

Scenario-based hydrogen skills analysis

A report for the Scottish Hydrogen Skills Group

September 2026

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Executive summary

Overview

GC Insight was commissioned by Skills Development Scotland (SDS) to undertake a scenario-based skills analysis of Scotland's emerging hydrogen sector on behalf of the Scottish Hydrogen Skills Group. This work supports national ambitions to scale green hydrogen production to 25GW by 2045, positioning Scotland as a global leader in clean energy innovation and export. The study responds to the strategic imperative to align workforce development with Scotland's hydrogen growth trajectory.

The study was underpinned by the scenario-based end-to-end supply chain research and analysis commissioned by Scottish Enterprise and undertaken by Arup, which details the end-to-end supply chain requirements of one small scale and one large scale archetype for hydrogen production, based on typical electrolytic hydrogen production projects.¹ It also builds on the Hydrogen Workforce Demand Report, published by SDS in October 2025.²

A taxonomy for hydrogen skills

As part of the study, a structured taxonomy of the skills and occupations required to support the growth of Scotland's hydrogen economy was produced. The purpose of this was to synthesise existing taxonomies and research on hydrogen skills, and provide an overarching, consistent taxonomy for future hydrogen skills work.

A hydrogen skills definition

To inform the analysis of the supply of skills of relevance to Scotland's hydrogen economy, a data-driven skills definition was established. This set out the further and higher education subject areas and apprenticeship frameworks of relevance to the provision of hydrogen skills. This included a broad range of subject areas which support occupations right across the hydrogen value chain.

To supplement the information available from Scottish Funding Council (SFC), Higher Education Statistics Authority (HESA) and SDS in terms of hydrogen-relevant provision, a range of hydrogen-specific training and qualifications was also mapped, to provide a two-tiered approach to illustrating the provision of hydrogen skills in Scotland.

Findings

Illustrative scenario modelling

Based on analysis of job requirements of the archetypes prepared by Arup and taking into consideration the Scottish Government's ambition to achieve 25GW installed hydrogen production capacity by 2045, the modelling set out in this report estimates that between 24,700 and 43,600 temporary construction jobs may be required during construction in the period to 2045. This means that a maximum of between 1,230 and 2,240 construction jobs could be needed annually. For operation and maintenance, between 6,920

¹ [Scottish Enterprise/ARUP \(2025\), Hydrogen economy research end-to-end supply chain map](#)

² [SDS \(2025\), Hydrogen Workforce Demand](#)

and 11,380 jobs may be required, dependent on the mix of small- and large-scale hydrogen production facilities ultimately developed.

The job volumes outlined within this modelling are designed to present a potential direction of travel and are subject to several caveats. For example, the extent to which hydrogen projects can progress will be dependent on availability of investment, grid connections, ability to secure hydrogen offtakers, cost competition with other renewable energy fuel sources and environmental/planning considerations to name a few. This is discussed in more detail in Chapter 5.

Skills demand

Demand for hydrogen skills is being driven by Scotland's wider energy transition, with curtailed renewable electricity and limited grid capacity increasing the need for hydrogen as an energy vector and export commodity, particularly given strong international demand.

The current hydrogen workforce in Scotland is estimated to be in the region of 500 FTEs.³ However, it is anticipated that this would scale up significantly if the sector develops. This research has identified that strong demand is emerging for experience and specialist technical skills across the hydrogen value chain, and within the different component parts and job families required for hydrogen production. Experienced workers are in greater demand than new entrants. Adjacent sectors provide highly transferable skills. These include oil and gas, industrial gas, aviation, maritime and renewables. However, competition from these and other engineering sectors as well as sequencing and timing of renewable energy jobs and differing pay levels makes attracting experienced workers challenging.

Considerable uncertainty in the industry means that granular detail on precise skills demand is difficult to achieve as jobs and skills requirements are still to be determined for many companies. As the sector develops, more certainty can be achieved but it will rely on industry-led data and information, based on live projects. The apparent lack of clarity and detail on skills needs has implications for skills planning. Therefore, it is critical for greater ongoing engagement between industry and education, with a specific focus on understanding jobs and skills needs, to forward plan for skills provision as far as possible.

Skills supply and challenges

Existing education and training provision offers a good pipeline of skilled education leavers across subjects of relevance to hydrogen, and delivery of hydrogen-specific courses and qualifications appears to be well-aligned geographically with the expected pattern of hydrogen development projects in Scotland currently.

If Scotland is to realise the benefits of hydrogen, there must be the right skills available to fuel its development and growth. No hydrogen-specific skills shortages were identified through this study, but developers face broader systemic skills challenges across engineering, construction, digital skills, etc. in line with other renewable and growth sectors. Hydrogen will be competing with a range of different sectors, many in the renewables space, for skilled and experienced workers. Success will depend on co-ordinated workforce planning and close collaboration between government, industry and the skills system to ensure the right skills are available where and when they are needed, including by pivoting or transitioning from one sector (or within energy) to hydrogen – through skills passports or other similar mechanisms and opportunities.

³ ClimateXChange (2024), Economic opportunities in Scotland's net zero and climate adaptation economy

As identified through consultations, there is also caution among developers and a perception of higher risk due to the degree of uncertainty in the industry, at least partly attributed to a perceived lack of clear strategic direction within government. Without greater certainty and strategic commitment to hydrogen as part of the energy mix in the UK, skills planning will be a particular challenge for all stakeholders.

Recommendations

The following recommendations are based on the findings of the research:

Recommendation 1:

Evidence-led skills planning to underpin all hydrogen skills provision, regularly updated in response to the known project pipeline and sector developments.

Recommendation 2:

Education-industry partnerships to ensure the best possible demand-led skills provision that is proactive, flexible and responsive to dynamic business need, particularly given current industry uncertainty.

Recommendation 3:

De-risk investment in skills development, to allow anticipatory skills education and training development, and to remove barriers to investment in skills and learning.

Recommendation 4:

Upskilling, reskilling and repurposing those transitioning from other industries, to ensure that new entrants and entrants from other sectors can be prepared with the right skills needed for working in and with hydrogen, potentially supported through a skills passport mechanism; and to ensure

that hydrogen jobs and careers are an attractive proposition, and awareness of such jobs and how to access them amongst workers in other sectors (such as oil and gas) can be increased.

Recommendation 5:

Work-based learning with more hydrogen-specific content and skills development, to increase work readiness and provide valuable live experience for education participants, so that the need for additional training and exposure to live work environments following education leavers entering the workforce is minimised.

Recommendation 6:

Sector attractiveness should be maximised, to enhance the potential for talent attraction to the hydrogen industry, and to influence the career choices of education leavers at all stages and pathways but transparency in terms of some of the uncertainty and lack of clarity around timelines.

Recommendation 7:

Strategic skills planning for hydrogen, giving consideration to a multi-sector approach where there are common skills challenges and needs as well as competition for the same skillsets, and taking a 'co-opetition' approach across employers and stakeholders to achieve common goals.

Recommendation 8:

Equality, diversity and inclusion measures to ensure that employment and career opportunities are fairly distributed, and to maximise the skills and talent pool for hydrogen employers.

1. Introduction

Study overview

- 1.1** GC Insight was commissioned by Skills Development Scotland (SDS) to undertake a scenario-based skills analysis of Scotland's emerging hydrogen sector. This work supports national ambitions to scale green hydrogen production to 25GW by 2045⁴, positioning Scotland as a global leader in clean energy innovation and export. The study responds to the strategic imperative to align workforce development with Scotland's clean growth trajectory, ensuring a just transition and maximising economic opportunity across regions.
- 1.2** The research is underpinned by the scenario-based research and analysis commissioned by Scottish Enterprise (SE) and undertaken by Arup.⁵ This report details the end-to-end supply chain requirements of one small scale and one large scale typical electrolytic hydrogen production project. The small-scale project scenario is 10-20MW and the large-scale is 400-600MW. The Scottish Enterprise report covers all of the stages, from Pre-FEED (Front-End-Engineering and Design) through to operation and maintenance and de-commissioning. This provided valuable insight into the supply chain requirements of the two scenarios, including indicative workforce estimates, but did not set out to explore skills implications in detail. The report highlights the timelines, nature and scale of the potential opportunities presented by the hydrogen economy in Scotland, based on these

scenarios. It provides an understanding of the requirements and implications for the Scottish supply chain across the development and implementation phases.

- 1.3** This study also builds on the Hydrogen Workforce Demand Report, produced by SDS on behalf of the Scottish Hydrogen Skills Group.⁶ This work synthesised existing evidence on hydrogen skills demand, and identified key gaps in the available data. The report articulated issues around emerging demand for hydrogen skills, including challenges around evidence for skills demand, and set out recommendations to support future skills planning for hydrogen.

Research objectives

- 1.4** SDS commissioned this research to develop a more detailed understanding of the skills requirements associated with each scenario in the Arup report, by gathering information through quantitative and qualitative research to understand the detailed requirements in terms of level, qualification and nature of employment (i.e. temporary or permanent). It is recognised that hydrogen remains an emerging industry and there is a degree of uncertainty about what skills demand will look like as the sector evolves and how this will be sequenced across the lifespan of a project.

⁴ [Scottish Government \(2022\) Hydrogen Action Plan](#)

⁵ [Scottish Enterprise/ARUP \(2025\). Hydrogen economy research end-to-end supply chain map](#)

⁶ [SDS \(2025\), Hydrogen Workforce Demand](#)

1.5 The findings presented in this report will be used by the Scottish Hydrogen Skills Group to help:

- better inform skills planning for future hydrogen projects
- understand how the skills system is placed to respond
- identify what needs to happen to ensure the required skills are available.

1.6 It will also help learning and training providers to understand how to respond to the needs of the hydrogen economy, including the ability to scale the findings based on the two scenarios and apply them to new and upcoming projects. Importantly, the analysis is designed to be adaptable at a regional level, enabling stakeholders to assess how skills demand and workforce requirements may vary across different parts of Scotland, including the balance between local (permanent) and mobile (transient) workers at different stages of project development.

1.7 The specific research objectives were to:

- understand the demand for skills and jobs in a hydrogen economy
- explore the occupations, jobs and levels that will be required, and consider at what stage in development these skills will be needed and map these across the two scenario based hydrogen projects
- explore the extent to which these skills may be available in other parts of the energy sector
- consider current and future skills gaps, challenges and how these can be addressed, with specific consideration of the skills required for new entrants at entry level, e.g. school and college leavers

- mapping of current provision of relevant education and training for hydrogen skills, including how this provision aligns with regional demand and workforce requirements, such as the need for local versus mobile workers at different stages of project development.

Study approach and report structure

1.8 The study consisted of:

- development of a structured taxonomy of the skills and occupations required to support the growth of Scotland's hydrogen economy, to underpin the research and analysis
- exploration of the specific skills and levels required within job positions and at what stage of the project they will be needed, aligned to the six stages in the SE report
- detailed desk research on skills supply, including:
 - preparation of a skills data definition for hydrogen, drawing on Scottish Funding Council (SFC) college superclasses and Higher Education Classification of Subjects (HECoS
 - Common Aggregation Hierarchy (CAH) codes from the Higher Education Statistics Authority (HESA), along with relevant apprenticeship frameworks from SDS
- creation of a 'heat map' of hydrogen-specific education and training, to identify where current provision is available
- a programme of consultations with developers, businesses and strategic stakeholders within Scotland's hydrogen ecosystem, to explore issues and challenges with the demand for and supply of skills needed in Scotland's hydrogen industry.

1.9 A more detailed description of the approach and methods is set out in Chapter 2. The remainder of the report is structured as follows:

- **Chapter 2** describes the methodology used to complete the research along with the challenges encountered.
- **Chapter 3** provides an overview of the strategic context for hydrogen skills in Scotland.
- **Chapter 4** presents the definition used for hydrogen skills, occupations and qualifications, setting out the agreed taxonomy.
- **Chapter 5** describes the two scenarios upon which the research and findings are based and applies the taxonomy for this work to these two scenarios.
- **Chapter 6** provides the findings on the current and anticipated skills demand in hydrogen.
- **Chapter 7** discusses the current supply of hydrogen-related skills in Scotland.
- **Chapter 8** describes the challenges for hydrogen skills.
- **Chapter 9** sets out the conclusions and recommendations drawn from the research.

2. Study approach and methods

Introduction

2.1 This chapter sets out the methods used for the scenario-based hydrogen skills analysis study. The methods comprised detailed desk research along with targeted consultations with developers, businesses and stakeholders.

Study approach – main methods

Desk research

2.2 GC Insight undertook a detailed and structured programme of desk research. The purpose of this was to explore the strategic context for hydrogen in Scotland, review existing definitions for hydrogen skills, and understand what is already known about demand for jobs and skills within the hydrogen economy.

2.3 The desk research included a careful review and analysis of the Scottish Enterprise report and the two project scenarios as these underpinned parts of this research.

A taxonomy for hydrogen skills

2.4 The first stage of the work was to develop a structured taxonomy of the skills and occupations required to support the growth of Scotland's hydrogen economy. Its purpose is to provide a consistent framework for classifying hydrogen-related roles, competencies and qualifications.

2.5 The approach to this element was predominantly desk based, involving a review of strategic policy documents, skills reports and scenario-based supply chain studies. This was complemented by occupational profiling and analysis of existing taxonomies developed by key industry stakeholders operating in the hydrogen sector including:

- Skills Development Scotland/Scottish Hydrogen Skills Group – Hydrogen Workforce Demand, October 2025
- ClimateXChange – Mapping the current and forecasted hydrogen skills landscape
- Midlands Engine Observatory – Mapping green and hydrogen skills in the Midlands Engine
- Aberdeen City Council/BP – Hydrogen in Scotland: Skills and qualifications gap analysis
- RGU ETI – Striking the Balance: Building a sustainable UK offshore energy workforce
- Hydrogen Skills Alliance/Cogent Skills – Green Jobs Delivery Group: Hydrogen Task and Finish Group – Findings and Recommendations
- Hydrogen Skills Alliance – Hydrogen Skills Framework
- OPITO/Opergy Group/Energy Skills Intelligence Hub – Opergy Common Skills Taxonomy
- HyAcademy EU - Hydrogen Skills Alliance – Definition of the hydrogen related skills and need in industry across Europe
- Enginuity Future Skills Hub – Hydrogen.

- 2.6** A draft taxonomy was reviewed and agreed, following input and refinement, by members of the Scottish Hydrogen Skills Group (SHSG).
- 2.7** The taxonomy (provided in Chapter 4) sets out the range of roles and skill levels required across the hydrogen project lifecycle, from design and construction to operation and decommissioning. It identifies where existing skills can be transferred or enhanced through new hydrogen-specific or 'delta' competencies. Delta competencies or skills refers to the specific differences or additional requirements between existing skills and what is needed for hydrogen roles i.e. the gap or extra knowledge or training needed to apply existing competencies in a hydrogen context, to adapt to new practices and procedures. Understanding delta competencies assists in clarifying what skills are transferable versus what new skills are required and thus helps to define training needs. This is key for skills planning and training design.

Establishing a skills data definition

- 2.8** To inform the analysis of the supply of skills of relevance to Scotland's hydrogen economy, GC Insight established a data definition for hydrogen skills. This was achieved through a critical review of subject classification systems and apprenticeship frameworks, and the identification of subjects most likely to provide skills of relevance to the hydrogen industry. The analysis was undertaken with reference to pre-existing skills data definitions (e.g. those developed for climate emergency or energy skills by GC Insight for SDS). The definition was then agreed by the SDS client team and the SHSG. This skills data definition for hydrogen sets out the subject areas and frameworks used to inform the analysis of hydrogen skills supply in Scotland. It draws on further

and higher education superclasses and subject Common Aggregation Hierarchy codes (HECoS CAH codes) used by SFC and HESA respectively, as well as Foundation, Modern and Graduate Apprenticeship frameworks. It is worth noting that in agreeing this data definition for hydrogen-relevant education, it was recognised that, due to the nature of data collected, this was a very broad definition that could arguably feed into many other sectors. To counter this, analysis of hydrogen-specific education and training has been incorporated into our analysis.

- 2.9** This data definition seeks to capture the range of skills provision that will be required across the hydrogen sector, in line with the agreed hydrogen skills taxonomy covering everything from the technical engineering capabilities to the professional services such as planning and architecture. However, given that it is reliant on aggregated data, the definition is necessarily broad and will capture courses that are not specifically focused on hydrogen. Nevertheless, the skills supply pipeline identified as a result of the definition should be considered as courses (and enrolments on courses) that have the potential to provide skills training and competencies of relevance to hydrogen, and so represents a theoretical pipeline of skilled education leavers.
- 2.10** There are recognised limitations on education and training data. It is retrospective and it should be recognised that there is a wide variety of qualifications being delivered through various teaching/training modes, and so any comparison is not like-for-like. It may not also be immediately apparent that certain courses contain a hydrogen-specific component if this is not explicitly mentioned somewhere that it can be picked up by the study team, and therefore would be excluded from this study.

2.11 The analysis has been prepared recognising these limitations to provide an overview of education and training activity within hydrogen skills-related subject areas across colleges, universities, and apprenticeships. It does not attempt to present a definitive potential pipeline figure for hydrogen skills-related provision. It does however seek to draw out some of the technical skills required in the construction and operation and maintenance phases. In considering supply side data, it is important to recognise that hydrogen will be competing for skills alongside many other sectors, both in construction and operations and maintenance – and there are already recognised skills shortages in some of these areas, particularly in construction. Scotland is expecting a strong pipeline of projects and developments across a number of sectors as exemplified in publications such as the Regional Transformational Opportunities work carried out for Highlands and Islands Enterprise⁷, and these will all require construction skills as well as workforces for the longer term.

Skills supply analysis

2.12 Apprenticeship, further education and higher education data was sourced from SDS, SFC and HESA to assess recent patterns in hydrogen relevant skills provision. This included examining five years of enrolments and qualifiers/ achievements across colleges and universities as well as the available apprenticeship pathways information. This was disaggregated by institution, qualification level, mode of study, learner characteristics and domicile, where data permitted. Data which detailed the breakdown of courses, frameworks or apprenticeships for example, was analysed independently to understand what provision was accessed.

Where relevant, other data (such as student profile and mode breakdowns) was analysed alongside the national average for all courses, frameworks or apprenticeships to understand specific factors of relevance to hydrogen-relevant FE and HE. To address known limitations in the granularity and consistency of published FE/HE datasets, targeted data requests were submitted to SFC and, where necessary, individual colleges and universities were approached to help clarify features or discrepancies in the data. All of the data was put into a data framework which allowed for easy navigation between the different disaggregated data and supported the analysis.

Education and training mapping

2.13 To accompany the skills supply pipeline analysis, the team also undertook desk-based analysis of hydrogen-specific education and training provision. This combined analysis of intelligence provided by SDS, along with supplementary desk analysis of courses delivered by public and private education providers.

2.14 The purpose of the mapping was to identify the range and level of courses and qualifications being provided with specific relevance to hydrogen; determine the location of provision; and establish a 'heatmap' of skills provision of relevance to hydrogen activity in Scotland. This heatmap provides a visual representation of the data gathered and aims to help the Scottish Hydrogen Skills Group (SHSG) better understand existing provision across the country and how the regional offer can support the development of a hydrogen workforce, as and when projects reach maturity.

7 GC Insight (as ekosgen), for Highlands and Islands Enterprise (2025) Regional Transformational Opportunities in the Highlands and Islands

Industry and stakeholder consultation

2.15 The second strand of work was to undertake primary research through consultation with relevant strategic stakeholders and hydrogen industry representatives. The purpose of the consultation programme was to capture qualitative, rich intelligence and insight on the current nature of skills demand for hydrogen, and how this is anticipated to change in light of future sector developments. A total of **14** consultations were undertaken with hydrogen developers, hydrogen supply chain companies and wider strategic stakeholders to explore specific issues and challenges related to skills demand.

2.16 These discussions explored organisations' current activity in hydrogen, perceived opportunities and risks, and detailed skills requirements across different project phases. They also helped identify where skills may be drawn from, where gaps are emerging, and what support will be needed to ensure a sustainable workforce for the sector. Key themes included:

- sector context and opportunities
- barriers to development
- skills needs and transferability
- future workforce support.

Methodological challenges

2.17 A number of challenges emerged during the research, and the primary one was securing participation from strategic stakeholders and businesses, including developers. GC Insight worked closely with SDS to raise awareness about the research, encourage engagement and secure consultations. However, this proved to be very difficult, despite the team offering flexibility in timings and modes of engagement. The key reason appears to be because of the time pressures and availability of potential interviewees, and due to the uncertainty over the future of the projects they were involved in. There is also a perception that some potential interviewees are not at the stage of focusing on the skills that will be required. This suggests that some developers may give consideration to required skills at a later point of project development than at the outset, though it is worth noting that one developer consultee emphasised that skills considerations were very much factored into their planning at the outset of their development process.

2.18 To mitigate any negative impacts of this on the research, some key organisations, including developers, were targeted to ensure that the interviews that were conducted resulted in the best possible insight and information.

3. The context for hydrogen skills in Scotland

Introduction

3.1 There is currently a range of policy support mechanisms and funds that aim to stimulate economic growth, boost the green hydrogen workforce, and support Scotland's green hydrogen export potential. This chapter provides an overview of the Scottish and UK Government policy environment for the green hydrogen sector in Scotland. It also gives an overview of key literature relevant to the Scottish hydrogen workforce and skills for hydrogen, including analysis of the key drivers and challenges from the literature base.

3.2 The Scottish and UK Governments both place a strong focus on boosting the hydrogen workforce to achieve production goals. The Scottish Government have a broad range of support and funding for the development of the Scottish hydrogen workforce⁸, while in a September 2025 update, the UK Government pledged a further £500 million to support the UK hydrogen workforce⁹. Supporting this, Scotland currently has a number of designated hydrogen hubs. In addition, there are around 120 planned green hydrogen projects at various stages of development¹⁰, as well as key innovation drivers such as the Hydrogen Accelerator at the University of St Andrews.¹¹

The strategic context

3.3 The Hydrogen Action Plan¹² is the Scottish Government's five-year framework to accelerate Scotland's transition to net zero while positioning the country as a global leader in hydrogen production and export. This includes the ambition to deliver 5GW of renewable hydrogen capacity by 2030 (in line with net zero targets) which has the potential to provide the equivalent to over 450,000 tonnes annually at full capacity; with this scaling up to 25GW by 2045. By 2045, it is estimated that this growth could generate:

- between 70,000 and 175,000 jobs, contributing between £5-16bn to GVA, where Scotland supports a domestic hydrogen market¹³; or
- between £5 billion and £25 billion in annual GVA and create up to 300,000 jobs, as an exporter of green energy to Europe.

3.4 However, it should be noted that SDS's Hydrogen Skills Demand report identified this latter jobs figure as an outlier, when compared with other employment forecasts for hydrogen.¹⁴

⁸ <https://www.gov.uk/government/publications/hydrogen-update-to-the-market-july-2025>

⁹ <https://www.gov.uk/government/news/500m-boost-for-hydrogen-to-create-thousands-of-british-jobs>

¹⁰ [SDS \(2025\) Hydrogen Workforce Demand](#)

¹¹ <https://h2-accelerator.org/>

¹² [Scottish Government \(2022\) Hydrogen Action Plan](#)

¹³ [Scottish Government \(2020\) Scottish Hydrogen Assessment](#)

¹⁴ [SDS \(2025\), Hydrogen Workforce Demand](#)

3.5 The plan also commits to continuing to map skills gaps for hydrogen transport applications and to strengthen delivery capacity in Scottish colleges (covering both technician pathways and leadership/commercial training) while developing age-appropriate hydrogen learning materials for upper-primary, secondary and young adult learners; in practice, this is already being illustrated by industry-linked facilities such as Hydrasun's Skills Academy, which builds competencies in hydrogen systems.

3.6 Furthermore, the Scottish Government has committed £100 million in funding rounds for hydrogen projects and launched the Hydrogen Innovation Scheme to drive technological advancement and reduce costs. The plan also emphasises collaboration across industry and academia to build expertise and infrastructure, ensuring Scotland captures emerging export opportunities, and support a just transition.

3.7 The Scottish Government's Green Industrial Strategy provides actions to ensure that Scotland receives the maximum economic benefits from net zero, recognising the void in Scotland's economy which will be left by the fossil fuels sector.¹⁵ The strategy sets out five key areas by which to deliver this, which are:

- wind
- carbon capture utilisation and storage
- green economy financial and professional services
- hydrogen
- building clean industries.

3.8 Alongside these opportunity areas, the strategy sets out a workforce offer. It will make the education and skills system more responsive to green priorities and raise the profile of green jobs. It will enhance transferability (including an Offshore Energy Skills Passport) and strengthen Foundation, Modern and Graduate Apprenticeships. It also commits to closer alignment between colleges, universities and industry in net zero sectors.

3.9 Through identifying barriers to, and increasing demand for, domestic, low-carbon hydrogen, this will boost the hydrogen market and increase investment opportunities. Meanwhile, focussing on developing regional hydrogen hubs close to production centres will support the creation of opportunities across Scotland. The strategy aligns hydrogen with other green energy sectors, such as onshore and offshore wind, to ensure these grow together, and opportunities for collaboration and development are realised. For example, there is capacity to utilise curtailed energy produced by wind farms for example (that cannot be circulated into the grid due to its limitations) to power electrolyzers for green hydrogen production. Through these actions, capitalising on Scotland's current and future green hydrogen production capacity, and proximity to significant international green hydrogen markets, the Scottish Government are aiming for Scotland to become a major international exporter of hydrogen. It also invests in public-sector capacity, with a free "Introduction to Hydrogen" continuing professional development (CPD) course for officials and comprehensive hydrogen planning/consenting guidance, helping accelerate high-quality decisions and project rollout.

15 [Scottish Government \(2024\) Green Industrial Strategy](#)

3.9 A Trading Nation – Realising Scotland's Hydrogen Potential: plan for exports was developed on the back of export targets outlined in the Green Industrial Strategy, and details the specific actions required to achieve these.¹⁶ Specific, short-term actions include constant bi-lateral communication with Germany and other key partners involved in importing hydrogen, ensuring supportive policy and infrastructure which enables hydrogen export, and supporting potential exporters in accessing global hydrogen supply chain opportunities amongst others. One of the critical enablers for hydrogen export outlined in the plan is the development of a skilled workforce to deliver the required infrastructure, lead innovation and operate hydrogen production sites.

3.11 The Draft Energy Strategy and Just Transition Plan¹⁷ outlines the Scottish Government's roadmap for a resilient, affordable, and clean energy system which ensures no-one is negatively impacted by decarbonising. Hydrogen plays a pivotal role, with targets aligned to 25GW of low-carbon hydrogen production by 2045. The plan seeks to establish a robust hydrogen economy, leveraging Scotland's renewable resources to meet domestic needs and tap into European demand, which is projected at 20 million tonnes of green hydrogen by 2030. Key actions include fostering investment, enabling infrastructure development, and supporting workforce reskilling to ensure communities benefit from the transition by providing training for key roles in emerging sectors such as green hydrogen. By integrating hydrogen into the broader energy mix, the plan aims to enhance energy security, reduce emissions, and create high-value jobs, positioning Scotland as a significant exporter in the global hydrogen market.

3.12 To deliver this, the draft Plan backs targeted hydrogen skills programmes and reskilling, such as the previously mentioned Offshore Energy Skills Passport and an updated Climate Emergency Skills Action Plan, to move experienced oil and gas workers and new entrants into hydrogen roles. It also prioritises regional hydrogen hubs (e.g. Aberdeen) and streamlined consenting to accelerate projects, while using the Talent Attraction & Migration Service to fill hard-to-recruit roles, in turn anchoring place-based training and quality jobs across Scotland.

3.13 Securing a Green Recovery on a Path to Net Zero: Climate Change Plan 2018–2032 – update¹⁸ sets Scotland's pathway to net zero, with hydrogen identified as a critical sector which can support decarbonisation across transport and energy sectors. The plan commits £180 million through the Emerging Energy Technologies Fund to support hydrogen projects and lays the groundwork for future hydrogen strategies. Additional investment of £120 million for Zero Emission Buses highlights hydrogen's role in transforming public transport. By prioritising innovation and infrastructure, the plan aims to reduce reliance on fossil fuels, stimulate green job creation, and accelerate the deployment of hydrogen technologies. This approach not only supports climate targets but also strengthens Scotland's position as a leader in clean mobility and renewable energy solutions. Scotland is embedding decarbonisation capacity with employers through a Net Zero Transition Managers programme in energy-intensive industries, dedicated roles that map, cost and drive site-level emissions cuts, then share learning as a cohort across firms.

¹⁶ [Scottish Government \(2024\) A Trading Nation - Realising Scotland's Hydrogen Potential: plan for exports](#)

¹⁷ [Scottish Government \(2023\) Draft Energy Strategy and Just Transition Plan](#)

¹⁸ [Scottish Government \(2020\) Securing a green recovery on a path to net zero: climate change plan 2018–2032 - update](#)

3.14 Scotland's National Strategy for Economic Transformation (NSET)¹⁹ details the Scottish Government's economic priorities for the next decade, focusing on creating a wellbeing economy and maximising opportunities in emerging sectors. Hydrogen is identified as a strategic growth area where Scotland holds global leadership potential, thanks to its abundant renewable resources and established expertise. The strategy reinforces commitments to scale hydrogen production to 25GW by 2045, aligning with the Hydrogen Action Plan. Financial investment will target innovation, cost reduction, and technological progress, ensuring Scotland remains competitive in global markets, and supporting with employment opportunities in a range of areas across hydrogen. By embedding hydrogen within economic transformation goals, NSET aims to deliver inclusive growth, attract inward investment, and create thousands of skilled jobs, positioning Scotland as a hub for clean energy innovation and export.

