Hydrogen East

H₂ East

H2 News Hub

Issue 3

February 2021

Top stories

In Issue 3 of **Hydrogen East**'s Sector Review, we take a look at important publications and developments over the month of January (2021).

On 21 January, the ENA set out **Britain's Hydrogen Network Plan,** which incorporated the role of the gas distributors in commencing 20% gas grid blending in 2023 to a full hydrogen grid transition by 2050.

BEIS announced early in the month on 2 January **£8mn of funding to create "the world's first net zero emissions industrial zone** by 2040". Successful projects will focus on hydrogen, CCS and energy integration.

Regen produced a vision of **building the hydrogen value chain,** exploring production through to end-user. It suggested that hydrogen development must begin low-carbon and scale up quickly to drive down costs and open new markets.

The **Nuclear Industry Association submitted its response in January to the government's consultation on *The Role of Hydrogen in Achieving Net Zero*,** highlighting the need to consider all technologies in hydrogen production, including nuclear.

On 27 January, the Hydrogen Import Coalition published a report considering **import costs of renewable energy by varying hydrogen carriers to Belgium**.

Contents

Upcoming webinars

9 February – **PIG**: Hydrogen at scale in the UK: A HyNet case study | **10 February** – **Mission Hydrogen**: How to scale up hydrogen vessels | **17 February** – **SIRACH**: Energy Systems – Looking forward to 2050 | **18 February** – **Hydrogen Triple Allicance**: How can renewables sustain resilient communities | **25 February** – **Reuters**: Who are the hydrogen end users? | **26 February** – **Dentons**: Scaling up green hydrogen in Europe

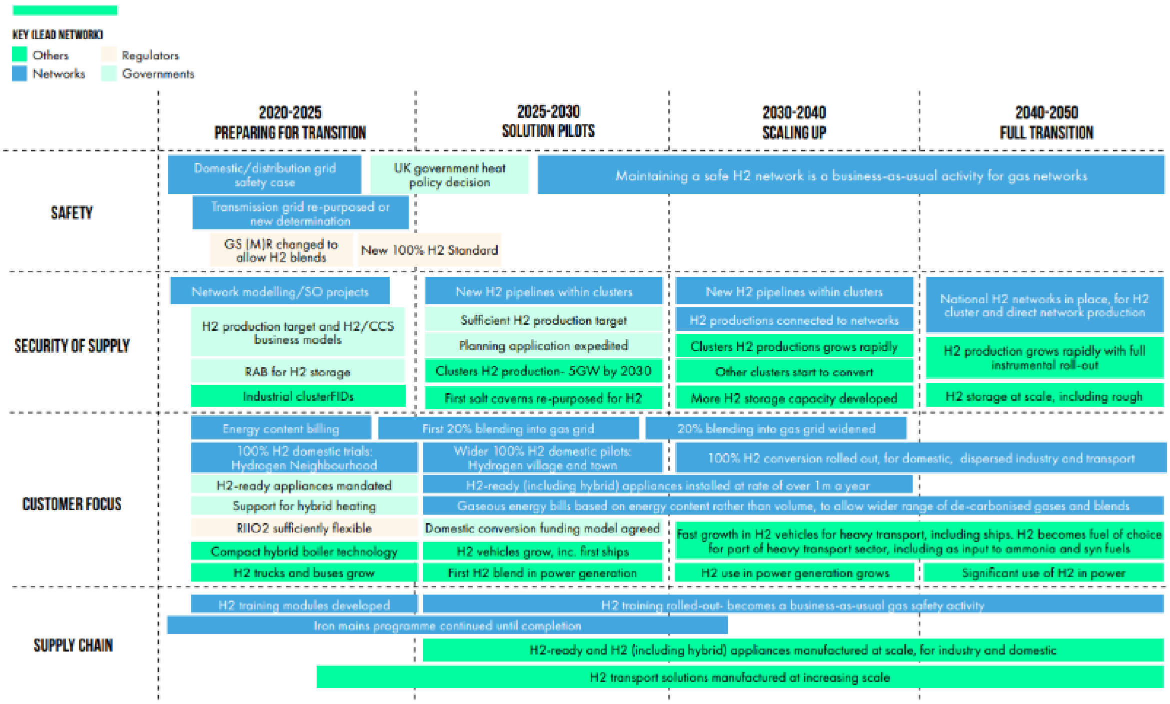
Gas networks set out hydrogen blueprint

Britain's five gas network companies have outlined how they are planning to deliver on the government's ambitions for hydrogen.

