Department for
Business, Energy
& Industrial Strategy

Hydrogen Strategy update to the market:

December 2022

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Introduction

The Government is committed to developing the UK's low carbon hydrogen economy: hydrogen is considered critical to delivering energy security and our decarbonisation targets, and presents a significant growth opportunity. It can play a pivotal role in our transition to a future based on renewable and nuclear energy, while ensuring that natural gas used during this transition is from reliable sources including our own North Sea production, and can provide clean energy for use in industry, power, transport, and potentially home heating.

In the UK Hydrogen Strategy we included the commitment to regularly summarise our policy development to keep industry apprised. Since publication of the Hydrogen Strategy we have doubled our low carbon hydrogen production capacity ambition to up to 10GW by 2030 (with at least half from electrolytic hydrogen) in the British Energy Security Strategy, provided greater clarity to investors through the Hydrogen Investment Package, and made substantial policy and funding strides across the hydrogen value chain. We summarised these ambitions, commitments and actions in the first Hydrogen Strategy update to the market in July 2022. This was published alongside other key elements of our policy support, which also included the launch of the first Electrolytic Hydrogen Allocation Round – offering joint Net Zero Hydrogen Fund (NZHF) and Hydrogen Production Business Model (HPBM) support – and our Hydrogen Sector Development Action Plan, and the appointment of a UK Hydrogen Champion. Hydrogen is closely integrated into Government's wider policy development on energy security and the energy transition both domestically and internationally, with hydrogen policy previously announced through the Net Zero Strategy and the Breakthrough Agenda at COP26.

This December 2022 Hydrogen Strategy update to the market summarises the extensive activity across Government since July to develop new hydrogen policy at pace and to design and deliver funding support. This includes announcements on shortlisted hydrogen projects in the Cluster Sequencing Process, the launch of a consultation on hydrogen transport and storage (T&S) infrastructure, the publication of the HPBM Heads of Terms, and an update on the ongoing first Electrolytic Hydrogen Allocation Round. The hydrogen policy development presented here underlines the Government's approach to promote every aspect of the UK hydrogen economy in collaboration with industry, investors and international partners to create a strong, globally competitive UK hydrogen sector.

Hydrogen production

In the first half of 2022 and through our July publications we moved at pace to confirm our approaches for hydrogen production funding, including consultation responses, the launch of the first two strands of the NZHF and the launch of the first Electrolytic Hydrogen Allocation Round (HAR1) (offering joint NZHF/HPBM support). We also set out detail on our production strategy in the July 2022 Hydrogen Strategy update to the market. Since July 2022 we have made further progress towards our production ambitions, including announcing the shortlist of four carbon capture, usage and storage (CCUS)-enabled hydrogen projects which have moved to the due diligence phase of the Phase-2 Cluster Sequencing process, and publication of our HPBM Heads of Terms alongside this update.

Supporting multiple low carbon production technologies

- We have continued to engage with stakeholders across hydrogen production routes to better understand their potential to help deliver our stretching 2030 ambition. This includes developing further information of the pipeline of UK projects, which has identified up to 20GW of potential hydrogen projects through to 2037.[1]
- We continue to work across government, industry and academia to consider issues related to the environmental impacts of hydrogen production. We are working closely with the **Critical Minerals Intelligence Centre** to support ongoing work to understand the critical minerals requirements for a hydrogen economy.
- Following a period of 60 days during which comments from interested parties within the territory of a WTO Member were invited, the **Low Carbon Hydrogen Standard (LCHS) guidance document was finalised in July 2022.** It is currently being used by hydrogen producers applying to the NZHF and HPBM allocation rounds to ensure that government funding supports production technologies that make a direct contribution to our carbon reduction targets.
- In the Low Carbon Hydrogen Standard: government response, BEIS indicated our intention to review the LCHS at regular points to ensure it remains fit for purpose and reflects our growing understanding of the sector. We intend to publish the first revisions early next year.

