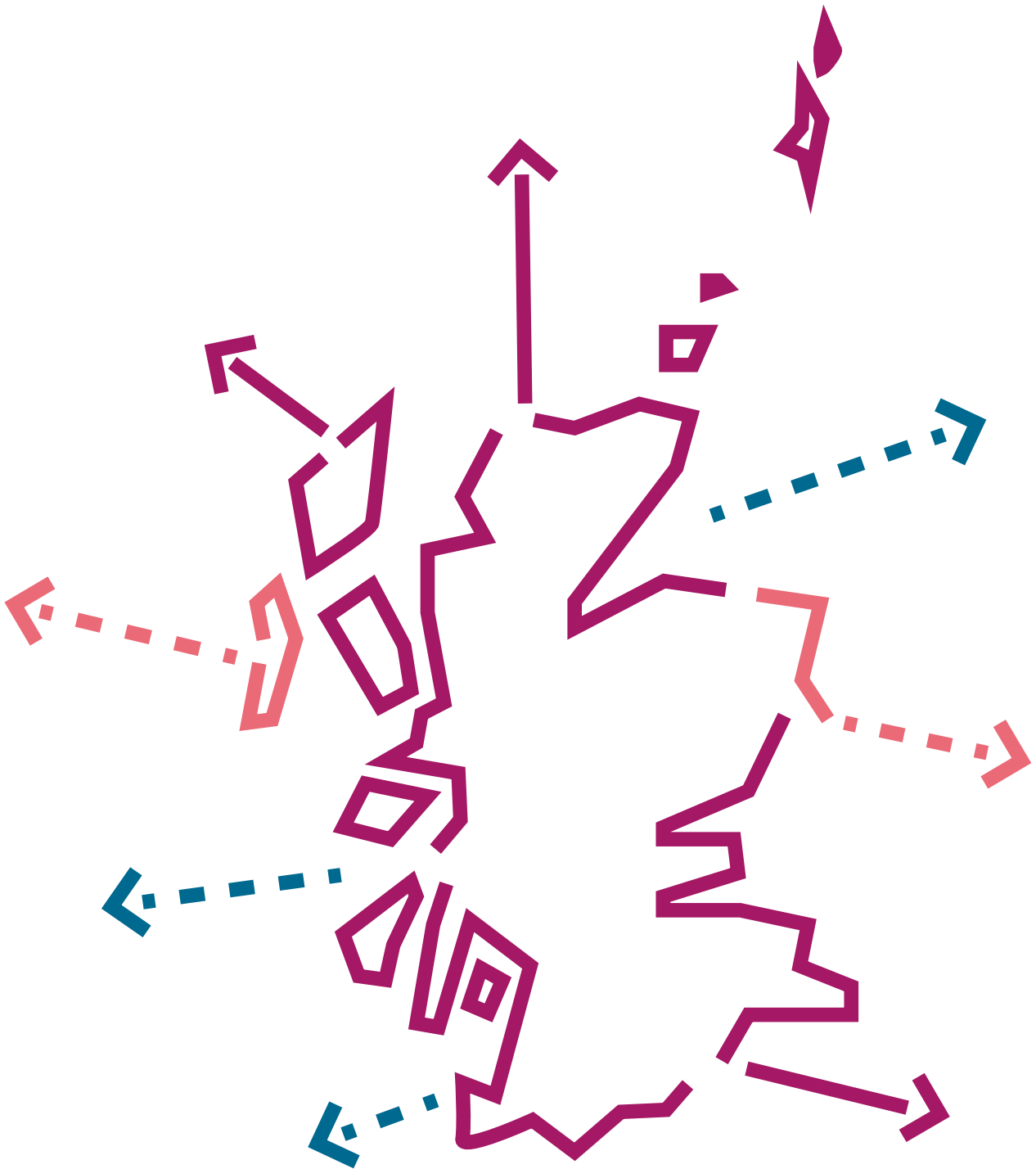


# A Trading Nation: Realising Scotland's Hydrogen Potential - A Plan for Exports



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# 1. Introduction

Scotland has vast renewable energy resources. Our ambition for renewable electricity generation is to double Scotland's overall renewable capacity to 35-39 GW by 2030<sup>1</sup>. This wealth of renewable electricity will be the primary route to decarbonisation for many parts of our energy system and will additionally support electrolytic production of hydrogen at scale, opening new economic opportunities for Scotland to become a leading producer and supplier of renewable hydrogen in the UK and exporting this into key European markets.

The Scottish Government has an international vision for the hydrogen economy in Scotland. This export-specific plan identifies the necessary steps for Scotland to realise these opportunities and become a net exporter of hydrogen and hydrogen products, whilst also harnessing the export opportunities across hydrogen supply chains. As outlined in the Hydrogen Action Plan (HAP)<sup>2</sup>, and supported by our export growth plan, A Trading Nation (ATN)<sup>3</sup>, our ambition is to support the delivery of 5 GW of low-carbon hydrogen production capacity by 2030, and 25 GW by 2045<sup>4</sup>. The export plan includes a Framework detailing the steps required to realising the export opportunities in Scotland.

There is growing demand for renewable and sustainable energy across the globe, driven in response to efforts to decarbonise economies and the setting of ambitious Net Zero targets. The recent destabilisation of global energy markets means that hydrogen is now seen as a key part of future energy strategies for many nations, including both potential export nations such as Scotland and those that will continue to be reliant on imports for their energy needs.

Scotland is particularly well placed to respond to others' import demand through its capacity to produce significant quantities of renewable and low-carbon hydrogen and hydrogen products, as well as by utilising its skills, experience, and knowledge gained over decades in the energy supply chain sector to support the development of hydrogen projects globally.

Developed in partnership with industry leaders, public sector partners, academia and across government, this plan is underpinned by new research that provides further evidence of the growing international demand for hydrogen and hydrogen products, as well as international trade opportunities for the Scottish hydrogen supply chain. The Worley Hydrogen Demand Study can be located [here](#) and the Arup Supply Chain Study [here](#).

The potential international trade opportunity from hydrogen is considerable, with recent International Energy Agency (IEA) forecasts<sup>5</sup> suggesting global demand for hydrogen, for use directly, or to be converted to hydrogen products, could reach 70 Mt in 2030 and over 400 Mt by 2050<sup>6</sup>. A significant portion of this will be internationally traded.

Scotland's significant natural resources, our long-standing experience in the onshore and offshore energy sectors, our growing domestic hydrogen sector, and our proximity to key markets mean that the developing international hydrogen market represents a

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1 [Draft Energy Strategy and Just Transition Plan \(www.gov.scot\)](https://www.gov.scot)

2 [Supporting documents - Hydrogen action plan - gov.scot \(www.gov.scot\)](https://www.gov.scot)

3 [Scotland: a trading nation - gov.scot \(www.gov.scot\)](https://www.gov.scot)

4 [Part 3 - The Renewable Hydrogen Export Opportunity - Hydrogen action plan - gov.scot \(www.gov.scot\)](https://www.gov.scot)

5 [Hydrogen - Analysis - IEA](https://www.iea.org)

6 [Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach - 2023 Update \(windows.net\)](https://www.windows.net), p.137

substantial new opportunity for Scottish exports. The Scottish Hydrogen Assessment<sup>7</sup>, completed in 2020, estimated that by 2045 approximately 3.3 Mt (126 TWh) of renewable hydrogen could be produced in Scotland, with approximately 2.5 Mt (94 TWh) of that either supplied to the rest of the UK or exported to other European markets annually.

This plan builds on the ambition statement and export vision set out in our HAP, and clearly sets out the practical and sequential steps needed to fully realise Scotland's export potential in hydrogen.

### Figure 1: Strategy to realise our Hydrogen Export Opportunities

Research and market insights have predicted significant demand for Scottish hydrogen and hydrogen products across the globe. With our significant resources to produce renewable energy, linked to our extensive experience and skills, Scotland is ideally placed to grow both its domestic and international markets for commodity and its supply chain.



#### Assurance of Demand

Critical in giving confidence to industry and others to enable the relevant investments in Scotland to capitalise on the global hydrogen opportunity. Research has shown significant demand already exists in markets that could be serviced from Scotland such as Germany.



#### Assurance of Supply

International markets will want to see a clearly articulated plan of how we aim to grow the production of hydrogen in Scotland beyond an ambition statement. Markets will want to see a clear roadmap of critical projects that will focus on delivery.



#### Connectivity Pillars

These are the building blocks that Scotland will need to have in place to develop into a producer and exporter of significant levels of hydrogen. This includes scalable production projects, hydrogen pipelines, new offshore wind developments, ports and storage.



#### Critical Enablers

There are many key enablers and decisions that will need to be taken to provide the investment and policy changes required for the sector to grow and to confirm Scotland as a hydrogen nation.

