Hydrogen East

H2 News Hub

Issue 9

August 2021

Top stories

In issue 9 of **Hydrogen East**'s Sector Review, we take a look at important publications and developments over the month of July (2021) – a month that saw us mark a year since our launch.

Hydrogen East co-founder, Nigel Cornwall presented the case for the **New Anglia "Hydrogen Hub"**, with the East of England capable of making a significant contribution to realising hydrogen's potential regionally and contributing to delivering the national strategy.

National Grid ESO published its **Future Energy Scenarios 2021**, mapping out four credible energy pathways for Britain over the coming decades, where hydrogen was highlighted as key to solving some of the hardest parts of the transition to net zero.

The Nuclear Sector Deal's Innovation Group launched **Unlocking the UK's Nuclear Hydrogen Economy to Support Net Zero**, a cross-sector action plan, exploring how to realise the opportunity of nuclear derived hydrogen.

Meanwhile, Cadent unveiled a roadmap, **Green Print – Future Heat for Everyone**, exploring how industry can rise to the challenge of transitioning 22mn homes to low carbon heat by 2050. It sought to balance the key technical, consumer and economic considerations with a particular focus on hydrogen.

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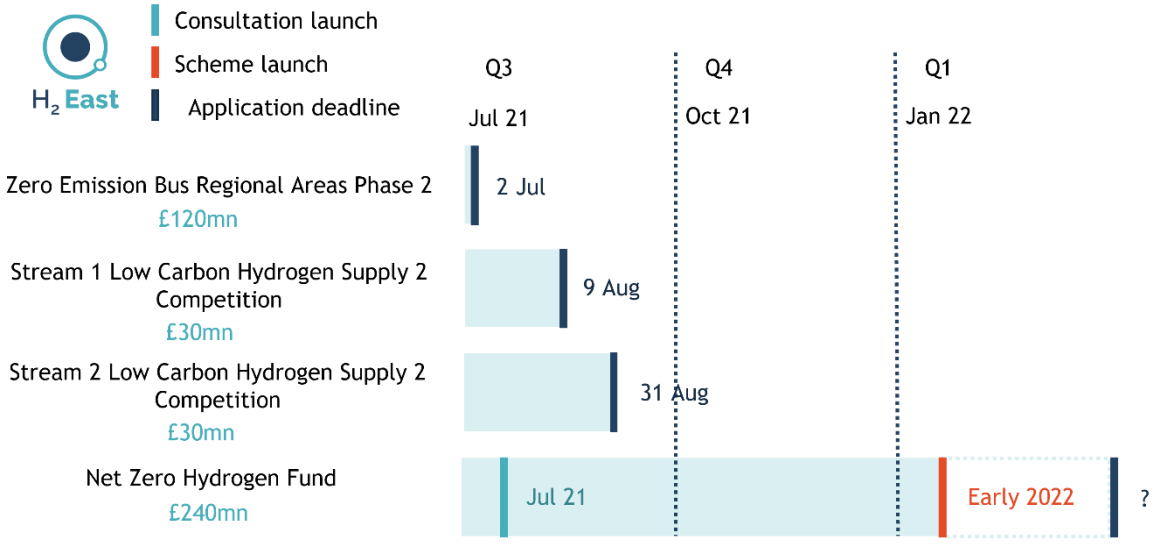
Upcoming webinars

10 Aug – **Siemens PSE:** Digital design solutions to accelerate Hydrogen applications | **12 Aug** – **Reuters:** Including Hydrogen Strategy in Offshore Wind Project Development Plans | **12 Aug** – **Mission Hydrogen GMBH:** eFuels vs. hydrogen – Opponents or a supplement? | **17-25 Aug** – **Infocus International:** Mastering Clean Hydrogen (Online Course) | **25 Aug** – **World Hydrogen Leaders:** World Hydrogen Finance & Investment