Hydrogen production funding support

- We launched Strands 1 and 2 of the Net Zero Hydrogen Fund in April, with all applicants assessed and interviews completed by the end of September. Strand 1 received 40 applications and Strand 2 received 17. The Strand 1 and 2 projects that successfully passed the technical assessment phase have been shortlisted into the financial review and due diligence process. **We aim to issue final grant offer letters in early 2023.**
- We launched the first Electrolytic Hydrogen Allocation Round (HAR1) (offering joint NZHF/ HPBM support) in July 2022 and had extensive engagement sessions with industry stakeholders and projects that had submitted an expression of interest throughout the summer. The application window closed on 12 October. We received 41 applications and are currently evaluating projects with the aim to publish a list of shortlisted projects, alongside detail on the Agreeing an Offer stage, in Q1 2023. **We also aim to launch a market engagement exercise about the next allocation round (HAR2) in Q2 2023.**
- We introduced the **Energy Bill** which includes provisions to enable the Government to bring forward the HPBM.
- We have published the **Heads of Terms for the HPBM contract** alongside this update, providing a framework for the principal terms and conditions that are expected to be included in the Low Carbon Hydrogen Agreement (LCHA) for initial projects. **We aim to release the draft full form LCHA to industry in May 2023.**
- We announced the **shortlist of four CCUS-enabled hydrogen projects** that would proceed to the due diligence stage of the **Phase-2 Cluster Sequencing Process (Track-1)** in August 2022.
- We have continued to fund innovation in production technologies through the £1 billion Net Zero Innovation Portfolio (NZIP, 2021-25) and UK Research and Innovation (UKRI). In recent months:

[1] Figures are based on potential deployment according to projects, and do not directly relate to HMG decisions on individual projects or volume support through specific funding allocation windows.

- The £60 million NZIP **Low Carbon Hydrogen Supply 2 competition invited tenders from those running feasibility projects for follow-on support**, with bids now being assessed.
- The NZIP **Hydrogen from Bioenergy with Carbon Capture and Storage (BECCS) competition Phase 1 began**, with details of the 22 scoping projects being supported published in August 2022. The scoping projects will conclude in January 2023.
- **Phase 2 of the Hydrogen BECCS Innovation Programme competition is published alongside this update,** with £25 million to support the best projects from Phase 1 to develop demonstration units.
- BEIS supported the **Clean Hydrogen Innovation Programme**, run by the Carbon Trust, which aims to stimulate the supply chain to identify the innovation gaps that have the greatest potential to reduce end-to-end costs of hydrogen production and use competitive innovation calls to find solutions.
- The Engineering and Physical Sciences Research Council (EPSRC) ran a **research call on the production and integration of zero carbon hydrogen**. In total 15 projects were funded for up to 18 months in duration (starting June 2022) and totalling £3.7 million.

Hydrogen networks and storage

Hydrogen T&S infrastructure are key strategic assets within a fully decarbonised economy, providing the link between hydrogen production and demand. In the second half of 2022 we have moved to the next stage in delivering our Hydrogen Strategy and British Energy Security Strategy commitments on hydrogen T&S.

- On 31 August 2022 we published a **consultation on hydrogen T&S infrastructure**, which closed on 22 November. As well as setting out our vision for how we expect hydrogen T&S infrastructure to emerge from the mid-2020s onwards and looking for input on strategic planning, the consultation sought the views of stakeholders on **high-level design options for business models aimed at supporting investment in hydrogen T&S infrastructure**. This was consistent with our earlier commitment to design new business models by 2025.
- Alongside this update we have published **an independent consultancy study which we commissioned as part of our review of hydrogen T&S infrastructure requirements up to 2035.**
- The first meeting of the hydrogen T&S infrastructure Working Group under the Hydrogen Advisory Council took place on 10 October 2022, with the Working Group set to meet on a regular basis. The initial focus of the Working Group is to explore the immediate barriers to the development of hydrogen T&S infrastructure and consider how these might be addressed.
- On 28 November 2022 we announced the 5 winners of the Longer Duration Energy Storage Demonstration Programme, Stream 2 Phase 2, including one hydrogen storage project, which will now build and demonstrate the technology prototype.