On 21 January, the Energy Networks Association (ENA) published *Britain's Hydrogen Network Plan*, as part of the Gas Goes Green programme, setting out how Cadent, National Grid, Northern Gas Networks, SGN, and Wales & West Utilities plan to oversee the transition of the UK's gas networks from natural gas to hydrogen. It details how the companies aim to progress to be ready to start blending up to 20% hydrogen into the gas grid by 2023, ahead of delivering the UK's first hydrogen town by 2030.

The plan is split into four stages of delivery, commencing with preparations for the transition over the next five years. This will involve continuing the iron mains risk reduction programme, completing the safety case, trialling 100% hydrogen in homes, and carrying out network modelling in a bid to ensure security of supply can be maintained. The information gathered from this first stage will enable government to make policy decisions on the conversion of networks.

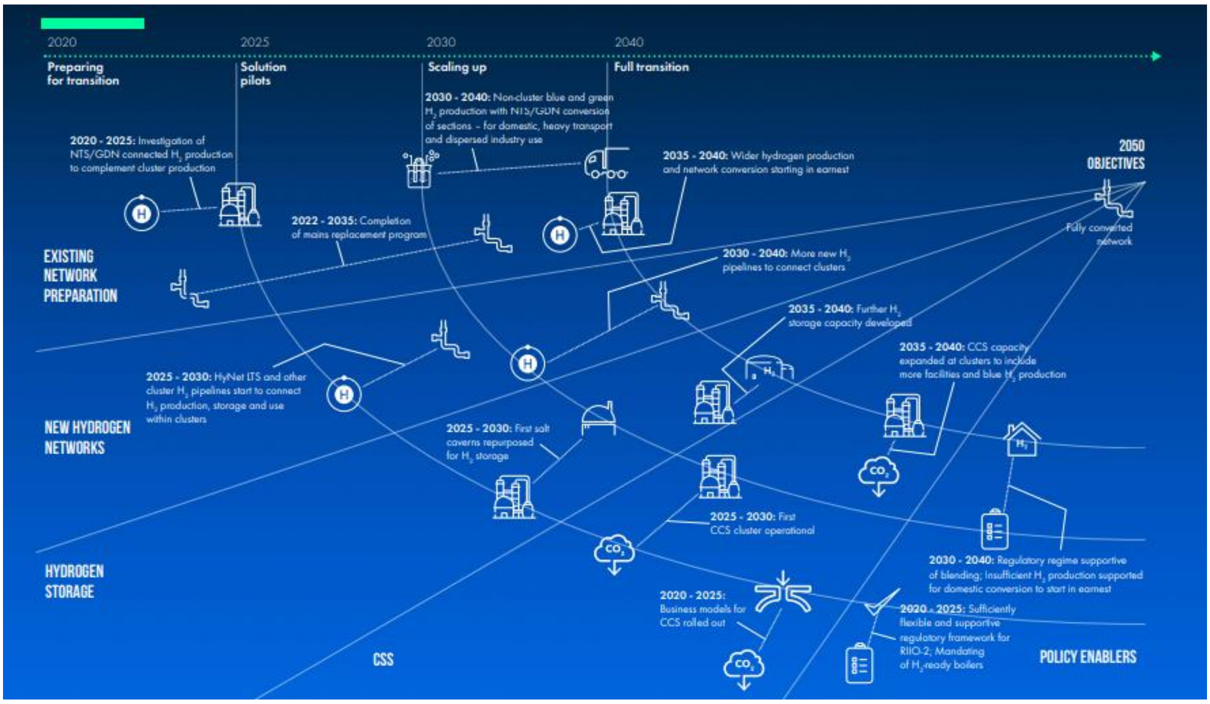
Figure 1: Delivering Britain's Hydrogen Network Plan (Source: ENA)



From 2025 to 2030, this will progress to solution pilots being carried out, including larger 100% domestic hydrogen pilots, 20% blending taking place in parts of the network, and billing on the basis of energy content, instead of volume, as the iron mains replacement programme continues.

In the 2030s, the networks will scale up, building new hydrogen pipelines between industrial clusters and to connect with storage facilities; connecting hydrogen production to the networks; and, with the iron mains replacement programme now complete, rolling out 100% hydrogen conversion for use in homes, dispersed industry and transport. The full transition will then occur in the 2040s with a national hydrogen network in place and hydrogen a normal part of training for Gas Safe engineers.

Figure 2: Ambition to Action for the Networks (Source: ENA)



Despite the networks setting out their plans to prepare for hydrogen conversion, the plan highlighted a set of wider actions needed outside of their control to ensure hydrogen adoption at scale.

