Written Evidence Submitted by RWE

(HNZ0085)

RWE is a leading energy player, with a portfolio of around 44 gigawatts of electricity generation capacity and 20,000 employees worldwide. In the UK, RWE employs over 2,600 people with a diverse operational portfolio of onshore wind, offshore wind, biomass, hydro and gas - generating enough electricity to power 10 million homes. The UK plays a key role in RWE's strategy to grow its renewables business and to become carbon neutral by 2040. This includes the Triton Knoll offshore wind farm currently in construction off the coast of Lincolnshire[1], and the Sofia[2] offshore wind farm in development.

Following the closure of RWE's last coal-fired power station in the UK in March 2020 (Aberthaw), RWE provides firm, flexible generation with around 7GW of modern and efficient gas-fired capacity.

RWE believes that hydrogen will be a crucial factor in reaching net zero, as well as being important for the further expansion of renewables. In many sectors, hydrogen is needed as an alternative to the direct use of electricity. Hydrogen will replace fossil fuels in many industrial processes and will be used in transportation in cases where battery electric vehicles are unsuitable.

We are one of the few companies involved in all stages of the hydrogen value chain, ranging from electricity generation from renewables to hydrogen production through to storage and distribution to industrial customers. Our gas-fired power stations, in the long-term, are well positioned to be an off-taker of low carbon hydrogen to provide firm, flexible power.

In the UK, we are actively pursuing hydrogen options as part of the South Wales Industrial Cluster via our 2.2GW gas-fired Pembroke Power Station.

- We are exploring the feasibility of blending and burning low-carbon hydrogen as a substitute for natural gas – early indications show 20% by volume could be achievable.
- Furthermore, access to floating offshore wind makes Pembroke a prime location to produce green hydrogen. We have identified potential options for electrolysis; partnering via Cluster partners to find an off-taker for the hydrogen produced.

RWE welcomes the high-level ambitions for hydrogen set out in the recent 10 Point Plan[3], but would urge the publication of the UK Hydrogen Strategy as soon as possible, to provide the detail required for actionable deployment of hydrogen production and demand creation. RWE stands ready to invest in both hydrogen production and use in power generation.

1a. 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:

The focus of measures should be on stimulating both supply and demand for hydrogen:

- **Supply:** Provide support and incentives to encourage investment and deployment of low-carbon hydrogen production capacity (e.g. a credible business model, such as a CfD);
- **Demand:** Stimulate demand for low-carbon hydrogen, for example, setting targets / quotas for use in industry / domestic heat / transport.

On hydrogen supply:

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[1] 857MW, RWE share 59%
[2] 1.4GW, RWE share 100%
[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf

- The initial focus should be on supporting investment in hydrogen in the Industrial Clusters, as this should lead to the best use of shared infrastructure, which in turn will reduce the costs of deployment.
- However, there is a need for the government to move beyond 'ad hoc' funding schemes for demonstration projects and pilot schemes towards a funding model that supports the wider commercialisation and market ramp-up of hydrogen production and supply.
- We fully support the Government's timescales and ambitions on developing hydrogen production business models. RWE are actively participating in the BEIS Hydrogen Business Model Expert Group, and in the 'Deployment Roadmap' Working Group sitting below the Hydrogen Advisory Council. We advise that, if the Government are to meet their target of 1GW of production capacity by 2025, the framework must be in place no later than start of 2022, so investors, such as RWE, can begin development in 2022.
- RWE commends the announcement of a £240 million Net Zero Hydrogen Fund; noting that we would like to understand further not only how the fund is expected to be deployed but also how it will be supplemented by the inevitable private investment needed to ensure delivery. As there is a global market for capital investment, and UK Government will have to offer competitive rates of return through the business models to attract investment.
- Regarding the Government's 5GW target by 2030 set out in the 10 Point Plan, based on analysis by third parties, RWE believes that the Government could go further and faster in order to reach net zero:
    - Aurora Energy Research[4] recently conducted a study into hydrogen supply and demand. They forecast demand for hydrogen will be around ~20TWh 2030, which is equivalent to ~4 - 7 GW of installed electrolyser capacity (depending on electrolyser load factor).
    - The Committee on Climate Change in their most recent report on the 6th Carbon Budget[5] estimate in three of their scenarios that hydrogen demand across all sectors will require 10GW of installed electrolyser capacity by 2030 (in addition to any blue hydrogen capacity).
- In light of these projections, we would urge that the Government review the 5GW target and consider whether further ambition is required, as part of its forthcoming Hydrogen Strategy.