Use of hydrogen

The effective and efficient use of hydrogen is a crucial part of the value chain, delivering the decarbonisation important in meeting the UK government's ambitious climate targets. It is our intention that hydrogen demand is guided by market forces, and the policy design set out in the UK Hydrogen Strategy reflects this. Work is aiming to ensure the regulatory and policy framework supports off-takers to be ready to switch to hydrogen when the commercial conditions are right. To this end we continue to build evidence and develop policy to support the use of hydrogen across the economy.

Our Hydrogen Strategy 2020s roadmap is helping us design policy that encourages early use cases while bringing forward applications with the greatest strategic potential to support deep decarbonisation of the UK economy. As a lead option for both early hydrogen use and in the longer term, we continue work on enabling fuel switching in the industry sector, especially across large 'anchor sites' in industrial clusters, and assessing the potential of electrolytic hydrogen to decarbonise dispersed sites. We are also developing policy to help grow the market for low carbon industrial products.

As we transition the wider energy system to net zero, we have also been building on industry feedback about the important strategic role low carbon hydrogen could play in meeting our future power system needs. We are assessing options for enabling a market-driven approach to developing this hydrogen usage pathway by the late 2020s, with further scale up by the mid-2030s.

Work is also ongoing to realise the full potential of hydrogen to decarbonise the transport sector and to capture the associated economic opportunities. We are improving Government signalling on transport decarbonisation, with end of sales dates proposed for new non-zero emission vehicles across all parts of the fleet – from the lightest mopeds to the heaviest trucks. We have further incentivised the use of hydrogen for transport by increasing Renewable Transport Fuel Obligation (RTFO) rules, and through further research and development (R&D) funding.

We believe that hydrogen may have the potential to offer a strategic option for decarbonising heat in buildings. As it is not yet an established technology, further assessment is needed of the technical feasibility, costs, benefits and other impacts ahead of strategic decisions in 2026 on the role of low carbon hydrogen in heating. Subject to those decisions, any deployment by 2030 is likely to be focused on a town pilot, with further expansion beyond 2030. Additionally, work continues to assess and develop the role of gas blending and hydrogen storage in balancing supply and demand in the early development of the market.

Use of hydrogen in industry

We have moved at pace in supporting uptake and use of low carbon hydrogen by UK industry to accelerate the pace of decarbonisation. Recently this has included publishing a summary of responses to our Call for Evidence on industrial boiler equipment we committed to in the UK Hydrogen Strategy and backing multiple avenues for innovation.

Policy development

- We published the **summary of responses to our Call for Evidence** on 'Enabling or requiring hydrogen-ready industrial boiler equipment'.

- We published an **external research study on hydrogen-ready industrial boiler equipment.**
- We announced that Government intends to sponsor the British Standards Institution (BSI) to ensure that **hydrogen-ready industrial-sized boiler equipment is covered by a Publicly Available Specification (PAS)**.
- In July 2022, Government published a summary of responses to the Call for Evidence: Towards a market for low emissions industrial products**,** which sought evidence on policies to help grow the market for low carbon industrial products, which in turn would incentivise the uptake of low carbon fuels for industrial processes. We are preparing to consult on detailed policy proposals for an improved emissions reporting system and demand-side policies to help grow the market for low carbon industrial products.
- Following publication of the Government's response to the call for evidence on Combined Heat and Power (CHP) decarbonisation pathways earlier this year, **we are working up detailed policy proposals on the future of the CHP Quality Assurance programme with the intention of consulting in 2023.** We are also continuing to engage with stakeholders on CHP.

Fuel switching and innovation

- We launched **a sixth competition round of the £289 million Industrial Energy Transformation Fund in October 2022**, supporting industry to invest in energy efficiency and decarbonisation measures, including investments in hydrogen fuel switches. This Phase 2: Autumn 2022 competition has been expanded to include support for Non-Road Mobile Machinery.
- We have continued to fund innovation in hydrogen end-use through the Net Zero Innovation Portfolio:
    - The **£26 million Industrial Hydrogen Accelerator competition has funded nine feasibility projects**, with details published in October 2022, and aims to generate evidence on end-to-end industrial fuel switching to hydrogen.
    - The **£55 million Industrial Fuel Switching 2 competition progressed 21 phase 1 feasibility projects**, many using hydrogen or derivatives, and invited tenders by 25 November 2022 for demonstration projects from developers whether or not they have taken part in Phase 1.
    - The **£40 million Red Diesel Replacement competition is progressing 17 phase 1 projects**; several involve hydrogen use in construction, mining and quarrying equipment, and dispensing of hydrogen at remote sites.
    - The **£10 million Green Distilleries Competition is progressing two hydrogen demonstration projects**.