Funding tracker

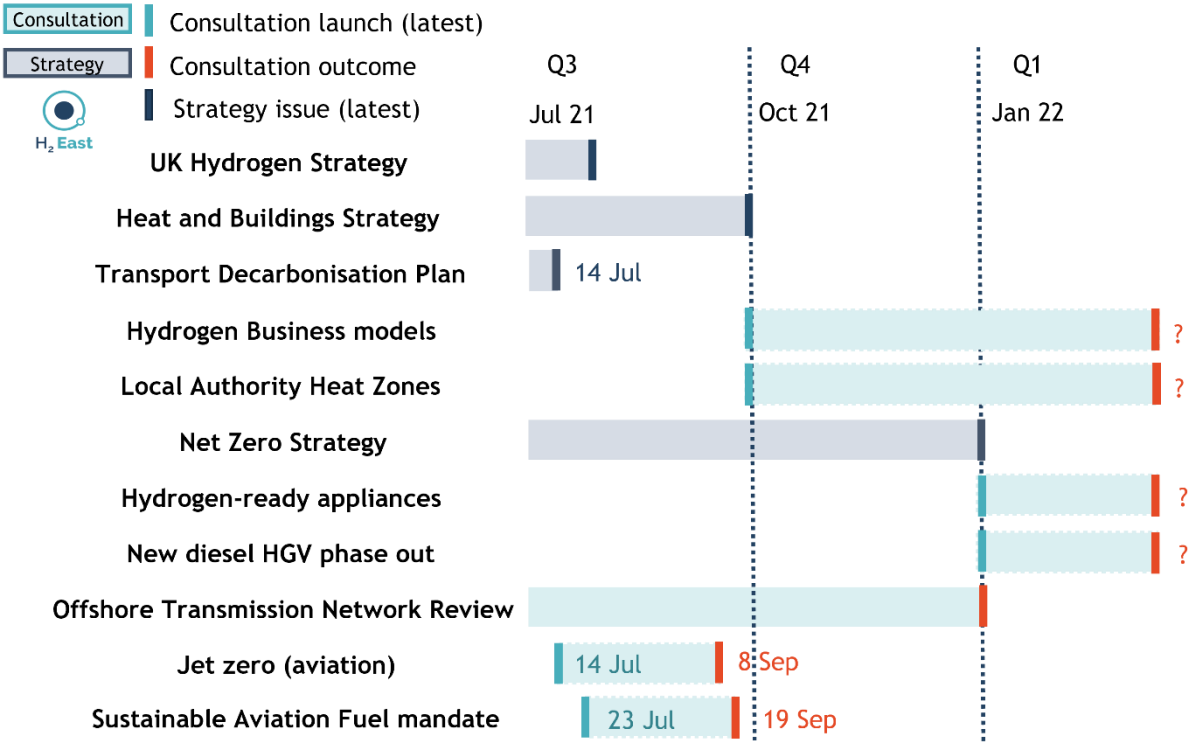
There are a number of funds already available for developers, local authorities and innovative organisations. These cover both feasibility studies and demonstrator projects.

The **Net Zero Hydrogen Fund**, expected to be consulted on in July 2021, has been promised for early 2022. This will be the primary area of government funding for hydrogen projects in the near-term, with up to £240mn on offer.



Policy tracker

A number of consultations and strategies are in development and are expected to be issued in 2021. Most crucially, the UK government has committed to launch of a **UK Hydrogen Strategy**, which is currently ear-marked for July 2021.



The New Anglia "Hydrogen Hub" – a Different Type of Cluster

It is clear that another energy carrier will be required to deliver the *2050 Net Zero emissions target.* Hydrogen is increasingly seen as playing a complementary but essential role beyond low-carbon electricity in decarbonising the economy, also supporting a more flexible, resilient, and integrated energy system.

Figure 1 The New Anglia "Hydrogen Hub"

(Source: Hydrogen East)

Against this background, global commitment to the deployment of hydrogen is accelerating, with national governments setting increasingly ambitious targets for the sector. The UK is part of the leading pack.

Emerging policy

The Government has already set a target of 5GW of hydrogen capacity by 2030 in the Prime Minister's *Ten Point Plan*. It is also boosting the formation of industrial clusters and backing proposals to promote the use of hydrogen in heating. Hydrogen already features in the *Transport Decarbonisation Strategy*. In turn, the *Hydrogen Strategy*, is likely to form an integral part of the *Net Zero Strategy* to be issued ahead of the CoP26 meeting in Glasgow.

