

Green Jobs Delivery Group - CCS Task and Finish Group

Findings and
recommendations
of the group



2024



Chair



Secretariat



Secretariat



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Introductory letter from the CCS Task and Finish Group Chair

It has been a pleasure to chair the Task and Finish Group (T&FG) for Carbon Capture and Storage (CCS) and I would like to thank all those who have taken part in the work. I would also like to acknowledge the backing provided by the CCSA (Carbon Capture and Storage Association) and ECITB (Engineering Construction Industry Training Board), in particular, for their support as part of the group's secretariat.

CCS plays a vital role in the UK's plans to make the transition to net zero and could play a key role in the future of the UK's economy – enabling the production of blue hydrogen, supporting decarbonisation strategies and reducing greenhouse gas emissions in hard to abate industrial sectors. It could provide thousands of jobs directly, support many more in the supply chain, and protect jobs by decarbonising high emitting sectors.

Delivering that contribution to the net zero transition and to the wider economy has to be underpinned by having a skilled workforce ready to meet the evolving needs of a wide range of new projects and technology, including CCS.

The challenges in accessing the skills required, and in making sure they are available in the right place and the right time, are considerable. The T&FG has sought to identify ways to address these challenges and seize the opportunities that CCS presents, through several recommendations for action. Our aim has been to build on the strong foundational work that has already been done by government, industry, and skills bodies in this area. We believe that the recommendations of the T&FG could help unlock greater opportunity across the CCS workforce.

The importance of getting this right extends beyond CCS alone. The skills required for the CCS sector are also needed to deliver other low carbon projects and are highly transferable. Failure to develop the workforce necessary for CCS, therefore, carries broader risks that could have a negative impact on the energy transition as a whole.

The opportunities are substantial. CCS projects offer the possibility of centres of activity and expertise in locations around the UK and provide an avenue to potential long-term career opportunities using skills that are vital to the UK's energy transition.

Through the combined efforts of government, industry, skills bodies, unions and others, the UK has an opportunity to build the skills the sector needs to enable the CCS industry to deliver the substantial contribution it offers to the UK economy and its net zero goals.

The stakeholders represented in this T&FG look forward to supporting further progress in developing the CCS workforce.



Andy Lane

Chair of the CCS Task and Finish Group



CCS T&FG Acknowledgements



A special thank you to the core team involved in the delivery of this work.

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Executive Summary

This report sets out the findings and conclusions from the work of the Carbon Capture and Storage (CCS) Task and Finish Group (T&FG).

Scope of this work

The report has been prepared for the Green Jobs Delivery Group (GJGDG) to inform the government's Green Jobs Plan, and also to enable the CCS sector to consider and plan for how it can play a role in resolving critical skills gaps, challenges and opportunities.

This work focuses on the transport and storage aspects of the CCS sector, with capture projects covered in other Task & Finish Groups. Further clarifications on scope are set out in the report itself.

It was developed with substantial inputs from across the sector, between mid-2023 and early 2024. The approach has been aligned, where possible, with other Task & Finish Groups of the Green Jobs Delivery Group.

Role of the CCS sector in the UK

The imperative to address CCS skills is rooted in the importance of the sector itself – both its role in industrial decarbonisation and its wider direct economic contributions. CCS will be an important decarbonisation technology for hard to abate emissions, it unlocks the capability of other adjacent technologies such as blue hydrogen, it will help to safeguard the UK's existing heavy industries, and it provides potential opportunities for members of the existing oil and gas sector workforce to transition to new net zero professions. It plays a vital role in the future of the UK's economy, energy system and net zero goals – including international opportunities such as storage of CO₂ from other jurisdictions.

Successful growth of the CCS sector will be underpinned by having access to a skilled workforce – one that can deploy and operate the wide range of projects that will deliver the shift to a low carbon future. Failure to develop the workforce necessary for CCS carries significant risks that will negatively impact the energy transition as a whole.

The opportunities are substantial, however, if the UK can build the right skills base in the CCS sector. CCS can provide thousands of jobs directly and support many more in the supply chain. CCS projects offer the possibility of centres of activity and expertise in locations around the UK, often in areas in need of regeneration and levelling up, and provide an avenue to long-term career opportunities using skills that are vital to the UK's economic future and transferable to other sectors.

Labour market demand

The T&FG have conducted a labour market analysis across roles in CCS transport and storage, from 2023-2030, aligned with assumed phasing of projects throughout the period.

