Written Evidence Submitted by Progressive Energy and HyNet North West (HNZ0022)

Progressive Energy are experts in clean energy project development in the field. We are passionate at translating key technologies, such as hydrogen and carbon capture, utilisation and storage (CCUS), into deployable at scale projects to make a material difference to climate change. We originated and now lead the development of the HyNet North West decarbonisation cluster.

HyNet North West will play a critical role in the world's fight against climate change, accelerating the UK's transition to Net Zero greenhouse gas emissions by 2050. With appropriate commitment now, HyNetNW can start to reduce the UK's greenhouse gas emissions as soon as 2025. The project plan is to deliver approximately 80% of the recently announced UK wide target of 5GW of low-carbon hydrogen by 2030. It will also capture and store 10 million tonnes per year of CO_2, equal to the 2030 UK-wide target.

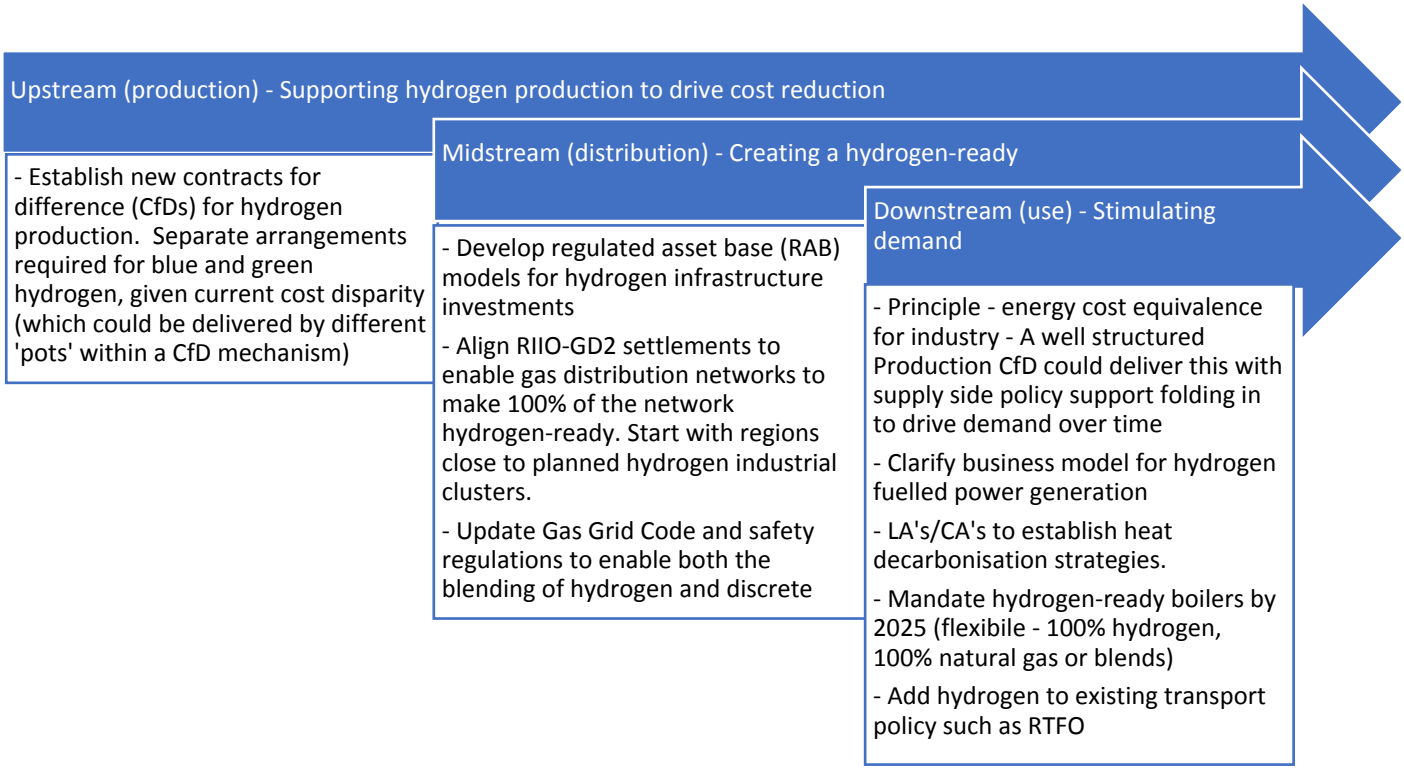
2021 is the year in which the UK's climate change credentials will be in the global spotlight as we host COP26. With the country still suffering through the pandemic, we are at a critical point on our road to Net Zero. Strong, ambitious decisions are needed now to set the course and to prioritise rapid delivery of material decarbonisation solutions.