Source: Scottish Government Hydrogen Export Opportunities

Markets for hydrogen are developing at pace in the UK and overseas, with the development of domestic and export markets both interdependent and complementary. In December 2023, the UK Government announced the results of the first Hydrogen Allocation Round (HAR1)<sup>8</sup>, with 11 projects across the UK (two of which are in Scotland)

<sup>7</sup> [Scottish Hydrogen Assessment \(www.gov.scot\)](http://www.gov.scot)

<sup>8</sup> [Hydrogen Production Business Model / Net Zero Hydrogen Fund: HAR1 successful projects \(published December 2023\) - GOV.UK](https://www.gov.uk/government/news/hydrogen-production-business-model-net-zero-hydrogen-fund-har1-successful-projects)

receiving £2bn in revenue support under a 15-year revenue support model, similar to a Contract for Difference. HAR2 is underway, and the UK Government is currently developing its approach to future HARs. The build out of Scottish production and supply chain capability will support UK energy security and decarbonisation goals, stimulating domestic markets and helping satisfy export demand which will help drive forward investment and sustainable development that will satisfy both.

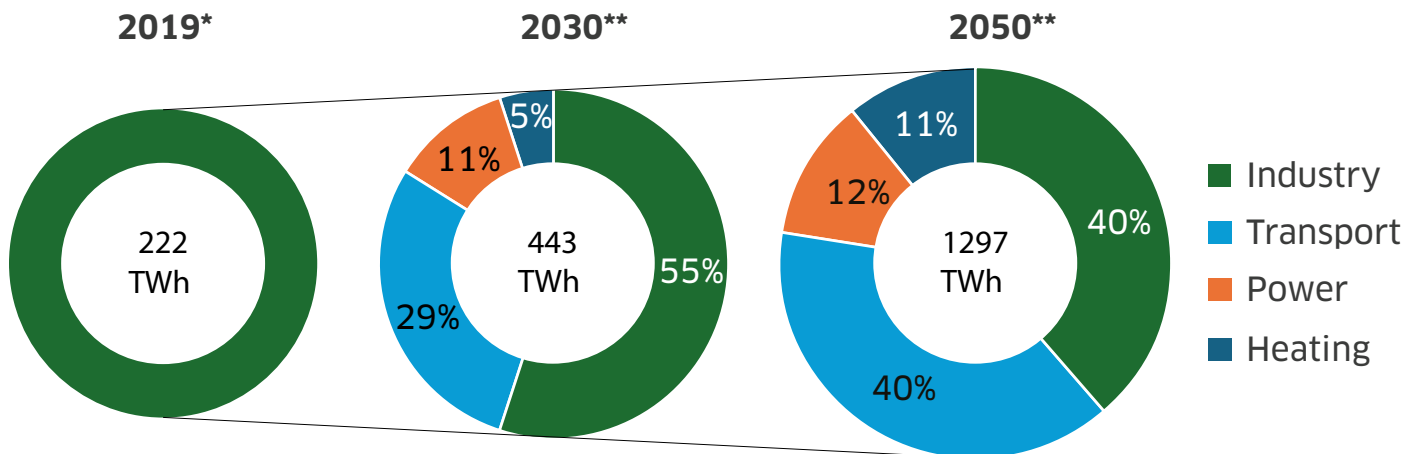
In north-western Europe, Governments and the EU are also mobilising to create demand for low-carbon hydrogen and incentivise production. This acceleration of the global hydrogen economy creates opportunities for Scottish produced renewable hydrogen, both with the UK and as exports internationally, providing the stimulus for demand necessary for rapid sector development.

Together, this export-specific plan, our HAP and [Green Industrial Strategy](#), provide the strategic pathway to develop a sustainable and successful hydrogen sector in Scotland.

## 2. Assurance of Demand for Hydrogen and Hydrogen Products

The scale up of production of internationally significant levels of hydrogen and hydrogen products for export will require large amounts of investment, both in production facilities and associated infrastructure for transport and storage. Critical to stimulating this growth and investment is the assurance that there is a growing global demand and market for hydrogen products.

**Figure 2: Average total demand for hydrogen by sector in north-western Europe (including from imports)**



Source: Worley Consulting

\* 2019 demand taken from the IEA.

\*\* Average of demand based on scenarios from the EHB, IEA, and Aurora.

Demand in Europe for renewable and low-carbon hydrogen is widely expected to increase substantially by 2050. The European Commission is targeting 330 TWh (10 Mt) of imported hydrogen by 2030<sup>9</sup>. Independent analysis<sup>10</sup> of hydrogen demand scenarios for north-western Europe shows that, in scenarios where a lack of domestic hydrogen supply is forecast, the volume of imports needed from countries such as Scotland ranges from 112–298 TWh in 2030 and 240–1725 TWh in 2050.

Further analysis suggests UK demand of up to 40 TWh<sup>11</sup>. The German government expects to import between 50% and 70% of its 2030 target hydrogen demand of 95–130 TWh, i.e. to import up to 45–90 TWh by 2030<sup>12</sup>. While these targets remain above the range of expected demand put forward by independent analyses, they nevertheless represent a clear policy intent within the developing international hydrogen economy. Countries like Belgium, Italy and the Netherlands have also included imports in their hydrogen strategies<sup>13</sup>. Aligned with this, our export intentions align with an increasing focus within Europe on the role of hydrogen imports via the North Sea and Baltic.<sup>14</sup>

9 [Hydrogen \(europa.eu\)](https://europea.eu)

10 [Worley Hydrogen Demand Study](#)

11 [Hydrogen Production Delivery Roadmap \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

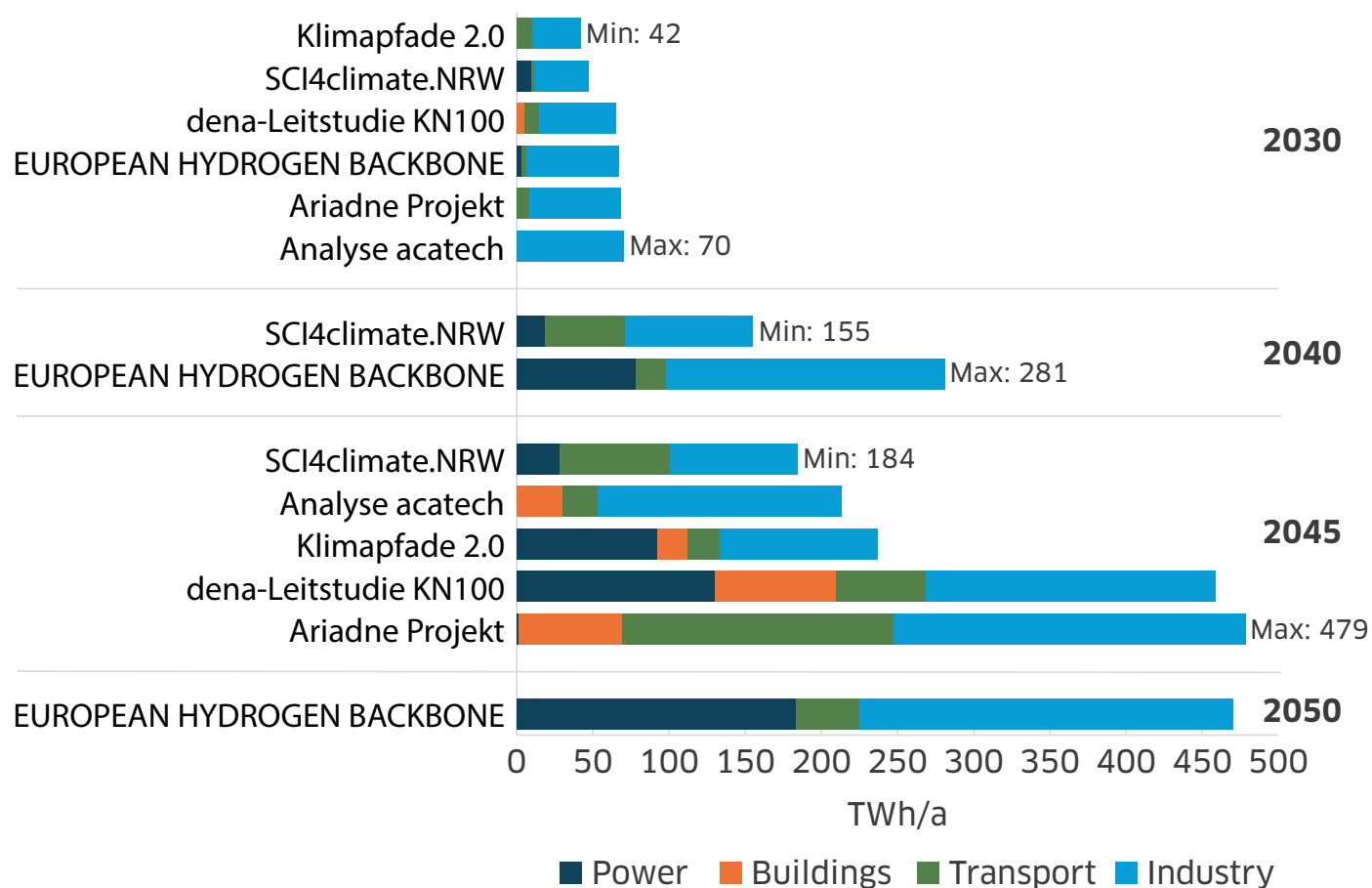
12 [BMWK - Import Strategy for hydrogen and hydrogen derivatives](#)

13 [Netherlands Hydrogen Strategy](#) : [Belgium Hydrogen Strategy](#) : [Italy Hydrogen Strategy- Preliminary Guidelines](#)

14 See Corridor c in European Hydrogen Backbone, Five hydrogen supply corridors for Europe in 2030, Executive Summary, slide 6, [EHB-Supply-corridors-presentation-ExecSum.pdf](#).