The timing and scale of hydrogen deployment in the UK energy system remains uncertain at this stage and will depend on technology commercialisation pathways and policy support that has yet to be defined. Policy is likely to provide strong signals to industry, underpinning short- to medium-term investments and contributing to the green economic recovery. Those investments will build the evidence base to inform the long-term direction of travel and the scale of the opportunity. However, hydrogen development will typically grow out of local conditions and lead to the formation of clusters with strong regional characteristics reflecting place-based opportunities and other decarbonisation measures adopted locally.

The region

The East of England already has strong foundations to support early deployment of a hydrogen cluster initially through continuing development of facilities at the Bacton terminal and the transformation of it into a diversified energy hub. Recent reports have borne out the potential for early deployment of both blue and green hydrogen close to the site and a range of near-term use cases have been identified. These could form an important role in supporting the New Anglia LEP's objective of Norfolk and Suffolk becoming the UK's *Clean Growth Region*.

Important regional characteristics are:

- Likely early availability of blue hydrogen at scale from legacy Southern North Sea (SNS) assets produced in combination with carbon capture, utilisation and storage (CCUS) that can be landed through existing pipes and good potential storage facilities offshore for CO2 and possibly hydrogen
- Excellent existing connections at the Bacton site with the onshore gas transportation system providing access to repurposed and new markets in London and the South East, but also major gas interconnectors connecting with mainland Europe

- Green hydrogen production at scale from continuing build-out of wind generation off the coast, as well as solar power onshore and possibly new nuclear development. These are all likely to make a major contribution in a rapidly changing but presently heavily constrained electricity system, and there will also be opportunities to use increasingly frequent clean generation surpluses for conversion through electrolysers, and
- While the region does not have significant industrial load like many other clusters currently under discussion and development elsewhere, it does have significant potential markets in, among other things, heavy transport in various forms (trucks, rail and shipping), heating, agriculture and food processing. These demands could offer security of demand and pull through investment in the necessary infrastructure.

Technology cost reductions are already surpassing expectations, with the gap between blue and green hydrogen set to narrow rapidly and even possibly to reverse.] The economic opportunity is therefore significant, especially if development can be targeted and aligned with existing regional strengths and capabilities. Here too, the East of England offers early-mover benefits given the existing supply chain and skills already established from the oil, gas and renewables sectors, and which can be progressively redeployed as we "build back better".

The opportunity

The recent Hydrogen East study has already highlighted that there could easily be 10-20TWh of regional demand for hydrogen as early as 2030 with the right development, coordinated action and appropriate policy support. This approach should allow local communities and businesses – who are likely to be adversely impacted by the loss of jobs associated with the traditional oil and gas sectors – to benefit directly through investment and jobs creation in clean growth sectors such as hydrogen production, distribution, transport and supply.

Today, hydrogen stands ready as a deployable technology to integrate power and transport decarbonisation especially in a region with a high proportion of heavy vehicles and longer average travel distances and applicability to heat and hot water. **The East of England can make a significant contribution to realising hydrogen's potential regionally and make a material difference to delivering the national strategy**.

Several analytical projects and assessments are already underway involving Hydrogen East and other local stakeholders to test regional options and opportunities. They include:

- The Bacton energy hub project, which might readily expand into a wider sub-regional hub combining both blue and green hydrogen
- The development of electrolysis capacity in conjunction with nuclear energy and heat to support development at Sizewell
- The recently launched Lowestoft Power Park project, looking at refurbishment of aging wind turbines and their paring with electrolysers for use by municipal buses and fleets

The issue for the region is not whether the region can contribute to realisation of the *2030 hydrogen* and *2050 Net Zero targets,* but how big that contribution could and should be. But to do this, **the *Hydrogen Strategy* needs to give due weight to both green and blue hydrogen and not be too focussed on industrial clusters**.