Progressive Energy welcomes HM Government's recognition of hydrogen's vital role in the UK's route to achieving Net Zero. Recent announcements such as the '10-point plan for a Green Industrial Revolution' and the Energy White Paper in which Government has laid out the priorities for the country to meet its Net Zero ambition have confirmed the central roles of hydrogen and CCUS. This excellent progress now needs to translate into immediate commitment to low cost and low risk projects, including HyNetNW being in operation by the mid 2020's.

Policy and regulatory recommendations to develop a hydrogen economy

Based on the CCC's carbon budget reports, we need to deliver quickly. This will require a step-up in policy and regulatory support from Government along the whole hydrogen value chain.

Below we have summarised where policy and/or regulatory support is most needed. This should sit



within a coherent hydrogen strategy.

Committee's request for submissions

We address the Committee's request for submissions on the listed topics below:

1) The suitability of the Government's announced plans for "Driving the Growth of Low Carbon Hydrogen":

Government's plans are generally **very positive**. As a team working in delivering hydrogen projects, having specific, short term intermediate targets is valuable, particularly where the commitments have to be delivered within this Parliament.

- the focus, scale and timescales of the proposed measures;
    i) The scale and timescale of the **1GW of hydrogen production by 2025 is very powerful** and will concentrate activity on pace as well as magnitude. However, we note that this is a "hope" rather than a target which may weaken resolve to this important, and with the right support, achievable, target. HyNetNW plans to deliver approximately one third of this target by 2025. Swift action by Government to implement Business Models for Low Carbon Hydrogen and CCUS is essential to secure the investment commitments required to deliver on this target.

    ii) In contrast, with our understanding of the opportunities in hydrogen production across the UK, we believe that **a target of 5GW by 2030 is not sufficiently aspirational**. In our view, this target should be at least doubled, with a role for both blue and green hydrogen. HyNetNW plans to deliver approximately 80% of this target.

iii) There is a real urgency to **finalise hydrogen business models** which are critical to support production and use. It is imperative that the promised hydrogen business model consultation is issued early in 2021 with a strong 'minded-to' position on the preferred option, such that projects are able to progress to financial close rapidly. Structured appropriately this can be financeable and provide a sufficiently attractive basis for customers to purchase and use hydrogen.

iv) In parallel, demand side policies such as a **Low Carbon Obligation** would support building the customer base.

v) We welcome recognition of the **importance of blending**. Progressive Energy is leading the HyDeploy project, a demonstration of blending up to 20% by volume hydrogen with natural gas. HyNetNW is being designed to be blending on average around 400MW of low carbon hydrogen into the gas distribution networks by 2030 (around10% of the UK's hydrogen blending demand). It is important to work with industry to see blending adopted, for the safety case, to ensure delivery of the wider regulatory changes to enable it and to develop public perception of hydrogen as a fuel source within their homes.

vi) **Recognition of the link between hydrogen and carbon capture and storage** (CCS) is particularly important to achieve meaningful scale on the timetable required. The business models must be coherently aligned in risk allocation and timescales.

vii) **Hydrogen village and town targets** are a great idea for multiple reasons including the change management journey of public perceptions. To the best of our knowledge, HyNetNW is the only project that will have the capability to deliver on this objective in the 10 Point Plan.

- how the proposed measures—and any other recommended measures—could best be co-ordinated;

i) To reiterate, the urgency is for completion of **hydrogen and CCUS business models** as these will be the key to unlocking investment. To this end, we would welcome the strengthening of the business model team.

ii) There will also need to be **sufficient policy clarity and resourcing for OFGEM and Xoserve** to deliver the wider regulatory, commercial framework and network code developments required to support supply of hydrogen.

iii) We have found there to be **multiple teams within BEIS** working on hydrogen. To ensure that policy development is consistent and delivered at pace, there must be co-ordination within BEIS itself and across Government, including Treasury and DfT and, in addition, with the CCS teams.

iv) Government policy also needs to translate into **specific policy and additional resources for key regulators** including the Environment Agency, Health & Safety Executive, Ofgem and the Planning Inspectorate. All of these have key roles to play in reviewing and licensing the assets and operations required to deliver a low carbon infrastructure. A

shortage of dedicated resources can lead to delays in processing applications and therefore in reaching investment decisions on the projects.