This includes sufficient hydrogen production taking place for widespread gas network conversion to occur from 2030, meaning production must expand beyond the needs of industrial clusters, with GW-scale capacity additions required each year; an expansion of hydrogen storage capacity at the level of several hundred GWh per year from 2025; and ensuring that carbon capture and storage is developed at scale in several clusters by 2030, with this cited as "critical" to network conversion to hydrogen.

It set out a set of policy support and decisions needed from government for hydrogen development in all sectors, addressing gaps, such as stating the need for a mandate for hydrogen-ready appliances to be in force no later than 2025, meaning most homes would have them by 2040; hybrid heating systems being supported now for roll-out at scale; and calling for the government's aim of 5GW of low carbon hydrogen production capacity by 2030 to be increased to 10GW, warning of the risk of insufficient volumes of hydrogen production being supported.

It also called for a regulated asset base (RAB) framework to be put in place from 2025 for hydrogen storage and from 2030 for domestic conversion; the RIIO2 framework to be managed in a sufficiently supportive, flexible way that allows a range of innovation projects and trials to be carried out in timely fashion; and to make sure the planning system can accommodate a large volume of applications for hydrogen production, storage, pipeline and other facilities, with it currently unclear if it can manage this in a timely manner.

Aberdeen plays host to world's first hydrogen double decker buses

The first hydrogen double decker buses in the world have now commenced their routes in Aberdeen.

The buses, which were officially launched into service on 28 January, save 1kg of CO_2 with every kilometre they drive, are virtually silent and take 10 minutes to fully refuel. Aberdeen City Council also has plans in place for the city to make its own hydrogen to power the buses, which are run by First Bus, to ensure it becomes an even greener energy source for the local community.

The £8.3mn project has been funded by Aberdeen City Council, the Scottish government and EU Fuel Cells and Hydrogen Joint Undertaking with an investment of about £500,000 per vehicle. It falls under the EU's JIVE (Joint Initiative for hydrogen Vehicles across Europe) project, which is aiming to support the commercialisation of hydrogen buses through joint procurement between cities. London and Birmingham are set to follow in Aberdeen's footsteps in future, with the overall objective to see almost 300 fuel cell buses in 22 cities across Europe by the early 2020s.

Project to develop hydrogen-powered plane gains funding

GKN Aerospace is leading H2GEAR, a UK collaboration programme, which will see the company's first hydrogen propulsion system for sub-regional aircraft developed.

On 27 January, it was announced that H2GEAR will receive a £27.2mn government grant – matched by industry – to develop an innovative liquid hydrogen propulsion system that could then be scaled up for larger aircraft and longer journeys. Its initial focus will be on significantly improving sub-regional aircraft hydrogen powered performance, though longer-term it will have the potential to create a "new generation" of clean air travel.

The programme will see GKN Aerospace collaborate with Intelligent Energy, Aeristech, Newcastle University, the University of Manchester and University of Birmingham. It is also aiming to create more than 3,000 jobs in the next decade.

H2GEAR was one of three projects to receive investment through the ATI Programme, which is supporting research into advanced technologies that will enable zero emission flight to become a reality. ZeroAvia's HyFlyer II is to receive a £12.3mn government grant as it looks to scale up its zero emission engines for demonstration on a 19-seat aircraft while InCEPTion, led by Blue Bear Systems Research, will receive £2.8mn to develop a fully electrified zero emissions propulsion system for aircraft.

Centrica considering storing hydrogen under North Sea

Centrica is exploring the potential of repurposing the Rough gas field into a hydrogen storage facility.

On 22 January, as it announced it had joined the Hydrogen Taskforce, it revealed that such a move would help to generate employment in the North East of England. Centrica was noted as joining the Hydrogen Taskforce at a "critical time" as it steps up to advise the government in light of the recently announced commitment of 5GW of low carbon hydrogen production capacity by 2030.

It was further highlighted how Centrica has a significant role to play in meeting the UK's ambitions, creating green jobs and ensuring it reaches net zero by 2050 – something its potential repurposing of the Rough gas field could help to drive towards.

Wales targets development of hydrogen energy sector

The Welsh government has set out a series of initial objectives geared towards developing a hydrogen energy sector in Wales.

On 18 January, it launched a consultation, seeking views on a hydrogen pathway, based on the findings of a *Hydrogen Development in Wales: baselining report*, published back in December. Within that report, key findings included that Wales is already home to world-leading hydrogen research and development projects and facilities, as well as that it has considerable expertise in the safe generation, storage, transport and use of hydrogen, primarily as an industrial gas in South Wales. This means there is a "solid foundation" for further development of hydrogen energy applications in Wales.

It set out a proposed pathway with the aim of informing activities to take place in the short-term – to 2025. Through ten key objectives, it is aiming to build momentum and lay the foundations for scale-up and commercial deployment from the end of the 2020s.