3.15 Tackling the climate emergency and growing the economy are two of the four key objectives of the **Scottish Government's 2025/26 Programme for Government**.²⁰ Recognising a tripling of the Scottish green jobs market since 2021, the Programme for Government aims to further boost this over the financial year and beyond through leveraging public and private investment into green energy projects including green hydrogen. This includes providing £10 million in 2025/26 to grow the sector and support decarbonisation, such as the redevelopment of the Grangemouth oil refinery to be a site of hydrogen production, likely to bring a significant number of hydrogen jobs to the region and supporting other hydrogen activity.

This also reinforces the Scottish Government's commitment to boosting Scottish hydrogen export potential, recognising its significant economic potential.

3.16 British energy security strategy²¹ sets UK-wide ambitions to strengthen the energy mix, support the UK's energy independence and accelerate the transition to clean power. Hydrogen is a key component, with a target of 10GW production capacity by 2030, at least 5GW of this coming from green sources. The strategy includes allocation rounds for electrolyser-based hydrogen, a certification scheme by 2025, and plans to blend up to 20% hydrogen into the current gas network. These measures aim to stimulate market confidence, reduce costs, and integrate hydrogen into the national energy mix. For Scotland, this creates opportunities to supply green hydrogen to UK markets, leveraging its renewable capacity and infrastructure. The strategy also supports job creation and investment, reinforcing hydrogen's role in achieving net zero and energy security.

3.17 Great British Energy, headquartered in Scotland, is a publicly owned clean power company which will support with accelerating renewable deployment and innovation, whilst reducing energy costs. Backed by £8.3 billion in initial investment, the initiative seeks to leverage public-private partnerships and electricity market reforms to boost energy independence and tackle climate change. Hydrogen is identified as one of the technologies to expand homegrown energy production, creating new jobs and supporting regional economies. By situating its headquarters in Scotland, the company offers strategic advantages for hydrogen development, aligning with national ambitions for

¹⁹ [Scottish Government \(2022\) Scotland's National Strategy for Economic Transformation](#)

²⁰ [Scottish Government \(2025\) Programme for Government 2025 to 2026](#)

²¹ [UK Government \(2022\) British Energy Security Strategy](#)

net zero and export growth. This approach positions Scotland at the forefront of clean energy innovation, combining public investment with private sector expertise to scale hydrogen infrastructure rapidly.

3.18 The UK Hydrogen Strategy²² is the UK Government's comprehensive plan to develop a low-carbon hydrogen economy, targeting 5GW of production capacity by 2030. With £300 million allocated for early-stage projects, the strategy aims to stimulate investment, build supply chains, and support innovation across transport, industry, and heating sectors. Recognising the projected surge in hydrogen demand over the next two decades, the policy focuses on creating a competitive domestic market while enhancing export potential. For Scotland, this provides opportunities to integrate with UK-wide initiatives, leveraging its renewable resources to supply green hydrogen and attract inward investment. By fostering collaboration between government, industry, and academia, the strategy underpins the UK's broader net zero objectives and positions hydrogen as a cornerstone of future energy systems.

3.19 The UK Government's Clean Energy Jobs Plan²³ complements Scotland's clean energy ambitions by setting out a UK-wide framework to accelerate the growth of green industries and deliver high-quality employment across the sector. The plan highlights the potential for Scotland to play a leading role in the clean energy transition, with projections showing that Scotland's clean energy workforce could more than double to around 60,000 jobs by 2030. Recognising Scotland's strengths in offshore energy and engineering, the plan identifies hydrogen as one of the key subsectors driving

this growth, alongside offshore wind, carbon capture, and nuclear. Through investment in skills development and workforce transition, with initiatives such as the £20 million UK and Scottish Government funding for energy transition the plan ensures that workers from traditional oil and gas sectors based in the North Sea can move into hydrogen and other low-carbon roles. By supporting the development of regional clean energy hubs, particularly in areas such as the North East and the Highlands & Islands, the Clean Energy Jobs Plan aligns closely with Scotland's Hydrogen Action Plan and Green Industrial Strategy. Together, these strategies aim to create a skilled workforce, attract investment, and establish Scotland as a global leader in hydrogen production, distribution, and export, driving economic growth while supporting a just transition to net zero.

Summary

3.20 Scotland's strategic direction for hydrogen is shaped by a broad policy framework that is intended to accelerate the transition to net zero, stimulate economic growth, and position the country as a competitive leader in the global hydrogen market. The Scottish Government's Hydrogen Action Plan, which sets ambitions of 5GW of renewable hydrogen capacity by 2030 and 25GW by 2045, is supported by over £100 million in government investment and initiatives such as the Hydrogen Innovation Scheme. Complementary strategies, including the Green Industrial Strategy, the Draft Energy Strategy and Just Transition Plan, and A Trading Nation export plan, set out to reinforce hydrogen's role in economic transformation, industrial decarbonisation, and export growth. These collectively prioritise developing

²² [UK Government \(2021\) UK Hydrogen Strategy](#)

²³ [UK Government \(2025\) Clean Energy Jobs Plan](#)

regional hydrogen hubs, aligning hydrogen with other green energy sectors such as offshore wind and carbon capture, and aim to ensure Scotland leverages its abundant renewable resources to meet rising domestic and European hydrogen demand.

3.21 This national focus is augmented by UK-wide policy instruments including the British Energy Security Strategy, UK Hydrogen Strategy, Great British Energy and the Clean Energy Jobs Plan, which together set out to expand investment, improve market confidence, and create opportunities to build an integrated, low-carbon energy workforce. Across all strategies, workforce development emerges as a critical enabler, with strong emphasis on reskilling, upskilling and supporting a just transition from traditional oil and gas roles into new hydrogen and clean energy careers. Combined, these strategies intend to establish a strategic environment that aims to boost Scotland's competitive position, attract inward investment, and generate long-term economic, environmental, and social value through the development of a world-leading hydrogen economy.

Understanding the hydrogen workforce

Sector drivers

3.22 Scottish Government's Hydrogen Action Plan (2022)²⁴ is targeting an increase in Scottish hydrogen production of up to 25GW per annum by 2045. Achieving this will require a significant increase in workforce as we progress towards this target, with estimates indicating that this could require a workforce of up to 7,346 highly skilled FTEs by 2030.²⁵ At the UK level, the hydrogen sector is estimated to support around 29,000 direct and 64,500 indirect jobs by 2030.²⁶ However, the extent to which these jobs materialise will be dependent on a favourable landscape for hydrogen development in terms of policy support, investment, price competitiveness, etc. It is also important to recognise that although there is a planned pipeline, there is understandable uncertainty in terms of the exact timing for projects coming to fruition and this can be subject to ongoing change. As an example, Aberdeen City Council pioneered a fleet of 25 hydrogen-powered buses. However, in February 2026 the council announced that this would be withdrawn alongside their joint venture into the Aberdeen Hydrogen Hub with BP, and the buses would be sold off. Electric vehicles are to be used instead, on the basis of cost advantage of an EV bus fleet versus hydrogen vehicles.²⁷

3.23 In order for Scotland to realistically achieve a just transition, net zero greenhouse gases, and ensure a sufficient workforce to deliver on its targets, it is imperative to capitalise on the 'goldilocks zone' of reducing reliance on oil and gas, which is estimated to be in the mid-to-late 2020s.²⁸ This

²⁴ [Scottish Government \(2022\) Hydrogen Action Plan](#)

²⁵ [SDS \(2025\). Hydrogen Workforce Demand](#)

²⁶ [Hydrogen Skills Alliance \(2024\) Green Jobs Delivery Group - Hydrogen Task and Finish Group Findings and Recommendations](#)

²⁷ [bbc.com/news/articles/cnv6e5l588jo](https://www.bbc.com/news/articles/cnv6e5l588jo)

²⁸ <https://www.rgu.ac.uk/wp-content/uploads/2025/05/RGU-ETI-Report-2025-Full.pdf>

represents the opportune period at which the declining oil and gas workforce will be most able to transition into renewable energy roles, with some stakeholders indicating transferability from some oil and gas roles to be as high as 90%. Beyond the goldilocks period, there is likely to be leakage in skills from the sector as people retire and move jobs, as well as tighter competition from other labour markets across the UK and beyond.

3.24 Scotland's hydrogen potential is distributed across several key regions, reflecting both existing energy infrastructure and emerging opportunities. The Highlands and Islands host several smaller-scale projects and major developments such as the proposed hydrogen export pipeline at Sullom Voe.²⁹ Developer Greencat is exploring a number of sites across Scotland³⁰, including at the Chapelcross regeneration site in Dumfries and Galloway (Creca scheme), and Statkraft are also exploring potential sites, including at Hunterston.³¹

3.25 The H100 Fife project³² is a flagship hydrogen demonstrator being delivered in Levenmouth, Fife. It is led by SGN in partnership with a consortium of public and private sector organisations³³, including Ofgem, the Scottish Government, and a range of technology and delivery partners. The project's primary aim is to demonstrate the feasibility of using renewable (green) hydrogen for domestic heating, to develop a replicable model for decarbonising heat at scale. Delivery activity centres on the production of hydrogen via electrolysis powered by offshore wind, its storage within a

dedicated facility, and distribution through a purpose built hydrogen network to approximately 300 homes in the local area. Alongside the physical infrastructure, the project also involves extensive consumer engagement, safety validation, and regulatory testing. The intended outcomes are to generate robust evidence on the technical and operational viability of hydrogen for heat, support the development of regulatory frameworks, and provide practical insights into workforce requirements, including the upskilling of gas engineers and the development of hydrogen specific operational and safety competencies. As such, H100 Fife represents a critical live testbed for understanding how hydrogen systems and associated skills requirements may develop in practice.

3.26 More broadly, there is likely to be a centralisation of projects as operations increase in size and logistics become more complex. This reflects the concentration of industrial infrastructure, energy demand and transport connectivity within the Central Belt, making it a logical hub for large-scale hydrogen production, storage and distribution, even though much of the primary generation capacity is situated further north and offshore.³⁴ In line with this, the British Geological Society have labelled the Scottish Central Belt a geological 'super-region', potentially benefiting from an annual share of £40 billion investment in jobs and economic growth in net zero technology.³⁵ While the growth potential identified in the research is largely geothermal and carbon capture storage, the former has strong potential to provide clean

29 [The Net Zero Technology Centre \(2023\) Hydrogen Backbone Link - Connecting Scotland to Europe](#)

30 [Greencat Hydrogen](#)

31 <https://www.hunterstonparc.com/>

32 <https://www.h100fife.co.uk/>

33 <https://www.sgn.co.uk/H100Fife>

34 [Climate Xchange \(2023\) Mapping the current and forecasted hydrogen skills landscape](#)

35 <https://www.bgs.ac.uk/news/goldilocks-zones-geological-super-regions-set-to-drive-annual-40-billion-investment-in-jobs-and-economic-growth/>

electricity to electrolyzers and fuel green hydrogen. Potential developments include creating a large-scale green hydrogen facility in Grangemouth³⁶ and the development of the world's first green hydrogen network in Fife.³⁷ These examples further illustrate the potential of the central belt to be a cluster of hydrogen innovation.

Challenges

3.27 Green hydrogen production for use and transportation/export as an energy source is a relatively new technology, and there is a large degree of uncertainty surrounding the detail and volume of workforce demands due to external factors such as investment, securing hydrogen off-takers, grid connections, etc. This can impact on planning and resourcing development of the relevant skills as providers in the skills system can deem it to currently be risky and uncertain, in particular, the sequencing and timing of what skills will be needed, when, and where. However, industry experts agree that there will be a significant workforce required to fulfil production targets. Jobs will be required across three distinct project phases (preconstruction, construction, and operation and maintenance) with distinct skills and roles required at each phase.

The need to acquire skills from other sectors increases as roles become more advanced and require more experience, with technical roles required for project design and delivery requiring significantly more experience. However when surveyed, the majority (84%) of employers believe that the scale of the current UK workforce (that is, in terms of volume of workers) is insufficient to provide these skills. Research from Aberdeen City Council indicates that hydrogen employers are most concerned about the availability of skills required at the concept development and commercialisation phase of preconstruction. Customer insights & proposition design, commercial & business development, and value chain management & commercial optimisation are the three key skill areas within this that employers expressed concern about, as highlighted in Figure 3.1. A lack of key skills at project preconstruction phase is likely to pose significant challenges to the capacity of projects to become realised, especially if they are unable to propose a strong offer to potential investors.

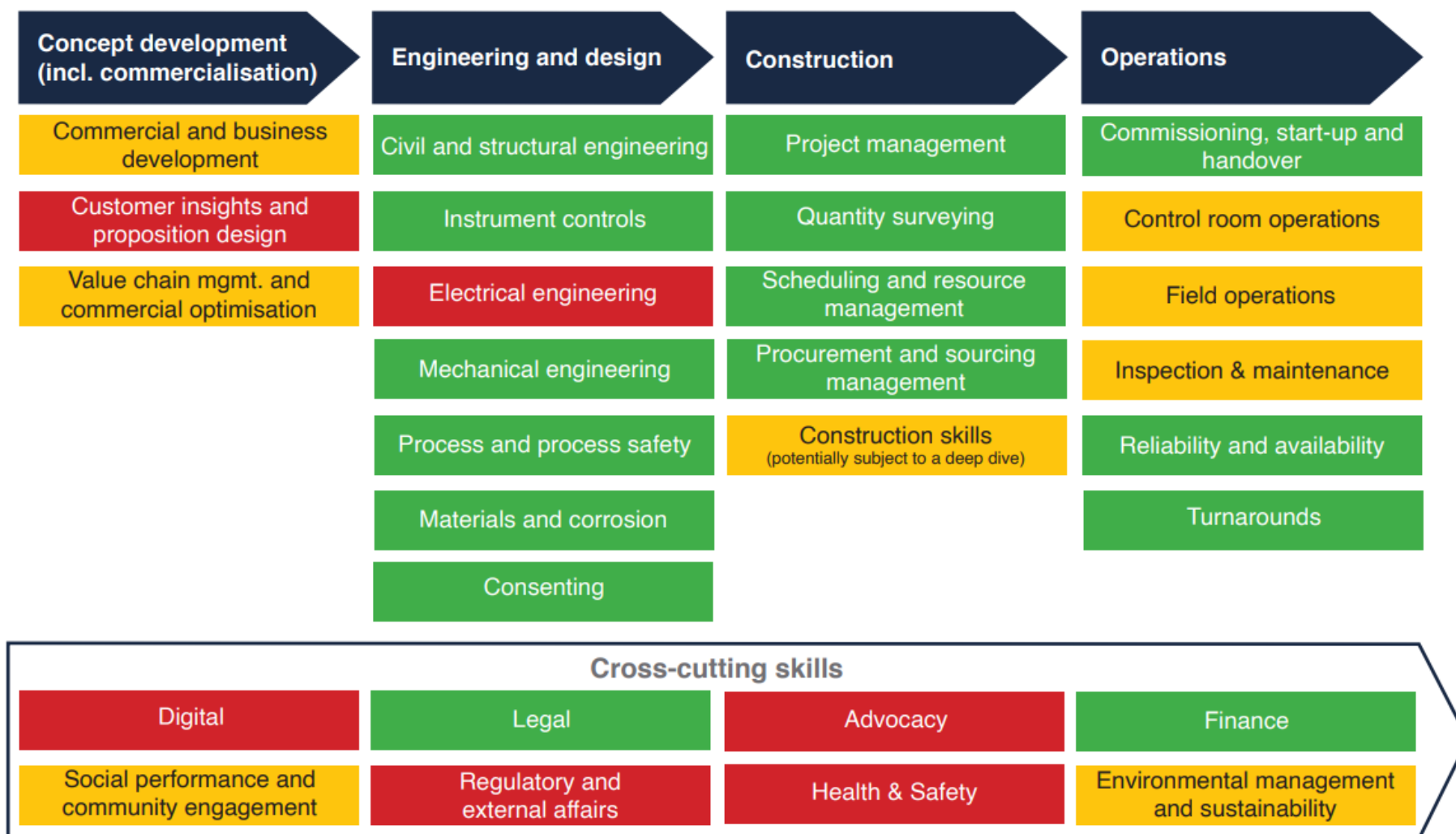
³⁶ <https://uk.rwe.com/project-proposals/grangemouth-green-hydrogen/>

³⁷ <https://www.sgn.co.uk/H100Fife>

³⁸ [Hydrogen Skills Alliance \(2024\) Green Jobs Delivery Group - Hydrogen Task and Finish Group Findings and Recommendations](#)

³⁹ [Aberdeen City Council and BP \(date unknown\) Hydrogen in Scotland - Skills and Qualifications Gap Analysis](#)

Figure 3.1: Heat map of skills in the hydrogen sector based on industry concerns around availability
(red = high concern, amber = medium concern, green = low concern)



Source: Aberdeen City Council, (Unknown). Hydrogen in Scotland: Skills and Qualifications Gap Analysis. ⁴⁰

⁴⁰ [Aberdeen City Council and BP \(date unknown\) Hydrogen in Scotland - Skills and Qualifications Gap Analysis](#)

3.28 Scotland's strong oil and gas heritage ensures that there is a significant pipeline of skills in a range of engineering design, project management, and professional services sectors. Almost 45% of the UK's total offshore workforce is within Scotland⁴¹, whilst 97% of land-based Scottish jobs in the extraction and support activities of natural gas and crude petroleum are in the North East.⁴²

3.29 Digital, data, and meta skills are all recognised as being vital for the hydrogen sector with a high degree of importance in the majority of hydrogen roles. With other sectors in green energy, as well as the wider economy, expressing challenges in accessing these skills, there is likely to be difficulty in finding people with these capabilities and significant competition from other sectors. In their research, Aberdeen City Council identified eight key cross-sector skill areas which the hydrogen sector requires. Across these, employers expressed high concern about access to digital, advocacy, regulatory & external affairs, and health & safety skills, and moderate concern about access to social performance & community engagement, and environmental management & sustainability.

3.30 There are also concerns that key manufacturing skills required for the construction of hydrogen components could also be lost to other green energy projects which are at more advanced stages of development.⁴³ This challenge is compounded by workforce attrition and an ageing energy

workforce, which is driving higher rates of retirement and a gradual loss of experienced staff.⁴⁴ As a result, the overall Scottish offshore energy workforce is expected to decline, with some estimates suggesting that this could fall by between 16 to 40 per cent between 2025 and early 2030s.⁴⁵ As well as skills, there is also the potential for bottlenecks with key materials and components required for hydrogen projects with limitations to the global supply chain of electrolyzers, as well as the renewable energy required to fuel them.⁴⁶ This will impact on the timing of developments in Scotland and thus will influence when skills are likely to be in demand. If the upsurge in demand for workers in renewable technologies is not in line with the decline in oil and gas, there is a risk that skilled workers will be lost from the potential hydrogen workforce.

3.31 Industry insight highlighted the significant cost of electricity as a major challenge for the hydrogen industry, comprising between 70-80% of production cost in the case of green hydrogen. In addition, a supply chain bottleneck of electrolyzers also impact on the cost of hydrogen. These challenges, along with those outlined above, have resulted in the cost of green hydrogen being around £5-7 per kilogram.⁴⁷

3.32 While research indicates that there is potential for curtailed energy produced by Scottish wind farms to power electrolyzers, hydrogen production must be near constant to become cost efficient. However, limitations in the electricity

41 [OEUK \(2025\) Workforce Insight report 2025](#)

42 [Business Register and Employment Survey/Annual Business Inquiry \(sourced through NOMIS\)](#)

43 [UK Government \(2024\) Clean Power 2030 Action Plan: A new era of clean electricity](#)

44 <https://www.ecitb.org.uk/news/ageing-oil-and-gas-workforce-presents-net-zero-challenge/>

45 <https://www.rgu.ac.uk/news/news-2025/uk-offshore-energy-industry-faces-grangemouth-scale-redundancies-every-fortnight-without-intervention-warns-new-rgu-report>

46 [Climate Xchange \(2025\) Scotland's capabilities in producing hydrogen products and derivatives](#)

47 <https://energy.sustainability-directory.com/learn/how-does-the-cost-of-renewable-electricity-impact-the-final-cost-of-green-hydrogen/>

transmission network mean that renewable power cannot always be delivered where and when it is needed, and this network congestion presents a further challenge.⁴⁸ This further enforces the need for strong capabilities across value chain management in the hydrogen workforce, to ensure projects are equipped to progress with sufficient access to resources including staff and components.

3.33 Further, there is considerable uncertainty for the hydrogen sector at the strategic level. Industry actors point to a lack of clarity from Scottish and UK Governments on the commitment to hydrogen, and delays and uncertainty in recent Hydrogen Allocation Rounds (HARs).⁴⁹ In addition, there is a perception amongst stakeholders that policy is more focused on ‘electrification first’, with hydrogen targeted where electrification is challenging – e.g. hard-to-abate sectors, high-heat industrial processes, or for industrial decarbonisation.

3.34 Market conditions have seen developers such as Scottish Power pause schemes that have been in receipt of awards under the HARs, citing challenging conditions and a limited route to market.⁵⁰ Whilst a number of other developers are progressing schemes, there is undoubtedly a degree of hesitancy or tempered confidence within the hydrogen industry currently. Hydrogen investment is still heavily dependent on certainty from government without which project investment stalls. This clearly will have an impact on the number of hydrogen production projects brought forward and their likelihood of coming to fruition. In turn, this will impact on the skills demand and requirement for the hydrogen workforce. A consequence of this is that skills

planning becomes more challenging due to the degree of industry uncertainty.

Implications arising for hydrogen skills and the hydrogen workforce

3.35 It is anticipated that the Scottish hydrogen workforce will be developed in part by transferring and augmenting the current catalogue of existing skills in other sectors, such as from oil and gas, or from other related industries, including renewable energy, where there may be a degree of overlap. However, a key consideration will be the extent to which demand from other sectors will mean competition for skills. Dependent on the timing and sequencing of development, sourcing labour may prove problematic – particularly given known pipelines for other major energy developments such as pumped storage hydro, on and offshore wind, and carbon capture and storage projects, or even proposed large-scale data centres.

Also, ongoing work to identify and quantify regional transformational opportunities in parts of Scotland is highlighting potential pipelines of development activity across a range of sectors – including renewable energy, and incorporating hydrogen – and consequently the likely competition for skills during development and construction, as well as during operational phases.

Further, an additional consideration is the extent to which pay and conditions within the hydrogen industry can compete with other renewable industries, and with oil and

⁴⁸ <https://www.climatexchange.org.uk/projects/redirecting-excess-renewable-energy-to-produce-hydrogen/>

⁴⁹ [Scottish Renewables \(2025\) Green Hydrogen Vision](#)

⁵⁰ <https://www.argusmedia.com/en/news-and-insights/latest-market-news/2775194-policy-delays-project-exits-cloud-uk-hydrogen-outlook>

gas. Irrespective of the impact of recent macro-economic events (e.g. ongoing conflict in Ukraine, conflict in the Middle East and political instability in Venezuela) on the viability of North Sea oil and gas fields, pay and conditions in the oil and gas industry have historically been more attractive than in other areas. This automatically puts the sector at a competitive advantage in terms of attracting and retaining workers. Thus if pay and conditions are not competitive enough within hydrogen, it will be challenging to attract and retain the required workforce.

3.36 Further, when and where projects happen, and the potential scale of these, will determine the skills required. Different stages of the hydrogen lifecycle will demand distinct skill sets, from early-stage feasibility, design and planning, through to construction, commissioning, operation and eventual decommissioning. For example, early development will rely heavily on engineering design, project management and regulatory expertise, while large scale deployment will require construction, manufacturing, logistics and operational skills. As projects increase in scale, they are likely to become more centralised and require a different mix of technical, digital and managerial capabilities. Mobility and local context will be vital throughout this progression, particularly as the sector enters the anticipated late 2020s 'goldilocks zone' and moves into the 2030s.

3.37 There is a high degree of skill transferability across different green energy sectors, with a key spine of jobs, the top five job families (operations, engineering, technicians,

projects, and procurement & supply chain management (PSCM)) representing 70% of offshore energy jobs in the UK. However, despite the transferability of core skills in these roles, there is a large degree of hydrogen specific knowledge that staff in these roles will need in order to work in the sector⁵¹, as well as specialised 'delta hydrogen' skills which will be required.⁵² Delta hydrogen skills are additional, hydrogen-specific technical and safety competencies that build on existing energy sector expertise, enabling workers to operate safely and effectively in hydrogen production, storage, and distribution environments.⁵³ Although there is some uncertainty surrounding the extent of these delta skills, and what they will require, these will be vital within the workforce.⁵⁴ At this stage, understanding of delta skills revolves around the technical process of electrolysis, and include knowledge and understanding of hydrogen health and safety, including The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). Research indicates that regulator engagement with Control of Major Accident Hazards (COMAH) forums will be vital to the development of a defined delta skillset.⁵⁵

Summary

3.38 Scotland's hydrogen ambitions are underpinned by a broad suite of Scottish and UK-wide policies designed to accelerate the transition to net zero, strengthen energy security, and build a competitive hydrogen economy. These strategic frameworks are intended to create a coherent policy environment that encourages sector growth,

51 [Hydrogen Skills Alliance \(2024\) Green Jobs Delivery Group - Hydrogen Task and Finish Group Findings and Recommendations](#)

52 <https://hydrogenindustryleaders.com/5-neil-smith-hs25.pdf>

53 [Hydrogen Skills Alliance \(2025\) Empowering the future: A strategic skills plan for the UK hydrogen economy](#)

54 https://cogentskills.com/wp-content/uploads/2024/09/NCC195-Skills-Training-Brochure_Web.pdf

55 <https://cogentskills.com/news/industry-leaders-launch-major-new-skills-study-for-comah-sites/>

innovation, and the expansion of high-value employment opportunities across Scotland. However, there is evidence to suggest that some stakeholders consider there to be a lack of certainty and clarity of direction for the strategic development of green hydrogen production currently.

3.39 At the same time, the growth of Scotland's hydrogen sector brings a series of practical workforce and skills challenges that will need to be carefully managed. Project timelines, investment decisions, and supply chain constraints introduce uncertainty around when and where skills will be required, which is exacerbated by how the policy landscape is perceived by developers. Scotland's established oil and gas workforce provides a strong base of engineering, project management, and technical capabilities, and the mid-to-late 2020s represents a key window to retain and transition these workers through careful, proactive and evidence-led skill planning. However, competition from other green sectors, demographics within the existing energy workforce, and growing demand for specialist skills (such as digital capabilities, manufacturing expertise, and hydrogen-specific 'delta skills') may affect the availability of talent. Ensuring that workers have access to both transferable and hydrogen-specific knowledge will be essential for delivering projects through development, construction, and operational phases.

3.40 Overall, the evidence indicates that Scotland's success in developing a world-leading hydrogen sector will depend not only on strategic investment and technological progress but also on effective workforce planning, coordination and resourcing. Close alignment between government, industry, and the skills system will be crucial to developing the

specialist capabilities required at the right scale, matching training to regional project pipelines, and supporting an effective, fair and inclusive transition for workers. With these elements in place, Scotland has a strong opportunity to build on its renewable strengths, emerging hydrogen hubs, and existing industrial expertise to position itself as a major producer and exporter of green hydrogen, contributing to economic growth and net zero objectives in the years ahead.

4. A framework for hydrogen skills

Establishing a hydrogen skills taxonomy

4.1 Employing an agreed taxonomy provides a consistent and systematic framework for classifying the wide range of occupations, skills and qualifications associated with Scotland's emerging hydrogen economy. A taxonomy enables comparability by aligning job titles, skills and qualifications across studies, sectors and regions. This structured approach helps to enable data on workforce demand to be aggregated, identify gaps in training provision and articulate priorities for investment.

4.2 The development of this taxonomy has incorporated research and thinking provided through a range of existing work done to define and taxonomise the hydrogen workforce, roles and required skills. As set out in Chapter 2, these are:

- Skills Development Scotland/Scottish Hydrogen Skills Group – Hydrogen Workforce Demand, October 2025
- ClimateXChange – Mapping the current and forecasted Hydrogen skills landscape
- Midlands Engine Observatory – Mapping green and Hydrogen skills in the Midlands Engine
- Aberdeen City Council/BP – Hydrogen in Scotland: Skills and qualifications gap analysis
- RGU ETI – Striking the Balance: Building a sustainable UK offshore energy workforce

- Hydrogen Skills Alliance/Cogent Skills – Green Jobs Delivery Group: Hydrogen Task and Finish Group – Findings and Recommendations
- Hydrogen Skills Alliance – Hydrogen Skills Framework
- OPITO/Opergy Group/Energy Skills Intelligence Hub – Opergy Common Skills Taxonomy
- HyAcademy EU - Hydrogen Skills Alliance – Definition of the hydrogen related skills and need in industry across Europe
- Enginuity Future Skills Hub – Hydrogen.