On hydrogen demand:

- We believe that the measures announced by the Government to date do not do enough to encourage and stimulate demand for hydrogen. This is a major missing link in the Government's current approach and should be addressed in the upcoming Hydrogen Strategy.
- It is not sufficient to focus solely on developing hydrogen production capacity, steps must also be taken to encourage end-use consumption for low carbon hydrogen both by replacing grey hydrogen usage (e.g. at oil refineries) switching away from fossil fuels and establishing essential infrastructure for distribution and storage.
- The only current incentive to encourage demand for low-carbon (specifically green) hydrogen is the Renewable Transport Fuel Obligation. However, according to the latest Government statistics,[6] very little hydrogen has been claimed through the scheme to date.
    - One way to stimulate demand for hydrogen is to allow the supply of green hydrogen as a substitute for fossil-based hydrogen in oil refineries, thereby allowing green hydrogen used in transport fuel production to be accreditable in a similar way to the European Renewable Energy Directive (RED II) legislation (i.e. allowing "intermediate product for the production of conventional fuel").

[4] http://www.auroraer.com/wp-content/uploads/2020/06/Aurora-Hydrogen-for-a-Net-Zero-GB-An-integrated-energy-market-perspective.pdf
[5] https://www.theccc.org.uk/publication/sixth-carbon-budget/
[6] In the November statistics release, just 306 litres equivalent of hydrogen was verified so far in 2020, compared with 807 million litres equivalent of verified renewable fuel (including e.g. biofuel).
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/932674/renewable-fuel-statistics-2020-second-provisional-report.pdf

- Alternatively, or in addition, the Government could introduce quotas / obligations for use of low-carbon hydrogen in industries, such as refineries, chemicals, etc. This is expected to give a strong pull for clean hydrogen from the demand side. It will increase the willingness to pay for hydrogen, thereby markedly decreasing the gap to make hydrogen economically viable for refineries and in the transport sector. However, such a scheme is only applicable in sectors where costs can be shifted to end-consumers without risking international competitiveness.

For the UK to become a world leader in production of green hydrogen by electrolysis at the lowest cost to the consumer, the definition of green hydrogen needs to allow access to renewable power from across the grid and from multiple renewable sources. This would allow electrolysers to run at higher utilisation factors than would be possible by direct connection to a single intermittent renewable source (thereby increasing hydrogen production and reducing the unit cost of production). Therefore the use of renewable Power Purchase Agreements (PPAs) / Green Guarantees of Origin (GGoO), rather than mandating directly-connected renewables, would ensure only green power is used for hydrogen production, whilst overcoming the impracticality of producing hydrogen at the renewable power source rather than the demand site.

Under the proposed RED II legislation, there are restrictions in accrediting renewable power for the production of green hydrogen to avoid use of non-renewable power, i.e. ensuring renewable origin, additionality, time correlation between assets and location correlation. RWE recognises that certification of green power is essential, however, this should be done in a pragmatic way through GGoOs, noting that, in the extreme, restrictions on access to renewable power complicate the business model for green hydrogen production unnecessarily, potentially making it un-investable. We would urge the UK not to impose similar restrictions. Support for the ambitious build out of renewable power in parallel should more than match the use for production of green hydrogen and allow the market to signal hydrogen production when it is most economic to do so.

On the 'focus': green hydrogen production should inherently form a significant proportion of this ambition, due to a natural fit given the UK's abundant renewable resource and the Government's ambitions for renewable power, particularly offshore wind (i.e. 40GW by 2030). Furthermore, research by ORE Catapult shows that, by 2050, green hydrogen can be cheaper than blue hydrogen and, with accelerated deployment, could be cost competitive with blue hydrogen by the early 2030s[7].