Use of hydrogen in power

Power has the potential to be a large off-taker of hydrogen through hydrogen-to-power plants. Government continues to develop this hydrogen usage pathway across a range of fronts:

- We have commissioned **key research to support assessment of the need and case for market intervention to support hydrogen to power plants** in line with our corresponding Net Zero Strategy commitment.
- The Government's **Review of Electricity Market Arrangements (REMA) programme** is assessing options for delivering an enduring market framework that works for our businesses, industry and households. We are using REMA to assess

how electricity markets can support hydrogen in the power system. **The REMA consultation closed on 10 October 2022 and has set out our thinking so far. We are currently analysing responses and aim to publish a consultation response in winter 2022/23.**

- We are exploring **ways to better align the Capacity Market with net zero**, including by supporting investment in low carbon technologies such as hydrogen-fired generation, and creating pathways for the decarbonisation of unabated gas generation, without jeopardising security of supply. **We aim to consult on any design changes in winter 2022/23.**
- This winter, we intend to publish a **consultation on updated Decarbonisation Readiness requirements**. The proposals would **require all new build and substantially refurbishing combustion power plants to be built in such a way that they could easily decarbonise by converting to either carbon capture or hydrogen generation technology within the plant's lifetime**. From 2030, the proposals would also require plants intending to demonstrate hydrogen conversion readiness to install generation equipment capable of firing 100% hydrogen from the point of initial construction.

Use of hydrogen in heat

We continue to coordinate a range of projects with industry, regulators and other stakeholders to assess and prepare for hydrogen's potential use for heating, ahead of strategic decisions on the role of hydrogen for heating being taken in 2026. Actions since July 2022 include:

- **A consultation on Improving Boiler Standards and Efficiency** has been launched alongside this update, in line with the commitment in the UK Hydrogen Strategy to **develop a government consultation on hydrogen-ready boilers and broader boiler and heating system efficiency**. This considers measures designed to improve in-home boiler performance and efficiency; requiring all new domestic-sized gas boilers to be hydrogen-ready from 2026; and the role of gas boiler-heat pump hybrids in the transition to low-carbon heating. This consultation will close on 21 March 2023.
- Publishing an **Open Letter on 27 October 2022 to the Gas Distribution Networks on planning for a potential pilot hydrogen town.** We are inviting them to submit proposals to undertake outline planning projects for areas that could be suitable for a possible pilot town and then wider early deployment of hydrogen heating. The **deadline for receiving proposals is 20 January 2023**.
- **Cadent and NGN are developing detailed plans for the village trial** to enable a decision on whether to proceed with the trial and in which location. This project will provide critical evidence for strategic decisions in 2026. The decision on trial location is expected in 2023.
- The Hydrogen Skills and Standards programme is progressing with research, and the following **draft standards documents have been consulted on by BSI and IGEM**: PAS 4442 (materials for pipework & fittings), PAS 4443 (valves & components), and update to IGEM/H/1 (reference standard).
- The NGN/Cadent/BEIS funded Hydrogen Home at Low Thornley near Gateshead celebrated a year since opening and has welcomed its 2,000th visitor.

Use of hydrogen in transport

Hydrogen is expected to play an important role in decarbonising heavy modes of transport and lighter duty vehicles where energy density requirements, infrastructure constraints and refuelling times favour hydrogen-based fuels. As an early source of demand, the transport sector will be crucial to driving near-term low carbon hydrogen production and wider sector development. The Department for Transport (DfT) is committed to working towards greater understanding of hydrogen demand projections in transport and how transport fits into the wider hydrogen economy.