To create consistent demand for low-carbon hydrogen, it has recommended deploying 200 fuel cell buses in a town, city or region in Wales; undertaking work to establish Wales as an early market for commercial fuel cell vehicles, noting that initiatives to coordinate demand for hydrogen fuel cell vans and trucks are already underway at a UK level; considering support for vehicle manufacturers, such as Riversimple; and working to attract vehicle integrators to Wales, as currently there are a lack of fuel cell vehicle options on offer.

It further called for the deployment of fuel cell trains in Wales, replacing diesel trains on several rural rail lines; the establishment of at least one renewable hydrogen production site that is 10MW or more by 2023/24; and scoping large-scale hydrogen production sites, acknowledging that there is a need to plan low carbon or renewable hydrogen production and delivery facilities in parallel with the deployment of initial, smaller scale ones. It also cited scoping industrial decarbonisation through skills development and R&D, supporting local projects and place-based approaches, and engagement with other hydrogen initiatives as key objectives to build momentum towards a Welsh hydrogen energy sector.

Report details hydrogen's role in changing energy landscape

Energy demand will rebound quickly following the Covid-19 pandemic, with hydrogen set to "change the landscape", according to research.

On 18 January, McKinsey published its *Global Energy Perspective 2021*, highlighting developments in the world's energy systems, as well as forecasting how energy demand will evolve in the years that follow. After Covid-19, it stressed government policies have become more important in the energy transition with the focus of stimulus packages set to play a key part in shaping energy systems in the following decades.

Power consumption will double by 2050 as energy demand electrifies, wealth increases and green hydrogen gathers momentum. On green hydrogen specifically, the report forecast it to become cost competitive in the 2030s, with indirect power demand for electrolysis accounting for around 40% of electricity demand growth from 2035 to 2050, mostly in industry and transport.

Low cost renewables will dominate power markets and outcompete existing fossil assets in most regions by 2030, with fossil fuel demand peaking in 2027. By 2036, half of the global power supply will come from intermittent renewable sources. Enabling this shift will require both traditional capacity and new, flexible capacity to ensure system security, with batteries to play an important role.

Government funding targets world's first net zero industrial zone

Six projects across the UK will receive a share of £8mn in funding as part of efforts to create the world's first net zero emissions industrial zone by 2040.

On 2 January, BEIS announced that the six projects had already produced initial plans on reducing emissions, with the funding to now support them in the development of detailed strategies for cutting emissions across major areas of industrial activity. This will involve looking at where related industries could benefit from using shared clean energy infrastructure, such as carbon capture, usage and storage (CCUS) and low carbon hydrogen production and distribution. It marks the latest phase of the government's £170mn Industrial Decarbonisation Challenge, which is supporting the Industrial Clusters Mission, aiming to deliver four low carbon regional zones by 2030 ahead of a net zero emissions one by 2040.

The projects to receive support include plans led by CR Plus consultancy for a South Wales Industrial Cluster, centred around a five stepped approach to net zero carbon; the Black Country Consortium's efforts to steer a potential 2.3MtCO_2 emissions a year by 2030 to zero through a coordinated programme of transformational projects around a zero carbon hub; and Peel Environmental's Net Zero North West Cluster Plan, which hopes to realise over 33,000 new jobs and over £4bn investment.

Elsewhere, the funding will support development of Scotland's Net Zero Roadmap, led by Neccus, which will look to enable large-scale industrial CO_2 emissions reduction in a way that focuses on ensuring the continued, but evolving, contribution of high-value industry and employment in a future net zero economy. It was noted how Scotland is well placed to lead a new scale CO_2 management industry, with offshore Scotland having some of Europe's best characterised and largest CO_2 storage sites. CCS and hydrogen, meanwhile, can create opportunities for jobs and economic activity, helping transition staff employed in sectors such as oil and gas.

Plans for a Net Zero Tees Valley cluster are another of the projects to receive backing. The Tees Valley is the UK's most compact and integrated industrial cluster and responsible for 8.8mn tonnes of CO_2, though also employs over 12,000 people, generates £12bn of exports annually and adds £2.5bn to UK gross value added. The plan is expected to combine carbon capture at scale, fuel switching to hydrogen, integration of renewables, low carbon energy sources and feedstock changes, together with improved process and energy efficiencies.

The Humber Industrial Cluster Plan is also among the selected projects, led by the Humber Local Enterprise Partnership. It will enable the Humber industrial cluster, which emits more CO_2 than any other in the UK – 30% more than the next largest – to reach net zero by 2040. It will take a phased approach, prioritising near-term, deliverable investments that lead to quick results and drive a substantial cut in the Humber's emissions by 2030. It will map out how CCS and hydrogen infrastructure can be scaled up over time, identifying the full range of interventions required to achieve net zero by 2040.