The direct workforce could peak at approximately 2,500-3,000 roles, in the period to 2030. This is based on current government plans, and is informed by the T&FG's analysis and archotyping rooted in current assumptions and project data.



Direct roles within the wider CCS sector including deeper supply chain jobs and associated cluster projects could therefore peak as high as ~15,000 direct roles by 2030. This extrapolation and analysis is based on assumptions of four active cluster projects by 2030, with a median projection of capture projects associated with each cluster.

It should be noted that the jobs in the scope of this analysis are not fully representative of the true scale of opportunity across the wider CCUS sector, as the modelling does not incorporate wider socio-economic impact, manufacturing supply chains and indirect job generation.

Scope was determined to avoid overlap with other Task & Finish Groups, as capture projects that use CCS infrastructure are captured in other groups and based on the most accurate, available data, which largely pertained to direct jobs. As such our projections are consistent with forecasts of market scale – including CCSA’s estimations that the CCUS sectors will create a peak of over 70,000 new jobs between now and 2035. Further benchmarking was performed with analyses provided by Robert Gordon University, Opergy Group, the Carbon Capture and Storage Association, and X-Academy.

The bulk of workforce demand falls in the construction sector onshore – including among semi-skilled crafts and labour, which are already projected to be constrained in capacity, particularly given demand for those same skills for construction activities in other parts of the energy and non-energy.

There is also notable volume across the offshore workforce, in fields such as subsea construction and associated offshore operations. This work provides more fidelity into offshore occupations, when compared to previous jobs and skills work in the CCS sector.

Labour market supply and drivers of the skills challenge

Using a heatmapping approach, the T&FG have identified a number of occupational pinch points where labour demand is forecast to exceed supply – particularly welding, pipefitting, civil engineering, subsea engineering, health and safety professionals and geoscientists.

Deep dives into these occupations helped elaborate the impact of and what drives these skills challenges.

Factors raised included:

- **High overlap between CCS skills and other sectors, especially in areas like construction** – with similar skills often needed for other net zero projects and wider infrastructure developments often happening concurrently, thus exacerbating CCS skills shortages.
- **Supply of talent in advanced skillsets, in disciplines like geosciences, is also a risk, albeit demand is smaller in volume** – with sectors struggling to attract and retain talent.
- **Transferability from other sectors including oil & gas may help, although should not be overestimated** – with viability to transfer skills potentially inhibited by continued demand including Oil & Gas work and decommissioning.
- **Workforce diversity and an ageing labour profile are also challenges that need to be addressed** – given low levels of diversity in the existing talent supply base.
- **The importance of addressing skills shortages, given that they otherwise risk driving inflation of labour costs** – impacting competitiveness and costs to CCS users, as well as wider economic outcomes including GDP, level of jobs supported and job displacement.

Deep dives also surfaced challenges around skills provision that need to be addressed to respond to these gaps. These include:

- **Misconceptions and a low level of awareness about ‘green jobs’ and CCS** – and what types of opportunity will exist in the CCS sector.
- **Challenges in attracting and retaining STEM qualified teaching and training professionals** – without whom scaling up training provision is difficult.
- **Current initiatives (such as apprenticeship programmes) can take several years before the industry sees benefit** – requiring urgent responses and anticipatory investment, alongside increasingly flexible approaches.
- **There is a growing risk of fragmented skills responses, both by sector and in location** – which risks diminishing the impact of investment into skills development.
- **This is compounded by a lack of certainty in policy and investment**, impacting the willingness of training providers to scale up and candidate appetite for courses.

Recommendations: urgency and opportunity

Along the critical path to delivery of the UK's CCS ambitions, the skills to deliver will increasingly become an issue the sector has to address. Given the lead times involved, this requires an urgency in how we respond – collectively across industry, the skills sector, and government – which should unlock opportunities for the UK economy and population.

Three sets of actions and recommendations are detailed in the full report.

First, the CCS industry (asset owners and engineering, procurement and construction organisations) should double down on what we know works well in addressing skills challenges.

This includes investment into skills initiatives ranging from STEM outreach and engagement, to apprenticeship programmes, vocational training initiatives, and much more – including innovating around opportunities such as pooled apprenticeships and more flexible delivery. The T&FG believe a Green Jobs Pledge could hold industry to account on continuing to focus on action and that a public information campaign could bring to life the nature of the sector and the jobs within it, ideally as part of wider cross-industry co-ordinated campaigns.