**Figure 3: Breakdown of expected hydrogen demand in Germany (TWh)**

**Hydrogen demand by sectors**



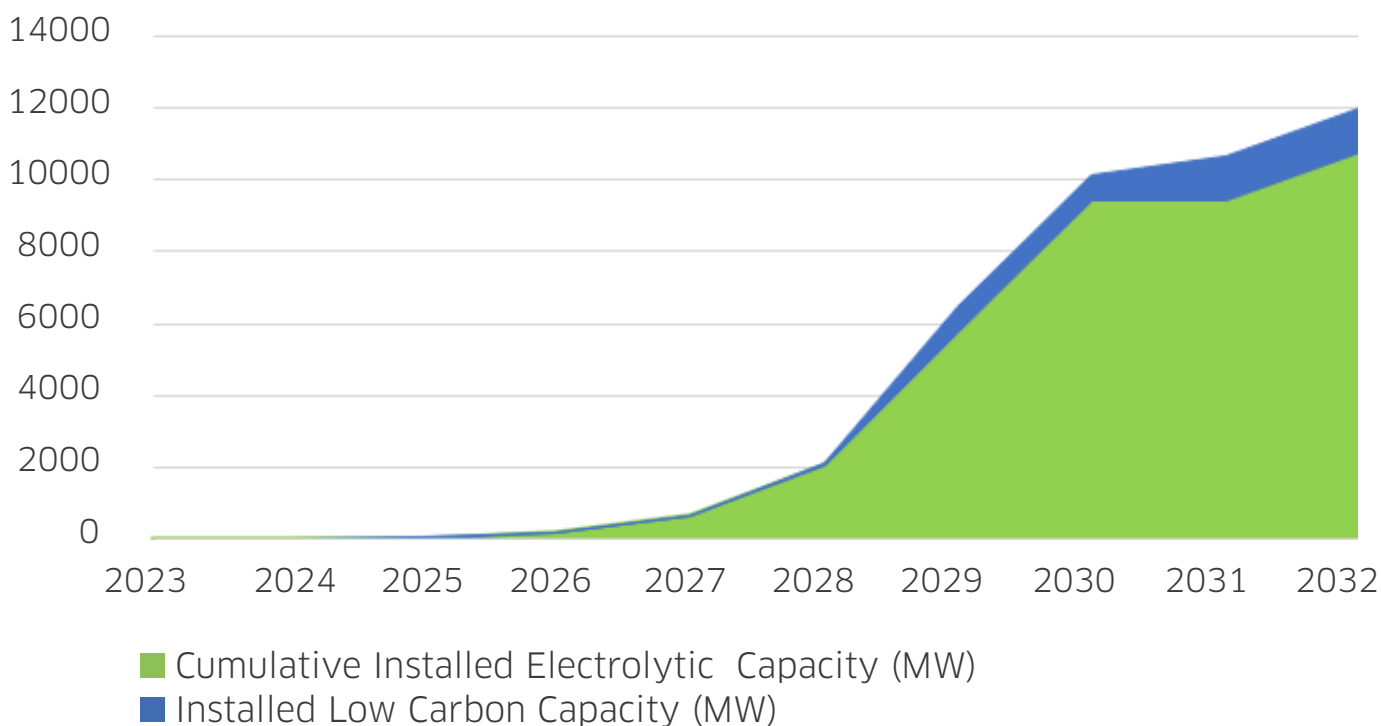
	Power	Buildings	Transport	Industry
<b>2030</b>				
Klimapfade 2.0			10	32
SCI4climate.NRW	9		2	36
dena-Leitstudie KN100		5	9	51
EUROPEAN HYDROGEN BACKBONE	3		3	61
Ariadne Projekt			8	60
Analyse acatech				70
<b>2040</b>				
SCI4climate.NRW	18		53	84
EUROPEAN HYDROGEN BACKBONE	78		20	183
<b>2045</b>				
SCI4climate.NRW	28		72	84
Analyse acatech		30	23	160
Klimapfade 2.0	92	20	21	104
dena-Leitstudie KN100	130	79	59	191
Ariadne Projekt	1	68	178	232
<b>2050</b>				
EUROPEAN HYDROGEN BACKBONE	183		42	245

Source: Net Zero Technology Centre and Cruh21, May 2024

### 3. Assurance of Supply

Our policies on hydrogen support a twin approach to accelerate and scale up renewable and low-carbon hydrogen production capacity and enable their use across multiple sectors. This approach will be critical for developing holistic domestic supply chain capabilities and skills. We are currently seeing a growth in hydrogen production activity in Scotland, with over 90 hydrogen production projects at varying stages of development, the vast majority of which are renewable hydrogen production.

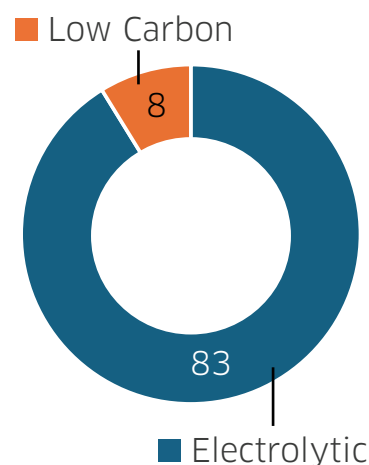
**Figure 4: Cumulative Planned Installed Hydrogen Production Capacity in Scotland (2023-2032)**



Source: Scottish Enterprise, data correct as of August 2024.

Scottish projects are among those that have attracted UK Government HAR1 funding and 15-year production contracts in accordance with the UK Government’s hydrogen production business model. The UK Budget this year included confirmation of support for the first round of electrolytic hydrogen production contracts, HAR1. This totalled £2.3bn in revenue support for over 15 years. The production projects to be funded include two in Scotland, Scottish Power Whitelee Green Hydrogen Project at the Whitelee wind farm near Glasgow and the Cromarty Hydrogen Project in the Highlands being developed in partnership between Scottish Power and Storegga, to support low carbon hydrogen production and directly create good quality, local jobs.

**Number of Projects**





Both projects will produce renewable green hydrogen for use in a combination of transport and industrial heat applications, and the Cromarty Hydrogen Project is exploring export of hydrogen from the region in future as the project scales up. Many projects based in Scotland are targeting future HAR to secure low-carbon hydrogen agreements. The Scottish Government continues to support Scottish hydrogen projects seeking to participate in these and has provided funding to projects' early development phase work. Similarly, HAR2 project applications with around 1 GW of projected capacity have received letters of support from the Scottish Government.

The recently announced Great British Energy will also look to invest in clean energy projects across the length and breadth of Scotland and the wider UK, including in world leading technologies such as floating offshore wind and green hydrogen and the development of local energy projects closer to home.

The UK's National Wealth Fund (NWF) builds on the success of the former UK Infrastructure Bank. It will have a broader mandate, extending beyond infrastructure to support delivery of the wider industrial strategy in areas where there is an undersupply in private finance. At least £5.8 billion of the NWF's capital will focus on the sectors announced in the manifesto: green hydrogen, carbon capture, ports, gigafactories and green steel. The UK Government is also exploring options to reward clean energy developers who invest directly in their supply chains.

Accelerating progress of the first tranche of renewable hydrogen production projects, which will be operational by 2030, will build confidence, drive investment across the value chain, bring forward more projects in the development pipeline, and pull a range of hydrogen technologies through to commercialisation.

This successful delivery and operation of hydrogen production and hydrogen products at scale will provide confidence for more investments in production capacity and other key hydrogen export facilitators such as ports, pipelines, and large-scale storage.

Similarly, integrated energy infrastructure connecting points of production and storage with end uses across the UK will be critical to enable the domestic hydrogen market to develop and ensure security of supply, drive down costs and produce surplus quantities of hydrogen for international export. Continued cooperation and engagement between the Scottish Government, its Enterprise Agencies, industry, and the UK Government will be key to strategically enable the hydrogen sector to grow from its relatively fragmented initial stage to a highly integrated system that can optimise export opportunities to Europe.

### **3.1 Scotland's Hydrogen Sector Market Development**

At present, neither renewable hydrogen nor low-carbon hydrogen are cost-competitive against fossil-based hydrogen without intervention to bridge the cost between fossil fuel alternatives.

There are two main factors that will impact the cost competitiveness of green hydrogen production: capital cost reductions and reductions in the cost of renewable power.

Capital costs are expected to fall as a result of technology improvements such as electrolyser efficiencies and a significant scale-up of supply chain capacities driven by the automated production of electrolysers and other supply chain key components.

While the cost of electrolysers and other key components will continue to be a factor, falling renewable electricity costs will be the key driver in lowering the cost of green hydrogen into the 2030s.

There is also considerable uncertainty regarding demand growth and the supply chain's capacity to scale up – both of which are intrinsically linked to the scale and deployment timescale for the pipeline of hydrogen production in Scotland. Here, government has a crucial role in identifying barriers to deployment and implementing targeted interventions to mitigate them.

Despite these expected cost reductions, it is clear that government support will be required if renewable hydrogen is to compete with fossil fuels<sup>15</sup>. As noted, the UK Government Hydrogen Business Model is a key enabler to facilitate this and increase production capabilities. There are many production projects currently in varying stages of development in Scotland. While these projects are sized to meet growing UK domestic demand, with individual project capacities ranging between 50 MW to 499 MW, production scales are anticipated increase from 2030 when large scale offshore renewables come online.