Policy development and funding support

- We implemented **RTFO guidance changes** from July 2022 **to enable increased flexibility in production of renewable hydrogen using electricity transmitted over a grid** whilst ensuring it continues to deliver cost effective carbon reductions.
- We began phase 2 activity in the **Tees Valley Hydrogen Transport Hub** by launching a **£20 million collaborative R&D competition** on 6 October 2022, run via Innovate UK. It builds on a successful phase 1 which saw £2.6 million in FY 21/22 support seven trial projects, kick starting hydrogen transport activity in the region. The next phase will significantly scale up use of hydrogen transport in Tees Valley, including through £300,000 to support local hydrogen-related skills development.
- We **launched the third round of the Clean Maritime Demonstration Competition (CMDC3)** on 29 September 2022, with **£60 million allocated for technology and system demonstrations**. Hydrogen and hydrogen related fuels are in scope. The application window closed on 9 November 2022 and **winners are expected to be notified in January 2023**, with projects running from April 2023 to March 2025.
- We **announced the winners of the second round of Clean Maritime Demonstration Competition (CMDC2)** on 29 September 2022. Over **£12 million has been allocated to 31 projects** to conduct feasibility studies and pre-deployment trials in clean maritime solutions between January and August 2023, with 17 of these projects exploring the use of hydrogen and/or hydrogen derived fuels.
- We **launched the first funding competitions as part of the Zero Emission Road Freight Demonstrators (ZERFD) programme** to demonstrate zero emission HGV technologies, including hydrogen fuel cell, at-scale on UK roads. Winning bidders are expected to be announced shortly.
- We provided £5.5 million funding via EPSRC in July 2022 for **a project using ammonia as a hydrogen carrier in commercial marine vessels**.
- We directed £10 million under Innovate UK's Net Zero Mobility programme to **early stage, highly innovative transport propulsion technologies,** for which hydrogen is a key thematic area.

In addition, we are:

- Expecting to **announce winners of funding from the £165 million Advanced Fuels Fund (FY 2022-2025) this month**. The Advanced Fuels Fund will support the development of commercial scale Sustainable Aviation Fuel (SAF) plants to kickstart a domestic industry. This includes a £22 million sub-pot to target technologies like power-to-liquids. Significant amounts of hydrogen are used in SAF plants to process and refine fuel and in the future, it can be used as an input along with carbon dioxide (point source/direct air capture) in power-to-liquids.

- Developing our response to our **consultation on setting a legal end date for the sale of new, non-zero emission buses** and calls for evidence on coach and minibus decarbonisation, which will be issued shortly.
- **Supporting the introduction of hydrogen fuel cell buses through Government schemes** such as the £270 million Zero Emission Bus Regional Areas scheme, depending on which technology is favoured by bus operators and local authorities. There is a further **£205 million dedicated funding for zero emission buses** remaining over the Spending Review.

Creating a market

Government's aim is to create a competitive, integrated UK market for low carbon hydrogen, with decisions and actions affecting the hydrogen value chain considered alongside wider energy, environmental, economic and social objectives.

Ensuring a supportive regulatory framework

- We have been reviewing non-economic regulatory issues and working with regulators through the **Regulators Forum** to understand and start delivering priority work.
- We have also hosted a workshop and multiple bilateral conversations with industry to collate regulatory issues, and have consulted on what regulatory issues need further exploration in the Regulatory Framework chapter of our hydrogen T&S infrastructure consultation. This **progresses our UK Hydrogen Strategy commitment to work with industry and regulators to consider what regulatory changes may be appropriate across the hydrogen value chain**.
- We are working with key regulators to consider what would be a suitable, non-economic regulatory framework for offshore first of a kind hydrogen projects, and are proactively encouraging stakeholders to contact BEIS to discuss their project so that we are aware of related projects across the UK prior to making any regulatory changes.

Gas blending

- We continue to target a **policy decision in 2023 on whether to allow up to 20% hydrogen blending** (by volume) in GB gas distribution networks, and are building the necessary evidence base to determine whether blending meets the required safety standards, is feasible and represents value for money.
- Our consultation on hydrogen T&S infrastructure included a chapter on blending. This primarily sought views on the potential benefits of blending and its proposed strategic role as a reserve off-taker, providing an early route to market for hydrogen producers whilst the number of end users grows and T&S infrastructure develops. We intend to publish our response to this consultation in Q2 2023.