Regen investigates path to developing a hydrogen value chain

The nature of emerging hydrogen markets, as well as strategically thinking about how hydrogen fits into a net zero energy system, are key considerations when it comes to maximising the benefits from developing a hydrogen value chain, according to Regen.

On 21 January, Regen published an insight paper in which it sought to investigate the hydrogen value chain, from production to end-user, while exploring how it can best be supported through targeted policy interventions. It warned that policymakers will need to tread carefully and should not consider hydrogen to be directly replacing natural gas or the same as electricity, stressing that any value chain would be complex.

Factoring in its complex value chain, as well as it being a relatively immature market, it set out that hydrogen will require a more strategic approach focusing on nurturing consumer demand-led markets that continue to drive innovation, carbon reduction and cost efficiency for low carbon hydrogen to then be able to deliver both its full economic and decarbonisation potential.

Figure 3: Comparison of energy densities – hydrogen vs natural gas (Source: Regen)

Gross Energy (Higher Heating Value	Hydrogen	Natural Gas	Density ratio (H2: NG)
Energy per mass (kWh/kg)	39.4	13.8	1.8 : 1.0
Energy per volume (kWh/m³ @ atm)	3.3	11.0	1.0 : 3.4

Regen highlighted the importance of considering what is needed to distribute and store hydrogen. While acknowledging a bulk of policy maker focus will likely be on investment in production and the development of consumer markets, it warned that assets and investment in distribution and storage cannot be overlooked. In contrast to natural gas, a hydrogen-based supply chain would require a much greater amount of storage and distribution capacity. This is owed to it introducing a production process into the supply chain and having a far lower volumetric energy density to natural gas – 3.3kWh per cubic metre versus 11kWh per cubic metre. This means it will have to be compressed to a much higher pressure and delivered at a higher flow rate if it is to deliver the same energy content.

An implication of hydrogen's lower energy density, it continued, is that a 100% or high hydrogen blended gas network would not be able to store and deliver the same daily energy supply without network investment and operating cost increases.

On costs generally, the report said that they will remain fairly high compared to natural gas – even with a significant reduction. Feedstock costs, conversion efficiency, production costs and CCUS for blue hydrogen are all key hydrogen levelised cost drivers, while there are additional distribution, logistical and seasonal storage costs as well. If hydrogen were to be pushed as a replacement for natural gas for heating, it would rank as a big strategic decision, requiring long-term policy interventions, for example through applying a carbon tax and long-term fuel subsidy.

Considering the scale of opportunity and the range of technological and market challenges to be overcome, there is a strong case for policy and regulatory interventions to ensure a hydrogen energy sector can develop, Regen said, suggesting this could be justified as part of a wider industrial strategy that will help transition skills and capabilities from the UK's oil and gas, chemical processing and heavy industry to net zero. Developing a hydrogen value chain would therefore be able to sit well within the UK's overall energy mix. It suggested one approach could be to set a clear set of criteria to measure policy outcomes against.

Suggested criteria included ensuring that it is low-carbon; scales up quickly to drive down costs and open new markets; supports ongoing innovation while creating opportunities for new disruptive solutions; avoids creation of new monopolies or incumbent-dominated markets; supports the UK's long-term energy strategy; and has market value and is consumer led.

Joint venture set to deliver UK's first low carbon hydrogen production hub

Essar and Progressive Energy, the developers of HyNet North West, have joined forces to deliver a low carbon hydrogen production hub at Essar's Stanlow Refinery in Cheshire.

On 13 January, Essar announced that a total investment of around £750mn has been committed to deliver two hydrogen hubs. An initial hub, which it was noted would be the UK's first, will produce 3TWh of low carbon hydrogen each year from 2025, followed "quickly" by a second facility twice the size, ensuring a total capacity of over 9TWh of hydrogen per annum. Follow on capacity growth is planned to reach 80% of the government's 2030 target for 5GW of low carbon hydrogen.

Natural gas and fuel gases from Essar's refinery will be converted into hydrogen, with carbon dioxide captured and stored in sub-surface reservoirs in Liverpool Bay. The hydrogen will be used across the HyNet region, for industries in the low carbon cluster, fuel buses, trains, heavy goods vehicles, the heating of homes and generating electricity. It will also enable Essar Oil UK to decarbonise its own energy demand, while contributing to the creation of a hydrogen economy across North West England and North East Wales.

Consortium backed with funding for offshore hydrogen production investigation

A consortium behind a project that could prove a "key first step" on the path to developing a commercial offshore hydrogen production industry has been awarded funding.