Stimulating demand will be equally important, and we are working with industrial hydrogen producers and prospective hydrogen off-takers to identify barriers and opportunities to facilitate match-making between suppliers and customers. This includes engagement with major industrial emitters, the public sector, and other key stakeholders.

The current number of project announcements is very high compared to those currently reaching Final Investment Decision (FID). Without operational support and offtake demand to justify expenditure many of these projects might not reach FID. Completion of technical design phases is also an important milestone in project development, and we are working with our Enterprise Agencies to support companies as they go through development phases. To that end, in Autumn 2024 we launched a funding call with Scottish Enterprise as delivery partner, aiming to provide support to projects.

As well as reducing production costs, lowering delivery costs will be a key factor in ensuring that Scotland can become a major competitor in the EU market. Scotland's proximity to demand markets in the north of Europe is key to enabling this through the development of hydrogen pipelines as the most cost-effective option for large scale transport of hydrogen<sup>16</sup>.

The provision of a supportive political and regulatory environment, including clear planning and consenting guidance, is also key to the deployment of hydrogen production in Scotland. We will publish comprehensive guidance for hydrogen consenting across onshore and offshore regimes before the end of the 2024. This guidance will cover all relevant consenting processes to support developers navigating the planning and consenting systems and serve as an aid for local planners and decision makers.

To raise awareness of the role that hydrogen may play in the future energy mix, we have worked with Edinburgh University, University of Strathclyde, and Aberdeen University to design a Continuous Professional Development (CPD) course entitled 'An Introduction to Hydrogen for the Public Sector'. This is intended for all local planning professionals throughout Scotland as well as members of the public.

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<sup>15</sup> [Cost reduction pathways of green hydrogen production in Scotland | ClimateXChange](#)

<sup>16</sup> [Green hydrogen production and international competitiveness | ClimateXChange](#)

Government support must help close the cost gap to enable Scotland to become a major competitor in the EU market. The Scottish Government is committed to supporting the scale up of offshore wind and hydrogen production to support domestic security of supply, net zero goals and realise economic benefits from a growing international hydrogen export market.

### **3.2 Hydrogen Derivatives and Products**

Hydrogen can be transported and stored in its pure form either as a compressed gas or as a cryogenic liquid. However, due to its physical and chemical properties, it may be more suitable in some instances to convert it to a derivative such as ammonia or [energy-carrying] product such as LOHC or synthetic hydrogen carbons to facilitate its transport and storage. Each hydrogen carrier has a unique set of advantages and challenges, influencing its suitability for different applications as outlined in the report, 'North Sea Alliance – Matching Scottish Production to German Demand'<sup>17</sup>.

Many of these hydrogen products are both useful for storing and distributing hydrogen and much sought-after sustainable commodities in their own right. Further understanding Scottish production capabilities, as well as domestic and international demand for these derivatives and products, is key to understanding which sectors of the economy are most likely to stimulate domestic and export demand for hydrogen and to quantifying the scale of the economic opportunity in producing, consuming and/or exporting hydrogen derivatives and products.

Research is currently underway to assess Scotland's capabilities for the production of hydrogen derivatives and products. This work is being conducted by ClimateXChange on behalf of Scottish Government and is expected to be completed soon. This will further identify potential offtake sectors and markets both domestically and internationally, as well as assess the scale of demand. It will be critical to identifying gaps in existing policies and regulations as well as policies stimulating or hindering the growth of hydrogen derivatives and product demand.

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<sup>17</sup> [Enabling Green Hydrogen Exports: Matching Scottish Production to German Demand \(netzerotc.com\)](https://www.netzerotc.com)

## 4. Connectivity Pillars

In addition to the necessity for supply and demand to align effectively, several foundational connectivity pillars have been identified as essential for the export of hydrogen. These pillars will be instrumental in fostering the growth of the hydrogen sector.

### 4.1 Ports

Scottish ports have already demonstrated their importance in unlocking the wider renewable energy potential in Scotland and will play a crucial role in the growing hydrogen sector. They are central to the creation of hydrogen hubs for land-based users such as distilleries, shoreside cold ironing for marine vessels, bus networks, and hydrogen-based chemical manufacturing. They can also facilitate the export of hydrogen and hydrogen products to external markets either via pipeline or through shipping. Maritime transportation of hydrogen from Scottish ports via shipments could be facilitated either in its liquid or gas form or as part of a chemical compound such as ammonia or LOHC.

With Scotland well-placed in terms of proximity and infrastructure connectivity to key hydrogen import locations in north-western Europe, we are continuing to support tangible industry-led projects that look to investigate and demonstrate the delivery of hydrogen and hydrogen products from Scottish ports into north-western Europe. These include the ports and authorities of Port of Cromarty Firth, Forth Ports, Aberdeen, Peterhead, Shetland, and Orkney Islands Council.

The proximity of port infrastructure to industrial sites might facilitate the export of hydrogen derivatives that require pre-treatment such as ammonia or LOHC. Scotland's existing industrial capabilities around some of its ports may be a critical factor to develop distribution networks into the UK and Europe, and coordination will be required to ensure port adaptation efficiency<sup>18</sup>.

Hydrogen can also be transported in its pure form as a compressed gas or as cryogenic liquid. While liquifying hydrogen uses energy due to the extremely low temperature conditions required, research to improve liquefaction technology, as well as improved economies of scale, could assist in lowering the energy required and the cost.

The need for coherence in transport and infrastructure planning is already driving a review of Scottish ports and terminal infrastructure preparedness for hydrogen exports, the results of which include the recent investments in Aberdeen, Arnish and the £100 million investment in Ardersier (£50 million from UK Investment Bank and £50 from Scottish National Investment Bank). Inverness and Cromarty Firth Green Freeport and Forth Green Freeport have been jointly selected by the Scottish and UK governments to become Scotland's first Green Freeports<sup>19</sup>, positioning them well to host hydrogen as well as offshore wind projects and companies.

In parallel with reviewing our domestic networks, we are engaging with key European ports such as the ports of Rotterdam, Antwerp, Wilhelmshaven, and Hamburg, which we expect to become major hydrogen hubs. This includes work with the ports of Rotterdam, Sullom Voe, Peterhead and other strategic partners on Phase 2 of the LOHC

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<sup>18</sup> NZTC Report Sets Out Plan for Green Hydrogen Export Between Scotland and Germany - [Enabling Green Hydrogen Exports: Matching Scottish Production to German Demand \(netzerotc.com\)](#)

<sup>19</sup> [Green Free Ports \(www.gov.scot\)](#)

for Hydrogen Transport from Scotland Project (LHyTS)<sup>20</sup>, led by the Net Zero Technology Centre (NZTC).

This project has carried out a feasibility assessment for a pilot trial for the shipment of LOHC from Scotland to the north-western European mainland via Rotterdam, indicating the viability of a strategic export route for hydrogen between Scotland and the EU. The assessment has also provided an understanding of the infrastructure requirements at the ports of Sullom Voe and St Fergus for the storage, handling, and shipping of LOHC to Europe.

### Figure 5: Liquid Organic Hydrogen Carriers: Hydrogen Transport from Scotland to Rotterdam



Liquid Organic Hydrogen Carriers: Hydrogen Transport from Scotland to Rotterdam (LHyTS)

Phase 3 of the project, led by NZTC, is currently being scoped and will consider front-end engineering design for the LOHC technology both at Scottish and Dutch ports.

Additionally, developers such as MHP and LH2 Europe are currently taking forward projects looking to establish end-to-end liquid green hydrogen and e-methanol supply chains and commercial-scale export, including via marine transport, from Scotland to Germany using liquefaction technology.

Other innovative examples include Scottish start-up Flexergy which is developing unique technology for ultra-efficient compression, storage, and distribution, an area with huge scope for improvement over current solutions, and has been supported by Scottish Government funding through the Energy Technology Partnership (ETP)<sup>21</sup>. If developed further, high pressure hydrogen gas compression technology may have potential to assist the maritime transport of compressed hydrogen across distances covering Scotland and north-western Europe.

Over the coming years we will continue to engage, seek and facilitate strategic partnerships with developers and Scottish and European ports and terminals to support the development of export infrastructure and options in Scotland and ensure that these are aligned with key north-western European import hubs.

<sup>20</sup> [Liquid Organic Hydrogen Carriers: Hydrogen Transport from Scotland to Rotterdam \(LHyTS\) \(netzerotc.com\)](https://www.netzerotc.com)

<sup>21</sup> [Energy Technology Partnership \(etp-scotland.ac.uk\)](https://www.etp-scotland.ac.uk)

## 4.2 Pipelines

The development of hydrogen offshore pipelines offers a strong strategic opportunity to support the large-scale transportation of hydrogen exports from Scotland to north-western Europe, given our proximity just 700km away from the Netherlands and 750km from the north German coast<sup>22</sup>. This will assist us to maximise Scotland's vast potential offshore energy resources by providing an additional route to market through the production of renewable hydrogen.