1b. how the proposed measures—and any other recommended measures—could best be co-ordinated;

UK-wide deployment of hydrogen supply and end-use will require significant collaboration between key sectors. To this end, RWE welcomes the establishment of the BEIS Hydrogen Advisory Council, and associated Working Groups (of which the latter RWE is a member)[8]. It is important that there is adequate coordination and governance to oversee the growth in hydrogen and to recommend the measures needed for the required pace of hydrogen deployment. These functions will require broad representation from producers, end-users and distributors (both high and low pressure), as well as cross-government coordination at the highest level. For example, whilst BEIS may have the energy portfolio, but close collaboration will be required with Dept. of Transport (to encourage use of Hydrogen in transport) and the Minister of Housing, Communities and Local Government will need to facilitate changes to planning rules and ensure roll-out of hydrogen in domestic heating.

[7] Offshore Renewable Energy Catapult (ORE) 'Offshore wind and Hydrogen – Solving the Integration Challenge' available here.

[8] RWE is a member of the 2020s Deployment Roadmap WG.

1c. 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:

CCS will be essential to a number of low carbon technologies required for Net Zero. Whilst many components of CCS have been proven around the world, the risks associated with CCS, in particular for transport and storage, could present a common risk point to a range of technologies. In addition to ensuring adequate system resilience for CCS, it will be valuable to have hydrogen production that is neither dependent upon CCS infrastructure nor on natural gas availability. Green hydrogen can help mitigate the risks of such dependencies, and early deployment at scale could realise additional benefits for the UK supply chain and drive down the cost of green hydrogen such that it can compete commercially in future.

1d. potential business models that could attract private investment and stimulate widespread adoption of hydrogen as a Net Zero fuel:

RWE are fully supportive of the work BEIS has undertaken to date on business models for low carbon hydrogen production, and are actively involved in the Hydrogen Business Model Expert Group on this matter.

A form of split Contract for Difference (CfD) appears to be favourable over alternatives to bring forward investment in green hydrogen. We urge BEIS to expedite development of the low carbon hydrogen business model to ensure that investors, such as ourselves, can start to develop real opportunities for green hydrogen as soon as is practicable.

Other specific considerations, with respect to the Low Carbon Hydrogen Production Business Model, include:

1. The Contract for Difference should protect on the producer cost side in addition to the revenue side (as with traditional renewable Contracts for Difference), i.e. the reference price should accommodate the fuel input price (power or natural gas) to protect against unmanageable market volatility, future market uncertainty and allow for confident investment.
2. The use of GGoOs can ensure only renewable power is used for green hydrogen production whilst overcoming the restriction that producing both the hydrogen and the renewable power source at the same location would impose. Attainment of certification must be kept clear and simple.
3. Counterparty (off-taker) risk needs consideration to avoid the risk of stranded assets.

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:

We commend the support for hydrogen trials that are taking place (e.g. HyDeploy and Spadeadam Test Facility). However, a great deal more needs to be done to demonstrate the safe operation of blending hydrogen into the National Grid network, and if the Government are to meet their target to, by 2023, complete testing necessary to allow up to 20% blending of hydrogen into the gas distribution grid for all homes on the gas grid.

Current consumers of natural gas, other than domestic, also need to demonstrate the ability to use blends. This is important for large consumers such as power stations, as a blend and changes of blend over time could severely affect their operation (an option to de-blend (remove the hydrogen from the natural gas) for sensitive users should not be seen as the sole answer to this issue, due to the prohibitive cost implications for the end-user). We note that the trials that have been announced are a step in the right direction but limited i.e. applied to closed off sections of the network. Ultimately, in order to prove the feasibility of blending into natural gas networks, "real life" trials of blending hydrogen into the distribution and transmission network should start, as soon as possible; starting with low percentage blends of hydrogen which can then be increased to understand the effect on plant.

In addition to the viability of hydrogen blends on infrastructure, the question of how to meter a blend of natural gas and hydrogen needs to be carefully considered due to the drastic difference in volumetric energy density between the two gases.

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:

The production of hydrogen, whether blue or green, will initially have a significant cost disadvantage compared to conventional hydrogen production, therefore a viable business model to support the CAPEX and OPEX of production is required. We commend the Government's work on Low Carbon Hydrogen Production incentivisation in the Hydrogen Business Model Expert Group. It is paramount that Government works closely with industry (including those knowledgeable in electricity markets) to ensure that a practicable business model is developed.