It is important that the *Hydrogen Strategy* recognises these regional drivers and opportunities, and also that it enables diversity. It needs to enable different pathways to enabling hydrogen to make a significant contribution to Net Zero and support *Local Industrial Strategies*. **It should allow development of thinking around different choices in a range of diverse and very different regional economic sectors**, in addition to supporting emergence of industrial clusters elsewhere in GB and in neighbouring European markets.

Blue hydrogen "essential" to UK's shift to low carbon energy

Blue hydrogen is set to prove crucial to the UK's transition to low carbon energy as it works to reach net zero by 2050, a report has said.

On 6 July, the UK Hydrogen and Fuel Cell Association (UKHFCA) released a position paper, *The case for blue hydrogen*. Within this, it set out how the UK is well placed to take advantage of opportunities from low carbon blue hydrogen, owed to its existing, historic large-scale production of natural gas and the government's commitment to the technology. It forecast that by 2030, the UK could deploy 10GW of blue hydrogen and reach 80GW by 2050, though this will call for clearer direction and support from government.

This will include setting and implementing low carbon hydrogen standards for the carbon content of hydrogen and providing business models and targeted support mechanisms, enabling low carbon production across all colours at scale, complementary to carbon pricing. Clarity and greater certainty is also needed around the support available for blue hydrogen, which would help to drive innovation and investment. It highlighted confirmation of the way forward for hydrogen blending into the gas grid and the implementation of certification schemes as two areas where clear direction from government is especially vital.

It further recommended government sets ambitious targets for blue hydrogen production equivalent to those of green hydrogen, with a need to grow all types of low carbon hydrogen at scale; develops an industry wide plan for international cooperation, given the potential of the UK to become a world leading producer of hydrogen; and enables the transition of traditional roles in oil and gas to blue hydrogen as part of a just transition, securing employment and leveraging skills from a legacy sector.

Green light for next phase of HyDeploy

The next phase of the HyDeploy project is set to begin in August, after being given the go-ahead by the Health and Safety Executive (HSE).

On 23 July, Northern Gas Networks (NGN) announced that Winlaton, Gateshead, will become the first community to receive hydrogen blending through the public natural gas network after the green light from the HSE. A 10-month pilot will see up to 20% hydrogen blending for 668 homes, a school and some small businesses. Customers will be able to use their gas supply and appliances as normal, with no changes needed to gas pipelines or pipework, due to current appliances being designed to operate with a blend of up to 23%.

HSE granted an exemption to HyDeploy for the current limit of a 0.1% hydrogen blend in the UK gas network after it gathered "extensive evidence" to demonstrate that the hydrogen blend will be as safe as natural gas.

INEOS backs clean hydrogen fund

INEOS Energy has agreed to purchase 25mn shares in the forthcoming IPO of HydrogenOne Capital Growth, representing 10% of the target fund raise of £250mn.

On 5 July, INEOS made the announcement, as well as revealing that it will have the right to appoint a non-executive director to the board and have co-investment rights within projects identified by HydrogenOne. HydrogenOne was first established in 2020, followed by the launch of HydrogenOne Capital Growth in July, which is set to invest into global hydrogen projects and hydrogen companies that provide the equipment and components that will form part of the hydrogen value chain, including fuel cell and electrolyser manufacturers.

Investment will mainly be in private hydrogen assets and also include hydrogen focused listed assets from global markets.

Hydrogen part of Anglian Water's path to net zero

Anglian Water has unveiled how it plans to reach net zero carbon by 2030.

On 21 July, it published a roadmap, setting out its net zero strategy to 2030. The target covers all of its operational activities and those of its supply chain, as well as a commitment to cut capital carbon by 70% against a 2010 baseline. Its approach is centred around maximising energy efficiency and renewable energy generation and storage; procuring green electricity for its remaining grid requirements; decarbonising its vehicle fleet; maximising the value of biogas; managing process emissions; opting for alternative fuels; and developing an offsetting strategy for residual emissions. Hydrogen is featured throughout the plan, namely in Anglian Water's approaches to transport, biogas and alternative fuels.

As part of preparations for a post-2030 net zero operating environment, it is committed to preparing a hydrogen roadmap for its business and engaging with key hydrogen stakeholders in the region, as well as taking on active role on wider hydrogen policy discussions in the UK with regulators, government, water sector bodies, Energy UK, the supply chain and key energy players in the market.