4.3 It has also used this existing portfolio of work on hydrogen skills to ensure that this approach is well aligned to those used across hydrogen skills. This is important to provide consistency across the hydrogen skills ecosystem, support transferability and understanding of regional differences in availability and development of skills, and support collaboration and partnerships. A hydrogen-specific skills taxonomy is crucial to help standardise job roles and skills requirements across a rapidly expanding component of Scotland's energy sector. It will help to provide a common language for all stakeholders across industry, education and the public sector. This also helps to prevent education and training overlaps and gaps, contributes to resolving workforce shortages, and assists in ensuring safety and regulatory compliance as the hydrogen economy scales up.

4.4 The draft taxonomy was shared with members of the SHSG, who were invited to provide feedback which would help shape the taxonomy, ensuring it is fit-for-purpose. The feedback received was incorporated into the following framework, which sets out the agreed taxonomy for hydrogen skills in Scotland.

Table 4.1: A taxonomy for hydrogen skills

Job family	Key skills	Relevant SOC Codes	Relevant SIC Codes	Phase	Transfer pathways
Business and market development	Customer insights; proposition design; funding navigation; deal structuring; value chain design and understanding; early stakeholder mapping	1132 – Marketing, sales and advertising directors 1133 – Public relations and communications directors 1134 – Purchasing managers and directors	20.11 – Manufacture of industrial gases 35.11 – Production of electricity 71.12 – Engineering activities and related technical consultancy	Concept; FEED	Energy business development, utilities, infrastructure finance
Procurement and supply chain management (PSCM)	Hydrogen equipment; localisation; logistics for electrolyser, compression and storage	1134 – Purchasing managers and directors	28.29 – Manufacture of other general-purpose machinery n.e.c., 42210 – Construction of utility projects for fluids	Concept; FEED; Construction	Oil & gas
Project/ programme management	FEED oversight for hydrogen plants; risk, interfaces (grid, compression, storage); carbon management and tracking within FEED and delivery	1121 – Production managers and directors in manufacturing, 1123 – Production managers and directors in mining and energy	35.11 – Production of electricity 42.21 – Construction of utility projects for fluids	Concept; FEED; Construction	Oil & gas

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Table 4.1: A taxonomy for hydrogen skills continued...

Job family	Key skills	Relevant SOC Codes	Relevant SIC Codes	Phase	Transfer pathways
Design management, and site engineering	Multidisciplinary coordination (civil/electrical/process); safety by design for hydrogen; civil engineering – site access, drainage, concrete pads; electrical controls	2121 – Civil engineers 2122 – Mechanical engineers 2123 – Electrical engineers 2124 – Electronics engineers 2125 – Production and process engineers 2127 – Engineering project managers and project engineers	28.29 – Manufacture of other general-purpose machinery n.e.c.	Concept; FEED	Oil & gas
Mechanical engineering (design)	Pressure systems; hydrogen embrittlement; chemical engineering; cryogenic design	2122 – Mechanical engineers	28.29 – Manufacture of other general-purpose machinery n.e.c.	Concept; Construction	Oil & gas
Electrical, controls and process	Electrolyser, power integration, process control	2123 – Electrical engineers 2124 – Electronics engineers	27.11 – Manufacture of electric motors, generators and transformers	All	Power/ controls engineers
Geotechnical / subsurface storage	Cavern/geological stability; hydrogen migration modelling; monitoring	2121 – Civil engineers	42.21 – Construction of utility projects for fluids	Concept; Operations	Oil & gas

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Table 4.1: A taxonomy for hydrogen skills continued...

Job family	Key skills	Relevant SOC Codes	Relevant SIC Codes	Phase	Transfer pathways
Chemical engineering	Process design and FEED for ammonia; thermodynamics and heat integration; utilities; storage and handling of chemicals	2125 – Production and process engineers	20.11 – Manufacture of industrial gases 20.15 – Manufacture of fertilisers and nitrogen compounds 20.14 – Manufacture of other organic basic chemicals 19.20 – Manufacture of refined petroleum products	Concept; FEED; Construction; Operations	Oil & gas; wider chemical/ petro-chemical sector
Digital and data	Data analytics and modelling; digital twins; IoT system integration; SCADA and control systems; cybersecurity; data governance and interoperability standards; AI-driven asset optimisation; GIS and spatial data management	2131- IT project managers 2132- IT managers 2133- IT business analysts, architects and systems designers 2134- Programmers and software development professionals 2135- Cybersecurity professionals 2136- IT quality and testing professionals 2137- IT network professionals 2139- Information technology and telecommunications professionals 2141- Web design professionals 2142- Graphic and multimedia designers	62.01- Computer programming activities 62.02 - Computer consultancy activities 62.03- Computer facilities management activities 62.09- Other information technology and computer service activities 63.11-Data processing, hosting and related activities 63.12- Web portals 63.99- Other information service activities nec 95.11- Repair of computer and peripheral equipment	Concept; FEED; Construction; Operations	Oil & gas; wider energy sector

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Table 4.1: A taxonomy for hydrogen skills continued...

Job family	Key skills	Relevant SOC Codes	Relevant SIC Codes	Phase	Transfer pathways
Legal and regulatory	Hydrogen-regulation; permitting and consenting; Intellectual property; trade; legislation and legal understanding	2412 – Solicitors and lawyers 2419 – Legal professionals n.e.c.	74.90 – Other professional, scientific and technical activities n.e.c.	Concept; FEED	Energy law
Planning / consenting	Planning and consenting processes across energy and environmental regulation; community liaison and engagement plans; stakeholder consultation and public communication; spatial planning and policy interpretation	2452 – Chartered technologists, planning officers and consultants 2454 – Chartered surveyors 1133 – Public relations & communications directors	70.22 – Business and other management consultancy activities 71.11 – Architectural activities 71.12 – Engineering activities and related technical consultancy 73.20 – Market research and public opinion polling 74.90 – Other professional, scientific and technical activities n.e.c.	Concept; Pre-FEED; FEED	Spatial Planning
Environmental	EIA; water use and supply management; biodiversity; assessment and management; emergency planning; communication of environmental impacts	2152 – Environment professionals 2454 – Chartered surveyors 2451- Architects	74.90 – Other professional, scientific and technical activities n.e.c.	Concept; Pre-FEED; FEED; Operations	Environmental Planning

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Table 4.1: A taxonomy for hydrogen skills continued...

Job family	Key skills	Relevant SOC Codes	Relevant SIC Codes	Phase	Transfer pathways
Manufacturing (fabrication, quality assurance, assembly)	Hydrogen-compatible materials; advanced welding/ machining; robotics/ automation/artificial intelligence/advanced manufacturing; hydrogen testing; quality assurance to hydrogen standards; hydrogen component assembly and delivery; pipeline design, construction and management	5223 – Metal working production and maintenance fitters 5224 – Precision instrument makers and repairers 2125 – Production & process engineers	28.29 – Manufacture of other general-purpose machinery n.e.c.	Construction	Fabrication Quality Assurance
Operations and maintenance	Control systems; project/site maintenance	521 – Welding trades 5221 – Metal machining setters and setter-operators 8133 – Energy plant operatives	35.23 – Trade of gas through mains	Operations	Oil & gas
Hydrogen safety and risk governance	Safe plant operations; safety management; early hazard scoping; risk registers; emergency preparedness	3582 – Health and safety managers and officers 3581 – Inspectors of standards and regulations 2483 – Environmental health professionals	71.12 – Engineering activities and related technical consultancy 71.20 – Technical testing and analysis 84.24 – Public order and safety activities	Pre-FEED; FEED; Construction; Operations; Decommissioning	Oil & gas; wider chemical/ petrochemical sector

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Table 4.1: A taxonomy for hydrogen skills continued...

Job family	Key skills	Relevant SOC Codes	Relevant SIC Codes	Phase	Transfer pathways
Decommissioning / repurposing	Asset integrity; dismantling; hydrogen-exposed materials handling; minimising end-of-life emissions (reuse/ recycling strategies)	8133 – Energy plant operatives 8159 – Construction operatives n.e.c.	42.21 – Construction of utility projects for fluids	Decommissioning	Oil & gas
Operations and maintenance	Site vehicle operation; waste management; tube trailer operations, refuelling station design/O&M, metering and data, hazardous area compliance for mobile assets	1140 – Directors in logistics, warehousing and transport 1241 – Managers in transport and distribution 1243 – Managers in logistics 4134 – Transport and distribution clerks and assistants 8239 – Other drivers and transport operatives n.e.c.	49.20 – Freight rail transport 49.41 – Freight transport by road 49.50 – Transport via pipeline	Operations	Oil & gas

Defining hydrogen skills supply

- 4.5** This section sets out the subject areas and frameworks that have informed the data-based analysis of hydrogen skills supply in Scotland. It draws on further and higher education superclasses and subject areas used by SFC and HESA respectively, as well as Foundation, Modern and Graduate Apprenticeship frameworks. This seeks to capture the range of skills provision that will be required across the hydrogen sector, in line with the agreed hydrogen skills taxonomy.
- 4.6** It should be noted that because of how FE and HE data is collated and aggregated, this represents a picture of skills of relevance to hydrogen, rather than specific hydrogen skills provision alone, recognising that these skills will be employed across several sectors and many different job roles. This is subject to a broader, qualitative mapping of hydrogen education and training. The analysis for both is presented in Chapter 7.
- 4.7** Table 4.2 sets out the apprenticeship frameworks, college FE superclasses and HECoS CAH codes for HE subjects that comprise the definition for hydrogen skills. Following this, Table 4.3 sets out the courses versus the main job families in the agreed hydrogen skills taxonomy.

Table 4.2: Skills supply definition for hydrogen skills

Apprenticeship frameworks				
Foundation Apprenticeships*	Modern Apprenticeships	Graduate Apprenticeships	FE Superclasses	HE CAH Codes
Accountancy (SCQF 6) Business Skills (SCQF 6) Civil Engineering (SCQF 6) Engineering (SCQF 6) Financial Services (SCQF 6) IT: Hardware & System Support (SCQF 6) IT: Scientific Technologies (SCQF 6) IT: Software Development (SCQF 6) Scientific Technologies (SCQF 6)	Business & Administration (SCQF 5–8) Civil Engineering (SCQF 6–8) Construction (Technical/ Professional routes) Digital Applications (SCQF 6) Digital Technology (Data, Cyber, Software) (SCQF 6/8) Digital Technology (SCQF 6/8) Driving Goods Vehicles (SCQF 6) Engineering Asset Lifecycle & Maintenance (SCQF 7) Engineering Construction (SCQF 6/7) Health & Safety related unit options within sector frameworks Engineering Manufacturing & Fabrication (SCQF 7) Engineering Technical Support (SCQF 7) Firefighting (SCQF 7) Freight Logistics (SCQF 5–7)	Business Management (SCQF 10) Construction and the Built Environment (SCQF 10) Cyber Security (SCQF 10) Cyber Security (SCQF 10/11) Data Science (SCQF 10) Engineering (SCQF 10) Engineering Technical Apprenticeship (SCQF 8) IT: Management for Business and Software Development (SCQF 10) Management for Business (SCQF 10)	AA: Business (general) AB: Management (general) AD: International Business Studies / Briefing: AF: Management Skills (specific) AG: Management Planning and Control Systems AK: Financial Management/Accounting BB: Export/Import/ European Sales BF: E-commerce CB: Computer Science CC: Using Software CD: Information Work/ Use EB: Economics EC: Law PL: Health and safety QA: Environmental Protection/Conservation QB: Energy Economics/ Management/ Conservation QD: Environmental Health/Safety QJ: Fire and Rescue Services RA: Science	CAH17-01-03 Marketing CAH17-01-01 Business and management (non-specific) CAH17-01-02 Business studies CAH17-01-04 Management studies CAH10-03-06 Others in technology CAH10-01-07 Civil engineering CAH10-01-09 Chemical, process and energy engineering CAH13-01-02 Building CAH10-01-01 Engineering (non-specific) CAH10-01-08 Electrical and electronic engineering CAH10-01-10 Others in engineering CAH10-01-02 Mechanical engineering CAH10-01-03 Production and manufacturing engineering

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Table 4.2: Skills supply definition for hydrogen skills continued...

Apprenticeship frameworks				
Foundation Apprenticeships*	Modern Apprenticeships	Graduate Apprenticeships	FE Superclasses	HE CAH Codes
	Housing (SCQF 6/7) Industrial Applications (SCQF 5) Life Sciences (SCQF 6-8) Management (SCQF 7-11) Occupational Health and Safety Practice (SCQF 7) Power Distribution (SCQF 5) Process Manufacturing (SCQF 6/7) Procurement (SCQF 6) Scientific, Technical and Formulation Processing (SCQF 5/6) Scientific, Technical and Formulation Processing (SCQF 6/7) Supply Chain Management (SCQF 7-11) Sustainable Resource Management (SCQF 5) Technical Apprenticeship in Project Management (SCQF 8) Water Industry (SCQF 5/6)		RD: Chemistry RJ: Materials Science SQ: Land Based Studies TA: Built Environment TC: Property: Surveying/ Planning/Development TD: Building Design/ Architecture TE: Construction TF: Construction Management TG: Building/Construction Operations TH: Building Maintenance/ Services TK: Construction Site Work TL: Civil Engineering TM: Structural Engineering VD: Quality and Reliability Management VE: Industrial Control/ Monitoring VF: Industrial Design/ Research and Development VG: Engineering Services VH: Facilities Management	CAH13-01-04 Planning (urban, rural and regional) CAH10-03-02 Materials technology CAH11-01-05 Artificial intelligence CAH11-01-07 Business computing CAH11-01-01 Computer science CAH24-01-01 Information services CAH11-01-04 Software engineering CAH26-01-04 Environmental sciences CAH07-01-01 Physics CAH07-02-01 Chemistry CAH15-02-01 Economics CAH16-01-01 Law CAH13-01-01 Architecture CAH25-01-03 Design studies

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Table 4.2: Skills supply definition for hydrogen skills continued...

Apprenticeship frameworks				
Foundation Apprenticeships*	Modern Apprenticeships	Graduate Apprenticeships	FE Superclasses	HE CAH Codes
			VJ: Contracting (Business/Industry) WA: Manufacturing (general) WB: Manufacturing/ Assembly WD: Testing Measurement and Inspection WE: Chemical Products XA: Engineering/ Technology XD: Metal Works/Finishing XE: Welding/Joining XF: Tools/Machining VD: Quality and Reliability Management VE: Industrial Control/ Monitoring VF: Industrial Design/ Research and Development VG: Engineering Services VH: Facilities Management VJ: Contracting (Business/Industry) WA: Manufacturing (general) WB: Manufacturing/ Assembly	CAH25-01-03 Design studies CAH11-01-03 Information systems CAH17-01-04 Management studies CAH17-01-05 Human resource management CAH26-01-06 Earth sciences CAH03-01-03 Ecology and environmental biology

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Table 4.2: Skills supply definition for hydrogen skills continued...

Apprenticeship frameworks				
Foundation Apprenticeships*	Modern Apprenticeships	Graduate Apprenticeships	FE Superclasses	HE CAH Codes
			WD: Testing Measurement and Inspection WE: Chemical Products XA: Engineering/Technology XD: Metal Works/Finishing XE: Welding/Joining XF: Tools/Machining XH: Mechanical Engineering XJ: Electrical Engineering XK: Power/Energy Engineering XL: Electronic Engineering YC: Chemicals/Materials Engineering YK: Power/Energy Engineering ZM: Logistics ZN: Purchasing/Procurement and Sourcing ZP: Distribution ZQ: Transport Services ZV: Road Transport	

Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Business and market development	Customer insights, proposition design, funding navigation, deal structuring, value chain design and understanding, early stakeholder mapping	Foundation Apprenticeships: Business Skills (SCQF 6) Financial Services (SCQF 6) Accountancy (SCQF 6) Modern Apprenticeships: Business & Administration (SCQF 5–8) Procurement (SCQF 6) Supply Chain Management (SCQF 7–11) Graduate Apprenticeships: Business Management (SCQF 10) Data Science (SCQF 10) IT: Management for Business (SCQF 10)	AA: Business (general) AD: International Business Studies / Briefing AK: Financial Management/Accounting	CAH17-01-01 Business and management (non-specific) CAH17-01-02 Business studies CAH15-02-01 Economics CAH11-01-07 Business computing
Operations and maintenance	Procurement and supply chain management (PSCM)	Foundation Apprenticeships: Business Skills (SCQF 6) Modern Apprenticeships: Procurement (SCQF 6) Supply Chain Management (SCQF 7–11) Freight Logistics (SCQF 5–7) Driving Goods Vehicles (SCQF 6) Graduate Apprenticeships: Business Management (SCQF 10)	AF: Management Skills (specific) BB: Export/Import/ European Sales BF: E-commerce EB: Economics VD: Quality and Reliability Management ZN: Purchasing/ Procurement and Sourcing	CAH10-03-06 Others in technology CAH17-01-01 Business and management (non-specific) CAH17-01-04 Management studies

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Project/ programme management	FEED oversight for hydrogen plants risk, interfaces (grid, compression, storage) carbon management and tracking within FEED and delivery	Foundation Apprenticeships: Business Skills (SCQF 6) Engineering (SCQF 6) Modern Apprenticeships: Technical Apprenticeship in Project Management (SCQF 8) Management (SCQF 7–11) Graduate Apprenticeships: Business Management (SCQF 10) Engineering (SCQF 10) Construction & the Built Environment (SCQF 10)	AB: Management (general) TF: Construction Management TG: Building/Construction Operations TL: Civil Engineering	CAH17-01-04 Management studies CAH10-01-01 Engineering (non-specific) CAH13-01-02 Building
Design management, and site engineering	Multidisciplinary coordination (civil/electrical/process) safety by design for hydrogen Civil engineering – site access, drainage, concrete pads electrical controls	Foundation Apprenticeships: Civil Engineering (SCQF 6) Engineering (SCQF 6) Modern Apprenticeships: Civil Engineering (SCQF 6–8) Construction (Technical/Professional routes) Engineering Construction (SCQF 6/7) Graduate Apprenticeships: Engineering (SCQF 10)	AB: Management (general) TA: Built Environment TD: Building Design/Architecture TE: Construction TF: Construction Management TG: Building/Construction Operations TH: Building Maintenance/Services TK: Construction Site Work	CAH10-01-07 Civil engineering CAH13-01-02 Building CAH10-01-01 Engineering (non-specific) CAH13-01-01 Architecture

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Mechanical engineering (design)	Pressure systems, hydrogen embrittlement, chemical engineering, cryogenic design	Foundation Apprenticeships: Engineering (SCQF 6) Modern Apprenticeships: Engineering Manufacturing & Fabrication (SCQF 7) Engineering Technical Support (SCQF 7) Engineering Asset Lifecycle & Maintenance (SCQF 7) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	XD: Metal Works/Finishing XE: Welding/Joining XF: Tools/Machining XH: Mechanical Engineering	CAH10-01-02 Mechanical engineering CAH10-01-01 Engineering (non-specific)
Electrical, controls and process	Electrolyser, power integration, process control	Foundation Apprenticeships: Engineering (SCQF 6) IT: Scientific Technologies (SCQF 6) IT: Software Development (SCQF 6) Modern Apprenticeships: Engineering Construction (SCQF 6/7) Process Manufacturing (SCQF 6/7) Power Distribution (SCQF 5) Digital Technology (Data, Cyber, Software) (SCQF 6/8) Graduate Apprenticeships: Engineering (SCQF 10) Cyber Security (SCQF 10) Data Science (SCQF 10)	RA: Science VE: Industrial Control/Monitoring VH: Facilities Management XA: Engineering/Technology XJ: Electrical Engineering XL: Electronic Engineering	CAH10-01-08 Electrical and electronic engineering CAH10-01-09 Chemical, process and energy engineering CAH25-01-03 Design studies

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Mechanical engineering (design)	Cavern stability, hydrogen migration modelling, monitoring	Foundation Apprenticeships: Civil Engineering (SCQF 6) IT: Scientific Technologies (SCQF 6) Modern Apprenticeships: Civil Engineering (SCQF 6–8) Scientific, Technical and Formulation Processing (SCQF 6/7) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	QB: Energy Economics/ Management/ Conservation RJ: Materials Science TM: Structural Engineering QA: Environmental Protection/Conservation	CAH10-01-07 Civil engineering CAH26-01-06 Earth sciences
Chemical engineering	Process design and FEED for ammonia, thermodynamics and heat integration utilities, storage and handling of chemicals	Foundation Apprenticeships: Scientific Technologies (SCQF 6) Engineering (SCQF 6) Modern Apprenticeships: Scientific, Technical and Formulation Processing (SCQF 5/6) Process Manufacturing (SCQF 6/7) Engineering Asset Lifecycle and Maintenance (SCQF 7) Graduate Apprenticeships: Engineering (SCQF 10)	RA: Science RD: Chemistry WE: Chemical Products	CAH10-01-09 Chemical, process and energy engineering CAH07-01-01 Physics CAH07-02-01 Chemistry

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Digital and data	Data analytics and modelling, digital twins, IoT, system integration, SCADA and control systems, cybersecurity, data governance and interoperability standards, AI-driven asset optimisation, GIS and spatial data management	Foundation Apprenticeships: IT: Software Development (SCQF 6) IT: Hardware & System Support (SCQF 6) Modern Apprenticeships: Digital Technology (SCQF 6/8) Digital Applications (SCQF 6) Graduate Apprenticeships: Data Science (SCQF 10) Cyber Security (SCQF 10/11) IT: Management for Business and software development (SCQF 10) Engineering Technical Apprenticeship (SCQF 8)	CB: Computer Science CC: Using Software CD: Information Work/ Use XL: Electronic Engineering	CAH11-01-01 Computer science CAH24-01-01 Information services CAH11-01-05 Artificial intelligence CAH11-01-04 Software engineering CAH11-01-03 Information systems CAH10-01-08 Electrical and electronic engineering
Legal and regulatory	Hydrogen-regulation permitting, intellectual property, trade legislation and legal understanding	Foundation Apprenticeships: Business Skills (SCQF 6) Modern Apprenticeships: Business & Administration (SCQF 5–8) Graduate Apprenticeships: Business Management (SCQF 10) IT: Management for Business and software development (SCQF 10)	EC: Law PL: Health and safety QA: Environmental Protection/Conservation QD: Environmental Health/Safety	CAH16-01-01 Law

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Environmental	EIA, water use and supply management, biodiversity assessment and management, emergency planning, communication of environmental impacts	Foundation Apprenticeships: Scientific Technologies (SCQF 6) Modern Apprenticeships: Scientific, Technical and Formulation Processing (SCQF 5/6) Life Sciences (SCQF 6-8) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	QA: Environmental Protection/Conservation QD: Environmental Health/Safety SQ: Land Based Studies	CAH26-01-04 Environmental sciences CAH10-01-07 Civil engineering CAH03-01-03 Ecology and environmental biology
Planning/consenting	Planning and consenting processes across energy and environmental regulation, community liaison and engagement plans, stakeholder consultation and public communication, spatial planning and policy interpretation	Foundation Apprenticeships: Business Skills (SCQF 6) Modern Apprenticeships: Construction (Technical/Professional) Housing (SCQF 6/7) Graduate Apprenticeships: Construction & the Built Environment (SCQF 10) Business Management (SCQF 10)	Planning and consenting processes across energy and environmental regulation, community liaison and engagement plans, stakeholder consultation and public communication, spatial planning and policy interpretation	CAH13-01-04 Planning (urban, rural and regional) CAH13-01-02 Building CAH13-01-04 Planning (urban, rural and regional)

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Manufacturing (fabrication, quality assurance, assembly)	Hydrogen-compatible materials, advanced welding, robotics/ automation/artificial intelligence, advanced manufacturing, hydrogen testing, quality assurance to hydrogen standards, hydrogen component assembly and delivery, pipeline design, construction and management	Foundation Apprenticeships: Engineering (SCQF 6) IT: Hardware/Systems Support (SCQF 6) Modern Apprenticeships: Engineering Manufacturing & Fabrication (SCQF 7) Industrial Applications (SCQF 5) Engineering Asset Lifecycle & Maintenance (SCQF 7) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	QA: Environmental Protection/ Conservation QD: Environmental Health/Safety SQ: Land Based Studies	CAH10-01-03 Production and manufacturing engineering CAH10-03-02 Materials technology CAH10-01-01 Engineering (non-specific)
Operations and maintenance	Control systems, project/ site maintenance	Foundation Apprenticeships: Engineering (SCQF 6) IT: Hardware/Systems Support (SCQF 6) Modern Apprenticeships: Engineering Asset Lifecycle & Maintenance (SCQF 7) Water Industry (SCQF 5/6) Power Distribution (SCQF 5) Scientific, Technical and Formulation Processing (SCQF 6/7) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	AG: Management Planning and Control Systems VD: Quality and Reliability Management VE: Industrial Control/Monitoring VG: Engineering Services VH: Facilities Management WA: Manufacturing (general) WD: Testing Measurement and Inspection XA: Engineering/Technology XJ: Electrical Engineering YK: Power/Energy Engineering YC: Chemicals/Materials Engineering	CAH10-01-02 Mechanical engineering CAH10-01-08 Electrical and electronic engineering CAH10-01-03 Production and manufacturing engineering CAH10-01-01 Engineering (non-specific) CAH11-01-01 Computer science

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Environmental	EIA, water use and supply management, biodiversity assessment and management, emergency planning, communication of environmental impacts	Foundation Apprenticeships: Scientific Technologies (SCQF 6) Modern Apprenticeships: Scientific, Technical and Formulation Processing (SCQF 5/6) Life Sciences (SCQF 6-8) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	QA: Environmental Protection/Conservation QD: Environmental Health/Safety SQ: Land Based Studies	CAH26-01-04 Environmental sciences CAH10-01-07 Civil engineering CAH03-01-03 Ecology and environmental biology
Planning/consenting	Planning and consenting processes across energy and environmental regulation, community liaison and engagement plans, stakeholder consultation and public communication, spatial planning and policy interpretation	Foundation Apprenticeships: Business Skills (SCQF 6) Modern Apprenticeships: Construction (Technical/Professional) Housing (SCQF 6/7) Graduate Apprenticeships: Construction & the Built Environment (SCQF 10) Business Management (SCQF 10)	AG: Management Planning and Control Systems EC: Law QA: Environmental Protection/Conservation QD: Environmental Health/Safety PL: Health and Safety TC: Property: Surveying/Planning/Development VJ: Contracting (Business/Industry)	CAH10-01-03 Production and manufacturing engineering CAH10-03-02 Materials technology CAH10-01-01 Engineering (non-specific)

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Operations and maintenance	Control systems, project/site maintenance	Foundation Apprenticeships: Engineering (SCQF 6) IT: Hardware/Systems Support (SCQF 6) Modern Apprenticeships: Engineering Asset Lifecycle & Maintenance (SCQF 7) Water Industry (SCQF 5/6) Power Distribution (SCQF 5) Scientific, Technical and Formulation Processing (SCQF 6/7) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	AG: Management Planning and Control Systems VD: Quality and Reliability Management VE: Industrial Control/Monitoring VG: Engineering Services VH: Facilities Management WA: Manufacturing (general) WD: Testing Measurement and Inspection XA: Engineering/Technology XJ: Electrical Engineering YK: Power/Energy Engineering YC: Chemicals/Materials Engineering	CAH10-01-02 Mechanical engineering CAH10-01-08 Electrical and electronic engineering CAH10-01-03 Production and manufacturing engineering CAH10-01-01 Engineering (non-specific) CAH11-01-01 Computer science

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Hydrogen safety and risk governance	Safe plant operations, safety management, early hazard scoping, risk registers, emergency preparedness	Foundation Apprenticeships: Scientific Technologies (SCQF 6) Modern Apprenticeships: SEngineering Construction (SCQF 6/7) Health & Safety related unit options within sector frameworks Firefighting (SCQF 7) Occupational Health and Safety Practice (SCQF 7) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	PL: Health and Safety QJ: Fire and Rescue Services VD: Quality and Reliability Management VE: Industrial Control/Monitoring	CAH10-01-07 Civil engineering CAH17-01-04 Management studies CAH10-01-10 Others in engineering CAH17-01-05 Human resource management CAH26-01-04 Environmental sciences
Decommissioning, repurposing	Asset integrity, dismantling hydrogen-exposed materials handling, minimising end-of-life emissions (reuse/recycling strategies)	Foundation Apprenticeships: Engineering (SCQF 6) Modern Apprenticeships: Engineering Construction (SCQF 6/7) Industrial Applications (SCQF 5) Sustainable Resource Management (SCQF 5) Graduate Apprenticeships: Engineering (SCQF 10) Construction and the Built Environment (SCQF 10)	TA: Built Environment TL: Civil Engineering QA: Environmental Protection/Conservation VF: Industrial Design/Research and Development WB: Manufacturing/Assembly XK: Power/Energy Engineering	CAH10-01-07 Civil engineering CAH10-01-03 Production and manufacturing engineering CAH10-01-09 Chemical, process and energy engineering

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Table 4.3: Skills supply definition – apprenticeship frameworks, college superclasses and HECoS subjects versus taxonomy job families
continued...