Hydrogen sector development

As the global hydrogen economy develops at pace, we want to ensure that UK companies and communities have the opportunity to remain at the centre of this economic growth opportunity. We want the UK's low carbon hydrogen economy to continue as one of the world's most attractive destinations for investment; UK supply chains to be well placed to win work in hydrogen projects right across the value chain at home and abroad; and we want to develop our skills pipeline to make sure we have the right skills in the right place at the right time. We are now focused on implementing the actions set out in July's Sector Development Action Plan.

Investment

We continue to focus on **engagement with investors and industry to facilitate the flow of private capital into the UK hydrogen economy** and to showcase UK hydrogen investment opportunities. For example, hydrogen featured prominently as part of the showcase of low carbon technology capabilities in the UK at the Green Trade and Investment Expo, where government officials promoted the potential investment opportunity alongside UK companies with leading expertise in areas like fuel cells, electrolysers and transport.

Supply chains

In the Hydrogen Sector Development Action Plan we committed to update on the industry-led process to voluntarily set levels of ambition for supply chain participation in UK hydrogen projects:

- As part of her role the UK Hydrogen Champion, Jane Toogood, will champion and promote this issue in her industry engagements and advise how best to engage industry to deliver the action.
- The proposed process is for **industry-led working groups to assess UK capabilities and recommend voluntary levels of ambition** in key parts of the value chain, which may include production; T&S; and potential end-uses, such as transport, power and industry.
- Working groups will have representation from across industry and the research and innovation (R&I) community, and are expected to start discussions in the New Year. The process will be supported by Hydrogen UK and industry recommendations will be presented to the Hydrogen Advisory Council. We aim to provide further details, including on the timetable for this work, in due course.

Exports and imports

- With our ambitious production ambition, we expect the UK to be well placed to participate in global trade. **We are exploring opportunities to export hydrogen, including from the UK to continental Europe**, where we see increasing hydrogen demand alongside established energy trading and interconnection with the UK. As global trade in hydrogen develops in the longer term, this could also **lead to a greater role for imports** in building supply chain resilience and supporting energy security as part of a diverse supply mix.
- We have committed to setting up a hydrogen certification scheme by 2025 to demonstrate high-grade British hydrogen for export and ensure any imported hydrogen meets the same high standards that UK companies expect.

- We are carefully considering the international developments and emerging evidence to ensure **our approach to hydrogen trade realises the greatest opportunities for the UK while maintaining sufficient supplies for domestic use**.

Research and innovation

BEIS, DfT and UKRI continue to fund hydrogen innovation programmes and technology-neutral programmes that include hydrogen projects through multiple avenues, including the flagship **£1 billion Net Zero Innovation Portfolio**. In addition to developments in key programmes noted in earlier sections of this report:

- In August 2022 we published external analysis commissioned from AFRY to understand the **role that long-duration electricity storage could play in the energy system**, how much may be required over periods of time, and the benefits of different technologies. This showed that long duration energy storage, supplied primarily by hydrogen, could provide between £13 billion and £24 billion in savings to the electricity system between 2030 and 2050.
- BEIS and the Natural Environment Research Council are **co-funding three projects under the £2.5 million Environmental Response to Hydrogen Emissions programme**, relating to soil sink response, climate atmospheres, air quality. A Knowledge Exchange Fellow call is also in review.
- Innovate UK has **awarded £6 million to Hydrogen Innovation Initiative's Seed programme**, a collaborative initiative between the Catapult Network, National Physical Laboratory, Net Zero Technology Centre, the Aerospace Technology Institute and Advanced Propulsion Centre. The programme spans the end-to-end hydrogen system and will pilot innovation support for businesses; generate enabling knowledge and capability; and demonstrate, focus and prioritise where future investments are required.
- Ofgem's Strategic Innovation Fund, delivered by Innovate UK, had approved 18 out of 40 projects to be taken forward to its Alpha phase as of July 2022. These projects began in August 2022, with **eight of the 18 (c.£3.5 million) being hydrogen related** and covering areas such as hydrogen compression, gas pipe coatings, digital gas systems, deblending for transport and rail decarbonisation using hydrogen from otherwise curtailed wind power.
- The **Innovate UK KTN End User Solutions directory** is being built by the Innovate UK KTN Futures team. This directory aims to provide visibility of which end users are using or planning to use hydrogen, combined with practical solutions providers who could help develop their hydrogen use further.