For transport, it will look to gradually switch its own and suppliers' HGVs to liquified natural gas in the short term, ahead of a longer term transition to hydrogen and biomethane from 2030. The viability of using hydrogen "by and post 2030" will be assessed by 2025. Highlighting biogas as one of the routes to hydrogen production and injection into a future hydrogen grid, it will actively consider opportunities associated with hydrogen from its bioresources assets for potential implementation after 2030. This will make sure it is prepared for a potential switch of the gas grid to hydrogen from 2040 onwards.

As it looks to drive towards alternative fuels, strategic objectives include building understanding of how it can best play its part in a future UK hydrogen economy and aiming to have a better understanding of the opportunity from hydrogen production and use in the business. It has already started exploring the potential for hydrogen in the business and how it could benefit future customers as well as the wider region.

To aid this work, it will build on its current work on hydrogen, which includes a technical and cost assessment of how it could produce green hydrogen through electrolysis, and see how it could fit into its energy mix and dispatchability strategy, post-2030; and consider implementing hydrogen pilot programmes, post-2025, to quantify benefits of hydrogen generation and use.

Partnership to deliver green hydrogen to UK and Ireland

SSE Renewables and Siemens Gamesa Renewable Energy have linked up under a partnership that will see green hydrogen delivered to the UK and Ireland.

On 26 July, SSE Renewables announced that they had signed a Memorandum of Understanding (MoU) that will see them explore the opportunity of producing and delivering green hydrogen through electrolysis. They will aim to co-locate hydrogen production facilities at two onshore windfarms in Scotland and Ireland, which will be announced at a later date.

The partnership will span the entire green hydrogen value chain, including construction, supply chain management, customer offtake and storage, end user requirements, reliability, and operation and maintenance. They will look to work with green hydrogen customers across a range of industries, such as transportation and major distilleries. Scotland and Ireland, it was further noted, could support the establishment of a hydrogen economy, due to their abundant renewable energy resource, offering longer-term opportunities to export green hydrogen to regions around the UK and into Europe.

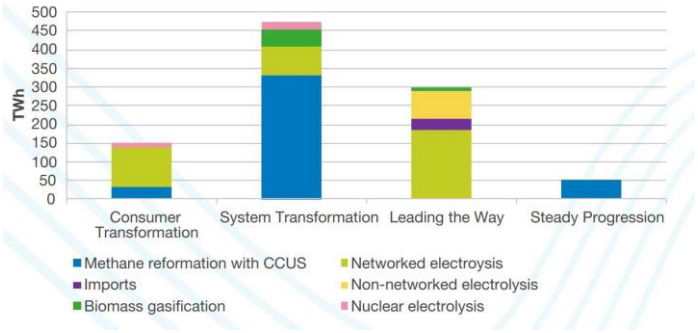
Hydrogen set to be crucial part of UK's net zero pathway

Hydrogen will prove critical to the UK reaching net zero, solving some of the hardest parts of the transition, namely HGVs, shipping and aviation, according to a report.

On 12 July, National Grid ESO published its *Future Energy Scenarios 2021*, mapping out four credible energy pathways for Britain over the coming decades, along with the level of societal change and policy direction needed to achieve targets. In three of the four scenarios, Britain reaches net zero by 2050 while in the most ambitious scenario, *Leading the Way*, the country becomes net negative by 2050, having reached net zero by 2047.

Figure 2: Hydrogen supply in 2050

(Source: National Grid ESO)



The supply and use of hydrogen was found to be central to all net zero scenarios. Electrolysis introduces significant flexibility to the electricity network, while hybrid heat pumps and hydrogen boilers replace natural gas. Storage capacity was also deemed to be as important as production facilities, ensuring the maximum whole energy system benefit can be gained.