Job family	Key skills	Apprenticeships	Superclass	HECoS Codes
Logistics, transport, distribution, refuelling	Site vehicle operation, waste management, tube trailer operations, refuelling station design/O&M, metering and data, hazardous area compliance for mobile assets	Foundation Apprenticeships: Business Skills (SCQF 6) Civil Engineering (SCQF 6) Modern Apprenticeships: Freight Logistics (SCQF 5–7) Driving Goods Vehicles (SCQF 6) Supply Chain Management (SCQF 7–11) Graduate Apprenticeships: Business Management (SCQF 10) IT: Management for Business and Software Development (SCQF 10)	AG: Management Planning and Control Systems BB: Export/Import/ European Sales BF: E-Commerce VE: Industrial Control/ Monitoring ZM: Logistics ZP: Distribution ZQ: Transport Services ZV: Road Transport	CAH10-03-06 Others in technology CAH13-01-04 Planning (urban, rural and regional) CAH10-01-07 Civil engineering

5. Scenarios for hydrogen production skills demand

Introduction

5.1 This chapter sets out the potential scenarios for hydrogen development and production in Scotland, to inform estimates of possible levels of skills demand. It gives consideration to the role requirements set out in the **Hydrogen Economy End-to-End Supply Chain Map** study prepared by Arup on behalf of Scottish Enterprise⁵⁶, and aligns these to the agreed hydrogen skills taxonomy developed for this study.

5.2 Based on Scottish Government ambitions for hydrogen production capacity, two scenarios are presented for likely skills demand by 2045. Further details of the modelling are provided in Appendix A.1.

4.3 It has also used this existing portfolio of work on hydrogen skills to ensure that this approach is well aligned to those used across hydrogen skills. This is important to provide consistency across the hydrogen skills ecosystem, support transferability and understanding of regional differences in availability and development of skills, and support collaboration and partnerships. A hydrogen-specific skills taxonomy is crucial to help standardise job roles and skills requirements across Scotland's energy sector. It will help to provide a common language for all stakeholders across industry, education and the public sector. This also helps to prevent education and training overlaps and gaps, contributes

to resolving workforce shortages, and assists in ensuring safety and regulatory compliance as the hydrogen economy scales up.

Archetypes for hydrogen production

5.3 As noted previously, part of this research is underpinned by the scenario-based research and analysis produced by Arup in August 2025, on behalf of Scottish Enterprise.⁵⁷ This detailed the end-to-end supply chain requirements of two hydrogen project archetypes: one small scale, typically of 10-20MW generation capacity, and one large scale, typically of 400-600MW generation capacity.

5.4 Arup's analysis and modelling span all stages from Pre-FEED (Front-End-Engineering and Design) through to operation and maintenance and de-commissioning. The report highlights the timelines, nature and scale of the potential opportunities presented by the hydrogen economy in Scotland, based on these scenarios. It provides an understanding of the requirements and implications for the Scottish supply chain across the development and implementation phases.

5.5 Based on Arup's modelling, the key metrics for each archetype are as follows.

^{56, 57} [Scottish Enterprise/ARUP \(2025\), Hydrogen economy research end-to-end supply chain map](#)

Table 5.1: Hydrogen production archetype overview

Small archetype	Large archetype
 30 months 10-20Mw 295 jobs • Capacity: 10-20MW production facility • c.30 month development and construction period • c.20+year operational lifespan • c.295 jobs required across all life cycle stages ○ Development: c.85 jobs ○ Construction: c.116 jobs ○ Operation: c.50 jobs ○ Decommissioning: c.44 jobs	 48 months 400-600Mw 641 jobs • Capacity: 400-600MW production facility • c.48 month development and construction period • c.20+year operational lifespan • c.641 jobs required across all life cycle stages ○ Development: c.148 jobs ○ Construction: c.264 jobs ○ Operation: c.125 jobs ○ Decommissioning: c.105 jobs

5.6 Analysing the role and function requirements for each archetype and aligning this to the hydrogen skills taxonomy presented in Chapter 4, the following breakdown of roles and skills is arrived at for each archetype.

Small archetype

5.7 Table 5.2 presents the skills breakdown for a small production facility (10-20MW). The larger proportion of the required workforce are in the development, construction and installation phases of the project lifecycle (29% and

39% respectively). Around 17% of the skills and workforce requirement is during the operational lifespan of the project. Skills in design management & site engineering, hydrogen safety & risk governance, legal & regulatory, operations & maintenance, planning/consenting, and project management are required throughout the full project lifecycle, with transport and logistics skills required from construction onwards. Throughout, design management and site engineering skills account for the largest proportion of skills requirement.

Table 5.2: Hydrogen production skills demand: Small-scale archetype (instances of employment)

Small archetype	Development	Construction/Installation	Operation	Decommissioning	Total
Business and market development	7.0	3.5	3.5	3.5	17.5
Chemical engineering	0.0	0.0	0.0	0.0	0.0
Decommissioning/repurposing	0.0	4.2	4.2	8.3	16.7
Design management, site engineering	53.8	64.3	13.3	13.3	144.7
Digital and data	0.0	0.0	0.0	0.0	0.0
Electrical, controls and process	0.0	0.0	0.0	0.0	0.0
Environmental	0.0	0.0	0.0	0.0	0.0
Geotechnical/subsurface storage	4.5	4.5	0.0	0.0	9.0
Hydrogen safety and risk governance	1.5	3.0	3.0	2.6	10.1
Legal and regulatory	6.5	7.8	7.8	7.6	29.8
Logistics/transport/distribution/refuelling	0.0	6.0	6.0	1.5	13.5
Manufacturing (fabrication, quality assurance, assembly)	0.0	8.2	2.3	0.0	10.5
Mechanical Engineering (design)	5.0	5.0	0.0	0.0	10.0
Operations and maintenance	1.0	3.5	7.0	5.8	17.3
Planning/Consenting	1.5	1.5	0.0	0.0	2.5
Procurement and supply chain management (PSCM)	1.0	1.5	0.0	0.0	2.5
Project/programme management	3.5	3.5	1.8	0.6	9.3
Total	85.3	116.4	59.6	44.1	295.4

Source: GC Insight analysis of Scottish Enterprise/Arup data

Large archetype

5.8 Table 5.3 presents the skills breakdown for a large-scale production facility (400-600MW). As with the small archetype, the larger proportion of the required workforce are in the development, construction and installation phases of the project lifecycle, though with the construction and installation phase accounting for a somewhat larger share (23% and 41% respectively). Around 19% of the skills and workforce requirement is during the operational lifespan of

the project (slightly more than for the small archetype). Skills in design management & site engineering, hydrogen safety & risk governance, legal & regulatory, operations & maintenance, planning/consenting, and project management are required throughout the full project lifecycle, with transport and logistics skills required from construction onwards. Throughout, design management and site engineering skills account for the largest proportion of skills requirement (54% overall).

Table 5.3: Hydrogen production skills demand: Large-scale archetype (instances of employment)

Large archetype	Development	Construction/Installation	Operation	Decommissioning	Total
Business and market development	15.0	9.0	9.0	9.0	42.0
Chemical engineering	0.0	3.0	3.0	0.0	6.0
Decommissioning/repurposing	0.0	4.2	4.2	8.3	16.7
Design management, site engineering	94.8	154.8	50.0	50.0	349.5
Digital and data	0.0	0.0	0.0	0.0	0.0
Electrical, controls and process	0.0	0.0	0.0	0.0	0.0
Environmental	0.0	0.0	0.0	0.0	0.0
Geotechnical/subsurface storage	7.0	7.0	0.0	0.0	14.0
Hydrogen safety and risk governance	3.5	3.5	3.5	2.6	13.1

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Table 5.3: Hydrogen production skills demand: Large-scale archetype (instances of employment) continued...

Large archetype	Development	Construction/Installation	Operation	Decommissioning	Total
Legal and regulatory	6.5	7.8	7.8	7.6	29.8
Logistics/transport/distribution/refuelling	0.0	10.0	10.0	3.5	23.5
Manufacturing (fabrication, quality assurance, assembly)	0.0	29.2	8.3	0.0	37.5
Mechanical Engineering (design)	12.0	12.0	0.0	0.0	24.0
Operations and maintenance	0.0	13.0	25.5	21.3	59.8
Planning/Consenting	3.5	3.5	1.8	1.8	10.5
Procurement and supply chain management (PSCM)	2.3	3.5	0.0	0.0	5.8
Project/programme management	3.5	3.5	1.8	0.6	9.3
Total	148.1	263.9	224.8	104.8	641.5

Source: GC Insight analysis of Scottish Enterprise/Arup data

Role commonalities and differences

5.9 It is worth noting that, across both archetypes, there is strong commonality in the types of roles required. There are some differences in role requirements for end-use solutions for supply to off-takers and waste management (additional requirement for waste water management in the large archetype), but the main differences lie in the number and duration of workers at each stage. Understandably, larger projects will require larger multi-disciplinary teams. Development timescales might be anything up to two years for small projects, whilst large projects may have development phases of up to five years. Also, the need for certain disciplines is repeated across stages. For example, project and programme management skills are required for the full life cycle of projects, as are hydrogen safety, risk and governance skills.

5.10 Process design, safety, site engineering/installation, operation & maintenance, and logistics/transport/distribution/refuelling are where the main hydrogen delta skills are required. It is in these roles where the greatest technical understanding of hydrogen is necessary. However, it should be noted that in senior management and executive roles, sufficient hydrogen safety and risk expertise is also required. In addition to this, a degree of hydrogen-specific knowledge will be required and expected in supporting professional services roles, such as planning & consenting, environmental, legal and architecture.

5.11 In addition, it was noted in consultations that there are a number of challenges in the difference between financing, insuring and permitting hydrogen schemes, and other renewable energy or similar projects. Again, this is due to the specific technical knowledge required, and understanding necessary to consider such schemes.

Table 5.4: Hydrogen delta skills demand by roles for small and large archetypes

Role	Hydrogen delta
Business and market development	Customer insights Funding landscape for hydrogen Hydrogen value-chain understanding
Chemical engineering	Process design and FEED Hydrogen handling and storage (hazardous substances) Thermodynamics
Decommissioning/repurposing	Handling and dismantling hydrogen-exposed materials Hydrogen asset integrity Hazardous substance handling and management
Design management, site engineering	Safety by design for hydrogen Civil engineering processes for hydrogen
Digital and data	Data analytics and modelling for hydrogen/electrolysis Hydrogen digital twins IoT system integration for hydrogen Interoperability standards for hydrogen SCADA and control systems AI asset optimisation
Electrical, controls and process	Electrolysis/electrolyser operation Power integration Hydrogen process controls
Environmental	Environmental Impact Assessment (EIA) for hydrogen schemes Assessment and management of hydrogen impacts Emergency planning for hydrogen schemes
Geotechnical/subsurface storage	Cavern/geological stability Hydrogen migration modelling Hydrogen monitoring

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Table 5.4: Hydrogen delta skills demand by roles for small and large archetypes continued...

Role	Hydrogen delta
Hydrogen safety and risk governance	Hazardous substance handling and management Safe plant operations for hydrogen Hydrogen safety management Hydrogen-specific risk registers Hydrogen-specific emergency preparedness
Legal and regulatory	Hydrogen-regulation Permitting and consenting Intellectual property Hydrogen legislation and legal understanding
Logistics/transport/distribution/refuelling	Site vehicle operation Waste management Hydrogen/ammonia tube trailer operations Hydrogen refuelling station design, operation and maintenance Hydrogen metering and data Hazardous area compliance for mobile assets
Manufacturing (fabrication, quality assurance, assembly)	Hydrogen-compatible materials Advanced welding and machining Application of robotics/automation/AI in advanced manufacturing for hydrogen Testing, tolerance, quality assurance and certification to hydrogen standards Hydrogen component assembly and delivery
Mechanical engineering (design)	Process design and FEED Hydrogen handling and storage (hazardous substances) Pressure systems Thermodynamics Hydrogen embrittlement Cryogenic design
Operations and maintenance	Control systems for hydrogen Hydrogen project/site maintenance Risk, hazardous substance handling and management Hydrogen interfaces (grid, compression, storage)

continued over the page...

Table 5.4: Hydrogen delta skills demand by roles for small and large archetypes continued...

Role	Hydrogen delta
Planning/consenting	Planning and consenting processes across hydrogen energy and environmental regulation Spatial planning and policy interpretation for hydrogen
Procurement and supply chain management (PSCM)	Hydrogen equipment Localisation of operations Logistics for electrolyser, compression and storage
Project/programme management	FEED oversight for hydrogen plants Risk, hazardous substance handling and management Hydrogen interfaces (grid, compression, storage)

Source: GC Insight analysis of Scottish Enterprise/Arup data

Scenarios for skills demand

5.12 Based on the above, two scenarios have been considered, for illustrative purposes. These have focused on the overarching Scottish Government ambition to achieve 25GW of hydrogen generation capacity by 2045. The scenarios are:

- **Scenario 1:** Hydrogen generation capacity is achieved through a mix of small- and large-scale facilities. This scenario assumes c.3 large-scale production facilities, and c.5 small-scale production facilities. Development progresses at a rate of between 1.25GW and 1.35GW installed capacity achieved per annum, tailing off towards 2043.
- **Scenario 2:** Hydrogen generation capacity is achieved through large-scale production facilities only. This scenario assumes c.3 large-scale production facilities with an installed capacity between 400MW and 450MW each. Development progresses at a rate of c.1.25GW installed capacity achieved per annum.

5.13 The following is assumed for each scenario:

- Development of hydrogen production facilities is already under way, with a view to realising installed and operational capacity in the current calendar year (2026).⁵⁸
- The balance of small- and large-scale facilities that commence development is largely consistent year-on-year.
- The assumed timescales for development and construction – 30 months for small-scale, 48 months for large-scale – are uniform and consistent for all projects.

Scenario 1: Mixed development of small- and large-scale production facilities

5.14 Under this scenario, the total requirement for construction employment is **c.43,600** jobs over the period to 2045. In any one calendar year, the total construction employment needed is **c.2,240** jobs.

5.15 Assuming a consistent pattern of development throughout the period to 2045, then it could be assumed that the scale of operational jobs realised at the following intervals is as follows:

- 2030: c.2,050 jobs
- 2035: c.5,160 jobs
- 2040: c.8,460 jobs
- 2045: c.11,380 jobs.

Scenario 2: Development of large-scale production facilities only

5.16 Under this scenario, the total requirement for construction employment is **c.24,700** jobs over the period to 2045. In any one calendar year, the total construction employment needed is **1,230** jobs.

⁵⁸ This is in line with known industry ambitions; for example, Greencat have ambitions to open their Binn Eco Park facility in 2026

5.17 Assuming a consistent pattern of development throughout the period to 2045, then it could be assumed that the scale of operational jobs realised at the following intervals is as follows:

- 2030: c.1,310 jobs
- 2035: c.3,180 jobs
- 2040: c.5,240 jobs
- 2045: c.6,920 jobs

Caveats

5.18 For the scenarios outlined above, the following caveats apply.

- The job requirement covers development/construction and operation and maintenance only. Given the likely lifespan of hydrogen production facilities, no decommissioning requirement is expected before 2045.
- As is the case for nearly all sectors, the jobs during the development and construction phases of hydrogen projects will necessarily be time-limited, and the requirement for these will decrease as projects move towards their operation and maintenance phase.
- In all likelihood, many construction jobs identified will be duplicates and should therefore not be considered unique workers or FTEs. That is, these jobs will likely be fulfilled by the same individuals moving from one contract to the next in any given calendar year, and across calendar years. So, for development and construction, these jobs should be seen as instances of employment that can be fulfilled multiple times by one individual worker.
- Though some economies of scale are built into the Arup supply chain modelling, no other economies of scale are assumed in the skills demand modelling presented here, in the absence of evidence to suggest how this may manifest. For example, in practical terms, the same developer building multiple schemes may realise economies of scale over a number of development sites.
- No efficiency gains over time have been built into the estimates, such as processes getting more streamlined or automated, and thus requiring fewer staff at various stages.
- In addition to the above, no assumptions have been included on future technological advances e.g. shortened timescales for development, increases in possible generation capacity for hydrogen production facilities, and so on.
- No judgment has been made on what may be realistic – that is, the scenarios have been developed on the basis of the stated Scottish Government target of 25GW by 2045, and flat rate of annual completion of installed capacity to achieve this.

Summary

- 5.19** As presented above, there are differing workforce requirements for the small- and large-scale archetypes. The small-scale projects are anticipated to require c.295 jobs over their lifespan, whilst the large-scale projects are expected to need c.640 jobs. The largest share of jobs is anticipated to be during the development and construction/installation phases of each project archetype. Around 15-20% of anticipated employment will be required during the operational phase of each project. Given the balance of jobs between the two project archetypes, and the possible development pathways to achieving the Scottish Government's target of 25GW by 2045, then between 24,700 and 43,600 construction jobs could be required during construction in the period to 2045, and a maximum of between 1,230 and 2,240 construction jobs will be needed annually.
- 5.20** For operation and maintenance, between 6,920 and 11,380 jobs will be required by 2045, dependent on the mix of small- and large-scale hydrogen production facilities ultimately developed.

6. Current and emerging demand for hydrogen skills

Introduction

- 6.1** This chapter examines the need for skills in the hydrogen sector now, but perhaps most importantly, going forward. It examines the drivers of demand in the first instance, before exploring the nature and volume of skills required by Scotland's emerging hydrogen industry.
- 6.2** The findings presented here have been informed by the analysis of the information and insights of key stakeholders interviewed in the research and those involved in hydrogen projects. The interviews explored the drivers and opportunities for the hydrogen industry in Scotland and what this means for skills needs covering skill types, levels, occupations in the construction phases as well as in operations and maintenance. The interviews also explored anticipated gaps and the implications. Given the industry uncertainty discussed in Chapter 3 and elsewhere in the report, there were limitations regarding the level of detail that could be provided by consultees, and this has impacted on the extent to which precise intelligence on the nature and volume of skills demand could be identified.

Drivers of demand

- 6.3** A key factor in the drivers of demand for skills in the hydrogen industry is the wider industry need to respond to energy challenges within Scotland. The proliferation of renewable energy developments in general, and specifically the significant pipeline of offshore wind developments through ScotWind and INTOG but also for other renewable technologies such as marine (wave and tidal) energy and onshore wind generation, mean that there is challenge with curtailed energy. Further, grid connections for new developments, and the current capacity of the electricity grid infrastructure in Scotland as well as elsewhere in the UK means that there is not a guaranteed route to market for renewable energy generation. Hydrogen production offers a solution of 'converting electrons to molecules', either as hydrogen or further conversion to hydrogen derivatives (including ammonia, methanol, and e-fuels such as synthetic aviation fuel), to allow for storage and transportation.
- 6.4** Allied to this, export markets for hydrogen produced in Scotland (along with elsewhere in the UK) mean that there could be increasing demand for hydrogen. This is particularly so in light of current volatility in energy markets arising from geopolitical matters, and its impact on oil and gas prices. For example, Germany is set to become one of the world's largest hydrogen importers, with a projected demand of 95-130 TWh by 2030, of which the majority will be imported.^{59,60} Scotland is well-positioned to take advantage

59 <https://www.hydrogenscotland.com/germany-hydrogen-derivatives-import-strategy/>

60 [Scottish Government \(2024\) Note on German Hydrogen Import Strategy](#)

of this export opportunity although Germany is also looking at importing hydrogen from other countries.^{61,62} In addition to this competition from other countries, currently the cost of hydrogen is still extremely high, which could also impact Scotland's exporting ambitions. It is therefore important that this risk is mitigated by a supportive policy, strategic and operational environment in Scotland and at UK level.

6.5 This means that hydrogen industry demand for skills typically span production and supply chain industries, plus the potential applications of hydrogen. The main demand for hydrogen skills will of course arise through the development, construction and operation of hydrogen production plants (e.g. electrolyzers), of which there is already a pipeline emerging in Scotland.⁶³ Alongside this, there will be a commensurate demand for skills in routine, preventative maintenance.

6.6 Consultees also noted a range of job opportunities across other parts of the value chain for hydrogen. This includes in energy vector handling and transport and logistics. Whether as hydrogen or one of its derivatives, there will be a need for skilled workers to facilitate the safe and efficient transportation of hydrogen as a fuel to its point of need/use, since there are specific skills and technical knowledge requirements to safely manage the storage and transportation of hydrogen. For example, in order to liquify hydrogen to transport significant amounts, it needs to be at an extremely low temperature (-253°C). It can also cause embrittlement in pipelines and is considered more 'leaky' than other gases.

In addition, other gases are typically solid at such low temperatures, and if present in the liquid hydrogen, may cause storage system malfunctions due to particles of solid ice. Condensed air can also form on the outside surface of uninsulated piping and could result in oxygen enrichment and explosive conditions.^{64,65} This demonstrates the specific need for hydrogen delta skills.

6.7 Component manufacturing was also highlighted as a demand driver for hydrogen skills. As the industry develops and grows, there is an increasing need for specialist equipment – such as valves and pressure gauges, for example – that are tailored specifically to hydrogen. This means that hydrogen skills and broader understanding of handling hydrogen will be needed in supply chain industries such as advanced manufacturing and engineering.

6.8 The potential for hydrogen production in Scotland was noted by all consultees. One perspective offered on how Scotland can capitalise on this was in the same way as for oil and gas, and for onshore wind, to build its capacity in skills and expertise as part of the sector's value creation. This is especially the case given the significant offshore wind potential, and thus the scope for hydrogen, to become part of Scotland's energy mix because of this.

6.9 However, there is considerable uncertainty in the hydrogen industry currently, and the scale of the opportunity in terms of skills and employment cannot therefore be quantified fully. Because of this uncertainty, there was feedback from the

61 <https://www.scottishpower.com/w/scotland-set-to-support-green-hydrogen-revolution-in-germany>

62 <https://www.scottish-enterprise.com/insights-and-events/research-evaluation-and-insight/2022/scot2ger-development-of-a-green-hydrogen-supply-chain-from-scotland-to-germany>

63 <https://www.hydrogenscotland.com/hydrogen-in-scotland/>

64 <https://www.surrey.ac.uk/fire-and-explosion-modelling-group/liquid-hydrogen-safety>

65 <https://h2tools.org/bestpractices/best-practices-overview/hydrogen-basics/liquid-hydrogen-properties-and-behaviors>

consultations that some hydrogen development projects are being paused or stopped, and a range of activity is not proceeding according to plan. This is corroborated by industry reports on projects being put on hiatus.⁶⁶ Therefore, this is negatively impacting on the understanding of what skills are required currently, and also what skills will be required in future. This is a key challenge for training and learning providers as they lack the information they need on the specific skills that will be needed and when. The progression of hydrogen projects is essential for showcasing the potential for jobs. This will create not only demand for skills, but aspiration to pursue hydrogen as a career choice. It will also add to the learning and give a more granular picture of the skills and workforce requirements.

- 6.10** Nevertheless, there is some evidence of companies pursuing development opportunities (in the case of hydrogen developers) or pivoting to opportunities related to the hydrogen supply chain e.g. oil and gas supply chain companies exploiting new business opportunities in hydrogen and working with developers. Some consultees noted an increase in such companies moving into the hydrogen space alongside their more established workstreams around oil and gas and other engineering sectors.
- 6.11** There is some evidence of engineering, procurement, and construction (EPC) start-ups focusing on hydrogen, or existing EPC companies pivoting to offer hydrogen services alongside their established offers (e.g. in oil and gas). Consultees also highlighted similar evidence of design engineering and management companies pivoting from

other sectors to hydrogen activity. These services, and the skills within them, are of particular importance as hydrogen projects move through the development phase and into construction delivery.

Nature of hydrogen skills required

Skill types

- 6.12** The consultations highlighted evidence of demand for specific technical hydrogen skills. This spans a wide range of supply chain sectors and components across engineering, project management, professional services, equipment provision and engineering solutions for the development and construction of hydrogen production plants in the first instance. However, some consultees were keen to stress that development of hydrogen projects use existing skillsets in the Scottish workforce: the application of those skills is what is different, rather than there being novel skills.
- 6.13** As noted above, EPC companies are already moving into the hydrogen space – through start-ups such as Logan Energy, Greencat, Clyde Hydrogen Systems and Láidir Circular Mobility, and through larger, more established EPC companies. Design engineering roles at the pre-FEED and FEED stages, as well as in the more detailed design and installation phases are becoming increasingly sought after. Whilst this is not necessarily problematic currently, with some developers noting easy access to EPCs for their hydrogen projects, it is anticipated that demand and competition for a range of engineering and construction services will increase as hydrogen projects come online.

⁶⁶ <https://www.spglobal.com/energy/en/news-research/latest-news/energy-transition/090225-scottishpower-halts-hydrogen-project-developments-in-challenging-market>

- 6.14** Allied to this, there is demand for equipment and component manufacturing skills. This includes fabrication and welding, but also advanced manufacturing and precision engineering. This will require higher level skills in machine operation (e.g. computer numerical control (CNC) machining), which often require a strong digital skills component, advanced welding skills, technical drawing interpretation, etc. As hydrogen production facilities move towards the procurement and construction phases, there will be increasing demand for the equipment and apparatus (e.g. electrolyzers, compressors, valves, gauges, etc.) that comprise a hydrogen production facility.
- 6.15** Longer-term (i.e. if a larger volume of hydrogen production plants becomes operational), there would be demand for operation and maintenance skills in hydrogen. For day-to-day production, this would include hydrogen plant technicians, electrolyser plant operators and system engineers (including specialists for pipelines or fuel cell systems), and electrical control and instrumentation (ECI) engineers or technicians.
- 6.16** Each of these roles will require an understanding of hydrogen gas handling, as well as management of high-pressure gas systems. Consultations identified that the understanding of hydrogen handling is where skills challenges sometimes arise. It is understood that these roles require an intermediate or higher level of technical expertise and experience, rather than entry level skills (i.e. minimum SQCF Level 7). One consultee noted that those with experience of working with industrial diesel systems, for example, would have highly transferable skills and expertise. Other technical proficiency

requirements include knowledge of water treatment, and the ability to maintain high-purity water systems essential for the electrolysis process.

- 6.17** Safety and hazardous substance handling skills are considered essential for the hydrogen industry, and this was raised by a number of consultees. Familiarity with and certification for ATEX⁶⁷ equipment and explosive atmospheres, Pressure Equipment (Safety) Regulations⁶⁸, and hazardous atmosphere handling are in demand for hands-on hydrogen roles. In addition, a sound working knowledge of these practices is necessary for wider roles in hydrogen. It was noted during consultations that challenges can arise with process safety in instances where prescriptive rules and experience with other gases or hazardous substances are applied without full appreciation of how hydrogen behaves.
- 6.18** Consulted stakeholders also noted that specific hydrogen expertise is necessary in supporting professional services roles, that is in the required legal, financial and regulatory functions to support hydrogen businesses. There are specific requirements on understanding hydrogen processes, which are considered by a number of consultees to be important, particularly in insurance for hydrogen operations.
- 6.19** However, consultees noted that other skills not specific to hydrogen production are in demand currently and will also be in greater demand in future. These include project management, digital and data analytical skills, etc. but also construction, engineering and fabrication skills – such

67 ATEX is the name commonly used to refer to regulations regarding explosive atmospheres, including The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (the 2016 EPS regulations) and the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR); originally ATEX (Atmosphères Explosibles) was derived from two European Directives for controlling explosive atmospheres: Directive 99/92/EC (also known as 'ATEX 137' or the 'ATEX Workplace Directive'), and Directive 2014/34/EU (also known as 'ATEX 114' or 'the ATEX Equipment Directive').

68 <https://www.hse.gov.uk/pressure-systems/pesr.htm>

as those typically provided by EPC companies. There is significant overlap with other activity such as housing, infrastructure development, and other renewable energy developments. With labour markets already tight because of the well-documented demand for (and thus shortage of) these skills, there is an acute skills challenge.

6.20 Downstream services, such as domestic, commercial, industrial heating engineers and inspectors will be needed if the use of hydrogen becomes more commonplace. There is also scope for existing natural gas pipelines to be repurposed for hydrogen use, if test cases and demonstrator projects prove the viability of hydrogen as a fuel for heating and cooking. Projects such as H100 are already seeing the training and upskilling of gas engineers and similar roles for working with hydrogen as part of the demonstrator in Fife which is an opportunity to learn about skills needs as this and similar projects progress.⁶⁹ The extent of this will be driven by the rate and extent of hydrogen installation as a heating source.

6.21 Broader engineering and construction roles will increasingly need an understanding of hydrogen systems and handling. These will be required alongside hydrogen-specific engineering and installation roles as hydrogen production plants are built out.

6.22 Data skills will also be required. Digital and data skills, such as in analysis and remote monitoring and metering, are needed to manage hydrogen plants, particularly where there is a high degree of automation. Similarly, AI and machine learning skills are applicable where such technology can be used to optimise the electrolysis process, reducing costs and increasing efficiency.

6.23 As noted above, understanding of safety and hazards at a managerial, director and executive level with relation to hydrogen will also be required. Whilst such roles will not be expected to be hands-on in terms of handling hydrogen, there will be an expectation and requirement for managing and holding responsibility for operational environments within hydrogen production sites.

6.24 There will also be demand for pivotable/transferable skillsets. In essence, these will be roles already existing in environments and workplaces where there is a high degree of handling high-pressure, high-temperature and low-temperature systems.

6.25 This includes process & chemical engineering, mechanical engineering & maintenance, electrical control & engineering, and project management. It will also encompass skilled trades and technical competencies such as pipefitting, welding & fabrication, and repair/maintenance.