- 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;
  i) Carbon capture and storage (CCS) is **necessary for low-cost bulk hydrogen production**. Government must deliver on its commitment to multiple CCS clusters. At a minimum all clusters must progress through the Front End Engineering and Design (FEED) and consenting stage under the Industrial Decarbonisation Challenge programme. Ideally, the four main clusters should progress in tandem, not with delays to a second tranche.

  ii) **Business models for CCS need to be implemented as soon as possible** to enable a seamless transition from FEED and consenting to Final Investment Decision (FID). BEIS has made excellent progress in developing credible models, and this process now needs to accelerate to a rapid conclusion and implementation phase.

  iii) Previous UK withdrawals from CCS programmes before FID have led to a natural concern about whether the commitment will be sustained this time. Therefore, **rapid implementation** of carbon capture, utilisation and storage (CCUS) business models and decision making on the allocation of the CCUS Infrastructure Fund is required to provide investor confidence.

  iv) HyNetNW can achieve low cost for CO2 transport and storage due to the opportunity to repurpose onshore and offshore gas extraction assets. **Delays in decision making, or a choice to not proceed with HyNetNW as one of the first two clusters by the mid 2020's**, would likely require decommissioning of certain assets and therefore a far higher ultimate cost to deliver HyNetNW CCUS.

- Potential business models that could attract private investment and stimulate widespread adoption of hydrogen as a Net Zero fuel;
  i) **Business models are absolutely critical**. The focus must be on a financeable business model for hydrogen production to unlock the sector. To create demand, business models would enable early hydrogen to be sold at the equivalent price to natural gas, giving early adopters a carbon benefit. We strongly advocate a CfD (Contract for Difference) regime which is familiar with the financing sector, and which has a track record in driving down support over time. In parallel, demand-side policies will play a role, particularly for wider use such as a hydrogen blend in the grid (noting that currently there are no carbon penalties here, so the CfD alone on this basis would be unlikely to drive demand in this sector).

  ii) Note that the interface between hydrogen and CCS business models must be carefully managed as financing projects will depend on both managing the risk allocation appropriately and be delivered on the same timeframe.

2) 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;

i) The UK is leading the way with our project, HyDeploy, a **large-scale hydrogen blending demonstration** on the private gas network at Keele establishes the principle that 20% of hydrogen can be blended into the gas distribution network without any need to replace domestic appliances. If rolled out across the UK gas distribution network, this equates to 29TWh of hydrogen per year with no changes required by consumers. Our larger trial will be starting in Spring 2021 where 650 households and businesses in Winlaton village in Tyne and Wear will become the first on the UK's public gas grid to be heated partially by hydrogen.

Both trials are establishing the safety case for trial operation, initially on a closed network then on a public network and ultimately looking to establish the basis for long term operation on the wider network. We are aware of other hydrogen blending projects now emerging across the globe, including Australia, Germany, Lithuania, US, many of which are looking to the UK.

ii) Moving **Gas Safety Management Regulations** (GSMR) to a standard which can allow changes to the hydrogen specification rather than multiple exemptions would be helpful (although exemptions can bridge the gap).

iii) The main area of focus must be **addressing the wider regulatory barriers to use of hydrogen** - the wider commercial and regulatory framework, specifically those which relate to billing. The BEIS blending group is a start to taking this forward, but needs close working with OFGEM as well as Xoserve and shipper/supplier community.

iv) **Industry needs confidence** that hydrogen will be a good technical, as well as economic solution, to its energy needs. The Industrial Fuel Switching programme is an excellent stage in building that confidence. Progressive Energy has already completed a first demonstration in Rochdale with a burner supplier, Dunphy Combustion, and plans are well progressed towards manufacturing site demonstrations at Unilever in Port Sunlight and Pilkington's in St Helens.

v) **Equipment vendors need to upgrade and, in some cases, redesign their commercial offerings to be "hydrogen ready"**. The availability and cost of hydrogen is currently a barrier to such design and validation and risks imported equipment overtaking domestic supply as the preferred options. Progressive Energy and partners are ready to work with Government to identify ways to increase the scale of testing and validation that can be completed.