On 8 January, it was announced the consortium behind the OYSTER project – Ørsted ITM Power, Siemens Gamesa Renewable Energy, Element Energy – had received €5mn from The Fuel Cells and Hydrogen Joint Undertaking (FCH2-JU) under the European Commission. The funding will support the partners as they seek to investigate and demonstrate a combined wind turbine and electrolyser system designed for operation in marine environments.

Compact electrolysis systems capable of withstanding harsh offshore environments, with minimal maintenance requirements, that still meet cost and performance targets allowing for production of low cost hydrogen were highlighted as crucial to realising the potential of offshore hydrogen production. The consortium consider their project as a "major advance" towards this goal. It will start in 2021, running until the end of 2024, and see a megawatt scale fully marinised electrolyser developed and tested in a shoreside pilot trial.

The electrolyser will be designed to be compact, allowing for it to be integrated with a single offshore wind turbine and follow the turbine's production profile. It will also integrate desalination and water treatment processes, meaning sweater can be used as feedstock for the electrolysis process.

Village set to become first on UK public gas grid to use hydrogen

More than 650 homes in Winlaton, near Newcastle, are set to become the first on the UK's public gas grid to be partially heated by hydrogen later this year.

On 3 January, the Financial Times reported that up to 20% hydrogen will be blended into the natural gas network that serves the village in Gateshead during the first quarter of 2021. The trial, which will mark a key milestone in tests to see whether hydrogen can reduce the climate impact of buildings in the UK, forms part of the HyDeploy project, run by Cadent and Northern Gas Networks (NGN). It will run for 10 months.

Head of Programme Management at NGN, Tim Harwood, said the 20% blend was a "stepping stone" towards 100% and will also increase understanding around driving public acceptance.

Study explores UK's geological hydrogen storage capacity

Only a few offshore gas fields are needed to store enough energy as hydrogen to balance the entire seasonal demand for UK domestic heating, according to research.

Researchers from the University of Edinburgh sought to compare geological storage capacity to storage need, using the domestic heating system in the UK as a case study with the aim of maintaining the existing gas distribution network. Hydrogen, they suggested, can be stored in gas fields offshore before then being transported through pipelines to existing gas terminals and into the gas network, balancing the "significant annual cyclicity" in energy demand for heating.

Publishing the study in the journal, Applied Energy, they found that the hydrogen energy storage demand in the UK is around 77.9TWh – approximately 25% of the total energy from natural gas used for domestic heating. The total estimated storage capacity of the gas fields, meanwhile, was found to be 2661.9TWh.

As well as highlighting that just a few offshore gas fields would be required, the researchers added that the study shows hydrogen storage would not compete for the subsurface space needed for other low carbon applications, such as carbon storage or compressed air energy storage.

Potential for large scale offshore hydrogen production in southern North Sea

Gas fields in the southern North Sea could use existing infrastructure and large offshore wind developments to develop large scale offshore hydrogen production, a study has found.

Researchers from the School of GeoSciences at the University of Edinburgh had sought to assess the hydrogen storage capacity of the UK continental shelf (UKCS). Publishing their findings in the International Journal of Hydrogen Energy, they found 6,900TWh of working gas capacity in gas fields, with the majority of this (85%) in the southern North Sea and in close proximity to either existing or planned large scale offshore wind developments. These could be used to produce hydrogen which could then be injected into seasonal energy stores in future, the researchers suggested.

With increased penetration of renewable energy sources, along with decarbonisation of the UK's gas supply, large scale energy storage is needed with hydrogen a potential option as an energy storage vector. The researchers had forecast a need of 150TWh of seasonal storage to replace seasonal variations in natural gas production, with low temperature/high pressure capacity storage sites identified as best.

Using data that had previously been used to assess CO_2 storage potential, the researchers quantified the hydrogen storage capacity of gas fields and saline aquifers, finding 9,100TWh in total – 6,900TWh in gas fields, together with 2,200TWh in saline aquifers on the UKCS. Furthermore, 29 of the gas fields were found to be situated 10km or less from wind developments, with this the case for 21 of the saline aquifer storage sites. While this offers substantial potential for hydrogen production with the gas fields, the researchers were more cautious on providing accurate estimations of hydrogen storage capacity in the saline aquifers, stressing it was a "low confidence" estimate.

Looking ahead, the researchers said further refinement of the study would need to consider the potential conflict with CO_2 storage sites, potential reactions between hydrogen and existing fluids in the gas fields, such as natural gas, carbon dioxide and hydrogen sulphide, as well as well integrity.