6.26 Outside of the immediate value chain for hydrogen, consultees noted the need for improved hydrogen skills and understanding within the planning system and that there is a gap in the skills and knowledge within the current planning workforce. Planning and permitting is considered hugely important to help bring schemes forward, and is often considered a major barrier to many different types of renewable schemes, largely due to the lack of capacity within the public sector to process applications. Recently released planning guidance from the Scottish Government⁷⁰ aims to contribute to addressing this in the short term. This is supported by resources including the Hydrogen Planning Process Map published by the Improvement Service's

⁶⁹ <https://www.h100fife.co.uk/>

⁷⁰ [Scottish Government \(2026\) Hydrogen: planning and consenting guidance](#)

National Planning Hub⁷¹, and the Scottish Government-supported Introduction to Hydrogen for the Public Sector CPD course.⁷²

Skill levels

- 6.27** Engagement with stakeholders did not provide sufficient clarity on the required skill levels for different hydrogen roles. However, there was a consensus that there is greater demand for experienced, skilled workers rather than entrants. At the same time, it was noted that the green hydrogen sector in Scotland is in its nascency, and so there is a concentration of expertise within a relatively limited value chain presently.
- 6.28** There were also mixed views on whether hydrogen-adjacent skills (that is, skills in roles fulfilling similar functions in other sectors to those found in the hydrogen industry, e.g. in industrial gas processing or engineering, that could very easily be transferred to hydrogen) were required, or not, to meet demand in the hydrogen industry. A number of consultees suggested that, in particular, skills in oil and gas are very well-placed to transition to hydrogen. However, encouraging workers to move from oil and gas is likely to be challenging as it is a high paying sector, and even if the need for skills declines in Scotland, there are opportunities to work overseas.
- 6.29** Other adjacent sectors where transferable skillsets exist include industrial gas manufacturing, aviation ground support, and shipping/maritime & marine services (diesel

handling). Additionally, transferable skillsets can also be found in renewable energy production & power grid integration, and aerospace & defence. It was also noted during consultations that Scotland is in a strong position in terms of the hydrogen-adjacent workforce in other sectors, such as chemical industries, refining, or industrial processes and maintenance. One consultee in particular noted that development of the hydrogen industry covers a wide range of project and activity types, creating a variety of opportunities for transferring skills.

- 6.30** This suggests there is a deep skills base to build from, even where re-training or contextualisation is necessary. This allows for training to bridge from existing competencies, rather than having to train from scratch. If hydrogen is to extract workers from oil and gas and potentially other sectors, it must be an attractive option and be seen to be a positive career choice.
- 6.31** It is also worth noting that some consultees suggested that there was no substantial need for HE-level skillsets currently, and that most skilled workers in demand would need to be educated through more vocational pathways. This appeared to be in the context of more operational roles, rather than discounting the need for degree- or postgraduate-qualified workers in specialised roles. Nevertheless, it was felt by consultees that the level of HE enrolments in relevant STEM subjects in Scotland is a real strength.

⁷¹ [Improvement Service, National Planning Hub - Hydrogen Planning Process Map](#)

⁷² <https://www.improvementservice.org.uk/products-and-services/planning-and-place-based-approaches/planning-skills/introduction-to-hydrogen-for-the-public-sector>

Volume of skills required

- 6.32** Consultees noted that currently the demand for hydrogen skills in Scotland is not at a significant scale in Scotland in terms of volume. Recent research has suggested that in the region of 500 FTEs are employed in Scotland's hydrogen sector⁷³, and the hydrogen industry in Scotland is currently in a phase dedicated to designing, installing, and commissioning projects.
- 6.33** Presently, there is a particular demand for design engineers, as part of wider demand for EPC services, as discussed above. These roles are critical for contract delivery during the development and construction phases of hydrogen production facilities.
- 6.34** It is also worth noting that direct employment in the hydrogen industry is not routinely tracked through official statistics or targeted data collection (for example, hydrogen production employment will be subsumed in data for SIC35 Electricity, gas, steam and air conditioning supply, whilst construction, development and installation employment will span construction, engineering and architectural SIC codes (e.g. 41-43, 71)), though this may change as the sector develops and grows.
- 6.35** This is in part due to the nascency of the industry, and the stage at which development projects are at. Evidence suggests that currently, though there are specific shortages for some roles, which the report goes on to discuss in Chapter 8, there is no expectation of a widespread shortage of skilled workers for hydrogen companies, outwith well-

documented wider cross-sector challenges around access to skills in areas such as construction and engineering, which are anticipated to become increasingly acute as other large-scale developments in offshore wind or pumped storage hydro move into their construction phase. It is worth noting, however, that this may change as delivery of projects moves forward, and more workers and skills are required. This then becomes an issue of skills volume and timing. One consultee noted the risk associated with this – particularly in a situation where too much focus is placed on construction phase skills, resulting in a clamour for operational skills when projects do come online.

Summary

- 6.36** Demand for hydrogen skills is being driven by Scotland's wider energy transition, with curtailed renewable electricity (offshore wind, marine, onshore wind) and limited grid capacity increasing the need for hydrogen as an energy vector and export commodity, particularly given strong international demand (e.g. from Germany). The potential for hydrogen to be rolled out in place of natural gas for domestic and commercial heating, etc. also has skills demand implications within the downstream gas services workforce, both for incumbents and future new entrants. Skills needs for the sector span the full hydrogen value chain, including development, construction, operation and maintenance of production plants, plus logistics, transport, component manufacturing, planning and regulatory functions, as well as in operations, maintenance and repair engineering in industrial, commercial and domestic settings.

73 [SDS \(2025\). Hydrogen Workforce Demand](#)

6.37 Strong demand is emerging for experience and specialist technical skills, such as hydrogen gas handling, high-pressure systems, electrolyzers, water treatment, ATEX/explosive atmospheres competence, and hydrogen-specific safety and regulatory knowledge.

6.38 Adjacent sectors provide highly transferable skills. These include oil and gas, industrial gas, aviation, maritime and renewables. However, competition from these and other engineering sectors (especially oil and gas due to beneficial pay and conditions for workers) makes attracting experienced workers challenging. The sequencing and timing of emergent opportunities will be vital to minimise leakage from the existing energy workforce.

6.39 Experienced workers are in greater demand than new entrants, with immediate needs in EPC design engineers, project management, construction services, operation & maintenance roles, and downstream heating & engineering services as hydrogen use expands.

6.40 The important factor is that there is currently little certainty in the industry about if and when projects will come to fruition. This negatively impacts on the understanding of what the labour skills/needs will look like as the hydrogen industry in Scotland develops. Without greater certainty, developers are either reluctant to commit to, or are unable to, articulate specific skills demand profiles without this certainty. As the sector – and the desired strategy and policy environment – develops, more certainty can be achieved but it will rely on industry-led data and information. Some businesses engaged in this research are at the vanguard of hydrogen project development in Scotland and have considerable experience and understanding of their

own skills requirements. This should be taken advantage of for the benefit of hydrogen industry development.

6.41 There was no suggestion that developers are not thinking about their own skills planning. However, industry uncertainty means that many businesses are engaging with skills considerations beyond the project development phase at a later point in time than would otherwise be the case. Additionally, the apparent lack of clarity and detail on skills needs has implications for skills planning in terms of curriculum development and careers information and advice. Thus, it is critical at this point for greater engagement between education and industry (and particularly those businesses with experience and understanding of skills requirements) to forward plan for skills provision as far as possible.

7. Supply of hydrogen skills in Scotland

Introduction

7.1 This chapter presents the supply-side picture of skills provision for hydrogen in Scotland. It comprises two parts. The first is a data-driven analysis of skills of relevance to the hydrogen industry, based on published data from Skills Development Scotland (SDS), Scottish Funding Council (SFC) and the Higher Education Statistics Agency (HESA), and according to the skills data definition set out in Chapter 4. The second part is a more qualitative consideration of hydrogen-specific courses delivered in Scotland currently, across public and private education and training providers.

The supply of relevant skills for hydrogen

Apprenticeship family

Foundation Apprenticeships

7.2 Foundation Apprenticeship (FA) data is available for the 2020-2022 cohorts. FAs are one or two-year programmes, aimed at providing work-based learning to pupils in the senior phase of secondary school (S5 and S6). FAs allow students to work with local employers, offering higher-level learning, and a nationally recognised qualification at Higher level. This aims to improve the range of skills young people have and increases their employability.

7.3 FAs have been running since 2016 and are now nearing the end of their eighth cohort of students, who will graduate in 2026. They have seen increased popularity over the last eight years, boosted by increased flexibility in 2018, when the one-year FA format was introduced. This increased flexibility in FA provision, and the existing framework which allows for delivery around school learning and other commitments, means the FAs are a popular avenue for many young people.

7.4 Table 7.1 highlights the number of FA cohorts in hydrogen-relevant frameworks between 2019 and 2022 in Scotland. Total FA cohorts have decreased across every year of analysis, representing a 20% decrease over the period between 2020 and 2022, likely due in some part to the COVID-19 pandemic in 2020. The most significant decreases have been in IT: hardware/system support (-63%), financial services (-42%) and accountancy (-41%) with the only framework which saw an increased cohort over the period being scientific technologies (+8%).

Table 7.1: Foundation Apprenticeship cohorts in hydrogen-relevant subjects (2020-2022)

Framework	2020	2021	2022	Change (2020-22)	
				Numerical	Percentage
Accountancy	119	67	70	-49	-41%
Business Skills	338	265	280	-58	-17%
Creative and Digital Media	305	292	290	-15	-5%
Engineering	327	257	215	-112	-3%
Financial Services	26	16	15	-11	-42%
IT: Hardware/System Support	40	6	15	-15	-63%
IT: Software Development	146	145	125	-21	-14%
Scientific Technologies	97	90	105	8	8%
Total	1,398	1,138	1,115	-283	-20%

Scottish Funding Council 2026 – note that the Construction FA is not included as this is at levels 4/5

Modern Apprenticeships

7.5 Modern Apprenticeship (MA) data is available from 2020/21 to 2024/25. Table 7.2 shows the combined uptake in all MA frameworks, hydrogen-relevant MA frameworks and the share of all MA starts each year that are in hydrogen-relevant frameworks. These are in line with the supply-side data definition set out in Chapter 4.

7.6 The number of starts on hydrogen-relevant MA frameworks have more than doubled (+103%) over the period of analysis and over a third of all MA starts in 2024/25 (35%) were onto frameworks of relevance to hydrogen, representing a significant increase as a percentage of total frameworks over the five-year period (+11%). This is likely due, in part, to new frameworks being developed over the period of analysis. For example, engineering asset lifecycle & maintenance, engineering manufacturing & fabrication, and digital technology technical apprenticeship had a combined 2,121 starts in 2024/25, and no starts in 2020/21.

Table 7.2: Modern Apprenticeship starts in hydrogen-relevant frameworks, 2020/21 to 2024/25

Year	2020/21	2021/22	2022/23	2023/24	2024/25	% Change
Hydrogen-relevant frameworks	4,457	7,546	6,897	7,093	9,035	103%
All frameworks	18,655	25,401	25,447	25,365	25,507	37%
Hydrogen-relevant frameworks as a % of all frameworks	24%	30%	27%	28%	35%	+11 p.p.

Skills Development Scotland 2025

7.7 Table 7.3 shows the total starts on hydrogen-relevant MA frameworks in 2024/25. The most popular were construction frameworks, comprising 39% of total starts. Business & administration (10%), engineering asset lifecycle & maintenance, and digital technology technical apprenticeship (both 8%) were also popular.

Table 7.3: Total starts into hydrogen-relevant MA frameworks

Framework	2024/25	%
Business & Administration	900	10%
Life Science and Related Science Industries	19	0%
Construction: Civil Engineering	1,272	14%
Construction: Professional Apprenticeship	881	10%
Construction: Technical	1,329	15%
Construction: Technical Apprenticeship	10	0%
Engineering Asset Lifecycle and Maintenance	734	8%
Engineering Construction	24	0%
Engineering Manufacturing and Fabrication	625	7%
Engineering Technical Support	88	1%
Industrial Applications	11	0%
Power Distribution	40	0%
Process Manufacturing	34	0%
Water Industry	46	1%
Digital Applications	528	6%

Framework	2024/25	%
Digital Technology	89	1%
Digital Technology Technical Apprenticeship	762	8%
Firefighting	175	2%
Housing	23	0%
Occupational Health & Safety Practice	33	0%
Procurement	62	1%
Management	562	6%
Project Management Technical Apprenticeship	61	1%
Driving Goods Vehicles	108	1%
Freight Logistics	609	7%
Supply Chain Management	10	0%
Total Hydrogen-relevant starts	9,035	

7.8 Table 7.4 shows total MA starts in all hydrogen-relevant frameworks in the 2024/25 academic year by local authority. The two local authorities with the highest share of hydrogen-relevant enrolments were Glasgow City and North Lanarkshire (10% each) followed by South Lanarkshire and Fife

(8% and 7% respectively). Regionally, Glasgow City Region⁷⁴ comprised 36% of hydrogen relevant MA enrolments, which is slightly higher than Greater Glasgow's share of the total Scottish working age population in 2024 (35%).⁷⁵

Table 7.4: Total starts into hydrogen-relevant MA frameworks by local authority

Local authority	2024/25	%
Aberdeen City	225	2%
Aberdeenshire	394	4%
Angus	178	2%
Argyll & Bute	121	1%
Clackmannanshire	75	1%
Dumfries & Galloway	227	3%
Dundee City	159	2%
East Ayrshire	266	3%
East Dunbartonshire	141	2%
East Lothian	125	1%
East Renfrewshire	106	1%
Edinburgh, City of	436	5%

Framework	2024/25	%
Falkirk	354	4%
Fife	602	7%
Glasgow City	904	10%
Highland	397	4%
Inverclyde	115	1%
Midlothian	156	2%
Moray	96	1%
Na h-Eilean an Siar	41	0%
North Ayrshire	266	3%
North Lanarkshire	880	10%
Orkney Islands	8	0%
Perth & Kinross	212	2%

Framework	2024/25	%
Renfrewshire	394	4%
Scottish Borders	178	2%
Shetland Islands	59	1%
South Ayrshire	179	2%
South Lanarkshire	694	8%
Stirling	81	1%
West Dunbartonshire	218	2%
West Lothian	321	4%
Outwith Area	0	0%
Total hydrogen-relevant starts	9,035	100%

⁷⁴ East Dunbartonshire, East Renfrewshire, Glasgow, Inverclyde, North Lanarkshire, Renfrewshire, South Lanarkshire, West Dunbartonshire

⁷⁵ Nomis: Population estimates - local authority based by single year of age, 2024

Graduate Apprenticeships

7.9 Graduate Apprenticeships (GA) data is available for the 2018/19 to 2022/23 cohorts. GAs provide in-work education up to Master's level for new and existing employees. Introduced in 2018, GAs have seen increasing popularity due to providing well-structured upskilling opportunities, but also due to the high level of engagement from employers who are increasingly seeing GAs as a successful way of bringing younger staff into their workforce.^{76,77}

7.10 Table 7.5 illustrates the GA cohorts in hydrogen-relevant frameworks between 2018/19 and 2022/23 in Scotland. The hydrogen-relevant GA cohort has increased over the period by almost a fifth (19%), reaching a peak of 968 in 2021/22 following the COVID-19 pandemic before decreasing slightly into the most recent year of analysis. The most significant increases over the period in real terms have been business management (+57), followed by data science (+38) and construction & the built environment (+36).

Table 7.5: Graduate Apprenticeship cohorts in hydrogen-relevant subjects (2029-2022)

Framework	2018/19	2019/20	2020/21	2021/22	2022/23	Change (2018/19-2022/23)	
						Numerical	Percentage
Business Management	293	311	394	381	350	57	19%
Construction and the Built Environment	64	122	84	121	100	36	56%
Cyber Security L10	54	50	53	45	50	-4	-7%
Cyber Security L11	25	53	42	58	50	25	100%
Data Science	17	45	62	56	55	38	224%
Engineering: Design and Manufacture	123	129	132	143	120	-3	-2%
IT: Management for Business	46	53	35	32	35	-11	-24%
IT: Software Development	129	156	126	132	130	1	1%
Total	751	919	928	968	890	139	19%

Scottish Funding Council 2026

⁷⁶ <https://www.universities-scotland.ac.uk/gablog/>

⁷⁷ <https://www.skillsdevelopmentscotland.co.uk/news-events/2022/july/growth-of-employer-confidence-and-investment-in-apprenticeships>

College provision in hydrogen-relevant subjects

Foundation Apprenticeships

7.11 Table 7.6 illustrates the total number of enrolments in hydrogen-relevant subjects (as detailed in Chapter 4) in Scotland over a five-year period between 2020/21 and 2024/25. There was a total of 81,600 enrolments into hydrogen-relevant frameworks in the 2024/25 academic year representing a decrease of 21% over the period since 2020/21. The most significant decreases have been in Fife

College (-74%), West Lothian College (-51%), and Shetland College of Further Education (-34%). The reason for this change is unclear, though it is worth noting that this change was experienced during a challenging fiscal environment for education and training in Scotland, and is set against the context of a decline in overall enrolments, albeit at a smaller scale (7%). Several colleges saw a significant increase in hydrogen-relevant college enrolments over the period including Argyll College (+67%), Perth College (+65%), and SRUC (+52%).

Table 7.6: Hydrogen-relevant college enrolments by provider, 2020/21-2024/25

Framework	2020/21	2021/22	2022/23	2023/24	2024/25	Change
Argyll College	255	475	955	875	425	67%
Ayrshire College	4,195	4,840	5,010	3,710	3,890	-7%
Borders College	895	1,420	1,305	1,335	950	6%
City of Glasgow College	8,725	9,895	7,785	6,140	6,450	-26%
Dumfries and Galloway College	1,450	1,945	1,875	1,820	1,720	19%
Dundee and Angus College	5,970	5,135	5,425	4,545	4,810	-19%
Edinburgh College	7,675	8,565	7,970	7,970	9,855	28%
Fife College	22,610	17,930	8,135	8,050	5,845	-74%
Forth Valley College	9,845	10,535	11,255	10,120	8,355	-15%
Glasgow Clyde College	4,415	5,385	5,475	5,045	4,710	7%

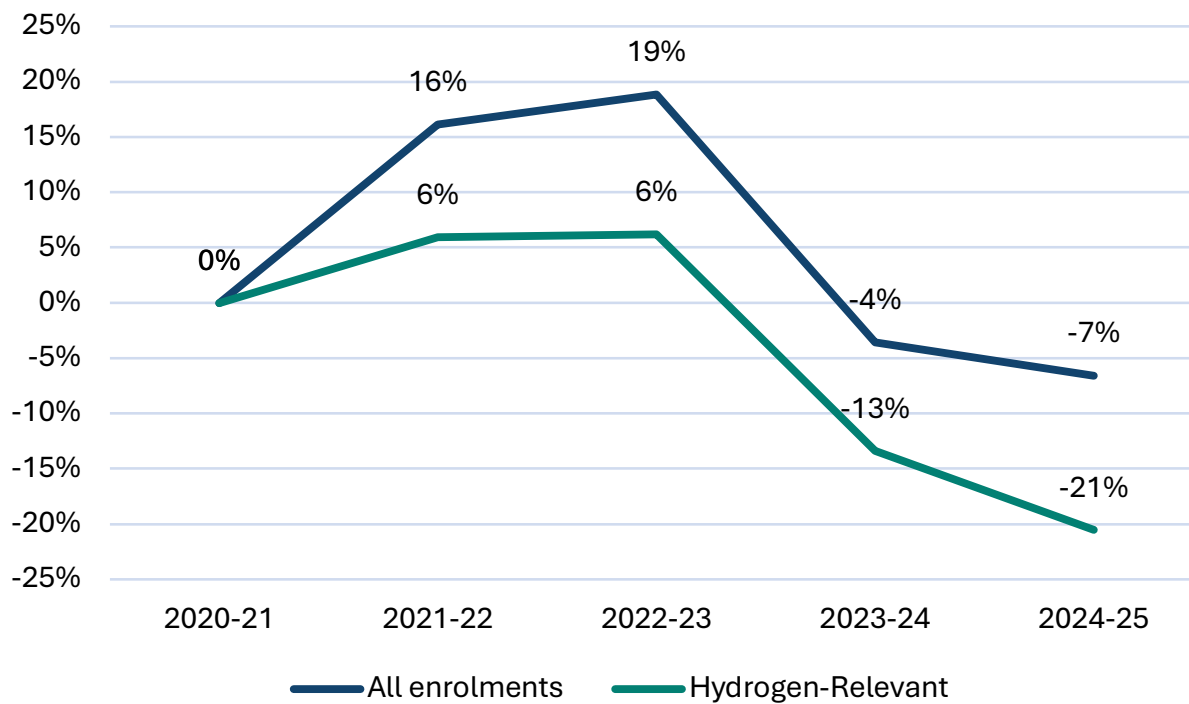
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Table 7.6: Hydrogen-relevant college enrolments by provider, 2020/21-2024/25 continued...

Framework	2020/21	2021/22	2022/23	2023/24	2024/25	Change
Glasgow Kelvin College	5,325	6,200	7,885	3,710	4,515	4,420
Inverness College	1,650	2,430	1,840	1,690	1,415	-14%
Lews Castle College	145	305	330	-	-	-100%
Moray College	1,010	1,125	1,270	1,320	820	-19%
New College Lanarkshire	4,610	4,845	5,905	4,365	4,190	-9%
Newbattle Abbey College	-	45	35	25	65	-
North East Scotland College	6,425	9,675	11,855	10,105	9,760	52%
North Highland College	520	390	445	-	-	-100%
North, West and Hebrides*	-	-	-	1,120	1,065	-
Orkney College	1,065	1,715	1,535	1,455	1,490	40%
Perth College	565	780	5,935	2,345	935	65%
Shetland College of Further Education	945	1,230	990	700	625	-34%
South Lanarkshire College	2,150	1,990	2,090	1,925	1,845	-14%
SRUC	135	95	230	160	210	56%
West College Scotland	7,370	8,160	9,535	6,645	5,710	-23%
West Highland College	550	665	670	-	-	-100%
West Lothian College	4,185	2,980	3,315	2,970	2,040	-51%
Total	102,685	108,750	109,050	88,960	81,600	-21%

7.12 Figure 7.1 highlights the percentage change of enrolments into hydrogen-relevant courses compared to all courses in Scotland over the period between the 2020/21 and 2024/25 academic years. Following a brief increase in all enrolments, and hydrogen-relevant enrolments, in the two years following the COVID-19 pandemic, both have also fallen below their respective totals for 2020/21. The total for hydrogen-relevant frameworks has fallen significantly more than the average for all frameworks, with a decrease of 21% over the period compared to 7% for all subjects.

Figure 7.1: College enrolments into hydrogen-relevant, and all frameworks using 2020/21 benchmark (2020/21-2024/25)



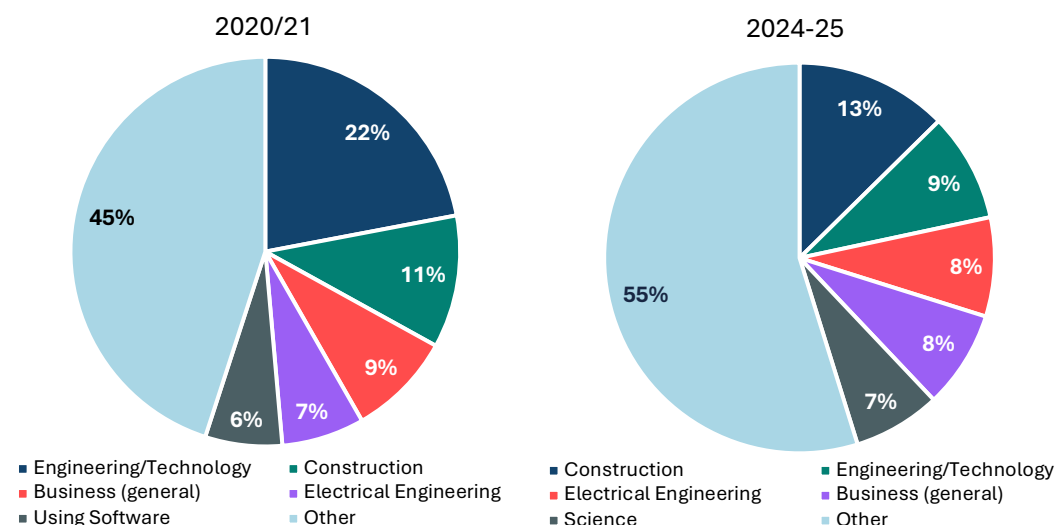
7.13 There is a broad range of potential reasons to explain why college enrolments for hydrogen-relevant courses have decreased while hydrogen-relevant apprenticeships and the share of hydrogen-relevant apprenticeships have increased and these will be significantly impacted by the challenging financial environment that the college sector is operating in. Evidence has shown that the availability of engineering-related subjects (which have a large degree of overlap with the definition of hydrogen here) has decreased over the period between 2014 and 2021 despite their popularity remaining relatively stable.⁷⁸ At the same time, the total number of 16 to 19-year-olds entering employment, further or higher education, or starting an apprenticeship has increased by 13% (2014-2023) and the mix of destinations for school leavers has increased, falling from two thirds in 2014, to 58% in 2023.⁷⁹

Provision by framework

7.14 Figure 7.2 shows the share of total hydrogen relevant-college enrolments for the five most popular superclasses in each year, along with all other hydrogen-relevant college courses combined, for 2020/21 and 2024/25. The most popular hydrogen-relevant college course, as a percentage of total hydrogen-relevant enrolments in the 2024/25 academic year, was construction (13%) followed by engineering/technology (9%), business (general) and electrical engineering (both 8%). However, where the five most popular courses comprised 55% of all hydrogen-relevant enrolments in 2020/21, in 2024/25 this figure was only 45%. This is largely due to the significant decrease in engineering/technology enrolments over the period, falling from 22%, to 9% of total hydrogen-relevant enrolments. This

could suggest that providers are diversifying the hydrogen-relevant courses that they offer. It will be important to ensure a good spread of skills and qualifications across the emerging hydrogen workforce to support the sector. However, this should be viewed in the context of the overall decreasing number of hydrogen-relevant college starts as illustrated at Figure 7.1.

Figure 7.2: Five most popular hydrogen-relevant college frameworks, and all other hydrogen-relevant frameworks in 2020/21 and 2024/25 as a percentage of total hydrogen-relevant frameworks



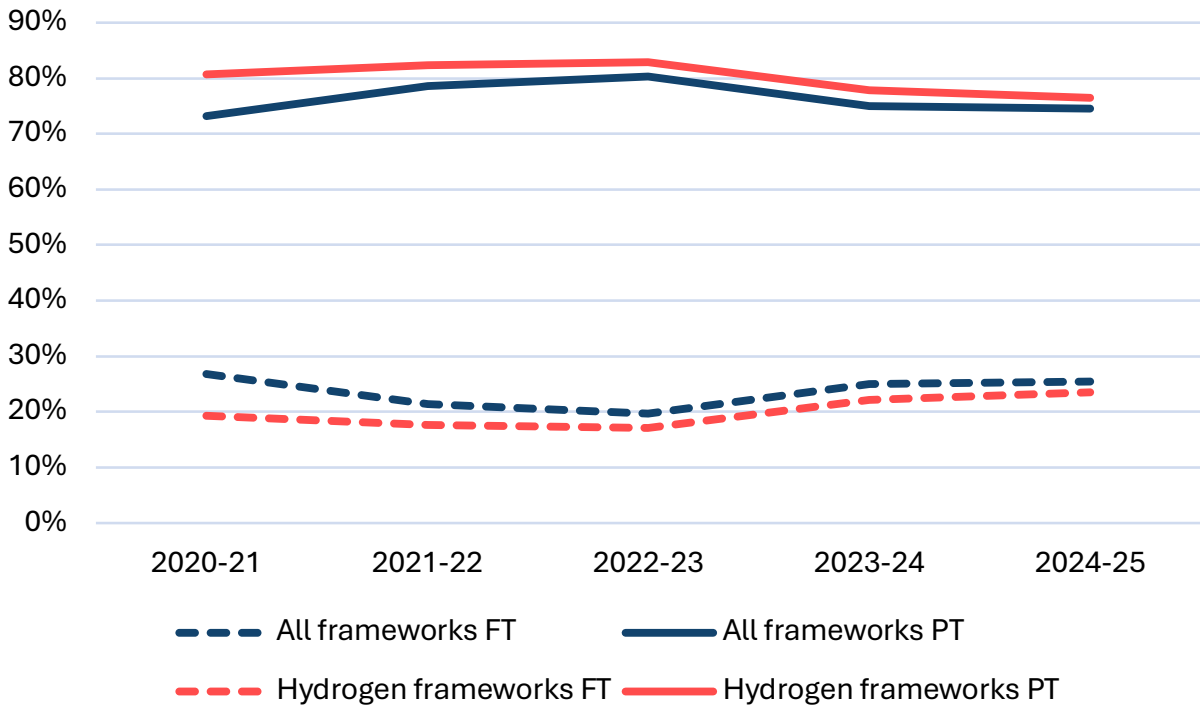
⁷⁸ [Enginuity \(2024\) STEM skills in Scotland: An Enginuity report](#)

⁷⁹ Ibid.

Full-time/part-time split

7.15 Figure 7.3 shows that the full-time/part-time split of hydrogen-relevant college enrolments in 2024/25 is in line with the average for all frameworks with three quarters of all frameworks being part time, compared to 76% of hydrogen-relevant frameworks. Hydrogen-relevant enrolments have fallen in line with the average over the period of analysis, with part-time courses being overrepresented compared to the average (+8) in 2020/21.