Hydrogen Champion

- The UK's Hydrogen Champion, Jane Toogood, was appointed in July 2022 and has been engaging with stakeholders across the value chain to develop an understanding of the key challenges for the deployment of hydrogen projects and scaling up the UK hydrogen economy, and the economic opportunities hydrogen presents. Since taking on the role, the Hydrogen Champion has met with over 80 stakeholders, including hydrogen production projects, potential end users of hydrogen and investors.
- **The Hydrogen Champion will share her initial findings in a report to the BEIS Secretary of State early in 2023**. This will synthesise insights from her extensive stakeholder engagement and propose a set of recommendations on how further

government and industry action could help to ensure that collective hydrogen ambitions are met.

Demonstrating international leadership

One year since the launch of the Hydrogen Breakthrough at COP26, the UK remains at the forefront of promoting international collaboration on hydrogen. Across bilateral relationships and multilateral forums we want to share our own expertise, learn from others and drive the global action that can help develop a global hydrogen economy and build on our UK hydrogen ambitions, and create opportunities for UK companies in international markets.

Bilateral relationships

We are continuing to build bilateral relationships, seeking to grow our domestic hydrogen economy and those overseas by exchanging policy and innovation expertise. We are working to enable closer collaboration on low carbon hydrogen alongside other clean energy priorities. This included an official Energy Partnership with the US which covers expediting the development of clean hydrogen globally, signing a Memorandum of Understanding (MoU) with Belgium, and releasing joint statements with Norway and with the Republic of South Africa, the latter through the expansion of a MoU on scientific cooperation to include hydrogen. Hydrogen and CCUS also featured in this year's North Sea Neighbours conference, which we jointly delivered with the Netherlands in November 2022. We will continue to prioritise engagement with countries and **expect to formalise cooperation with other partners over the coming months**.

COP27

- At COP27 in Sharm el-Sheikh, Egypt, the UK announced the £65.5 million for the Clean Energy Innovation Facility, which provides grants to researchers and scientists in developing countries to accelerate the development of clean technology.

Breakthrough Agenda

- Following its launch at COP26, **the Breakthrough Agenda Report was published in September 2022** by the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA) and the UN Climate Change High-Level Champions (UN HLAC). The report is focused on supporting stronger international collaboration to drive faster reductions in global greenhouse gas emissions, and it sets out key recommendations for global cooperation on clean hydrogen, including on standards, certification, demand creation, R&I, and finance and investments. These areas will be of crucial importance to create a global market for low carbon hydrogen and link closely to our domestic policy priorities, including the development of a clear set of common standards, closer cooperation on R&I and demand creation.
- Progress on these actions in 2023 will be tracked through the next Breakthrough Agenda report from the IEA, IRENA and UN HLAC, and discussed through the Hydrogen Breakthrough dialogues co-led by the UK and USA. Further co-convenors of the dialogues are likely to be agreed. Progress will be reviewed at the Clean

Energy Ministerial and Mission Innovation Ministerial, and reported on at COP28 alongside an updated set of Priority International Actions for Hydrogen in 2024.

Mission Innovation Clean Hydrogen Mission

- The UK used its role as one of the five co-leads of the Clean Hydrogen Mission, and co-coordinator of the Mission's R&I activities, to shape **the Mission's Action Plan 2022-2024** that was published at CEM-MI Ministerial in Pittsburgh in September 2022. The Action Plan aims to stimulate greater international cooperation on clean hydrogen technology and industrial processes and achieve cost reduction across the full value chain of clean hydrogen to reach an end-to-end cost of US$2/kg by 2030.

Clean Energy Ministerial

- We are participating in the Clean Energy Ministerial's (CEM's) 'Hydrogen Twin Cities' initiative**,** where cities are matched with others to cooperate on hydrogen production and deployment. **Aberdeen has been selected as one of the successful cities and will work in partnership with Kobe in Japan** to exchange lessons and knowledge on hydrogen development and deployment.
- We have participated as a member of the expert panel for the CEM-led Northwest European Hydrogen Monitor, which explores the status of hydrogen in the north-western European region and how the sector could evolve towards 2030. A report summarising the findings of this initiative was published in November 2022.