3) 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;

i) Production: The **existing Hydrogen Supply Competition programme** has provided valuable support. The **Net Zero Hydrogen Fund** will also be critical, particularly to drive projects forward and maintain momentum given the hiatus to business models. This fund should be made available as soon as possible for development funding ahead of implementation of business models.

ii) Storage: **Hydrogen enables cost efficient bulk energy storage**. Salt cavern storage of hydrogen has been in use for decades in the UK. HyNetNW is planning over 1TWh of storage in the North West by 2030. This compares with Tesla's Australian high profile mega battery which 4 orders of magnitude smaller. Determination of the commercial and regulatory framework for hydrogen storage alongside production and distribution is essential to unlock investment.

iii) Distribution: The physical assets, pipelines, to enable low cost transport of **hydrogen to major industrial and power users**, as well as nodes on the gas network for blending, is what will unlock multi-site decarbonisation. Cadent is developing this network for HyNetNW. Funding for design and consenting of the first 85km of the HyNetNW network has been approved by Ofgem in its RIIO GD2 determination. The expectation is that funding for construction would form part of a RAB.

iv) Metrology: Programmes are underway to confirm **metering accuracy** for hydrogen and blends. Further development may be required in this area to support changes to gas billing methodologies.

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

i) We have covered most of this in our answers above – i.e. **carbon capture and storage infrastructure** for blue hydrogen and **build out of renewables** for green, linked to distribution and storage. HyNetNW is designed as a full chain integrated decarbonisation system, which provides a low cost, low risk, delivery of Government Net Zero policy.

ii) For use as a hydrogen blend in the grid, **no further substantial infrastructure changes are required** beyond those planned for HyNetNW. Use of 100% hydrogen as a fuel in the domestic setting, beyond blending, will require conversion of the gas grid and replacement of domestic appliances, but the expectation is that the costs of this will be limited. The biggest cost that will be incurred will be the change out of boilers, cookers etc, but legislation of hydrogen ready boilers at the earliest opportunity provides this optionality at minimal ultimate cost.

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

i) Domestic: At scale, blue hydrogen can be produced at scale for around £20-25/MWh more than natural gas. The cost of a hydrogen ready boiler is around £100 more than a standard boiler. Assuming a 15-year life and around 13MWh per annum, this equates to around £0.50/MWh. Assuming 90% boiler efficiency, combined this equates to £23-£28/MWh of heat delivered over natural gas.
An air source heat pump has an average annual coefficient of performance (COP) of 2.5-3.0. At current domestic electricity price of £190/MWh implies £64-76/MWh per unit of heat which is around £14-26/MWh more than natural gas (domestic price of ~£45/MWh @90% efficiency = £50/MWh heat). The installation cost is £5000-£8000, which is

between £2500 and £5500 more than a gas boiler. This is £12-28/MWh, giving a combined cost of heat over natural gas of £26-£54/MWh, which excludes any upgrading required of the distribution system). Note that today, the RHI support regime for an air source heat pump is £100/MWh, with take up still relatively limited. This suggests that the implementation costs today are probably higher than conservatively calculated above, and that there are non-financial barriers to adoption.
It is likely therefore that the cost of hydrogen solutions will be substantially lower than heat pumps. In reality much of what will drive decisions will be the practical issues for users associated with such changes. Heat pump solutions will require investment by individual householders, rather than centralised investment in hydrogen production.

ii) Industrial: Whilst there are exceptions, for many industrials, electrification is simply not an option. Many industrial processes require high temperature heat which cannot be achieved through electrification even with resistive heating (and certainly not heat pumps) Electricity costs are typically over three times natural gas costs, which would therefore equate to a trebling in energy bills. In addition, a change from gas to electricity would be a much more substantial technology change with high capex requirements. Conversion costs to hydrogen are generally expected to be smaller modifications. Therefore fuel switching is a much more straight forward solution in the vast majority of industrial applications.

6) 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.

i) It will depend on what sector is being displaced:
   - For industrial use, **hydrogen offers clear benefits of high temperature heat using largely existing equipment**. For many industrial processes, electrification is not a technical option whereas the change from natural gas to hydrogen, a replacement of the gaseous fuel, is a predictable conversion.
   - For dispatchable power generation there are few alternative options. The electricity system requires low carbon dispatchable power generation available to balance the availability of intermittent renewables and demand fluctuations. Low cost storage of hydrogen enables existing Combined Cycle Gas Turbines (CCGT) facilities to be repurposed to low carbon by replacement of fuel. Modelling by BEIS for the Energy White paper shows a benefit in generation from hydrogen in delivering greater system flexibility and lower cost overall solutions, and this was with relatively limited levels of hydrogen assumed to be available for this application.
   - For domestic use: in practice, it is the practical issues which are likely to dictate the pathway, for example space in people's homes, level of insulation, availability of finance to make changes etc. Blending does not impact any of these factors, so is suitable for early adoption.

ii) Whilst we do not know the exact 2050 split by sector or final demand, there is **no doubt that hydrogen will play a role within our energy system**. The focus must be on rapidly building capacity for applications we know need hydrogen today.

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