Blue hydrogen is capable of providing a clean baseload and flexible hydrogen supply but of course it will be dependent on natural gas and CCS. Green hydrogen has very high purity, does not require either gas or CCS infrastructure, but will require access to renewable power. Direct connection to renewable power provides certainty of origin but with the associated intermittency and lower availability. In advance of a national hydrogen network or a local blue hydrogen supplier, this intermittency is unlikely to be acceptable to end-users and storage to resolve this is unlikely to be economic. Waiting until UK power generation is fully decarbonised will hold back UK green hydrogen deployment. Intermittency issues for green hydrogen could be avoided by removing any requirements for direct connection and instead allowing the use of certified tradable green power, for example GGoOs, from multiple sources as this would increase the availability of green power for hydrogen production.

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

Infrastructure planning policy for green hydrogen needs to be appropriate to the technology and timescales in line with the UK supply chain potential for electrolyser production capacity and deployment timescales.

The physical characteristics of hydrogen mean that it can only be stored at relatively high pressures and therefore storage will be significantly more expensive than for natural gas storage. Only limited storage capability exists at present, therefore it will be important to drive innovation in hydrogen storage as well as providing support for development of large-scale hydrogen stores in the future. Large-scale deployment of green hydrogen should be considered in tandem with the infrastructure to store hydrogen.

During the initial roll out of hydrogen, costs will be reduced by locating hydrogen production adjacent to demand (hence the need for PPAs / GGoOs, as noted above) since the distribution infrastructure will have to be developed in parallel, with the associated costs. As hydrogen usage builds up, local hydrogen networks should be created to supply multiple off-takers (but still in a relatively small area). Then at the next stage, it would be economically rational to re-utilise the existing natural gas distribution and transmission networks (that would otherwise become obsolete in a decarbonised world without natural gas) for hydrogen transportation around the country.

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:

The strategic advantage to the UK of early and extensive deployment of green hydrogen, in combination with offshore wind, will boost the UK's energy independence. It will also provide UK industries with a competitive advantage: modelling by the ORE Catapult shows that producing green hydrogen from offshore wind could supply a growing import demand from Europe, with a value of up to £48bn by 2050, contributing to a cumulative GVA of £320bn by 2050, mainly from global electrolyser exports[9].

We would point the Committee to the recent report by the Committee on Climate Change on 6th Carbon Budget[10], which we believe to be the most authoritative assessment of cost-effective pathways to net zero. In that report, low-carbon hydrogen plays a crucial role. Indeed, by 2050 hydrogen production is projected to be equivalent to today's electricity production levels (up to 380 TWh by 2050). It is used in areas less suited to electrification, particularly shipping and parts of industry, and is vital in providing flexibility to deal with intermittency in the power system. It may also have a material longer-term role in buildings and other transport, such as heavy goods vehicles.

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:

RWE believes that hydrogen and electrification will both play major and complementary roles in the path to Net Zero. Noting the complexity of the situation, priority should be given to deployment where it has the largest impact in terms of carbon emission reduction both in the short and longer term, i.e. due consideration is needed for hydrogen deployment in general to ensure the UK builds the necessary infrastructure for hydrogen and there is confidence in wide-scale end-use of hydrogen.

Focus therefore should not only be on those sectors where hydrogen is currently seen as the only viable option to decarbonise but also on sectors where hydrogen provides a holistic lower cost option than electrification, such as heavy duty transport, parts of industry and heat. The electricity system would require significant re-enforcement at every level if hydrogen did not play its part. Noting that RWE believes that the initial focus should be on supporting investment in hydrogen in the Industrial Clusters, as this is where low carbon hydrogen can be most easily deployed (e.g. to replace existing grey hydrogen use), where it will have the largest initial impact on carbon emission reduction and will lead to the best use of shared infrastructure (e.g. local hydrogen networks) (thereby reducing the cost of deployment).

(January 2021)

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[9] Offshore Renewable Energy Catapult (ORE) 'Offshore wind and Hydrogen – Solving the Integration Challenge' available here.

[10] https://www.theccc.org.uk/publication/sixth-carbon-budget/