International Partnership for Hydrogen and Fuel Cells in the Economy

- We participated in the 2022 annual steering committee meeting of the International Partnership for Hydrogen and Fuel Cells in the Economy, where the committee members agreed to deliver coordinated work on hydrogen standards and certification over the next year.

Research and Innovation

- Innovate UK held a UK-Australia Global Expert Mission to explore opportunities in industrial decarbonisation, including hydrogen. Following this, **in early 2023 Innovate UK will hold a Global Business Innovation Programme to Australia** which will see hydrogen businesses taken to the market to explore collaboration opportunities followed by a circa £2.8 million bilateral competition for early-stage feasibility studies.
- Following a successful Global Business Innovation Programme on hydrogen held in the Republic of Korea in July 2022, **Innovate UK has signed an MoU with the Korea Institute of Energy Technology Evaluation and Planning** which has enabled their inclusion **in a bilateral competition to be launched in 2023,** which will include hydrogen as one of the in-scope technology sectors.
- HSE is participating in work by the International Energy Agency **Hydrogen Technology Collaboration Programme** on Safety and Regulations, Codes and Standards for Large Scale Hydrogen Energy Applications.

Upcoming opportunities

Our UK Hydrogen Strategy set out that the UK Government would work in partnership with industry, the academic and research and innovation community, and other hydrogen stakeholders to enable and develop the UK hydrogen economy. This includes gathering feedback on our policy development and ensuring that stakeholders are aware of future government funding opportunities for hydrogen. Currently open or upcoming opportunities include:

- **A market engagement exercise about the second electrolytic hydrogen allocation round (HAR2)**, which we aim to launch in Q2 2023.
- A **consultation on potential reform options for the CHP Quality Assurance scheme**, being planned for publication in 2023.
- The **Industrial Energy Transformation Fund Phase 2: Autumn 2022 competition**, which is open for applications until 13 January 2023.
- Phase 2B of the **Industrial Hydrogen Accelerator competition**, which is intended to launch by the end of 2022, offering the opportunity for projects that were successful in the phase 2A feasibility competition to apply for grant funding to build demonstrations or conduct FEED studies.
- Phase 2 of the **Hydrogen BECCS competition**, launched alongside this update, offering the opportunity for projects that were successful in Phase 1 to apply for funding to build demonstrators of their Phase 1 designs.
- A consultation, intended to be published in **winter 2022/23, on design changes to the Capacity Market** to better align it with net zero and improve delivery assurance.
- A consultation, intended to be published in winter 2022/23, on proposals for **updating Decarbonisation Readiness requirements** to ensure new build and substantially refurbishing combustion power plants have viable decarbonisation plans.
- A **consultation on Improving Boiler Standards and Efficiency**, which will close on 21 March 2023.
- An invitation to the Gas Distribution Networks to submit proposals for **plans for a potential pilot hydrogen town** by 20 January 2023.
- Innovate UK are aiming to run a circa £4.5 million competition in early 2023 to fund collaborative R&D projects aimed at developing hydrogen supply chains.

Conclusion

This second Hydrogen Strategy update to the market builds on our first update in July 2022 by setting out our continuing efforts to deliver our Hydrogen Strategy and growth in ambition, including progress towards delivering key funding support both in the near term through the first funding and allocation rounds under the Net Zero Hydrogen Fund and Hydrogen Production Business Model, and in the medium term through policy development on our hydrogen transport and storage business models.

Since publishing the UK Hydrogen Strategy, there has been an increased focus on driving significant private sector investment in the hydrogen sector, delivering economic opportunities across the UK's industrial heartlands and using hydrogen to support UK energy independence. As we move into a key delivery phase in 2023 which is expected to see the first award of NZHF funding and first business model contracts signed, Government policy

continues to provide a clear investable framework for industry and investors in UK hydrogen. With Government, the private sector and innovators continuing to pull in the same direction, the UK is well positioned to deliver the economic growth, jobs, energy security and net zero benefits that hydrogen can unlock.

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