Transitioning to hydrogen and using it to heat homes will not be as simple as just using the natural gas pipe network to transport it. Additionally, infrastructure and governance must be in place, along with producers, suppliers and network operators and sufficient demand. For example, for the 2030 target of 5GW of production capacity to be met, there will have to be a rapid increase in demand over the 2020s or spare production capacity built in anticipation of demand at a later date. *Leading the Way* assumes the target will be met through government support, though initially operating at a reduced load factor. *System Transformation* sees it reached in 2032, though also at reduced capacity.

Considering the emergence of industrial clusters with a demand for hydrogen, the ESO assumed that they will act as an anchor for hydrogen supply within a particular region. They could be connected by a hydrogen backbone, supplying and storing hydrogen, while supporting increased use across the country. In *System Transformation* and *Leading the Way*, it is assumed hydrogen supply to the wider region grows out of these hubs. Adequate hydrogen storage is as important as production, providing additional energy at times of peak demand. It was found to rapidly increase in *System Transformation*, which has the highest proportion of hydrogen use, reaching over 50TWh by 2050.

In *System Transformation*, the nationwide gas grid is almost entirely converted to transport hydrogen by 2045. It sees 70% of hydrogen come from methane reformation with green hydrogen, nuclear and biomass gasification providing additional volumes, while the use of biomass and carbon capture utilisation and storage (CCUS) contributes almost 10%.

In *Leading the Way*, meanwhile, demand for hydrogen comes from a mixture of heating and industrial needs, along with road transport, shipping and aviation. It also sees maximum use of electrolysis, either onshore or offshore, with hydrogen produced from a limited amount of biomass gasification.

Government to explore hydrogen's role in large-scale, long-duration storage

The government has launched a consultation, seeking evidence on large-scale and long-duration electricity storage (LLES).

Published on 20 July, BEIS outlined how LLES could play a crucial part in decarbonising the energy system, owed to its ability to provide storage over different durations, helping to balance the system across longer periods of lower generation or higher demand. Specifically, it is seeking information to build understanding on barriers within the current market for large-scale and long-duration electricity storage, how they could be addressed and the risks that may be associated with potential interventions to support deployment.

The consultation does acknowledge a role for hydrogen as an LLES technology, providing system flexibility through electrolysis. However, the lack of a market to which interventions could apply and the fact hydrogen projects will require a range of interventions in the long-term across the value chain mean the challenges it will not face the same financing challenges as other LLES technologies that have a clearer path to market.

Although hydrogen storage is a mature technology, it has not yet been well demonstrated as an option to deliver grid scale electricity storage. Furthermore, there are potential innovation barriers it could face, as well as financing ones.

The consultation suggested a Cap & Floor approach could prove a potential solution in the longer-term, once a hydrogen market is in operation, though noted this will be dependent on how other parts of the hydrogen value chain develop. Information gathered through the call for evidence will help to inform the government's work to clarify how to best address hydrogen.

The consultation will close at 11:45PM on 28 September.

Cromarty Firth an ideal fit for UK's largest green hydrogen electrolyser

The Cromarty Firth could play host to the UK's largest green hydrogen facility after the North of Scotland Hydrogen Programme carried out a feasibility study.

On 23 July, ScottishPower announced that the programme's Distilleries Project study, of which it is a part of, had identified a number of sites around the Cromarty Firth that could become the home of a 35MW electrolyser by 2024, producing up to 14 tonnes of green hydrogen per day. The study itself had explored the viability of a green hydrogen hub in the Firth, supplying distilleries in the region with hydrogen at a competitive price, helping to decarbonise their heating and processes when making whisky.

The Firth having a large regional concentration of renewable energy potential was deemed to be a key strength, with future offshore wind development sites capable of supplying the volume of power needed for the electrolyser. It also has significant existing infrastructure already, a proven track record of success in renewables, an experienced local supply chain and strong links to industry, transport and heat networks.

After the successful feasibility study, the project will now advance into its next stage of development. This will involve detailed engineering, community engagement and commercial development, preparing the project for a final investment decision by 2023.

The aim would then be for the electrolyser to be in place by 2024 as the project follows a phased development plan, meeting local and distillery demands and proving the technology at this scale initially, before an expansion of green hydrogen in its second phase to meet growing energy demands nationally and internationally.