Case made to MPs for role of nuclear in hydrogen production

The Nuclear Industry Association (NIA) has called on government to consider all current technologies that can produce clean hydrogen for it to meet its full potential, especially those able to dos through electrolysis, which includes nuclear.

The NIA was responding to the Science and Technology Committee's call for evidence which forms part of its inquiry, launched in December, that is seeking to explore the role hydrogen can play in achieving net zero. It outlined how through either electrolysis or use of primary heat from nuclear power stations, nuclear can offer an efficient, carbon free alternative to producing hydrogen. The NIA added that it is also an option that does not rely on unproven technologies and, together with renewables, is the only currently available "at-scale option" for clean hydrogen production.

It cited its own calculations where the nuclear industry will be capable of having an additional 18GW of capacity focused solely on the production of hydrogen and district heating, either from large scale plants or small reactors by 2050.

Figures from a recent report from the Nuclear Innovation and Research Advisory Board (NIRAB) were also highlighted, stating that clean hydrogen from nuclear can be produced for $2.5/kg (£1.83/kg) compared to the cost of production from natural gas with carbon capture storage (CCS), which is $2.3/kg (£1.68/kg). This means hydrogen production from nuclear is highly cost competitive and commercially viable. Furthermore, while the NIA believes that CCS will play a key role in stimulating the UK's hydrogen market, it is not yet commercially viable nor are there any large scale projects in operation. Based on this, it called for green hydrogen from nuclear or renewables to be the "default option" for hydrogen production in the UK for the long-term.

The NIA is to publish a full report on the role for nuclear energy in hydrogen production, along with the sector's vision for 2050, by the end of January.

Elsewhere, Sizewell C (SZC) also responded, setting out that while hydrogen can play a key role in the future energy landscape, nuclear energy can play a significant role in the generation of low carbon hydrogen. NNB GenCo is proposing to construct a twin UK EPR nuclear power station at Sizewell in Suffolk and, once built, it will produce vast amounts of low carbon heat with some of this set to be made available for heat-assisted electrolysis. According to its experts, Sizewell C could make the conversion to hydrogen ore productive and up to 10% cheaper than electricity-only processes, due to it being able to supply heat.

It stressed that with support from government, new nuclear projects such as SZC can play a significant role in delivering a hydrogen economy in the UK, further highlighting its advantageous location – proximate to the Bacton terminal, which could become a major hydrogen reception/processing point and close to ports, such as Felixstowe and Harwich, all of which could become consumers of synthetic fuels.

To support low carbon nuclear generated hydrogen, SZC stressed the need for new support mechanisms for a range of low carbon hydrogen production methods and the importance of full consideration of the lifecycle carbon emissions of these different approaches. To maximise the opportunity to build a market in low carbon hydrogen, it suggested the scope of existing mechanisms, such as the Renewable Transport Fuels Obligation, are extended to nuclear generation hydrogen as well.

Belgian study shows potential of importing green hydrogen

Large-scale importing of green hydrogen is both cost effective and technically feasible, a study has found.

On 27 January, the Hydrogen Import Coalition published a report where they detailed their findings, having explored importing renewable energy by means of hydrogen carriers to Belgium, covering all steps of the value chain. When delivered to Belgium, costs were found to range from €65-90/MWh by 2030 to 2035, with the potential to fall to €55-75/MWh or less by 2050. It further revealed that the most promising hydrogen-based energy carriers, such as ammonia, methanol and synthetic methane, are not hindered by technological scale up challenges today and can already be deployed in existing transport lines and off-take markets.

A diversified portfolio of initial projects and demonstrators for all carriers and technologies can further reduce cost gaps and boost understanding, with the report "strongly" recommending a fast realisation of such projects through a more detailed roadmap and a national industrial hydrogen strategy.

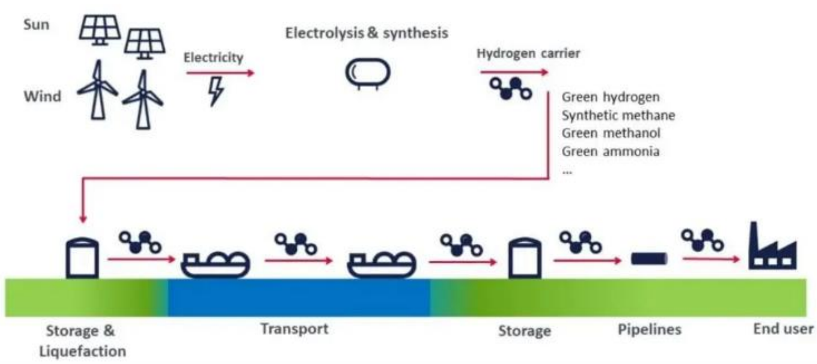
For renewable energy imports to be scaled up, it stressed any competitive disadvantage with fossil alternatives must be mitigated. Better incorporating environmental externalities in energy markets through applying cost-reflective carbon pricing was recommended, with the coalition suggesting that through temporary incentives, such as Carbon Contracts for Difference, the cost gap can be bridged and a level playing field ensured. Investment support could also be needed for the remaining funding gap to be closed and the maturity of technologies involved to be boosted in a similar fashion to the way wind and solar were developed. A stable, robust roadmap, together with an energy policy and regulatory context open to importing renewable energy and feedstock, alongside domestic production, is also needed for scaling up.