The NZTC Hydrogen Backbone Link Phase 1 report in September 2023, and supported by the Scottish Government, considered several options for pipeline routing offshore that could connect major energy hubs in north east Scotland to the onshore European Hydrogen Backbone. It concluded that whilst it would be feasible to use existing pipelines, the development of a new pipeline would enable accelerated deployment. In particular, developing pipelines linking St Fergus, Port of Cromarty, Flotta and Shetland and then to Germany could reduce transportation costs to 32 pence per kilogram of hydrogen, making the cost of delivered green hydrogen produced in Scotland internationally cost-competitive<sup>23</sup>. Phase 2 of this project is now well underway and will sit alongside studies from Crown Estate Scotland and Scottish Futures Trust which look further into the commercial case for a pipeline.

The scope of Phase 2 also includes investigating a hydrogen import link from the Irish Sector to Scotland. The Scottish-Irish Backbone Link addition considers how a hydrogen pipeline network could be established between the two countries to facilitate the cost-effective, safe and secure future of Europe's energy needs.

The location of international transport infrastructure will need to be strategically considered alongside the build-out of the UK's domestic hydrogen production, transport, storage, networks, and locations. Given Scotland's projected supply of excess energy and current grid constraints, we will continue to make the case for pipeline connectivity to come out of Scotland, thus leveraging Scotland's renewable generation potential, industry skills and existing infrastructure assets.

It will also be critical that we continue to engage with our EU partners to explore and facilitate cooperation and off-take agreements, as well as work with UK and EU governments to assist the development of business models for international hydrogen transport pipelines.

Cooperation between North Sea countries and regions, as well as Ireland, will be essential to capitalise on the existing infrastructure and renewable generation potential, and to overcome the regulatory and technical hurdles to establish a well-functioning international market for hydrogen and hydrogen products. To this end, we will continue to work through our international offices and with the UK Government<sup>24</sup>.

## 4.3 Large-Scale Storage

For hydrogen exports, flexible, large-scale integrated storage solutions are critical to provide confidence to off-takers that there will be a robust and continuous supply of hydrogen. Security of supply was identified as a key issue during our stakeholder engagement process, which informed the development of this plan.

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<sup>22</sup> <https://renews.biz/96570/germany-approves-core-hydrogen-network/>

<sup>23</sup> [Hydrogen Backbone Link: Connecting Scotland to Europe](#)

<sup>24</sup> The key regulation and legislation around pipelines are reserved to UK Government

Hydrogen storage solutions will be required at all scales to suit different scenarios. Storage of hydrogen for export markets in the long term will require large geological storage. However, interim projects will be able to utilise alternative small- and medium-scale solutions. Many projects are already assessing the case for hydrogen storage at different scales in Scotland. A number of Hydrogen Innovation Scheme<sup>25</sup> projects that received Scottish Government funding in May 2023 were supported to further develop understanding of hydrogen storage, including H2GEN, H2Shore, StorageUpscale and Green Hydrogen Integration at Sullom Voe.

In addition, Edinburgh University has evaluated offshore geology and suitability for large subsurface hydrogen storage through its HyStorPor project<sup>26</sup>. The project has shown that subsurface geological storage of hydrogen is possible.

Nonetheless, over the coming years, further feasibility studies and subsurface trials will be required in porous media and lined rock cavern storage in order to confirm their suitability for hydrogen storage in Scotland.

Opportunities for the geological storage of hydrogen will need to be assessed and coordinated with the strategic ambition and vast potential for CO<sub>2</sub> storage in the North Sea, which is estimated at up to 46 Gt of CO<sub>2</sub> storage in Scottish waters<sup>27</sup>.

Offshore hydrogen transport pipelines also offer the potential to store large quantities of hydrogen through line-packing – putting more gas into a pipe than is being withdrawn – thus requiring strategic coordination for the development and operation of multiple storage options.

The UK Government is currently developing a hydrogen storage and transport business model that will support up to two storage projects at scale and associated regional pipeline infrastructure to be in operation or construction by 2030. UK Government are committed to designing, by 2025, a new business model for hydrogen transport and storage infrastructure.

Additionally, the development of onshore pipeline infrastructure currently being considered through National Gas Project Union will be key to enable the large-scale export of hydrogen to demand centres in the south of the UK. This project is critical to providing developers in Scotland with further assurances of demand by connecting production and storage with end users domestically. It is likely that the first large-scale storage sites in the UK will be situated in the North of England, with the highest levels of hydrogen production coming from Scotland it is therefore essential that good connectivity to those sites is needed to help enable our large-scale production ambitions.

However, neither the hydrogen production business model nor the transport and storage business models are currently designed to support hydrogen for export. We will continue to make the case for the UK Government to expand the hydrogen storage and transport business model to include revenue support for the storage of hydrogen for international export.

In addition to enabling hydrogen exports, storage can also assist the development of hydrogen supply chains, the delivery of employment opportunities and increase labour force skills.

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25 [Emerging Energy Technologies Fund - Hydrogen Innovation Scheme: successful projects - gov.scot \(www.gov.scot\)](https://www.gov.scot/topics/energy/emerging-energy-technologies-fund/hydrogen-innovation-scheme/successful-projects)

26 [HyStorPor \(ed.ac.uk\)](https://www.ed.ac.uk/hy-stor-por)

27 [Opportunities for CO<sub>2</sub> Storage around Scotland - an integrated strategic research study \(sccs.org.uk\)](https://www.sccs.org.uk/research-studies/opportunities-for-co2-storage-around-scotland)

## 4.4 Certifications and Regulations

A fit-for-purpose international regulatory regime and interoperable certification schemes should reduce barriers to trade and ensure high standards in the hydrogen economy. To be able to export hydrogen from Scotland, we need to ensure that the hydrogen produced meets the requirements of importing countries. International regulatory co-operation is of vital importance to achieve this.

The UK Government has introduced a Low Carbon Hydrogen Standard<sup>28</sup> that sets the threshold for the level of carbon emissions permitted in the production of hydrogen for it to be considered 'low-carbon' in the UK. This standard is currently voluntary unless applying for financial support through government schemes, and the UK Government intends to introduce a certification scheme based on the Standard<sup>29</sup>. The introduction of this scheme recognises the importance of offtaker confidence that purchased hydrogen complies with an agreed standard and emission limits.

To avoid fragmentation of standards and certification within the UK, we do not plan to develop Scotland-specific versions and are working with the UK Government to ensure that the regulations it proposes do not act as a barrier to our export ambitions.

The UK Government has committed to publishing a pathway to international alignment ahead of launching its certification scheme. We will work with the UK Government to ensure that the UK hydrogen certification scheme and standard can facilitate trade for producers looking to export hydrogen or its derivatives.

There is also movement internationally around accepted methods for determining the emissions associated with hydrogen production. The International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE),<sup>30</sup> and subsequently the International Organisation for Standardization (ISO),<sup>31</sup> have been developing an agreed methodology for determining the greenhouse gas intensity of hydrogen production.

We commissioned a study that compares existing and developing emissions related standards for hydrogen globally, including the UK Low Carbon Hydrogen Standard. The study also quantifies the greenhouse gas (GHG) emissions associated with producing and exporting hydrogen to the EU from Scotland and other countries, and how these compare to EU requirements. The study finds that in terms of GHG emissions, electrolytic hydrogen produced in Scotland and exported to the EU could be one of the most competitive of the countries considered. The study will be published via ClimateXChange in the coming months.

To achieve our hydrogen export ambitions we must ensure that the regulatory framework for renewable hydrogen developments supports the scale-up of hydrogen at pace, whilst protecting the environment and communities. Since the regulatory regime for hydrogen in Scotland is a mix of reserved and devolved powers, we are working closely with the UK Government through the UK Regulators Forum to assess regulatory requirements and ensure that action is taken to address any identified gaps and issues.

As development of regulations and standards gathers pace, we will look for opportunities to influence the appropriate international regulatory and standards system through collaboration with standards-setting bodies.

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28 [UK Low Carbon Hydrogen Standard - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

29 [UK Low Carbon Hydrogen Certification Scheme - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

30 [IPHE WP Methodology Doc Ver3 Jul 2023 | iphe](#)

31 [ISO/TS 19870:2023 - Hydrogen technologies – Methodology for determining the greenhouse gas emissions associated with the production, conditioning and transport of hydrogen to consumption gate](#)



## 5. Supply Chain

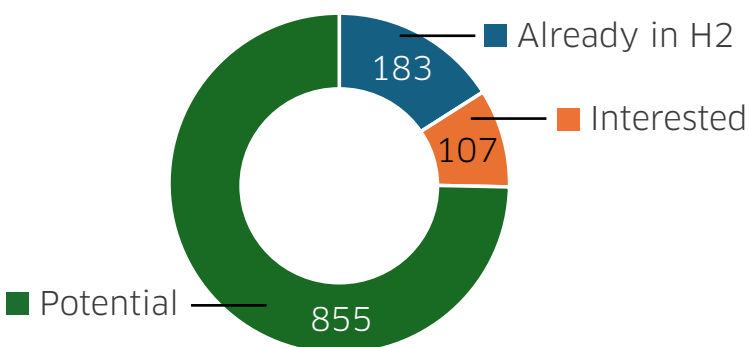
With 60 years of supply chain expertise in the upstream oil & gas industry as well as offshore energy and downstream petrochemicals, Scotland has many of the products, technologies and engineering skills required to accelerate the adoption of hydrogen as a major energy vector.