Vision unveiled for zero carbon hydrogen produced from nuclear

Nuclear derived hydrogen could be a low-risk route to hydrogen production while helping to unlock net zero, according to a new plan.

Figure 3: The Roadmap to a UK Nuclear Economy

(Source: National Grid ESO)

On 14 July, the Nuclear Sector Deal's Innovation Group launched *Unlocking the UK's Nuclear Hydrogen Economy to Support Net Zero*, a cross-sector action plan, exploring how to realise the opportunity of nuclear derived hydrogen. It set out how sites previously identified as having the potential for new nuclear could provide 90% of 2050 zero carbon hydrogen demand. By operating 24/7, a nuclear energy source can also maximise use of electrolysers, reducing unit costs. It highlighted forecasts from the International Atomic Energy Agency (IAEA), which found high purity nuclear hydrogen could fall below £1.50/kg, making it competitive with other low carbon hydrogen technologies.

Mapping out how a UK nuclear hydrogen economy could develop between now and 2050, it set out how today, nuclear already has gigawatts of grid-connected generating capacity, a proportion of which could be used for nuclear generation. Flexible co-generation, switching between electricity and hydrogen production, could be used both now and in future to optimise capacity on a rapid basis to gain maximum net zero benefit. Into 2025, nuclear heat-assisted hydrogen production would be demonstrated, with increasing efficiency of hydrogen production methods, leading into 2040 where planned new build of LWR, SMR and AMR with advanced hydrogen production technology can be used to scale up production. By 2050, there would be 12GW of capacity, with 1,600Mt of hydrogen a year.

It further outlined how 3GW of nuclear capacity with today's technology could account for the whole of the UK's current hydrogen demand, adding that all technologies to provide nuclear hydrogen are already commercially available today and can be deployed with low risk. This could see 25,000 high value jobs created, meet 45% of the 2030 hydrogen target, fuel 40,000 hydrogen buses, decarbonise 50% of UK shipping emissions, heat 1mn homes with low carbon hydrogen and deliver 10% of the predicted 2050 hydrogen demand.

It went on to make a series of recommendations, including the need to create appropriate measures that deliver an immediate term use case for nuclear derived zero carbon hydrogen to activate the market; enhancing UK supply chain capability to its full potential across the entire hydrogen value chain; and a focused effort on communicating the benefits of nuclear hydrogen products, demonstrating the societal value of nuclear-derived hydrogen.

In future, it called for the establishment of support schemes to incentivise the full hydrogen value chain for a range of markets; innovation funding focused on accelerating technology innovation, delivering increased efficiencies and scalability, using heat and electricity from nuclear power plants; enabling policy that will embrace the potential for nuclear to decarbonise sectors such as heavy industry, transport and direct heat; and defining a low and zero carbon hydrogen standard, ensuring consistent access to finance and market mechanisms for all relevant technologies as they come to commercialisation.

Hydrogen to be used for transport where batteries cannot reach

Hydrogen will prove most effective in transport in areas where batteries are unable to reach, according to the government's Transport Decarbonisation Plan.

On 14 July, it published its "greenprint" for decarbonising all modes of transport by 2050, setting out plans to improve public transport, support active travel, create a net zero rail network by 2050, ensure net zero domestic aviation emissions by 2040, and lead the transition to green shipping. It could save 1,300 to 1,800MtCO2e, deliver £9bn in benefits from better air quality and help to create and support highly skilled jobs.

It includes two commitments for hydrogen: the publication of an overarching hydrogen strategy this summer, focused on the increased production of hydrogen and use across the economy, including in transport, as well as £3mn investment in 2021 to establish the UK's first multi-modal hydrogen transport hub in Tees Valley.

In transport, the focus will be on the use of genuinely green hydrogen and maximising its opportunities, ensuring it is able to play a full part in a renewable energy system. The government's R&D funding and support will hone in on rail, maritime, aviation and heavy road freight, all sectors where a proven winning technology is yet to emerge and hydrogen offers in-use advantages and the largest global market potential. The aim is to maximise its potential alongside electrification on trains, buses and coaches.