Belgium is targeting an 80% reduction in CO_2 emissions by 2050 compared to 2005 levels which led to Deme, Engie, Exmar, Fluxys, Port of Antwerp, Port of Zeebrugge and WaterstofNet joining forces to form the Hydrogen Import Coalition. Hydrogen will play a key role in a mix of solutions to achieve results and is already extensively used as a feedstock in Belgium for many industrial processes, meaning Belgium is ideally placed to become a frontrunner in the development of a green hydrogen economy. It has a well-developed pipeline network connecting neighbouring states, seaport and terminal infrastructures, industrial clusters and a strong customer base.

The coalition partners are now set to analyse how to prepare their seaports to receive the hydrogen carriers of the future, seeking maximum synergy to serve national interests, with pilot projects being set up.

Alexander De Croo, Prime Minister of Belgium, said: "Hydrogen will play a decisive role in the energy transition and in making our industry sustainable. This study provides essential new insights for the further roll-out of a hydrogen economy and the further reduction of CO_2 emissions. The next step is to develop a long-term strategy for importing hydrogen."

Figure 4: Hydrogen production process (Source: Hydrogen Import Coalition)



Vision for UK-wide hydrogen hub network
Getech has set out plans to establish a national network of hydrogen generation, storage and retail hubs in the UK.

On 26 January, it announced that it had agreed a strategic partnership with H2 Green to collaborate on creating a network of industrial land assets that will see a shift from higher cost, on-demand hydrogen to a system designed around surplus storage and optimised cost. Getech will use its location analytics expertise and support H2 Green in locating, ranking and building a network of large scale hydrogen hubs, leading to a UK network capable of supporting both public and heavy duty transport fleets.

H2 Green has also signed an agreement with SGN to explore regenerating sites across Scotland and the south of England to include within a network of green hydrogen hubs.

Companies target 100MW hydrogen facility in Hamburg
Shell, Mitsubishi Heavy Industries (MHI), Vattenfall and Wärme Hamburg have signed a letter of intent for a 100MW hydrogen project in Hamburg.

On 22 January, MHI set out how the companies are exploring how they can jointly produce hydrogen from wind and solar power at the Hamburg-Moorburg power plant site. Along with the development of a scalable electrolyser with an initial output of 100MW, they are also planning to further develop the site into a Green Energy Hub, exploring to what extent the existing infrastructure at the location can be used for the production of energy from renewable sources. Subject to final investment decision and according to the current state of planning, once the site has been cleared, the production of green hydrogen is expected for 2025, making the electrolyser one of the largest plants in Europe.

The partners were noted as regarding the location as having ideal conditions for further use. Notably it is connected to both the national and local networks and overseas ships are able to call at the location directly, using the quay and port facilities as an import terminal. The municipal gas network company is also planning to expand a hydrogen network in the port within the next 10 years, while many potential customers for green hydrogen are situated near the site, enabling the project to cover the entire hydrogen value chain.

Green hydrogen set to decarbonise airport
Kirkwall Airport in Orkney is set to have its heat and power decarbonised through green hydrogen as part of a new project.

On 27 January, the European Marine Energy Centre (EMEC) announced it is collaborating with Highlands and Islands Airports Limited (HIAL) to decarbonise the airport. It will see a hydrogen combustion engine installed and demonstrated at the airport in 2021 as part of a package of initiatives. Doosan Babcock has been contracted with its combined heat and power (CHP) manufacturer, 2G, for the provision of the hydrogen combustion technology. 2G's hydrogen-ready CHP system will be paired with the airport's existing heating system to meet the heating and power requirements of the airport's main buildings.

It will be deployed for an extended trial period at the airport with the CHP plant using green hydrogen supplied by EMEC to generate electricity, as well as recovering and using by-product heat to deliver an efficient, comprehensive energy solution. With the Scottish government setting a target for the Highlands and Islands to become the world's first net zero aviation region by 2040, decarbonising airport groundside activities was cited as a key step in enabling HIAL to achieve that goal.