Figure 7.3: Full-time/Part-time split of hydrogen-relevant, and all college starts (2020/21-2024/25)



Profile of learners

7.16 Table 7.7 offers a breakdown of enrolments into hydrogen-relevant frameworks, and all frameworks by age. As illustrated, enrolments into hydrogen-relevant frameworks are on average younger than the average for all frameworks, with 22% of hydrogen-relevant enrolments aged under 16 compared to 16% of all frameworks. The narrow majority of hydrogen-relevant enrolments (51%) are under 20, compared to 45% of all enrolments and the share of hydrogen-relevant enrolments over the age of 25 is 9% lower than the average for all frameworks.

7.17 There is a much higher share of male enrolments into hydrogen-relevant courses (68%) when compared to the average for all courses (49.6%), as shown by Table 7.8. This is likely explained by the large number of STEM subjects which sit within the definition of hydrogen skills employed here. There are well established challenges with engaging women and girls in STEM learning and employment, with the Scottish Government having a range of actions aimed at improving this.⁸⁰ Despite this, the percentage of female enrolments into hydrogen-relevant courses has also decreased by 4% since the 2020/21 academic year.

Table 7.7: Hydrogen-relevant and all framework enrolments by age (2023/24)

Age	All	Hydrogen-relevant frameworks	Difference
Under 16	16%	22%	+6%
16-17	15%	13%	-2%
18-19	14%	15%	+2%
20-24	13%	16%	+3%
25+	42%	33%	-9%

Scottish Funding Council 2026

80 <https://www.gov.scot/policies/science-and-research/women-stem/>

Table 7.8: Hydrogen-relevant and all framework enrolments by sex (2023/24)

	All frameworks	Hydrogen-relevant frameworks
Male	49.6%	68%
Female	50.4%	27.9%
In another way / Prefer not to say / Other / Unknown	*	4.1%

*Data for all frameworks from SFC website, excludes enrolments where the sex of student is not 'Male' or 'Female' as defined in FES 2 Guidance, Code List P ⁸¹

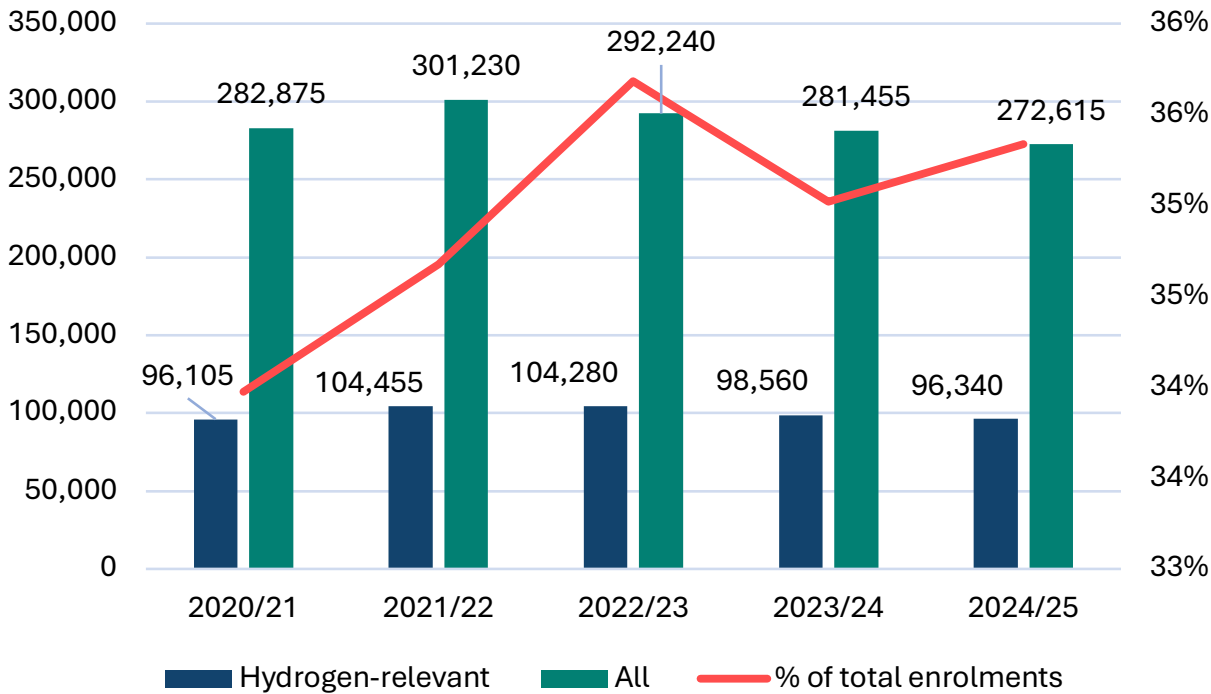
Universities

Overall university provision

7.18 There was a total of 96,340 enrolments into hydrogen-relevant university courses (as detailed in Chapter 4) in the 2024/25 academic year, representing 35% of total enrolments in Scottish universities as illustrated by Figure 7.4. Hydrogen-relevant enrolments have remained stable over the period of analysis since 2020/21, with enrolments for all subjects decreasing slightly (-4%). At the same time, the share of all enrolments comprised by hydrogen-relevant subjects has grown by 1.3%. This may suggest that hydrogen-relevant subjects are growing in popularity or that providers are increasing hydrogen-relevant provision.

⁸¹ <https://www.sfc.ac.uk/publications/college-statistics-2024-25/>

Figure 7.4: Hydrogen-relevant and total university enrolments, 2020/21-2024/25



HESA student enrolments by HE provider and subject of study 2014/15 to 2024/25

Provision by subject

7.19 Table 7.9 offers a breakdown of total full time equivalent (FTE) enrolments in hydrogen-relevant subjects in Scotland in the 2024/25 academic year, broken down by course. The most popular courses were law and business studies with a tenth of total hydrogen relevant enrolments, followed by computer science (9%), management studies (8%), and business and management (non-specific) (7%). These more popular courses are much broader and will provide skills for

wide range of sectors besides hydrogen. In contrast, courses with fewer enrolments, such as earth sciences and ecology & environmental biology, are more specialised and more closely aligned with hydrogen-related sectors. The higher enrolment in broader subjects such as law and business studies likely reflects their wider applicability across multiple industries, rather than a stronger link to hydrogen. As a result, enrolment patterns in these broader courses are not necessarily indicative of hydrogen-specific skills supply.

Table 7.9: Hydrogen-relevant university enrolments by course (2024/25)

Course	Number	%	Course	Number	%
Law	9,950	10%	Chemical, process and energy engineering	2,370	2%
Business studies	9,570	10%	Engineering (non-specific)	2,180	2%
Computer science	8,975	9%	Earth sciences	1,425	1%
Management studies	7,510	8%	Environmental sciences	1,320	1%
Business and management (non-specific)	6,780	7%	Information systems	1,240	1%
Design studies	4,825	5%	Ecology and environmental biology	1,215	1%
Economics	4,375	5%	Artificial intelligence	1,160	1%
Mechanical engineering	4,055	4%	Information services	1,050	1%
Software engineering	3,745	4%	Human resource management	1,005	1%
Electrical and electronic engineering	3,690	4%	Production and manufacturing engineering	1,005	1%
Marketing	3,370	3%	Planning (urban, rural and regional)	555	1%
Civil engineering	3,285	3%	Others in technology	455	0%
Physics	3,225	3%	Business computing	95	0%
Chemistry	2,695	3%	Others in engineering	95	0%
Building	2,615	3%	Materials technology	15	0%
Architecture	2,490	3%			

Provision by institution

7.20 Table 7.10 shows the total hydrogen relevant enrolments between 2020/21 and 2024/25, broken down by education provider. The largest share of enrolments in 2024/25 was at the University of Edinburgh (14%) followed by the University of Glasgow (12%), with Glasgow Caledonian University and the University of Strathclyde also having significant shares (11%). Providers who experienced significant increases in enrolment over the period were SRUC (+93%, however this is based on relatively small figures compared to other providers), Abertay University (+69%), Glasgow Caledonian University (+31%) and Robert Gordon University (23%). Over three quarters (76%) of hydrogen-relevant university enrolments in 2024/25 were in the Central Belt of Scotland, with 18% being in the North East, 2% in the Highlands and Islands, and 3% at the Open University.⁸²

⁸² No breakdown by campus available: uses total provider enrolments with geographical grouping based on main campus e.g. all Heriot Watt enrolments classified as Central Belt due to main Edinburgh campus.

Table 7.10. Hydrogen-relevant university enrolments by provider (2020/21-2024/25)

Provider	2020/21	2021/22	2022/23	2023/24	2024/25	% of total	% Change
Abertay University	1,420	2,100	2,310	2,480	2400	2	69%
Edinburgh Napier University	7,215	7,605	7,705	7,140	7,100	7	-2%
Glasgow Caledonian University	7,910	8,585	9,910	10,085	10,325	11	31%
Glasgow School of Art	1,220	1,255	1,335	1,325	1,370	1	12%
Heriot-Watt University	8,055	7,710	8,180	7,190	6,435	7	-20%
Queen Margaret University, Edinburgh	440	485	525	445	465	0	6%
Robert Gordon University	5,870	5,535	6,275	6,300	7,220	7	23%
SRUC	140	130	110	2,85	270	0	93%
The Open University	4,375	4,275	3,815	3,645	3,85	3	-25%
The University of Aberdeen	4,925	4,815	4,750	4,715	4,275	4	-13%
The University of Dundee	4,380	4,725	5,200	4,285	3,805	4	-13%
The University of Edinburgh	12,820	13,435	1,3190	1,325	13,290	14	4%
The University of Glasgow	10,630	12,880	12600,	11,425	11,515	12	8%
The University of St. Andrews	3,005	2,410	3,250	3,140	3,295	3	10%
The University of Stirling	3,810	4,335	4,020	3,860	3,010	3	-21%

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Table 7.10. Hydrogen-relevant university enrolments by provider (2020/21-2024/25) continued...

Provider	2020/21	2021/22	2022/23	2023/24	2024/25	% of total	% Change
The University of Strathclyde	12,030	11,150	12,215	11,480	11,030	11	-8%
The University of the West of Scotland	5,250	6,420	6,700	5,340	5190,	5	-1%
University of the Highlands and Islands	2,620	2,280	2,170	2,200	2,055	2	-22%

HES HESA student enrolments by HE provider and subject of study 2014/15 to 2024/25

Full-time/part-time split

7.21 Table 7.11 shows that the vast majority of enrolments into both hydrogen-relevant, and all university courses, were full time in 2024/25, and there was a higher share of hydrogen-relevant enrolments which are full time compared to the average for all subjects (+7%).

Table 7.11. Hydrogen-relevant and all university enrolments by full-time/part-time (2024/25)

	Full-time	Part-time
All	79%	21%
Hydrogen-relevant	86%	14%
Difference	+7%	-7%

HES HESA student enrolments by HE provider and subject of study 2014/15 to 2024/25

Provision by level

7.22 Table 7.12 shows that there is a higher share of hydrogen-relevant enrolments into postgraduate courses when compared to the average for all courses (+5%). Since the 2022/23 academic year the share of postgraduate enrolments into hydrogen-relevant subjects has decreased at a higher rate than for all subjects (-5% compared to -3%). A large share of the hydrogen-relevant enrolments is in subjects such as law, and engineering, which often require postgraduate education in order for students to specialise in a certain career path. This could explain the larger share of postgraduate enrolments into hydrogen-relevant courses.

Table 7.12. Hydrogen-relevant and all university enrolments by level, 2022/23-2024/25

	2022/23		2023/24		2024/25	
	Undergraduate	Postgraduate	Undergraduate	Postgraduate	Undergraduate	Postgraduate
All	68%	32%	70%	30%	71%	29%
Hydrogen-relevant	61%	39%	34%	36%	66%	34%

HES HESA student enrolments by HE provider and subject of study 2014/15 to 2024/25

Summary

7.23 Overall, the evidence shows that there are a range of different providers supplying hydrogen-relevant skills at a range of levels and across different parts of Scotland. Both Modern and Graduate Apprenticeship starts have increased in recent years, growing the pipeline of skills available to the sector with relevant work-based experience. There has been a decrease in enrolments in relevant subjects at college level, but this change is typical of wider trends in the college sector, and FE starts in relevant subjects for hydrogen account for nearly one third of all FE starts. Meanwhile, enrolments at HE level have remained broadly constant in recent years – though the share of hydrogen-relevant courses at university has increased against a backdrop of decreasing enrolments.

7.24 However, it is worth remembering here that this is a broader data-driven look at the supply of skills for hydrogen. Given data definitions and how enrolment data is collated by respective responsible bodies (particularly for FE and HE data), then this must be considered the widest theoretical pool of education leavers that the sector can draw from, and many of the learners identified here will undoubtedly have aspirations to enter other sectors besides hydrogen. Nevertheless, they will be training in subjects that can – and will – provide relevant skills for the hydrogen sector. However, the extent to which people undertaking these qualifications articulate into hydrogen careers will be dependent on jobs being available to them in this sector as well as the attractiveness of these roles.

Hydrogen education, training and qualification provision

7.25 This section summarises the provision of hydrogen-specific education, training and qualifications in Scotland. This was done by mapping education and training providers as far as possible across the different types of provision, with reference to their focus and coverage in terms of geography, course content, and target learner group. A textual analysis of course details from college, university and training provider websites, and any other material of relevance to course delivery was undertaken.

Overview of provision

7.26 There is a wide range of hydrogen-specific education and training delivered in Scotland. The research identified a total of 20 providers across different sectors. In total, six of Scotland's universities currently deliver hydrogen-specific courses or modules, whilst five colleges (including UHI North, West and Hebrides) provide training. The remaining providers are industry bodies or private providers. This list should not be considered exhaustive; there may be other training courses and providers that have not been identified as part of this research, and new courses may also have been developed/launched since the research was undertaken.

7.27 Table 7.13 summarises these.

Table 7.13. Hydrogen-specific education and training providers

Provider name	Type of provider	Training provided	Location
University of Strathclyde	University	MSc Advanced Mechanical Engineering (Hydrogen Applications modules) ⁸³	Glasgow
University of Aberdeen	University	Energy Transition Systems, Introduction to Renewable Energy – Hydrogen ⁸⁴	Aberdeen
Robert Gordon University	University	Hydrogen Energy Systems ⁸⁵	Aberdeen
University of St Andrews	University	Hydrogen Accelerator (Industry support and knowledge exchange) ⁸⁶	St Andrews
Heriot-Watt University	University	Institute of GeoEnergy Engineering – Hydrogen & Storage Modules ⁸⁷	Edinburgh
University of the Highlands and Islands (North, West and Hebrides; Orkney)	University/College	PDA Hydrogen: An Introduction for Technicians ⁸⁸ Hydrogen Vessel Crew Training	Stornoway Orkney
Fife College	College	Hydrogen Engineer Training (upskilling) ⁸⁹	Fife
North East Scotland College	College	Engineering Construction Modern Apprenticeship SIAS Level 2 Award Introduction to Hydrogen Safety	Aberdeen
Dundee and Angus College	College	Fuel Cell Trainer, Hydrogen Vehicle Safety Awareness Course ⁹⁰	Dundee
Energy Skills Partnership	Industry Skills Body/Academy	Hydrogen Awareness, Hydrogen for Transport Course ⁹¹	Scotland-wide

⁸³ <https://www.strath.ac.uk/courses/postgraduate/taught/advancedmechanicalengineering/>

⁸⁴ <https://www.abdn.ac.uk/events/conferences/renewable-energy/>

⁸⁵ <https://www.rgu.ac.uk/study/courses/hydrogen-energy-systems>

⁸⁶ <https://h2-accelerator.org/>

⁸⁷ <https://www.hw.ac.uk/study/postgraduate/petroleum-engineering>

⁸⁸ <https://www.uhi.ac.uk/en/courses/pda-hydrogen-an-introduction-for-technicians-scqf-level-7/>

⁸⁹ <https://www.fife.ac.uk/news/uk-s-first-hydrogen-training-centre-opens-for-next-generation-of-green-gas-engineers-at-fife-college/>

⁹⁰ <https://dundeeandangus.ac.uk/courses/imi3ev26-k-1pa/> and <https://dundeeandangus.ac.uk/courses/cchyv126-k-1pb/>

⁹¹ <https://esp-scotland.ac.uk/hydrogen-resources/>

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Table 7.13. Hydrogen-specific education and training providers continued

Provider name	Type of provider	Training provided	Location
OPITO	Industry Skills Body/Academy	Hydrogen Technology Series, Hydrogen Vocational Qualifications, Introduction to Energy Transition Qualifications & APTUS ⁹¹ which includes an Introduction to Hydrogen module	Aberdeen (UK-wide reach)
Hydrasun Hydrogen Skills Academy ⁹²	Private Provider	Hydrogen Safety Awareness, Hydrasun Hydrogen Safety Awareness – Technician Level, Hydrasun Hydrogen Safety Training – Engineering Level, Hydrogen Systems Leak Detection, Hydrogen Systems Small Bore Tubing Integration, Pressure Testing- Pneumatic Testing and Helium Leak Detection	Aberdeen
Scottish Carbon Capture and Storage	Industry Research & CPD Provider ⁹³	Introduction to Hydrogen for the Public Sector	Scotland-wide
Penspen	Private Provider	Repurposing Pipelines for Hydrogen ⁹⁴	Aberdeen
Health and Safety Executive	Regulator and training Provider	Hydrogen: The Fundamentals ⁹⁵	UK-wide (Scotland coverage)
SIAS	Private Provider	Award in the Introduction to Hydrogen Safety ⁹⁶	UK-wide (Scotland coverage)

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⁹² <https://www.hydrasun.com/full-project-lifecycle-capabilities/hydrogen-skills-academy>

⁹³ <https://sccs.org.uk/resources/education-training>

⁹⁴ <https://www.penspen.com/our-services/training-courses/repurposing-pipelines-for-hydrogen/>

⁹⁵ <https://training.hse.gov.uk/courses/hydrogen-the-fundamentals>

⁹⁶ <https://siasuk.com/awards/award-in-the-introduction-to-hydrogen-safety/>

Table 7.13. Hydrogen-specific education and training providers continued

Provider name	Type of provider	Training provided	Location
Swagelok	Private Provider	Tubing System Design Elements – Hydrogen Applications ⁹⁷	Global (training delivered in UK)
UFI VocTech Trust	UFI VocTech Trust Charitable Trust Skills Provider	Immersive Hydrogen Training ⁹⁸	UK-wide (Scotland coverage)
EPIT	Private Provider	Hydrogen Safety & Explosion Protection Awareness ⁹⁹ , Safety of Hydrogen Systems & Principles of Protection in Explosive Atmospheres ¹⁰⁰	Aberdeen

⁹⁷ <https://www.swagelok.com/en/engineering-services/training/tubing-system-training/hydrogen-application-design-elements>

⁹⁸ <https://ufi.co.uk/voctech-directory/immersive-hydrogen-training/>

⁹⁹ <https://www.epitgroup.com/product/hydrogen-safety-explosion-protection-awareness-2026/>

¹⁰⁰ <https://www.epitgroup.com/product/safety-of-hydrogen-systems-principles-of-protection-in-explosive-atmospheres-iecex-unit-ex-001-ex-011-2026/>

7.28 Across these providers, almost 50 different qualifications are delivered. Where these qualifications explicitly align with the Scottish Credit and Qualifications Framework (SCQF), these typically span SCQF levels 6-11. Alongside this, there are a number of Modern Apprenticeship frameworks that are adapting to incorporate Hydrogen National Occupational Standards (NOS) to meet zero-emission targets. Existing engineering and plumbing frameworks at SCQF Levels 5-8, particularly for 'hydrogen-ready' technologies can provide good experience to support transition into the sector.

7.29 There are also a range of introductory and beginner courses, designed to introduce learners to key concepts of hydrogen technology, safety and operations. A number of these are self-guided online learning and certificates, designed to provide initial understanding. Some of these are delivered by industry skills bodies, but others are delivered by private providers (e.g. OPITO accredited training centres and EPIT Group).

7.30 There are also a number of different industry qualifications currently being delivered by different private providers.

Table 7.14: Private industry qualifications providers

Provider name	Location
Penspen	Aberdeen
SIAS	UK-wide (Scotland coverage)
Swagelok	Global (training delivered in UK)
EPIT	Aberdeen

7.31 These are typically short-form courses that focus on specific competencies across safety, systems operation and hydrogen workplace fundamentals. A full list is provided in Appendix A.2, but competencies covered include:

- hydrogen production and energy systems – including electrolysis, fuel cells, and integration with renewable/energy systems
- hydrogen storage and transport – covering subsurface storage, pipeline/tubing design, and repurposing infrastructure
- hydrogen safety and hazard management – fundamentals, hazard awareness, ignition risks, hazardous atmospheres, and risk mitigation
- leak detection and pressure testing – hydrogen-specific leak detection methods and pressure-testing practices
- hydrogen system design and engineering – mechanical design, system principles, safety engineering, and risk management
- installation, maintenance and inspection – including Ex equipment inspection, maintenance, pipefitting, and energy infrastructure fabrication
- process safety and governance – process safety fundamentals, management, and leadership responsibilities
- competence assessment and workforce training – assessment methodologies and vocational hydrogen competencies

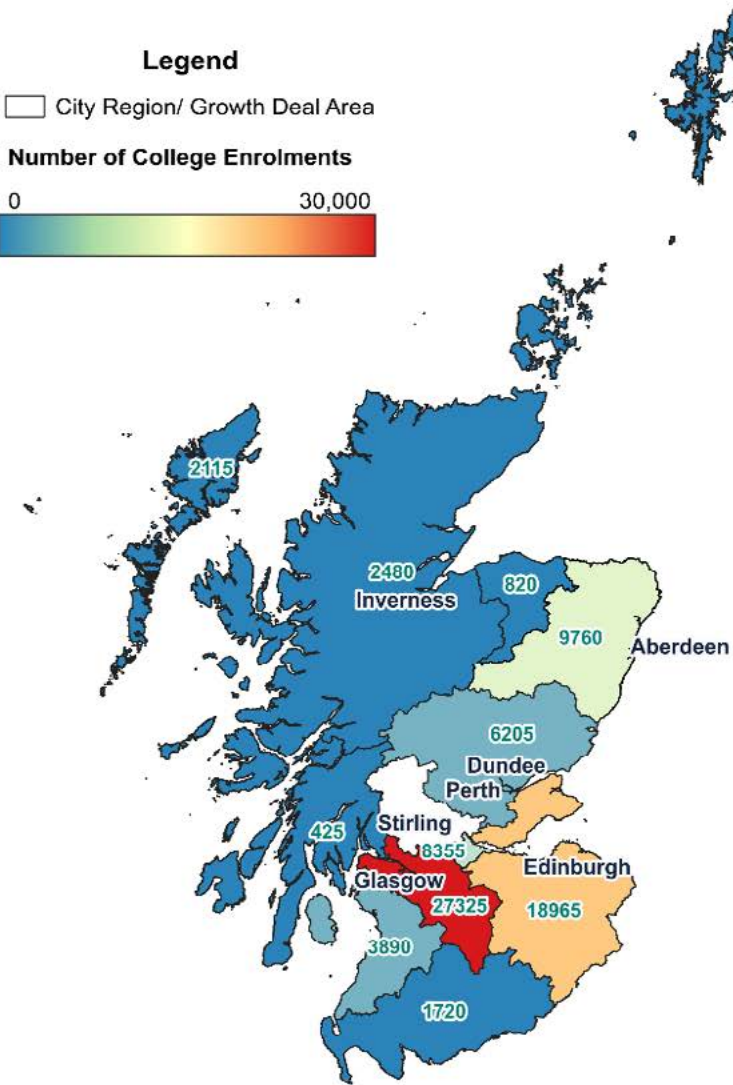
- hydrogen policy, planning and sector awareness – policy frameworks, planning awareness, and sector-specific knowledge
- cross-sector safety standards and compliance – including IECEx certification and industrial safety compliance.

7.32 While no data on student/learner numbers was available for the above courses at the time of writing, one private provider indicated that for each course they deliver, class sizes are typically no more than 12 at a time, and courses are delivered at a rate of one per month. However, this will differ depending on the provider, demand for the course, costs involved etc.

Provision heat map

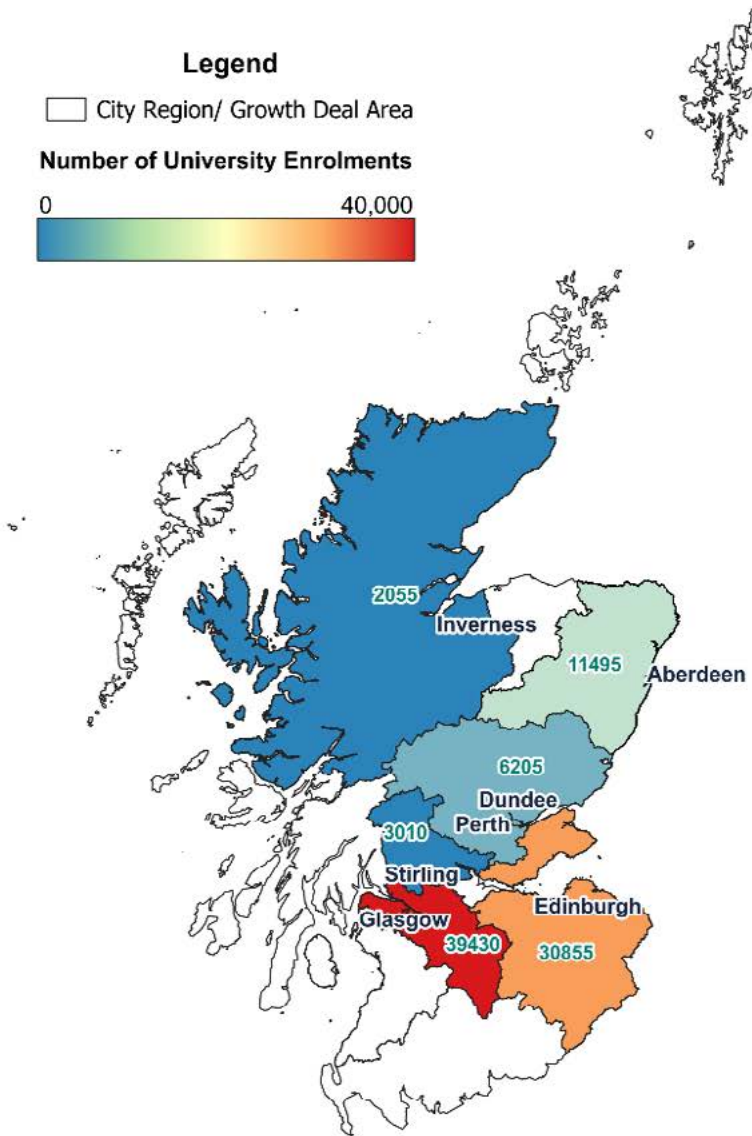
7.33 Figures 7.5-7.7 set out the scale of enrolments in hydrogen-relevant courses for FE, HE and MA provision respectively. The pattern of enrolments broadly follows population distribution throughout Scotland. Enrolment data relates to the location of the university, not the individual.