Hydrogen transport hubs, meanwhile, are valued due to the way they can unite transport with industry and energy sectors, driving local industrial strategies, levelling up and local benefits. Further advantages include accelerating technology development and the ability to test at scale, providing better understanding of operational costs, enabling benefits to be felt by users sooner.

World-leading hydrogen storage facility planned for Yorkshire

SSE Thermal and Equinor have unveiled plans for what would be one of the world's largest hydrogen storage facilities in Yorkshire.

On 15 July, they announced the facility, earmarked for their existing Aldbrough site on the East Yorkshire coast, would have an initial capacity of 320GWh and could store low carbon hydrogen from as early as 2028. The current gas storage facility, commissioned in 2011, is co-owned by the pair and has nine underground salt caverns, each equating to around the size of St Paul's Cathedral. These would be converted to store hydrogen, or new purpose-built caverns could be created.

The Aldbrough Hydrogen Storage facility would be "significantly larger" than any facility currently in operation around the world, while also providing ideally placed to store low carbon hydrogen produced and used in the Humber region.

SSE Thermal and Equinor's partnership in the Humber would rank as the UK's first end-to-end hydrogen proposal, seeing production, storage and demand projects connected in the region. It would initially store hydrogen produced for the Keadby Hydrogen Power Station – proposed by SSE Thermal and Equinor as the world's first 100% hydrogen-fired power station – though owed to its large scale, it would have the potential to extend well beyond power generation. The partners suggest the facility could enable growing hydrogen ambitions across the region, unlock the potential for green hydrogen and supply an expanding offtaker market, including heat, industry and transport, from the late 2020s.

The storage facility, along with the partners' other projects in the region, are still in the development stage. Final investment decisions will depend on the progress of necessary business models and associated infrastructure.

Cadent plots 2050 transition for 22mn homes to low carbon heat

Cadent has mapped out how the industry can rise to the challenge of transitioning 22mn homes to low carbon heat by 2050.

Figure 4: The different areas of Cadent's "Green Print"

(Source: Cadent)

On 20 July, it published *Green Print – Future Heat for Everyone*, setting out the scale of the challenge ahead, stressing the need for a "mosaic of low carbon heating solutions" and outlining 12 steps to realise the transition. These steps form its "Green Print", a roadmap for low carbon heating that seeks to balance the key technical, consumer and economic considerations with a particular focus on the role of hydrogen.

Presenting the task as one of "unprecedented scale", it drew on estimates of the Climate Change Committee (CCC) which has forecast £250bn of investment will be needed to upgrade insulation and heating in homes, as well as provide the necessary infrastructure.

Around 80% of homes that exist in 2050 have already been built and their energy performance remains relatively poor – 61% of the housing stock is rated EPC "D" or lower. Therefore, the challenge ahead will equate to the equivalent of retrofitting 67,000 homes every month, or 800,000 per year, between now and 2050.

To prove the technical case, hydrogen must be shown to be safe in the gas network and at home, while action must be taken to enable the development of a hydrogen economy. This can be done through setting production targets; developing production and carbon capture and storage business models; supporting industrial cluster development; accelerating hydrogen blending; mandating hydrogen-ready appliances; and upgrading the gas network. It also cited prioritising innovation and injecting pace into building infrastructure as key.

When it comes to ensuring consumer wants and needs are properly considered, it called for them to be central to decisions on the future of heat and for unnecessary "format wars" to end. For example, the continuous argument between hydrogen boilers and heat pumps is unhelpful and the debate should, instead, focus on how both can be delivered. Other key steps here involve understanding consumer views on heating and being upfront with them on how much the transition ill cost, as well as how it will be paid for.

Finally, to ensure robust economic decisions, it stressed the need for a market design and regulatory framework that incentivises industry to invest; to stop planning in silos and, instead, coordinate local area plans for decarbonisation across power and gas; to plan for peak demand, not average demand; and deepen understanding of the critical economic factors that will determine the energy mix.

It explained that while hydrogen is not available for homes today, there is enough information to see it will be an option in future and a necessary one. However, there is a lack of certainty on the extent of the role it will play, which will be determined by how a range of factors change over time. Therefore, it will be crucial to refine analysis as and when new information emerges.

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