Significant renewable resources and a large associated pipeline of domestic hydrogen projects, coupled with strong, transferable experience from existing sectors, mean Scotland's supply chain is well placed to become a leader in the renewable and low-carbon hydrogen sector. This will create opportunities to export skills, capability, and expertise to emerging markets. The vision is for Scotland to be recognised as a trusted partner and reliable provider of supply chain expertise for development of clean hydrogen projects in overseas markets.

With a robust and tested approach to supporting exporters to grow their goods and services into critical international markets, Scotland already has over 150 companies actively involved in the hydrogen sector both domestically and in overseas markets. Around one thousand others have relevant skills and capabilities in delivering products, solutions, and services across the supply chain, many of which are making plans to enter the sector imminently. Through our existing export support ecosystem, we will work with these companies to raise their ambition and increase their focus to diversify, research, identify and access new international trade opportunities in the growing hydrogen sector globally. Our enterprise agencies are already working to support companies with the transition, turning 'potential' companies into 'interested' companies and 'interested' companies to 'already in H2' as noted in the chart below.

**Figure 6: Breakdown of Scottish business activity and interest in the hydrogen sector by company Hydrogen status**

### Company H2 Status



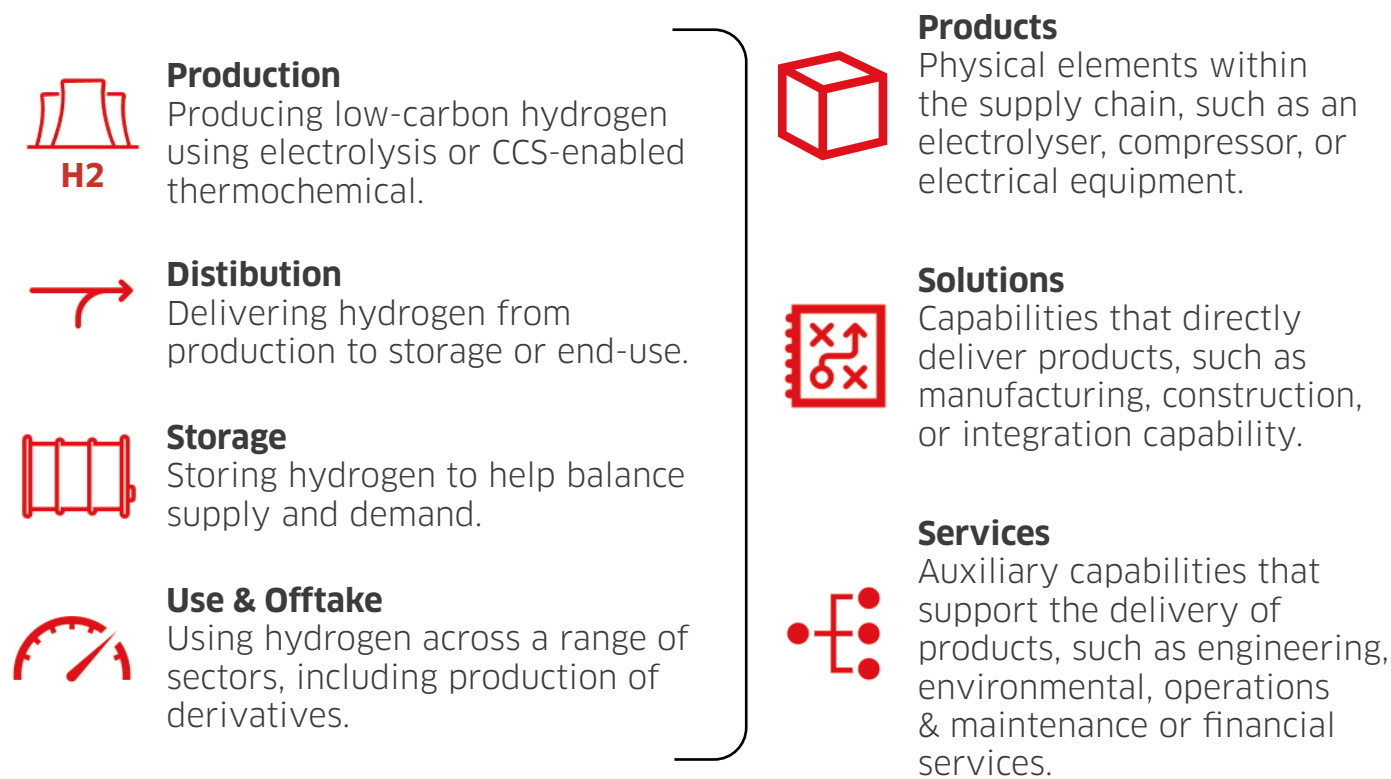
Source: SE benchmarking study October 2024

The Scottish Government and Enterprise Agencies want to ensure that Scottish companies are strongly positioned to capitalise on the economic opportunities presented by hydrogen both in Scotland and globally. Research, recently commissioned from Arup<sup>32</sup>, provides insight into the key target markets that represent the greatest potential for Scotland to export supply chain capability. Through a data driven assessment of 170 different markets across the globe, the study applied multi-criteria analysis, centred around the three core themes of Ambition, Capability and Alignment, which produced a list of key countries for deeper analysis.

<sup>32</sup> [Arup Supply Chain Study](#)

To assess the opportunities for Scotland to export supply chain capabilities, the supply chain model below was used to break down the supply chain into the key segments of the hydrogen lifecycle including production, distribution, storage, and use. For each of these segments, supply chain capabilities were identified across products, services and solutions.

**Figure 7: The Low Carbon Hydrogen Supply Chain**

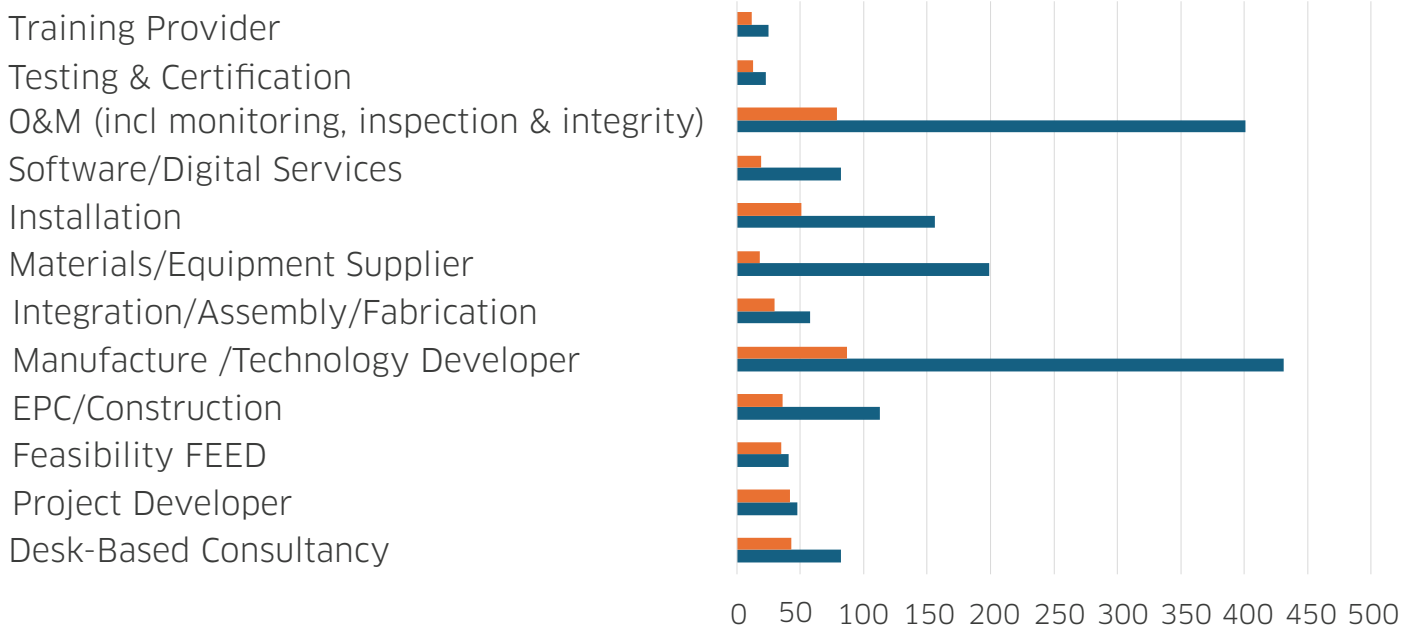


Scottish companies have played key roles in delivering some of Scotland’s leading, early hydrogen demonstrator projects and are now preparing to scale up rapidly in response to the growing pipeline of projects in planning or under development. Scotland’s supply chain has relevant and transferable strengths built over many decades that include equipment manufacturers, integrators and fabricators, experience with transport and hydrogen refuelling stations, development engineering, operational and maintenance services, and project management. All of these position our company base very well to respond to the anticipated roll-out of hydrogen production, transportation, storage, and utilisation infrastructure domestically and in international markets.

Development of Scotland’s hydrogen supply chain is currently being monitored and supported across the Enterprise Agencies in a cross-organisational way that helps identify relevant Scottish supply chain companies when working with project developers and inward investors. Those with products, services and expertise that are in demand across the global hydrogen sector can then be assisted to access opportunities in key international markets.

