of flexibility, which in turn could be utilised by local DNOs or National Grid ESO. In turn this could reduce the socialised costs of electrical networks and allow the temporal alignment of heating usage requirements with the availability of zero carbon electricity generation. This local storage could also reduce the need for system-wide electrical storage or the over provisioning of generation capacity.

4. ENA works closely with the Heat Pumps Association and Ground Source Heat Pump Association to ensure the electricity networks are ready for the roll-out of heat pumps, and to ensure quicker and easier connection of heat pumps for customers.

5. Heat pumps, although very efficient, could place significant load on the network when clustered within communities that have a poor quality or leaky housing stock, or a lack of local storage, as in these scenarios flexibility cannot play as significant a role as it does for EV chargepoint connections. This is due to average time of use within the household – something which cannot be as easily shifted away from peak load within a house that is not well sealed or does not include storage, like it can for EV charging.

6. Certain types of heat pumps also have a heavy reliance on inflexible direct heating (boost) elements on low temperature days, which again has the potential to significantly increase the network and generation requirements during peak periods. The specification of heat pumps or efficiency measurement methodologies should take this into account, and reward the correct specification, installation and sizing of good quality heat pumps, with a sensible set of assumptions around the lowest temperature conditions in a given area.

7. ENA’s Low Carbon Technologies working group has recently launched a new connections process and associated database for heat pumps, to enable quicker and easier connection of heat pumps for customers. Guidance is also being produced to help installers with sizing and minimising connections costs for customers.

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[2] CCC (2020) Reducing UK Emissions: 2020 Progress Report to Parliament, https://www.theccc.org.uk/publication/reducing-uk-emissions-2020-progress-report-to-parliament/ 177.
[3] Navigant, *Pathways to Net Zero* (2019) available at https://www.energynetworks.org/assets/files/gas/Navigant%20Pathways%20to%20Net-Zero.pdf 5

8. ENA is of the view that heat pumps and heat networks will play an important part in decarbonising buildings but it is important not to discount other technologies - those available now and those that may come in the future - in a manner that limits customer choice, access to heat on demand, increases the cost of energy or impacts system operation.

9. In addition to heat pumps and heat networks, 'hydrogen ready' boilers, currently being developed under the BEIS-funded Hy4Heat programme should also be allowed as a 'low carbon ready' solution, as should hybrid heating systems. Both of these options are likely to form part of a net zero energy system, along with heat pumps and biomethane, which could be able to deliver negative emissions if certain feedstocks are used to generate the gas in combination with carbon capture and storage. While the government's long-term approach to heat decarbonisation is still being developed, all of these options should be permitted depending on local circumstances.

10. In its recent report net zero – The UK's contribution to stopping global warming, the Committee on Climate Change (CCC) unequivocally recognised the role of decarbonised gases in the UK meeting net zero emissions by 2050 alongside CCUS. Hydrogen is noted by the CCC as offering a means of decarbonising industry, transport (HGVs and shipping in particular) and heat that would meet the further ambition of a net zero reduction in emissions[4]. Our members wholly support that conclusion, as well as the critical role CCUS has to meeting net zero.

11. Navigant's 'Pathways to Net Zero' report finds that to meet net-zero emissions low carbon and renewable gases will need to be fully integrated into the energy system. By 2050, all gas end-users will be supplied with hydrogen and/or biomethane. Hydrogen will be produced by natural gas reforming and by electrolysis using renewable and low carbon power sources. Alongside this, energy efficiency measures will be introduced, there will be some electrification across demand (for low-temperature industrial processes for example), and there will be CCUS including from biogenic feedstocks providing negative emissions. This consultation fails to recognise the potential of such technologies and the role of the gas networks in delivering them. ENA's individual members are expected to publish their own Future Energy Scenarios soon. ENA's Common Energy Scenario sets out common factors and assumptions across transmission, distribution, gas, and electricity for Ofgem and the RIIO-2 Challenge Group[5] .

12. A hybrid heat system using either hydrogen or biomethane in combination with a heat pump reduces annual gas demand, which in turn reduces the required amount of low carbon and renewable gas. The heat pump will provide base load heat and the gas boiler would contribute to meet peak heat demand.

(January 2021)

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[4] https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf page 271

[5] http://www.energynetworks.org/assets/files/ENA%20Common%20RIIO2%20Scenario%20report%20-%20March%202019%20FINAL.pdf