Figure 7.5: College enrolments in hydrogen-relevant courses in Scotland



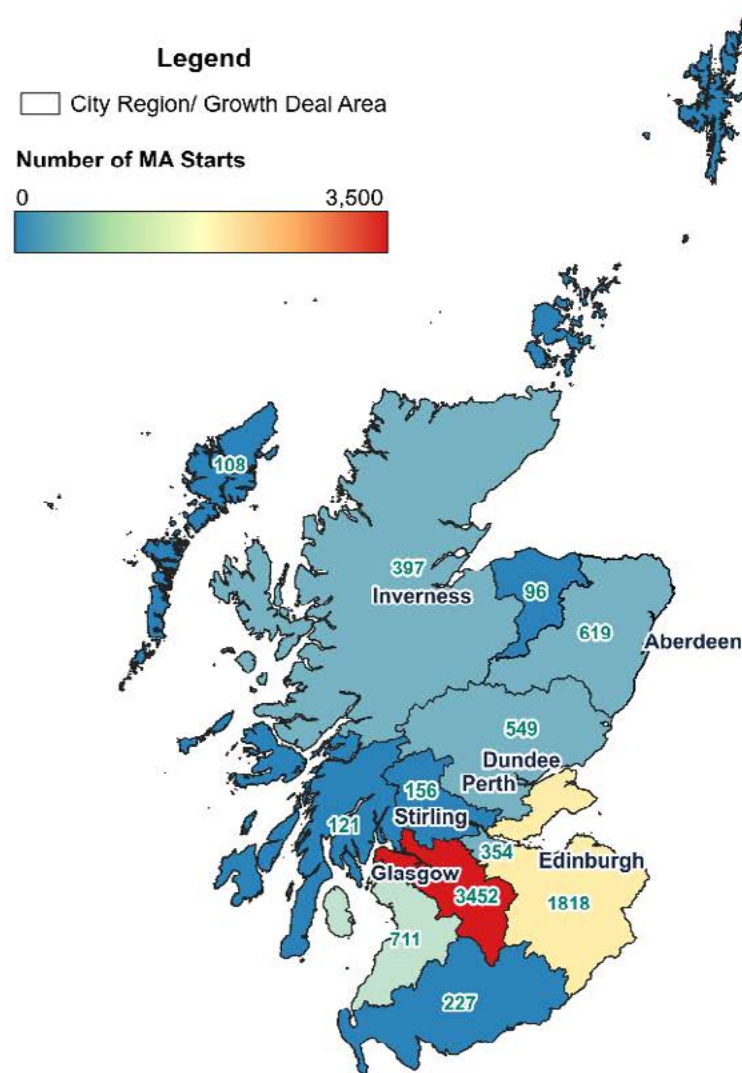
Source: SFC, 2026; white areas indicate no enrolments

Figure 7.6: University enrolments in hydrogen-relevant courses in Scotland



Source: HESA, 2026; white areas indicate no enrolments

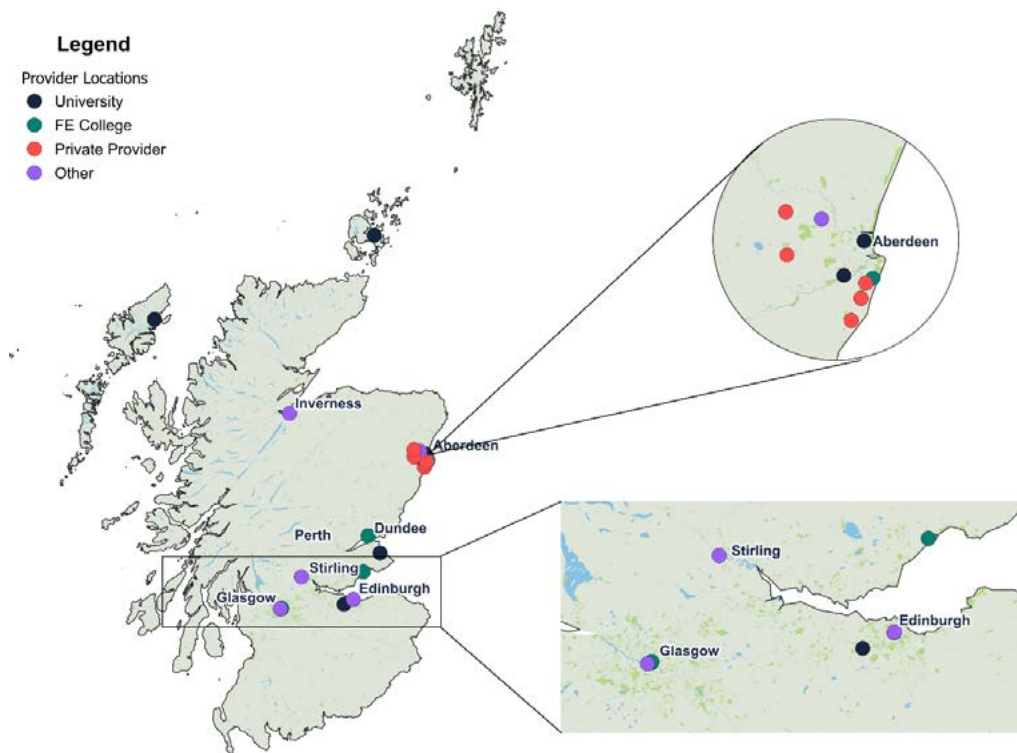
Figure 7.7: MA starts in hydrogen-relevant courses in Scotland



Source: SDS, 2026

7.34 Plotting the location of hydrogen-specific education and training provides more insight. This is set out in Figure 7.8. Current delivery is broadly aligned with the location of known hydrogen development activities at the current time.¹⁰¹ However, there are some emerging clusters of hydrogen-specific delivery in Aberdeen, Dundee, Edinburgh, Fife, and Glasgow.

Figure 7.8: Provision of hydrogen-specific education and training in Scotland



101 Location of current hydrogen projects is withheld due to uncertainty and sensitivity surrounding some developments

Summary

7.35 Overall, based on the distribution of providers engaged in delivering hydrogen-specific training and qualifications versus the location of hydrogen development projects, the evidence suggests that the current pattern of provision across Scotland and range of public and private training options should provide a good framework to support the required skills supply to service the hydrogen sector. However, as will be discussed in the Chapter 8, the lack of standards and certifications in hydrogen presents some challenges with regard to education and training.

8. Challenges in hydrogen skills provision

Introduction

8.1 The growth of hydrogen will require the right skills to be available, but it is not operating in a vacuum. Other sectors and industries will also be competing for workers with similar skillsets. While oil and gas, and related sectors, may provide a potential recruitment pathway into hydrogen, this cannot be assumed and is unlikely to be sufficient as demand grows over time. Although current demand for hydrogen-related roles remains limited, future expansion of the sector is expected to increase pressure on the available talent pool. This chapter discusses the associated challenges.

Skills shortages and challenges in meeting demand

8.2 The perspective from consultees is that there are not any hydrogen-specific skills shortages at present, over and above wider challenges with skills across the economy. Yet it is access to skills that are not necessarily hydrogen-specific (e.g. construction, engineering/fabrication, CNC machining) that could potentially impact on the development and growth of the hydrogen industry in Scotland. One consultee noted that any skills shortages they may encounter are a systemic, cross-sector issue, where the right skills, at the right time, and in the right volume are problematic. This is something that is evident in other renewable and green energy sectors, as well as in other growth sectors more broadly.

8.3 With regard to hydrogen-specific skills, despite current perceptions the position could change over time as there is more certainty and development in the sector. Also, some of the evidence included in the desk-based review suggests that there are concerns over particular roles. Being able to access the right skillsets at the right time is critical for the development of the hydrogen industry.

8.4 Nevertheless, there is a sense amongst stakeholders that sought-after skills needs for hydrogen developers can be met as the industry develops. A number of consultees felt that 'pivotal' skilled workers can easily be converted to hydrogen from adjacent sectors, where there is an element of process engineering and management. For development and construction of hydrogen production facilities, it was felt that the necessary engineering, construction and fabrication skills were easily transferable from gas, chemicals, and other process industries. As projects progress to production, then similar functions could also transition to hydrogen. Key to this, will be upskilling workers from these roles with key hydrogen safety and regulation training to ensure that their skills can be utilised in a hydrogen setting.

8.5 Elsewhere in the value chain, some specific roles were highlighted with regard to shortages. For example, design engineers for required components produced by supply chain companies (e.g. valves, gauges, pipework, etc.) and the ability to test both components and systems. One specific shortage of skills highlighted was CNC (computer numerical

control) machine operation/engineering to create required components for hydrogen systems. This requires digital skills as well as process engineering skills.

- 8.6** For downstream applications and uses of hydrogen, e.g. in domestic heating, it is possible that the required skilled workers are already there, and their skillset can be updated through top-up upskilling to layer on hydrogen specific skills and knowledge – the hydrogen ‘delta’ skillsets discussed in Chapter 3. This is what several consultees cited as the critical additional requirement – hydrogen awareness and understanding of its behaviour, how quickly it disperses, and how that affects safe operation and maintenance.
- 8.7** However, there was a consensus amongst consultees that this is a certification and standards issue, rather than one of skills shortage. In the immediate term, skills and knowledge of hydrogen handling can be addressed through short course provision focusing on hydrogen safety and hazard management. Whilst hydrogen-specific standards are still evolving, there is a degree of uncertainty, but for how certain tasks or functions should be performed rather than around a lack of skills, i.e. a consistency challenge. Once standards and certifications are established for hydrogen, then (re)training workers entering the sector is not considered by consultees to be problematic.
- 8.8** Without an established set of industry standards for hydrogen, then there is a degree of employers – and education and training providers – not fully knowing what they are training or providing qualifications for. Cogent Skills have led on the development of a suite of National Occupational Standards (NOS) for hydrogen. However, the

view presented by consultees was one of industry standards, and it is anticipated that an established set of industry standards will help to augment and refine training provision, and possibly the NOS themselves.

- 8.9** It is also worth noting that the Hydrogen Skills Framework developed by Cogent Skills and the Hydrogen Skills Alliance is directly contributing to this augmentation and refinement. The framework is a structured roadmap designed to map workforce competencies, support training, and guide curriculum development for the growing UK hydrogen sector. It tackles the critical training benchmarks needed to meet net zero targets and build a safe, future-ready clean energy workforce, and outlines the specific skills, competencies, and training pathways required across the hydrogen value chain. In doing so, it provides a reference point for employers and education and training providers to build training pathways and assess workforce readiness.¹⁰²
- 8.10** An additional concern is that early projects may be too small individually to sustain dedicated operation and maintenance teams once production commences. This, however, is not a shortage challenge; it is more one of the (small) scale of projects, and the ability to sustain a dedicated workforce for each. This could be resolved through a shared hub or regional team model in the first instance. This is something that has been proposed or piloted for other industries. For example, the Moray Shared Apprenticeship Scheme was a localised pilot model designed to train young people in food and beverage services. It allowed apprentices to develop their SVQ Level 2 or 3 by splitting their working hours between two or more local hospitality employers.¹⁰³ Similar schemes operate elsewhere in the UK, such as the Cyfle

¹⁰² [Hydrogen Skills Alliance \(2025\) Hydrogen Skills Framework](#)

¹⁰³ <https://www.moray.gov.uk/jobs-and-employment/employability/moray-shared-apprenticeship-scheme/>

Building Skills Shared Apprenticeship Scheme¹⁰⁴ and Aspire Shared Apprenticeship Programme¹⁰⁵ in Wales, or the East Bank Shared Apprenticeship Programme in London.¹⁰⁶

- 8.11** A small number of consultees noted the cost of taking on apprentices was an increasing challenge for smaller companies. A shared apprenticeship model could be considered, however, these are not without their challenges.
- 8.12** An additional point of consideration is that there is typically an ageing workforce within potential 'feed' sectors (e.g. engineering). Workers that could upskill and pivot to hydrogen may be older, and it was suggested by at least one consultee that there may not be motivation to do so. However, other avenues for capturing the skills and expertise of older workers may be possible, such as through a mentoring approach.
- 8.13** Finally, some consultees noted that there were synergies between what is happening in Scotland, and the rest of the UK. The nascency of the hydrogen industry meant there was a need for consistency in all aspects of development, including approaches to skills development. It was suggested that one advantage of this was that the rest of the UK could potentially help to meet any skills shortages here by providing labour, supporting the delivery of training, or identifying best practice or learning for wider application in the Scottish market, given the scale of the opportunity in Scotland.

Skills supply challenges

Education and training

- 8.14** As noted above and reported by consultees, the current situation regarding the reported lack of consistent and accepted standards for hydrogen (but recognising the development of NOS for hydrogen) means that there is a perception that there is a limited extent to which education and training can respond to and anticipate the needs of hydrogen developers. Though existing provision provides a relatively strong pipeline of skilled education leavers, and in locations broadly aligned to the current siting of hydrogen projects, the constraining effect of uncertainty in the industry, and lack of clarity amongst industry actors on agreed standards, means that education and training providers may be challenged in tailoring delivery, and responding to industry need as hydrogen production develops in Scotland. However, as the NOS, Hydrogen Skills Framework and hydrogen-focused qualifications become more established and awareness of these increases, this situation may change.
- 8.15** However, some consultees were of the view that the education and training available currently is of the right kind, as far as it can be (acknowledging that the current suite of available qualifications may need to be tailored as and when there is greater consensus on industry standards).
- 8.16** There is a greater demand for more experienced workers, versus skilled sector entrants, though the latter will be required so that a pipeline of talent can satisfy the need to build expertise. This raises a question of how to

¹⁰⁴ <https://www.cyflebuilding.co.uk/cyfle-building/shared-apprentice-scheme/>

¹⁰⁵ <https://www.cardiffcapitalregion.wales/news-events/latest-news/the-week-to-shine-a-light-on-ccrs-shared-apprenticeships/>

¹⁰⁶ <https://workwhile.org.uk/east-bank-apprentice-information/>

deliver education and training for young people and new labour market entrants and also build in the necessary live experience that employers are increasingly seeking, indicating the need for collaboration between industry and academia surrounding forthcoming opportunities. This is not something unique to hydrogen but is common across renewable energy and related sectors. This is compounded by the fact that as we transition away from oil and gas, the sector is likely to decline and take on fewer apprentices who are set up with the experience to transition into hydrogen. An over-reliance on drawing the required experience from oil and gas could lead to a skills gap as the sector declines.

These challenges can typically be addressed by a high degree of work-based or project-based learning for FE/ HE students and apprentices, and ongoing supervised operational experience as education leavers (and apprentices) enter the workplace. Other solutions can include secondments or other arrangements to allow workers from other industries to work on hydrogen projects, to build understanding of hydrogen behaviour and awareness of industry challenges, and to make any transition much easier. Similarly, co-opetition amongst hydrogen developers with regard to sharing learning from live projects is critical for navigating the inconsistency that arises from evolving and yet-to-be-agreed standards.

- 8.17** However, the discussions with consultees indicated that education and training providers were able to respond to the needs of hydrogen developers, even if the lack of certification standards were impacting on the extent to which this could be achieved, and the degree of uncertainty in the industry currently was constraining the extent to which available training may be being taken up. As an

example of this, one consultee noted that training on hydrogen safety and hazard management was recently being offered free of charge by a private training provider to hydrogen supply chain companies, and yet this was not taken up at all. This is considered by stakeholders to be indicative of the lack of clarity in strategic direction being set for the industry by government, and the consequent (limited) market for hydrogen education and training.

- 8.18** Finally, there was some recognition of the need to build the longer-term pipeline of skills to meet anticipated future demand. One consultee recognised the need to engage with schools including late primary school pupils in addition to secondary pupils as well as college and university students. Again, this is not unique to hydrogen skills and is common across renewable energy technologies as well as sectors that rely heavily on STEM skills. It also demonstrates the longer-term challenges in supplying sufficient skills if the known pipeline of hydrogen projects and other projects in adjacent sectors comes to fruition.

Industry-driven challenges

- 8.19** As noted elsewhere in this chapter, and in other parts of the report, there is a lack of certainty and confidence in the industry. The consensus amongst consultees was that this partly lay with government (UK, Scottish and to a certain extent local), and the perceived lack of strategic direction and certainty through policy and funding instruments for the hydrogen industry. This has resulted in some schemes being paused and put on hold. This is not confined to smaller developers. For example, Scottish Power halted all of its hydrogen projects in the latter part of 2025, including

its Whitelee project and a joint venture with Storegga in Cromarty (though it should be noted that this latter project has recently been acquired by Protium¹⁰⁷), citing “challenging conditions and a limited route to market”.¹⁰⁸ The Whitelee project was to supply transport and industry, while offtake for Cromarty included whisky distilleries.¹⁰⁹ This included two Hydrogen Allocation Round 1 (HAR1) -supported projects with grants.

8.20 Some consultees suggested that the HARs have not had desired effect. Initial delays to awarding meant that some awarded schemes have now been withdrawn as a result of changing market conditions. It was noted that only around half of awarded HAR1 projects were moving forward, and of a target capacity of 250MW, less than half that capacity was progressing. Under HAR2, there were more applications, and the round was oversubscribed, but it is understood that there were issues with signing up to contracting structure under HAR2, resulting in further delays.

8.21 For some consultees, there was also a need for strategic direction on hydrogen applications and end uses. One consultee suggested that the hydrogen industry was very supply-driven at the moment – that is, there was a need to generate a solution to the considerable supply of curtailed energy. Consequently, it was argued, there needed to be more focus on end uses for hydrogen, a more demand-led approach for innovation and sector development. Any lack of demand-led considerations – beyond hydrogen export opportunities¹¹⁰ – would necessarily constrain the

development of end-use markets for hydrogen, and in turn opportunities for hydrogen developers, and demand for skills. One consultee’s perspective that taking a demand-led approach would be relatively easy, since hydrogen was a very flexible and versatile energy vector with a wide range of applications.

8.22 Some consultees indicated that the hydrogen market is smaller than expected compared with projections from five years ago. It was also suggested that the hydrogen market has also fallen short of expectations set in last year’s hydrogen supply chain report. In addition, it was suggested that developments coming forward were perhaps at the smaller end of the scale than was originally anticipated. Some education providers have suggested a perceived recent decline in hydrogen development in Scotland has reduced the demand for specialised hydrogen training. The risk here is that without the potential for developments at scale, then sufficient demand for skills, and the commensurate demand for education and training, would not be generated. At the same time, it was noted that some companies are helping other nations in developing their hydrogen technology and industries – indirectly contributing to increasing competition from other markets.

8.23 Also, there was a view amongst consultees that battery technology has improved quicker than expected. The issue of electric vehicles (EVs) and apparent advances in battery technology was highlighted, with particular reference to the shift in Aberdeen from hydrogen to EV for the public fleet.¹¹¹ However, some consultees argued that hydrogen is

¹⁰⁷ <https://protium.green/protium-secures-storegga-scottish-portfolio/>

¹⁰⁸ <https://fuelcellsworld.com/2025/09/02/news/scottishpower-shelves-uk-hydrogen-projects-despite-securing-subsidies-in-har1>

¹⁰⁹ <https://www.spglobal.com/energy/en/news-research/latest-news/energy-transition/090225-scottishpower-halts-hydrogen-project-developments-in-challenging-market>

¹¹⁰ <https://www.gov.scot/news/realising-scotlands-hydrogen-potential/>

¹¹¹ <https://www.bbc.co.uk/news/articles/cnv6e5l588jo>

a better option for transport, stating that it is more efficient, and more aligned with existing (hydrocarbon) fuel systems and infrastructure – and thus more sustainable in the longer term. Also, short term opportunities for hydrogen with construction vehicles (which are unsuitable for EVs) was highlighted.

- 8.24** The critical point here is that without certainty, developers will not commit, and demand for skilled hydrogen workers will be lower. Education and training providers will not speculatively develop courses/content where there is no evident demand, and this is especially problematic when certain aspects of the market for hydrogen are not already in place – such as the export market for hydrogen. This is somewhat compounded by the lack of clarity on industry standards for equipment and training. Greater certainty will help set the direction for companies, and thus their training and skills requirements.
- 8.25** Because of the nascency of the hydrogen industry, there is a limited supply chain, and thus a concentration of expertise in certain parts of the hydrogen value chain. This means that there is a need for external expertise to be brought in by some parts of the sector (and thus a constraint on the supply of skills), since there is limited scope to develop the required skills internally in the short term. For some businesses, this impacts on the awareness regarding key issues – skills needs, safety and regulatory requirements that require training, etc.
- 8.26** Consequently, the combined issues set out above mean that to a degree, it can be argued that the hydrogen industry does not fully know what skills it needs, and at what point.

It can be complex to forecast what workforce and skills be required and when. The scenario-based planning can be used as a tool to support workforce planning in the meantime but must be used alongside real-time project pipeline information.

- 8.27** One solution to this would be increased engagement and collaboration between hydrogen energy companies and education providers. Co-ordinated joint working at a strategic level is critical to address what is fundamentally a market failure. In addition, consultees felt that skills planning and training development needs to be grounded in real delivery experience, not theory. Thus, organisations working on hydrogen projects currently should be directly and actively engaged in the development on training and skills frameworks.
- 8.28** As with other issues raised in this report, it is something that is not unique to the hydrogen sector, yet it is acknowledged by stakeholders and consultees that more engagement is needed, with adjacent sectors providing good practice examples. For example, the Acorn Project's Scottish Cluster for carbon capture and storage, brings together academia, industry partners and skills organisation OPITO to align skills with the workforce, and anchor provision in upcoming project timelines.¹¹² This would facilitate the exposure of academia and education and training providers to specific industry challenges on understanding education needs, and also open up industry to up-to-date research and innovation. Greater levels of knowledge exchange in this regard will only be beneficial to sector development, and tailoring education and training to industry needs in a proactive and flexible way.

¹¹² <https://theacornproject.uk/scottish-cluster>

External challenges

8.29 As discussed, it cannot be assumed that the Scottish hydrogen workforce can be built by transferring existing skills from oil and gas. Hydrogen will be competing for these skilled workers with other renewable energy sectors that are also growing. Compounding this, oil and gas is a high paying sector and any sector that does not meet salary levels and other terms and conditions will find it difficult to attract people. Some estimates suggest that, despite recent growth, those working in clean energy sectors still earn 15% less than oil and gas counterparts globally.¹¹³ Even if oil and gas declines in Scotland, it is a very international sector with opportunities to work in other parts of the world and so it cannot be assumed that workers would seek to change to hydrogen in order to remain in Scotland.

8.30 As well as not being able to rely on utilising skills from oil and gas, hydrogen will be competing with other growth sectors and industries such as land-based and offshore wind. There will be competition for construction and engineering skills, as well as skills for operation and maintenance. Hydrogen must be seen to be an attractive, stable and positive career choice if it is to recruit and retain staff. Other sectors will be doing the same. Whilst this is an issue for each sector, it also offers an opportunity for a strategic approach to skills planning that will focus on ensuring that aligned growth sectors have the skills they need. This may require a co-opetition approach, where competing employers and sectors work together to address common challenges.

8.31 Finally, consultees raised the issue of electricity pricing and argued that hydrogen is held back by the way electricity is costed and charged for in the UK – and that it is more costly in Scotland than elsewhere in the UK. It was suggested that the biggest challenge for the development of hydrogen, and thus for the demand for and supply of skills, will continue to be the electricity price, which continues to be more challenging in Scotland in the absence of regional pricing. Thus, cheaper hydrogen in countries such as Morocco¹¹⁴ where production costs are lower would be at a competitive advantage.

Summary

Education and training

8.32 This chapter has set out a range of challenges regarding skills supply for the hydrogen industry. It is clear that the industry requires workers to have or to quickly develop hydrogen-specific skills – the hydrogen ‘delta’. There are largely no hydrogen-specific skills shortages yet, but developers face broader systemic skills challenges across engineering, construction, digital skills, etc. in line with other renewable and growth sectors. Meanwhile, hydrogen competes for talent with oil and gas, offshore/onshore wind, and other renewable energy technologies, all seeking similar technical skills. While oil and gas retains an advantage due to higher pay and global mobility, hydrogen will face challenges in attracting workers to transition from this sector.

¹¹³ <https://www.pinsentmasons.com/out-law/news/global-energy-labour-market-thriving>

¹¹⁴ <https://gh2.org/countries/morocco>

- 8.33** Ensuring the establishment and awareness of hydrogen standards and certification is a considerable challenge for hydrogen skills provision. There is a developing suite of NOS for hydrogen roles which are being prepared by Cogent Skills, complemented by the Hydrogen Skills Framework. Despite this, employers cannot fully articulate the full extent of what to train for, and this will impact course development by providers, and thus uptake, despite the availability of training (as set out in Chapter 7).
- 8.34** Industry uncertainty is considered to be suppressing skills demand. The consensus amongst consultees was that this is being driven by a range of factors including paused or withdrawn projects, delays in Hydrogen Allocation Rounds, unclear strategic direction within government, and competition from rapidly advancing battery technologies. Nonetheless, hydrogen's flexibility as an energy vector means that better stimulating and articulating the demand for end-uses can create a more stable driver for hydrogen production.
- 8.35** Small or early-stage projects may struggle to sustain dedicated teams given their scale and available resource. One solution may be the use of shared regional or 'hub' operation and maintenance or apprenticeship models – though this would impact on the skills demand factors outlined in the scenario modelling presented in Chapter 5.

9. Conclusions and recommendations

Introduction

9.1 The study has generated a great deal of data, insights and findings on the skills needs, pipeline and challenges for the development of a strong hydrogen sector in Scotland. This chapter provides the conclusions drawn from the research along with a set of recommendations for hydrogen skills planning and resourcing.

Conclusions

9.2 There is no doubt that the hydrogen economy is a significant opportunity for Scotland. It has potential to contribute to economic growth and be a key component in Scotland achieving its net zero targets and a just transition. It could provide a substantial number of jobs across a range of occupations, roles and skills areas.

9.3 The current hydrogen workforce is estimated to be in the region of 500 FTEs currently. However, it is anticipated that this could scale up significantly if the sector develops. Strong demand could emerge for experienced workers and specialist technical skills across the hydrogen value chain, and within the different component parts and job families required for hydrogen production.

9.4 Expanding the sector brings workforce challenges, with consultees citing uncertainty in the sector caused by lack of strategic direction at government level having a knock-on effect on project timelines and likelihood. Also,

sector expansion brings challenges for supply chains and competition for talent across other green industries. While Scotland's existing industries – and specifically oil and gas, industrial gas production, engineering, etc. – have the potential to provide a strong base of transferable skills, demand for specialist and hydrogen specific capabilities has shown some signs of growth. However, some education providers have suggested a perceived recent decline in hydrogen development in Scotland has reduced the demand for specialised hydrogen training.

9.5 Existing education and training provision offers a good pipeline of skilled education leavers across subjects of relevance to hydrogen, and delivery of specific hydrogen courses and qualifications is well-aligned geographically with the pattern of hydrogen development projects in Scotland currently.

9.6 If Scotland is to realise the benefits of hydrogen, there must be the right skills available to fuel its development and growth. Hydrogen will be competing with a range of different sectors, many in the renewables space, for skilled and experienced workers. Success will depend on coordinated workforce planning and close collaboration between government, industry and the skills system: to ensure the right skills, including hydrogen delta skills, are available where and when they are needed; and to provide the opportunity for workers to pivot across different renewable sectors, with pathways and structures to do this.

9.7 Consultations suggested there is also caution and a perception of higher risk due to the degree of uncertainty in the industry, at least partly attributed to a lack of clear strategic direction within government. Without greater certainty and strategic commitment to hydrogen as part of the energy mix in the UK, skills planning will be problematic.

Recommendations

Recommendation 1: Evidence-led skills planning

This research has identified the skills needs of the hydrogen sector in Scotland based on the two scenarios. This should underpin the current approach to skills planning and resourcing in Scotland. Whilst this report provides information available during the research period, this is a changing sector and the timeline for projects and hydrogen sector developments as they progress and are announced will very likely change, and in some cases be delayed. This is not specific to hydrogen, for example there are similar issues in major projects in land-based renewable energy generation and for offshore wind and other marine energy.

Ongoing skills planning should continue to be evidence-led, based on the project pipeline and the development of the sector. This will require good quality data collection and analysis and up-to date information from industry on current and projected skills needs. The Scottish Hydrogen Skills Group should lead on actions to continuously develop the hydrogen skills evidence base. It is therefore recommended that the need for skills is reviewed regularly by the group, and updated and used proactively by all relevant partners, including industry in this as much as possible to ensure opportunities to learn from live hydrogen projects.

Recommendation 2: Education-industry partnerships

As well as information from industry about their current and projected skills needs, employers in the hydrogen sector should be involved in developing the skills pipeline through partnerships with education, from primary through to secondary and tertiary provision. There are some very good examples of these types of education-business partnerships in other sectors, for example land-based services, and carbon capture and storage, as well as financial & professional services, oil & gas, and STEM industries more broadly.

This can involve: delivering industry-related activities schools and colleges; providing study visits and work placements; offering CPD for teachers and lecturers around key developments in the hydrogen sector; supplying hydrogen-related materials for teaching staff to use in classwork; providing experiential careers learning opportunities; and sponsoring events. While educating students on potential roles, there also needs to be transparency about the lack of certainty surrounding the sector while highlighting transferability of skills across different renewable energy disciplines. The focus should be on building technical skills that can pivot depending on how different clean energy technologies progress.

Recommendation 3: De-risk investment in skills development

Lack of certainty of what skills will be needed and when can be a significant barrier to investment in skills and learning. For example, the college sector may be reluctant to develop and provide course content if the requirement for these skills is not confirmed and needed in the short term. Similarly, employers in the supply chain will be unlikely to invest in staff development, or recruit for these skills, if there is no certainty on there being a need. Added to this, potential learners and recruits to the sector, including people who influence their decisions, will be reluctant to commit to specialist learning and development if there is no assurance of reliable employment using them.

Investing in skills development for education, employers and workers must be de-risked and this is likely to require public-sector support and collaboration. This may include: co-creation of curriculum or course content informed by detailed intelligence gathering and horizon scanning for emerging industry and business need; maximising the use of skills partnerships and hubs, to match public investment with private sector insight to avoid skills mismatches; co-investment between industry and academia as and when there is a clear requirement; and use of pilot programmes to test and validate course delivery ahead of wider-scale roll-out.

Recommendation 4: Upskilling, reskilling and repurposing

The demand for skills will not be met by any one route and will likely require a mix of new entrants to the labour market, career changers, and repurposing from other sectors. Hydrogen will also be competing with other sectors for these staff and so the sector must ensure it is attractive to potential recruits.

Skills planning will have to consider how new entrants can be prepared with the skills needed, for example through work-based learning, FE and HE. However, there should also be mechanisms in place to enable career changers to acquire the skills they need for a career in the hydrogen sector. This might include short courses, boot camps and micro-credentials. Another potential route for recruitment will be pivoting and repurposing workers with the right skills from other sectors.

This could be through a skills passport or similar mechanism (though recognising that currently hydrogen-focused roles are not at a sufficiently high scale to be included in the existing Energy Skills Passport). In practice, this could see skills mapping done across workers in adjacent sectors to identify their transferability, with qualifications or skills passports provided, and top-up training provided to ensure the hydrogen delta is addressed. Secondments and project-specific placements can also play a role here.

Repurposing skills will require hydrogen to be an attractive option, for example competitive terms and conditions, and well-articulated career pathways. It must be recognised that whilst the oil and gas workforce has valuable skills with application in hydrogen, oil and gas is well paid and international, and it may be hard to extract workers from it into hydrogen.