**Figure 8: Scottish Companies active or potentially looking at activity in hydrogen supply chain broken down by sub-sector at October 2024**

**High Level Categorisation**



■ No. of companies (active & confirmed interest)  
■ No. of companies (all companies)

**5.1 Markets and Opportunities**

Scotland, with its stable political system and established trading history, is in a good position to target export opportunities for supply chain goods and services in key overseas markets such as the existing key export markets United States, France and Germany and emerging markets identified as Mexico, Brazil, Canada, Malaysia, Indonesia, China, Norway, Denmark, UAE, Saudi Arabia, Oman and Namibia.

The international market assessment and prioritisation exercise completed by Arup identified a number of priority markets for the export of goods and services from the Scottish supply chain, alongside existing key export markets such as the EU and USA. Egypt, Chile, India, Australia, Spain, and Morocco were identified as key emerging opportunity markets, primarily driven by the size and scale of their hydrogen ambition, perceived likelihood of a gap in their domestic capabilities, and Scotland’s ability to capitalise on these opportunity areas through trade links and ease of doing business. These include:

- supply of subcomponents to in-market electrolyser manufacturing (Spain)
- supply of cross-cutting products, such as process and electrical equipment, across the supply chain (Spain)
- providing expertise and technology gained from its domestic renewables, oil, and gas sectors (Chile/Australia/India)
- providing project delivery experience for market supply chain projects (Egypt)
- sharing early knowledge and experience around infrastructure and transport (Spain/Chile)

- exporting storage vessels to market (Egypt)
- open to International Investment (Australia).

Whilst the data suggests that these markets will provide significant opportunities for Scotland's supply chain, other key markets with significant clean hydrogen markets will also remain important, e.g. USA, EU countries and Japan. Given the early development and scale of those major markets, they will still provide opportunities across our supply chain due to other factors such as existing trading relationships, market familiarity, geographic proximity, etc.

We will determine in more detail the key aspects of the clean hydrogen value chain in which Scotland has a clear competitive advantage and will identify and support those supply chain companies that have the products and services with export potential.

Playing a role in the development of the hydrogen sector in international markets will require public and private sector partners to understand, engage with, and create a foothold in markets with high ambition. To enable this, our international hubs and Scottish Development International (SDI) will continue to prioritise engagement in markets offering the greatest opportunities for the export of Scottish supply chain goods and services, and we will support Scottish companies at home and abroad to seize these opportunities.

## **5.2 Company Engagement**

There are a number of notable large companies already active in many clean hydrogen projects in overseas markets and a handful of SMEs with a track record or niche product/service offerings actively targeting international opportunities or already delivering exports. A significant proportion of the emerging hydrogen supply chain capability is from within the traditional energy company base seeking to diversify their business into wider energy transition areas.

As a result, many companies that could be selling into the hydrogen sector won't necessarily identify as a hydrogen company because at this stage such opportunities may be considered a diversification opportunity for those currently selling into traditional oil & gas or other renewable energy markets. Improved understanding of the range of products and services required for hydrogen projects will enable more effective identification of market opportunities for those companies able to support the wider development of hydrogen beyond the the core technology.





Enterprise Agencies have been working hard to establish relationships with many key companies via events, webinars, and individual company meetings. These opportunities are being utilised to communicate with developers about supply chain opportunities related to their projects. These regular engagements continue to raise general awareness of the scale of opportunity on the horizon and offer links to project developers, other companies and stakeholders, investors, and funding. The number of Scottish supply chain companies with potential to sell into the hydrogen sector in overseas markets is expected to grow as the sector expands domestically and more companies with potential begin to diversify into this new aspect of the energy transition.

## 6. Critical Enablers




The following Critical Success Factors Framework provides a clear path for the growth of the hydrogen sector in Scotland. It identifies the critical success factors and the critical enablers that will need to be considered and delivered over the coming decades. This phased and structured approach should give confidence to domestic off-takers and prospective importers, as key milestones and projects are delivered, that we can deliver on our hydrogen ambition. Moreover, that Scotland can be seen as both a credible producer of hydrogen and hydrogen products for export as well as home to a world-class hydrogen supply chain with capabilities that can be applied internationally.

**Figure 9: Hydrogen Export Critical Success Factor Framework**

### CSF Framework – Assess & Test

	Hydrogen Supply	Connect	Hydrogen Demand	International Competitive Advantage	Timeline	Critical Enablers 
 <b>Assess</b>	<p>Understand the relationship between domestic usage of H<sub>2</sub> and economic export opportunities</p> <p>Consider domestic supply projects and relationship with demand</p> <p>Recognise developers' needs and their requirements on regulation to support project viability</p> <p>Assess impact of the structure and costs of the electricity market in Scotland to H<sub>2</sub> projects</p>	<p>Assess the dynamic nature of H<sub>2</sub> sector in Scotland, through an adaptable and agile approach</p> <p>Identify key storage &amp; transport infrastructure requirements to facilitate export growth</p> <p>Ensure emerging Certification and Regulation supports future Scottish H<sub>2</sub> exports</p> <p>Assess green electricity requirements to ensure H<sub>2</sub> exports are a commercially viable proposition</p>	<p>Identify and develop international H<sub>2</sub> export opportunities for Scotland</p> <p>Identify specific market demand for different H<sub>2</sub> products</p> <p>Develop robust international networks for H<sub>2</sub> transportation in potentially a range of carriers</p>	<p>Demonstrable alignment with UKG policies and levers to facilitate growth in Scotland's H<sub>2</sub> export capacity</p> <p>Demonstrate the international strengths of the Scottish H<sub>2</sub> supply chain</p> <p>Have clear plans to transition our workforce into the H<sub>2</sub> sector</p> <p>Enhancing the H<sub>2</sub> export capabilities of Scottish companies</p>	<p>2024-2026</p> 	<p>Innovation</p> <p>Skilled Workforce</p> <p>Investment</p> <p>Cost Competitiveness</p>
 <b>Test</b>	<p>Develop key projects across multiple H<sub>2</sub> products</p> <p>Inform and influence international H<sub>2</sub> production and transportation plans</p> <p>Plan to meet key infrastructure requirements from customers</p>	<p>Co-ordinate support and focused on H<sub>2</sub> projects with the greatest export potential</p> <p>Create alignment on funding and regulation with UKG to help develop EU/ International Markets</p>	<p>Scotland's H<sub>2</sub> and Hs products meet international standards and regulations and are certified by appropriate certification schemes</p> <p>Scottish H<sub>2</sub> and H<sub>2</sub> products imported &amp; used in international markets</p>	<p>Enterprise Agencies track emerging projects to promote Scotland's export capacity</p> <p>Pilot projects demonstrate Scotland's export capabilities</p> <p>Scotland's successful initial H<sub>2</sub> exports create international confidence</p>	<p>2027-2029</p>	<p>Innovation</p> <p>Skilled Workforce</p> <p>Investment</p> <p>Cost Competitiveness</p>

## CSF Framework – Export & Scale

	Hydrogen Supply	Connect	Hydrogen Demand	International Competitive Advantage	Timeline	Critical Enablers 
 Export	<p>Projects demonstrate necessary production, regulation &amp; transport assurance</p> <p>Successful delivery demonstrates Scottish credibility for exports</p>	<p>Transport vectors in place for identified H<sub>2</sub> and H<sub>2</sub> products</p> <p>Ports and storage facilities in place with expansion plans to meet future growth</p>	<p>Successful fulfillment of export contracts at cost and on time</p> <p>Demonstration of Scotland ability to deliver internationally</p> <p>Establish and grow emerging international H<sub>2</sub> market demands</p>	<p>Scottish H<sub>2</sub> exports delivered reliably</p> <p>Market demands increase for Scottish H<sub>2</sub> and H<sub>2</sub> Product exports</p> <p>Seen as a credible supplier with growth planned to meet market growth demands</p>	<p>2030-2035</p>	<p>Innovation</p> <p>Skilled Workforce</p> <p>Investment</p> <p>Cost Competitiveness</p>
 Scale	<p>Secure significant parts of the target international markets and expand exports</p>	<p>Expanded critical export infrastructure in place to accommodate increased volumes of H<sub>2</sub> trade</p> <p>Domestic production expands to create capacity to meet international demand</p>	<p>Expand Scottish H<sub>2</sub> exports into new &amp; emerging markets as the global transition to H<sub>2</sub> accelerates</p>	<p>Maximise economic benefits for Scotland from the export potential of H<sub>2</sub> across international markets</p>	<p>From 2035 onwards</p>	<p>Innovation</p> <p>Skilled Workforce</p> <p>Investment</p> <p>Cost Competitiveness</p>

### 6.1 Innovation

The Scottish Government continues to recognise the importance of hydrogen research, development, and innovation projects to help better align investment opportunities within our economic priorities.

The current research into hydrogen production, storage, distribution, and end user technologies will be crucial as we look to expand the scale of renewable hydrogen projects over the coming years.