Recommendation 5: Work-based learning

Work-based learning for the skills required by the hydrogen sector is a very important and valuable pathway that must be harnessed to help ensure there is a strong pipeline of skills. This will include ensuring that employers in the sector have the information they need across the relevant frameworks and how they apply to hydrogen. While the apprenticeship frameworks provide experience for energy sectors, consideration should be given to how hydrogen-specific skills can be incorporated to increase readiness to work in the sector.

Pathways for hydrogen work-based learning should be aligned with project timelines and consider regional industrial partnerships to allow smaller projects and employers to employ apprentices. Existing qualifications and frameworks could be mapped onto the skills needs and any gaps identified and resolved, taking into consideration the National Occupational Standards for hydrogen. This should be undertaken in close partnership with industry for both the construction and operation phases.

Recommendation 6: Sector attractiveness

As discussed, to attract talent, a career in hydrogen must be seen to be an attractive option. It will therefore be important to promote and clearly articulate the career opportunities presented by hydrogen to potential recruits including school leavers, career changers, and through employability support providers. The opportunities should also be articulated to people who influence the career choices of others, such as careers advisers, parents and carers, teachers, and education providers.

Key to making the sector an attractive career option, there must be certainty (as set out at Recommendation 3) that people who develop the skills and enter the sector will have long-term job security, from when they are ready to work. Given the current position in hydrogen and the potential changes in the project pipeline and timings, it is recommended that through training and learning, potential recruits to hydrogen are provided with a set of transferable skills that are to some extent energy-sector agnostic and so can be applied elsewhere in the economy to provide reassurance and continuity of employment.

Recommendation 7: Strategic skills planning

It is clear that hydrogen will be competing for skills with other sectors and although this is challenging, it is an opportunity for a strategic approach to skills planning across a cluster of sectors that will have the same, or very similar skills needs. This would involve organisations involved in skills planning to take a 'multi-sector' approach, demonstrating how skills can be applied in different sectors to the benefit of individuals, employers and sectors. This would also mean employers in hydrogen and other sectors being prepared to work co-operatively to achieve common goals.

Recommendation 8: Equality, diversity and inclusion

All skills planning, resourcing and development should be underpinned by a commitment from all partners to ensure that the opportunities are fairly distributed. As a new energy sector, hydrogen presents an opportunity to take a fresh approach to building a wholly balanced, inclusive and diverse workforce. Scotland, in common with the rest of the UK, is facing a challenge of persistent economic inactivity driven by a range of factors for example physical and mental ill-health, and caring responsibilities. In line with equality, diversity and inclusion measures being taken in other sectors as part of skills planning and to provide an equitable range of pathways into the hydrogen industry, with the right support and training, hydrogen has the potential to offer good quality employment for people who are economically inactive, as well as for people from under-represented groups.

Appendices

A.1 Technical note on scenarios for skills demand

Overview

This technical note sets out the approach to preparing the scenarios of skills demand for hydrogen production in Scotland. The analysis and modelling undertaken to prepare the scenarios was based on information contained within the Hydrogen Economy Research: End-to-End Supply Chain Map report produced by Arup in August 2025, on behalf of Scottish Enterprise.¹¹⁵

It should be stressed that these scenarios are purely for illustrative purposes only, to demonstrate the range of potential skills demand from development of the hydrogen sector, as the pipeline of planned hydrogen schemes in Scotland comes to fruition.

The archetypes

Arup's research and analysis detailed the end-to-end supply chain requirements of two hydrogen project archetypes: one small scale, typically of 10-20MW generation capacity, and one large scale, typically of 400-600MW generation capacity.

Based on Arup's modelling, the key metrics for each archetype are set out in Table A1.1.

Table A1.1: Hydrogen production archetype overview

Small archetype	Large archetype
■ Capacity: 10-20MW production facility ■ c.30-month development and construction period ■ c.20+year operational lifespan ■ c.295 jobs required across all life cycle stages • Development: c.85 jobs • Construction: c.116 jobs • Operation: c.50 jobs • Decommissioning: c.44 jobs	■ Capacity: 400-600MW production facility ■ c.48-month development and construction period ■ c.20+year operational lifespan ■ c.641 jobs required across all life cycle stages • Development: c.148 jobs • Construction: c.264 jobs • Operation: c.125 jobs • Decommissioning: c.105 jobs

Source: Scottish Enterprise/Arup (2025)

¹¹⁵ [Scottish Enterprise/ARUP \(2025\). Hydrogen economy research end-to-end supply chain map](#)

Each archetype was supported by a full supply chain matrix, which detailed role requirements and equipment specification, broken down by supply chain element, sector, sub-sector and

component, and also by project stage. These are detailed in Table A1.2.

Table A1.2: Hydrogen production archetype overview

Supply chain elements	Supply chain sectors	Supply chain sub-sectors	Project stage
Service Products Solutions	Engineering Project management Professional services Equipment Engineering solutions End use solution Logistics Site	Design management Electrical design Process design Geotechnical design Mechanical design Civils design Procurement Project co-ordination Stakeholder management Owners engineer CDM Management Project finance Health and safety Insurance Legal Planning, permitting, consenting and regulation Key equipment Ancillary equipment Water Electricity Other Manufacturing Installation/assembly Construction/ commissioning O&M Decommissioning Supply to offtakers Equipment delivery Software Site preparation Security Labour Waste management Safety	Development Execution (Construction) Lifetime (Operation) End of life (Decommissioning)

Modelling employment requirements

For each scenario, a flat rate of development was assumed. In each case, it was assumed that some development was already underway, and that some hydrogen production facilities would come online in 2026. On this basis, a consistent rate of generation capacity was assumed through to 2045, to achieve the stated Scottish Government target of 25GW of hydrogen production in that period.

For the modelling, it was also assumed that:

- The balance of small and large-scale facilities (under scenario 1) that commence development is largely consistent year-on-year.
- The assumed timescales for development and construction – 30 months for small-scale, 48 months for large-scale – are uniform and consistent for all projects. In the absence of any other evidence, no delays were assumed for project timescales.

A cumulative total of jobs per calendar year was arrived at, based on the number of projects anticipated to be under way, or at the operational phase in any one calendar year. No adjustment was made for potential 'sharing' of jobs through a 'hub' or regional approach as was suggested during consultations.

All modelled employment requirements are the result of GC Insight analysis, based on information contained within the Arup report.

Caveats

For the developed scenarios, the following caveats apply:

- The job requirement covers development/construction and operation and maintenance only. Given the likely lifespan of hydrogen production facilities, no decommissioning requirement is expected before 2045.
- As is the case for nearly all sectors, the jobs during the development and construction phases of hydrogen projects will necessarily be time-limited, and the requirement of these will decrease as projects move towards their operation and maintenance phases.
- In all likelihood, many construction jobs identified will be duplicates and should therefore not be considered unique workers or FTEs. That is, these jobs will likely be fulfilled by the same individuals moving from one contract to the next in any given calendar year, and across calendar years. So, for development and construction, these jobs should be seen as instances of employment that can be fulfilled multiple times by one individual worker.
- Though some economies of scale are built into the Arup supply chain modelling, no other economies of scale are assumed in the skills demand modelling presented here, in the absence of evidence to suggest how this may manifest. For example, in practical terms, the same developer building multiple schemes may realise economies of scale over a number of development sites.
- No efficiency gains over time have been built into the estimates, such as processes getting more streamlined or automated, and thus requiring fewer staff at various stages.

- In addition to the above, no assumptions have been included on future technological advances – e.g. shortened timescales for development, increases in possible generation capacity for hydrogen production facilities, and so on.
- No judgment has been made on what may be realistic – that is, the scenarios have been developed on the basis of the stated Scottish Government target of 25GW by 2045, and flat rate of annual completion of installed capacity to achieve this.

A.2 Hydrogen qualifications mapping

Table A2.1 Hydrogen-specific education and training providers

Provider name	Type of provider	Location
University of Strathclyde	University	Glasgow
University of Aberdeen	University	Aberdeen
Robert Gordon University	University	Aberdeen
University of St Andrews	University	St Andrews
Heriot-Watt University	University	Edinburgh
University of the Highlands and Islands	University/FE College	Stornoway/Orkney
Fife College	FE College	Fife
North East Scotland College	FE College	Aberdeen, Fraserburgh
Dundee and Angus College	FE College	Dundee
Energy Skills Partnership	Industry Skills Body/Academy	Scotland-wide
OPITO	Industry Skills Body/Academy	Aberdeen (UK-wide reach)

Provider name	Type of provider	Location
Hydrasun Hydrogen Skills Academy	Private Provider	Aberdeen
Scottish Carbon Capture and Storage	Research & CPD Provider	Scotland-wide (Edinburgh-based partnership)
Penspen	Private Provider	Aberdeen
Health and Safety Executive	Regulator and training Provider	UK-wide (Scotland coverage)
SIAS	Private Provider	UK-wide (Scotland coverage)
Swagelok	Private Provider	Global (training delivered in UK)
UFI VocTech Trust	Charitable Trust Skills Provider	UK-wide (Scotland coverage)
EPIT	Private Provider	Aberdeen

Table A2.2 Hydrogen-specific courses and qualifications.

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
MSc Advanced Mechanical Engineering (Hydrogen Applications Modules)	HE	SCQF 11	Full-time / Part-time	University of Strathclyde	Internal + industry collaboration	1 year FT / 2–3 PT	Hydrogen systems; thermodynamics; mechanical design	Graduates / professionals
MSc Energy Transition Systems	HE	SCQF 11	Full-time / Part-time	University of Aberdeen	Internal + industry collaboration	1 year FT	Hydrogen production; energy systems; policy	Graduates / professionals
Hydrogen Energy Systems	HE Short Course	SCQF 11	Online	Robert Gordon University	University-developed		Hydrogen production, storage and energy systems	Professionals / postgraduate learners
Institute of GeoEnergy Engineering – Hydrogen & Storage Modules	HE	SCQF 11	Full-time / Part-time	Heriot-Watt University	Internal + Industry collaboration	1 year MSc	Subsurface hydrogen storage; reservoir engineering	Graduates / professionals
Masters Courses (Hydrogen-related Modules)	HE	SCQF 11	Full-time / Part-time	University of Edinburgh	University-developed	1 year	Hydrogen energy; geoenergy; sustainable systems	Postgraduate students

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Introduction to Renewable Energy – Hydrogen	HE Short Course			University of Aberdeen	University-developed		Hydrogen installation; maintenance; safety	Students / professionals
Hydrogen Engineer Training	FE / Industry Cert	Industry (BPEC / IGEM aligned)	Blended	Fife College	Industry-led	Short course	Hydrogen installation; maintenance; safety	Gas engineers / technicians
Engineering Construction Modern Apprenticeship	Apprenticeship	SCQF 6–7	Work-based + college	North East Scotland College	SDS framework development + industry-led (ESP collaboration); qualification awarded by Qualifications Scotland	3–4 years	Fabrication; pipefitting; energy infrastructure	Professionals / postgraduate learners
Modern Apprenticeships (Hydrogen NOS integration)	Apprenticeship	SCQF 5-8	Work-based	FE Colleges and employers across Scotland	SDS framework development; qualification awarded by Qualifications Scotland		Engineering maintenance; Hydrogen competencies	Graduates / professionals

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
PDA Hydrogen: An Introduction for Technicians	FE Qualification	SCQF 7	Part-time / blended	UHI North, West and Hebrides (Lews Castle College, Stornoway)	Industry consultation	5-12 months	Hydrogen production, storage, transport, safety	Postgraduate students
Safe Hydrogen Gas Handling	Qualification	SCQF 6	Blended	FE colleges (provider varies)	Qualifications set by Qualifications Scotland		Hydrogen gas safety procedures	Technicians
Operating Principles of an Electrolytic Hydrogen Facility	Qualification	SCQF 7	Work-based + college	FE colleges (provider varies)	Qualifications set by Qualifications Scotland		Electrolysis Hydrogen production systems	Technicians
Design Principles of a Hydrogen System	Qualification	SCQF 8		FE colleges (provider varies)	FE colleges (provider varies) Qualifications set by Qualifications Scotland		Hydrogen system design principles	Technicians / engineers

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Hydrogen Awareness	Training Course	Beginner	Online	Energy Skills Partnership	Collaboration		Hydrogen awareness and safety basics	General learners
Hydrogen for Transport Course	Training Course	Beginner	Online	Energy Skills Partnership / Aberdeen City Council	Collaboration		Hydrogen transport sector awareness	School / college students
Hydrasun Hydrogen Safety Awareness	Training Course			Hydrasun	Industry-led		Hydrogen safety fundamentals	Workforce / trainees
Hydrasun Hydrogen Safety Awareness – Technician Level	Training Course	Beginner		Hydrasun	Industry-led	1 day	Safe working with Hydrogen	Technicians

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Hydrasun Hydrogen Safety Training – Engineering Level	Training Course	Beginner		Hydrasun	Industry-led	1 day	Hydrogen system design safety	Engineers
Hydrasun Hydrogen Systems Leak Detection	Training Course	Beginner		Hydrasun	Industry-led	1 day	Hydrogen leak detection techniques	Technicians
Hydrasun Hydrogen Systems Small Bore Tubing Integration	Training Course	Beginner		Hydrasun	Industry-led	1 day	Industrial tubing assembly	Technicians
Hydrogen Systems Pressure Testing – Pneumatic Testing & Helium Leak Detection	Training Course			Hydrasun	Industry-led	1 day	Hydrogen safety fundamentals	Workforce / trainees
Hydrogen Systems Pressure Testing	Training Course	Beginner		Hydrasun	Industry-led	1 day	Pressure testing; leak detection	Technicians / engineers
Hydrogen Technology Series	Industry Certificate	City & Guilds Assured	Online / self-study	OPITO	Industry-led		Hydrogen introduction; production; supply chain	Technicians / operators

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Hydrogen Vocational Qualifications	Qualification			OPITO	Industry-led		Hydrogen vocational competencies	Workforce transition
Introduction to Energy Transition Qualifications & APTUS	Qualification	Beginner		OPITO	Industry-led		Hydrogen knowledge within energy transition training	Technicians
Repurposing Pipelines for Hydrogen	Industry CPD	Professional CPD	In person	Penspen	Industry-led		Hydrogen pipeline design and repurposing	Engineers / infrastructure professionals
Tubing System Design Elements – Hydrogen Applications	Training Course		In person	Swagelok	Industry-led		Hydrogen tubing design; materials science; leak detection	Engineers / technicians
Hydrogen: The Fundamentals	Industry Certificate	Hydrogen safety certificate	Online	Health and Safety Executive	Government regulator		Hydrogen hazards and safety awareness	Safety professionals

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Introduction to Hydrogen Safety	Industry Qualification	SIAS Level 2		SIAS	Industry-led		Hydrogen safety procedures	Workforce / technicians
Introduction to Hydrogen for the Public Sector	CPD	Professional CPD	Online	Scottish Government / Universities (Edinburgh, Strathclyde, Aberdeen)	Government–university collaboration		Hydrogen policy and planning awareness	Public sector professionals
Fuel Cell Trainer	Training Course	Beginner	In person	Dundee & Angus College	ESP collaboration		PEM fuel cell principles; Hydrogen	Staff on the Lucas Nülle CarTrain and TruckTrain
Hydrogen Vehicle Safety Awareness Course	Qualification		In person	Dundee & Angus College			Hydrogen vehicle safety procedures	Students / technicians
Hydrogen Vessel Crew Training	Qualification			UHI Orkney, Stromness	Maritime sector collaboration		Hydrogen vessel operation and safety	Maritime crews

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Hydrogen Safety Training (Surf n Turf Project)	Training Course			Surf 'n' Turf / Orkney Islands Council / UHI Orkney, Stromness	Project collaboration		Hydrogen fuel use for maritime vessels	Vessel crews
Immersive Hydrogen Training	Training Course			Ufi VocTech Trust / ESP	Collaboration		VR Hydrogen refuelling station training	Students / workforce upskilling
Hydrogen Safety & Explosion Protection Awareness	Industry Cert	Industry Level	In person	EPIT Group	Industry-led	2 days	Hydrogen-specific: Hydrogen properties, hazards, ignition risks; Technical: hazardous area classification, explosion protection methods, inspection and maintenance of Ex equipment; Cross-sector: safety standards (IEC 60079 / 80079)	Professionals (engineers, technicians, electrical and mechanical personnel working in hazardous environments)

Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Safety of Hydrogen Systems & Principles of Protection in Explosive Atmospheres (IECEX Units Ex001 & Ex011)	Industry Cert	Industry Level	In person	EPIT Group	Industry-led	3 days	Hydrogen-specific: Hydrogen system safety; Technical: explosion protection principles, hazardous atmosphere management, Ex equipment certification (IECEX); Cross-sector: industrial safety compliance	Professionals (engineers, technicians, electricians working with hazardous areas)
Introduction to Hydrogen Safety: SIAS Level 2 Award	Industry Cert	Industry Level		SIAS	Industry-led		Hydrogen safety fundamentals; hazards; handling	Technicians / workforce
Process Safety Awareness	Industry Training						Process safety fundamentals; hazard awareness	Workforce / technicians
Process Safety Management for Operations (PSMO)	Industry Training						Process safety management; risk mitigation	Operations professionals

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Process Safety Leadership for Senior Executives (PSL)	Industry Training						Leadership in process safety; governance	Senior leadership / executives
Workplace Competence Assessor	Industry Cert						Competence assessment methodologies; workplace assessment	Trainers / assessors
Hydrogen Safety Qualification: Level 1 (Build Your Base)	Industry Cert	Beginner					Hydrogen fundamentals; safety awareness	New entrants
Hydrogen Safety Qualification: Level 2 (Expand Your Knowledge)	Industry Cert	Intermediate					Hydrogen hazard management; operational safety	Technicians
Hydrogen Safety Qualification: Level 3	Industry Cert	Advanced					Advanced Hydrogen safety and system risks	Engineers / specialists

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Table A2.2 Hydrogen-specific courses and qualifications continued...

Course name	Qualification type (FE, HE, Apprenticeship: FA/MA/GA, industry cert)	Level (SCQF / Degree level / industry level)	Delivery mode (full-time, part-time, online, blended)	Provider	Development source (internal, industry-led, collaboration, OPTIO / Hydrasun)	Course duration (weeks / months / years)	Skills covered (technical / cross-sector / hydrogen-specific)	Target learner group (new entrants, upskilling, professionals)
Hydrogen Safety Fundamentals – Half-day	Industry Training	Beginner				Half-day	Hydrogen properties; hazard awareness	Workforce / trainees
Level 2 Award in Hydrogen Safety Practices (TLM)	Industry Qualification	Level 2		TLM	Industry-led		Hydrogen safe working practices	Technicians / operators
SIAS Level 2 Award – Introduction to Hydrogen (Reynolds Training)	Industry Cert	Level 2	In person	Reynolds Training / SIAS	Industry-led	1 day	Hydrogen properties; storage; safety	Workforce / technicians
PgCert Hydrogen Safety	HE Qualification	Postgraduate Certificate	Part-time / Online		University-developed		Hydrogen safety engineering; risk management	Professionals / engineers

Table A2.3 Hydrogen skills catered for by qualification/certification

Course name	Role / Job Taxonomy Reference	Skills Provided	Skill Level (Beginner / Intermediate / Advanced)	Cross-sector Relevance	Assessment Method (Exam, Practical, Portfolio)	Certification / Accreditation
MSc Advanced Mechanical Engineering (Hydrogen modules)	Mechanical Engineering (design)	Thermodynamics, fuel cells, Hydrogen system design	Advanced	Aerospace, automotive, energy engineering	Exam + dissertation	MSc Degree
MSc Energy Transition Systems	Chemical Engineering	Hydrogen production systems, energy systems integration	Advanced	Energy transition, utilities	Exam + coursework	MSc Degree
Hydrogen Energy Systems (RGU)	Chemical Engineering / Electrical Controls	Hydrogen production, storage and energy integration	Advanced	Oil & gas, power systems	Coursework	University credit (SCQF 11)
GeoEnergy Engineering – Hydrogen Storage Modules	Geotechnical / Subsurface Storage	Hydrogen geological storage modelling and monitoring	Advanced	Oil & gas subsurface engineering	Exam + project	MSc Degree
University of Edinburgh Hydrogen-related Masters	Chemical Engineering	Hydrogen systems, power engineering, sustainable energy	Advanced	Energy engineering	Exams + dissertation	MSc Degree

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Table A2.3 Hydrogen skills catered for by qualification/certification continued...

Course name	Role / Job Taxonomy Reference	Skills Provided	Skill Level (Beginner / Intermediate / Advanced)	Cross-sector Relevance	Assessment Method (Exam, Practical, Portfolio)	Certification / Accreditation
Introduction to Renewable Energy – Hydrogen	Chemical Engineering	Hydrogen within renewable energy systems	Beginner	Renewable energy sector	Coursework	Short course certificate
Hydrogen Engineer Training (Fife College)	Manufacturing / Operations and Maintenance	Hydrogen installation, maintenance and safety	Intermediate	Gas engineering, heating systems	Practical assessment	BPEC / IGEM aligned certification
Engineering Construction Modern Apprenticeship	Manufacturing / Fabrication	Pipefitting, welding, Hydrogen infrastructure fabrication	Intermediate	Oil & gas construction	Portfolio + practical	Modern Apprenticeship
Modern Apprenticeships (Hydrogen NOS integration)	Operations and Maintenance	Engineering maintenance and Hydrogen competencies	Intermediate	Oil & gas maintenance	Workplace assessment	MA certification (framework by SDS; certification via Qualifications Scotland)
PDA Hydrogen: An Introduction for Technicians	Electrical, Controls and Process	Hydrogen production, storage, safe operation	Beginner–Intermediate	Energy sector technicians	Coursework + assessment	PDA (SCQF 7) awarded by Qualifications Scotland; delivered by UHI partners

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Table A2.3 Hydrogen skills catered for by qualification/certification continued...

Course name	Role / Job Taxonomy Reference	Skills Provided	Skill Level (Beginner / Intermediate / Advanced)	Cross-sector Relevance	Assessment Method (Exam, Practical, Portfolio)	Certification / Accreditation
Safe Hydrogen Gas Handling	Hydrogen Safety and Risk Governance	Safe handling of Hydrogen gas	Beginner	Industrial gas sector	Assessment	SCQF Level 6 unit (Qualifications Scotland; delivered by FE colleges)
Operating Principles of an Electrolytic Hydrogen Facility	Electrical, Controls and Process	Electrolysis systems operation	Intermediate	Power generation	Assessment	SCQF Level 7 unit (Qualifications Scotland; delivered by FE colleges)
Design Principles of a Hydrogen System	Design Management / Mechanical Engineering	Hydrogen system engineering design	Intermediate	Energy engineering	Assessment	SCQF Level 8 unit (Qualifications Scotland; delivered by FE colleges)
Hydrogen Awareness (ESP)	Business and Market Development	Hydrogen value chain awareness	Beginner	Public sector, education	Online quiz	Certificate of completion
Hydrogen for Transport Course	Logistics / Transport / Distribution	Hydrogen transport technologies and infrastructure	Beginner	Transport decarbonisation	Online quiz	Course completion certificate

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Table A2.3 Hydrogen skills catered for by qualification/certification continued...

Course name	Role / Job Taxonomy Reference	Skills Provided	Skill Level (Beginner / Intermediate / Advanced)	Cross-sector Relevance	Assessment Method (Exam, Practical, Portfolio)	Certification / Accreditation
Hydrogen Skills Academy (Hydrasun)	Manufacturing / Operations and Maintenance	Hydrogen safety, leak detection, tubing integration	Beginner	Industrial gas sector	Assessment	Industry competency certificate
Hydrasun Hydrogen Safety Awareness	Hydrogen Safety and Risk Governance	Hydrogen hazards and safety controls	Beginner	Industrial gas handling	Assessment	Training certificate
Hydrasun Hydrogen Safety Awareness – Technician	Hydrogen Safety and Risk Governance	Safe working with Hydrogen systems	Beginner	Energy technicians	Practical + test	Industry certificate
Hydrasun Hydrogen Safety Training – Engineering Level	Hydrogen Safety and Risk Governance	Hydrogen system design safety	Intermediate	Engineering design safety	Assessment	Industry certificate
Hydrasun Hydrogen Systems Leak Detection	Operations and Maintenance	Leak detection technologies and monitoring	Beginner	Oil & gas inspection	Practical	Industry certificate
Hydrasun Hydrogen Systems Small Bore Tubing Integration	Manufacturing / Fabrication	Small bore tubing installation and assembly	Beginner	Oil & gas fabrication	Practical	Industry certificate

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Table A2.3 Hydrogen skills catered for by qualification/certification continued...

Course name	Role / Job Taxonomy Reference	Skills Provided	Skill Level (Beginner / Intermediate / Advanced)	Cross-sector Relevance	Assessment Method (Exam, Practical, Portfolio)	Certification / Accreditation
Hydrogen Systems Pressure Testing	Manufacturing / QA	Pneumatic pressure testing and leak detection	Beginner	Oil & gas testing	Practical	Industry certificate
Hydrogen Technology Series (OPITO)	Electrical, Controls and Process	Hydrogen production, storage and supply chain	Beginner–Intermediate	Energy sector workforce	Exam	City & Guilds Assured Certificate
Hydrogen Vocational Qualifications (OPITO)	Operations and Maintenance	Hydrogen technical competencies	Intermediate	Oil & gas transition	Assessment	Vocational qualification
Introduction to Energy Transition Qualifications & APTUS	Project / Programme Management	Energy transition technologies including Hydrogen	Beginner	Energy sector trainees	Assessment	OPITO qualification
Repurposing Pipelines for Hydrogen (Penspen)	Decommissioning / Repurposing	Hydrogen pipeline conversion and asset integrity	Intermediate	Oil & gas pipeline sector	CPD assessment	CPD certificate
Tubing System Design – Hydrogen Applications (Swagelok)	Mechanical Engineering (design)	Hydrogen tubing design, materials and integrity	Intermediate	Industrial gas systems	Practical	Industry training certificate

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Table A2.3 Hydrogen skills catered for by qualification/certification continued...

Course name	Role / Job Taxonomy Reference	Skills Provided	Skill Level (Beginner / Intermediate / Advanced)	Cross-sector Relevance	Assessment Method (Exam, Practical, Portfolio)	Certification / Accreditation
Hydrogen: The Fundamentals (HSE)	Hydrogen Safety and Risk Governance	Hydrogen hazards, regulatory safety	Beginner	Industrial safety professions	Exam	Hydrogen safety certificate
Introduction to Hydrogen Safety (SIAS)	Hydrogen Safety and Risk Governance	Hydrogen safety awareness	Beginner	Industrial gas handling	Assessment	SIAS Level 2 Award
Introduction to Hydrogen for the Public Sector	Planning / Consenting	Hydrogen policy, planning and regulation	Beginner	Beginner Public sector planning	Coursework	CPD certificate
Fuel Cell Trainer (Dundee & Angus College)	Electrical, Controls and Process	PEM fuel cell operation and experimentation	Beginner	Engineering education	Practical	Course completion
Hydrogen Vehicle Safety Awareness	Hydrogen Safety and Risk Governance	Safe working near Hydrogen vehicles	Beginner	Automotive / transport sector	Practical assessment	Training certificate
Hydrogen Vessel Crew Training	Logistics / Transport / Distribution	Hydrogen vessel operation and maritime safety	Intermediate	Maritime industry	Practical + exam	Maritime certificate

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Table A2.3 Hydrogen skills catered for by qualification/certification continued...

Course name	Role / Job Taxonomy Reference	Skills Provided	Skill Level (Beginner / Intermediate / Advanced)	Cross-sector Relevance	Assessment Method (Exam, Practical, Portfolio)	Certification / Accreditation
Hydrogen Safety Training (Surf n Turf Project)	Logistics / Transport / Distribution	Hydrogen maritime fuel safety	Beginner	Maritime operations	Training assessment	Project training certificate
Immersive Hydrogen Training (VR)	Operations and Maintenance	Hydrogen refuelling station operation simulation	Beginner	Energy workforce training	Simulation assessment	Course completion certificate
Hydrogen Safety & Explosion Protection Awareness	Hydrogen Safety and Risk Governance	Hydrogen energy basics; Hydrogen hazards and ignition risks; hazardous area classification; explosion-protected equipment; IEC 60079 and 80079 standards; inspection and maintenance of Ex equipment	Beginner	Oil & gas; renewables; manufacturing; utilities; hazardous industrial environments		EPIT Certificate of Training (valid for 5 years)

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Table A2.3 Hydrogen skills catered for by qualification/certification continued...

Course name	Role / Job Taxonomy Reference	Skills Provided	Skill Level (Beginner / Intermediate / Advanced)	Cross-sector Relevance	Assessment Method (Exam, Practical, Portfolio)	Certification / Accreditation
Safety of Hydrogen Systems & Principles of Protection in Explosive Atmospheres (IECEX Units Ex001 & Ex011)	Hydrogen Safety and Risk Governance / Electrical, Controls and Process	Explosion protection principles; hazardous atmospheres; IEC 60079 standards; Ex equipment certification schemes; protection techniques (flameproof, intrinsic safety, pressurised systems etc.); Hydrogen system safety fundamentals	Intermediate	Oil & gas; Hydrogen production; manufacturing; utilities; hazardous environments		IECEX Record of Training (valid for 3 years)

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