#### 6.1.1 SHINe

Launched in May 2024, the Scottish Hydrogen Innovation Network<sup>33</sup> (SHINe) is funded by Scottish Enterprise to enhance the hydrogen landscape in Scotland and accelerate hydrogen innovation. It will run until 2026 and bring together Scotland’s hydrogen innovation ecosystem, providing a single front door for innovative companies from Scotland and elsewhere seeking hydrogen expertise, demonstration opportunities, testing facilities, and partnerships. Initial engagement is beginning with several hydrogen innovation companies, and this work will allow new and emerging companies to become part of the supply chain for hydrogen and stimulate the innovation needed for the sector to evolve.

33 SHINe | Scottish Enterprise ([scottish-enterprise.com](https://scottish-enterprise.com))

## 6.2 Skilled Workforce

Consultation with industry has emphasised the critical need to expand and transition Scotland's workforce to strengthen and support the future hydrogen economy. The Hydrogen Action Plan<sup>34</sup> highlights the importance of this work and commits to working with industry and partners to establish the skills required to underpin our energy transition.

Our recently published [Green Industrial Strategy](#) also emphasises the need to collaborate with industry and partners to develop the necessary skills for supporting the energy transition.

Together with our Enterprise Agencies, we will continue to work across the ecosystem to ensure Scotland has a strong environment for growth to maximise export potential.

## 6.3 Investment

To achieve our ambitions for economic growth through building a new hydrogen sector, we must cultivate a thriving green industrial ecosystem for investment. Public bodies, businesses, investors, local government, communities, regional partnerships, and others have essential roles and responsibilities in the investments required to build a green economy which supports innovation, investment, and growth. In return, there are rewards to be won in the form of profitable businesses providing high-value jobs across our communities; a low-emissions society; and a productive economy to support excellent public services.

### 6.3.1 Strategic Investment

We will work across government and with industry to ensure that investment for the development of wider renewable infrastructure considers the alignment and future integration of hydrogen infrastructure where possible.

In addition, we will continue to work with the UK Government, making the case for and urging it to support infrastructure development for the offshore transportation of green hydrogen from Scotland's ports and harbours.

It is important that the supporting market and regulatory frameworks, as well as strategic planning to guide the roll-out of hydrogen transport and storage infrastructure, consider the onshore and offshore transportation of hydrogen in parallel, particularly in consideration of pipelines.

### 6.3.2 Inward Investment

Our Shaping Scotland's Economy: Inward Investment Plan (IIP)<sup>35</sup>, published in October 2020, outlined a plan for Scotland to be a leading destination for inward investment aligned with Scotland's values of fair work, net zero, and inclusive prosperity.

The IIP highlights the important role inward investment can play in Scotland's economic growth by delivering high-value jobs to the economy.

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<sup>34</sup> [Hydrogen Action Plan \(www.gov.scot\)](http://www.gov.scot)

<sup>35</sup> [Shaping Scotland's economy: inward investment plan - gov.scot \(www.gov.scot\)](http://www.gov.scot)

Scotland already has a successful track record of attracting inward investment. Our strong workforce, competitive cost base, world-class universities, supportive business environment, natural resources, and high quality of life are what makes global companies decide to locate here.

Accordingly, Scotland has many of the supporting conditions to help attract the new inward investments, in both the production of hydrogen and in supply chain, which will be needed to grow and support a successful new hydrogen sector.

### **6.3.3 Capital Investment/Scottish National Investment Bank**

The Scottish Government's Global Capital Investment Plan<sup>36</sup> sets out how we will enhance Scotland's position on the international stage as a dynamic and innovative nation with an outward facing economy.

The Scottish Government recognises that the role of private sector investment is critical in achieving pace and scale – whether directly into businesses and projects in Scotland, through partnership with public sector investment, or through public sector borrowing on capital markets.

The Capital Investment Plan is central to securing the significant investments needed to grow the Scottish hydrogen sector. Key actions identified in the plan, such as building an investor-ready pipeline of investable projects and opportunities, establishing the appropriate regulations and incentives to support investment, and mobilising our global networks, as well as the work of the Scottish National Investment Bank<sup>37</sup>, are vital components to ensure a successful hydrogen sector in Scotland.

## **6.4 Cost Competitiveness**

To compete effectively with other international regions, Scotland must produce cost-competitive green hydrogen. Developing a pipeline between the UK and Northern Europe would be critical to help facilitate the export of this hydrogen. Research has been commissioned by Scottish Futures Trust to look at the economic case for the development of a hydrogen pipeline and the impact that this would have on our ability to produce and export cost effective green hydrogen to key markets, and this will be published shortly.

Furthermore, to secure Scotland's share of the hydrogen demand market, the domestic sector needs clarity on required hydrogen products, quantities, timelines and costs. We will continue to make the case for the UK Government to expand the Hydrogen Business Models to include export support.

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<sup>36</sup> [Investing with Purpose: Scotland's Global Capital Investment Plan](#)

<sup>37</sup> [Delivering patient, mission-impact investment to the Scottish economy | Scottish National Investment Bank \(thebank.scot\)](#)



## 7. Short-Term Actions and Conclusions

This plan outlines key actions essential for achieving our export goals. These actions, summarised below, must be developed and implemented in phases that align with the demand and supply of hydrogen and hydrogen products in both domestic and international markets.

**Figure 10: Summary of key short-term actions**

<p><b>Assurance of Demand for Hydrogen and Hydrogen Products</b></p> <ul style="list-style-type: none"><li>• Assess, on an ongoing basis, market demand for hydrogen products, focusing on volumes, products, costs, timelines and potential market access barriers, including emissions and certification.</li><li>• Deepen bi-lateral collaborations with Germany and other key markets to support the development of hydrogen infrastructure and import demand from Scotland, and engage in international market mechanisms like Germany's H2 Global as appropriate, where possible.</li></ul>
<p><b>Assurance of Supply</b></p> <ul style="list-style-type: none"><li>• Create a supportive policy environment to enable the development of opportunities for hydrogen exports from Scotland, and work with the relevant authorities, to address gaps on hydrogen production, transport and storage.</li><li>• Collaborate with UK Government, making the case that UK hydrogen certification schemes must align with EU standards and approved certification schemes to support trade and investment.</li><li>• Work with UK Government and our Enterprise Agencies to develop regional hydrogen hubs within an integrated hydrogen trading market which connects production, transport and storage both domestically and internationally.</li></ul>
<p><b>Connectivity Pillars</b></p> <ul style="list-style-type: none"><li>• Engage with EU partners and stakeholders in the North Sea neighbouring regions to advance the Hydrogen Backbone Link project and build evidence for a hydrogen pipeline and hydrogen derivatives infrastructure connecting Scotland and continental Europe.</li><li>• Work with Ireland to explore the viability of potential hydrogen export pipeline routes into the North of Europe over the longer-term, building on Scotland's existing gas interconnection into Ireland.</li></ul>
<p><b>Supply Chain</b></p> <ul style="list-style-type: none"><li>• SDI will support current and potential exporters in accessing global hydrogen supply chain opportunities through the provision of specific research, delivering trade delegations to target markets and linking Scottish companies products and services with potential buyers.</li><li>• Alongside SDI, we will improve our understanding of the project landscape and value chain opportunities for supply chain collaboration in the identified key and emerging export markets.</li></ul>

## Critical Enablers

- Step up our work with the UK Government to utilise reserved and devolved powers, ensuring our collective vision for the development of the hydrogen sector recognises the significance of exports for all UK nations.
- Partner with Enterprise Agencies to facilitate investment and growth in Scotland's hydrogen economy, enhancing infrastructure and capacity for increased export potential.
- Continue to encourage the UK Government to establish subsidy programs and market mechanisms that support early hydrogen export projects and enhance competitiveness in international markets.

It is clear that there are huge opportunities for the development of the hydrogen sector across the globe, and that Scotland can be a significant player both in commodity and within the supply chain in a number of key markets.

This plan provides specific focus on the significant international trade opportunities and sets out the key steps required to secure and maximise the economic benefits that can be delivered for Scotland.

The Critical Success Factor Framework that has been developed to support the plan helps to articulate a sequential and structured approach to growing the Hydrogen sector in Scotland. It is not intended to provide definitive answers but provide clarity of the direction we must all move in, with pace, to support the growth of export in the interests of ensuring a sustainable and successful hydrogen sector in Scotland.

Building strategic connections and strong relations in the UK and internationally will be central to our success. Our recent Green Industrial Strategy supplements the opportunities highlighted within this plan and the HAP, and helps to form a route map towards securing hydrogen export activity.

The Scottish Government will build on the work with the UK and overseas governments, industry, academia and other stakeholders to deliver a hydrogen sector in Scotland that will help address the sustainable balance required around hydrogen supply and demand.

Scotland should be one of the principal players within the north-western European nations for hydrogen as a commodity and within the supply chain of goods and services. We have the environment, skills, knowledge, and experience to become a driving force behind the growth of the hydrogen sector in Europe and beyond. It is an opportunity that could revolutionise the energy sector in Scotland and more widely. This "Energy Revolution", and the transitioning of economies to a green and sustainable future, offers huge opportunity and we must ensure Scotland is front and centre in seizing these. By working together, in true partnership, we will have the greatest chance to turn this global ambition into an economic reality.



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Any enquiries regarding this publication should be sent to us at

The Scottish Government  
St Andrew's House  
Edinburgh  
EH1 3DG

ISBN: 978-1-83601-761-5

Published by The Scottish Government, October 2024

Produced for The Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA  
PPDAS1452460 (10/24)

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