Second, place-based co-ordination of skills activity in the clusters, combined with wider cross-government policy enablers around the deployment of CCS, could maximise impact across the UK.

With projects progressing 'in-place' within each cluster, localised activity will be key. To maximise this though, a continued focus on strengthening coordination mechanisms at the cluster level is key, including continuing to embed the role of Local Skills Improvement Plans (LSIPs) - which can avoid duplication and prevent initiatives being diminished by fragmentation. Steps to make the clusters great places to live and work are also necessary, requiring local and national policy responses to enable place-making (including topics such as affordable housing and community facilities).

Planning and sequencing processes also need to consider coincident construction risks, as well as certainty on the market mechanisms that will be in place to drive full deployment of CCS across the UK. This will, in turn, help to avoid saturating the market with demand in a way that could miss opportunities to create local jobs and benefits.

Finally, and perhaps most critically, the CCS sector still requires continued certainty from government around CCS policy and investment. This enables projects to continue progressing, underpins the core job creation opportunity and, in the skills context, provides the certainty needed for employers and the skills ecosystem to invest in developing the required skills.

As an industry, the CCS sector looks forward collectively to taking many of these recommendations forward and partnering with government and skills providers on next steps, following the Green Jobs Plan. The report provides ideas for immediate next steps.



1. This report

This report provides:

- **Analysis of the future workforce demand for CCS developments in terms of scale and requirements for critical roles.**
- **Insight into the challenges faced in meeting that demand.**
- **Identification of opportunities and recommendations for how those challenges can be tackled.**

1.1 The report's purpose and who it is for

The Green Jobs Delivery Group (GJDG) was set up to serve as a forum for action on green jobs and skills – driving collaboration between national and local government, industry, the skills and education sector, trade unions and other key stakeholders.

This report provides an input from the Carbon Capture and Storage (CCS) Task and Finish Group (T&FG) to the work of the UK Government's Green Jobs Delivery Group (GJDG). Together with analysis by other T&FGs, the report's findings and recommendations are intended to inform the Government's Green Jobs Plan.

The Green Jobs Plan, scheduled for publication in 2024, will set out headline actions and solutions to deliver the skills needed in the UK workforce to deliver net zero and nature ambitions. It is also expected to include a framework for monitoring, which will be undertaken on a regular basis.

In preparing this report, the CCS sector has convened a range of stakeholders from across the sector. Through this convening, the sector has explored challenges and opportunities related to how to build a CCS workforce available at the right scale, at the right time, and in the right place. It has also sought to identify solutions within the parameters of existing government policy and regulatory frameworks, where possible.

The CCS T&FG has been chaired by bp, with lead secretariat support provided by the CCSA and the ECITB. Members of the CCS T&FG are listed in Annex A. The T&FG has solicited inputs from a wider range of stakeholders from across the CCS ecosystem, including at the Department for Energy Security and Net Zero's CCUS Council.

Role of the Green Jobs Delivery Group Task and Finish Groups

T&FGs were tasked to create a clear set of actions supported by a monitoring framework on sectoral and, where relevant, cross-cutting workforce challenges and skills gaps, taking into account recommendations from the Green Jobs Taskforce. More specifically, members of the CCS T&FG agreed to:

- Develop a shared understanding of relevant challenges.
- Help identify solutions within the parameters of existing government policy and regulatory frameworks where possible.
- Agree shared goals / objectives, with associated measures.
- Provide analysis and recommendations to the Green Jobs Delivery Group.
- Be signatories to a sectoral action plan and support its implementation.

Figure 1-1: The role of Task and Finish Groups

1.2 Scope of the report

The report focuses primarily on the part of the CCS industry associated with transport and storage of carbon dioxide (CO₂). This scope was determined to avoid overlap with other Task & Finish Groups, as capture projects that use CCS infrastructure are captured in other groups – for example, Power & Networks considered decarbonised power using CCS, and Hydrogen considered blue hydrogen generation using CCS.

Given the work of the T&FG has focused on the transport and storage of CO₂, and not the subsequent utilisation of CO₂, the report typically uses the acronym 'CCS' (Carbon Capture and Storage). However, it uses 'CCUS' when discussing the wider sector or supply chain, or when cross-referencing other sources such as government documentation which refer to CCUS.

In considering the skills and jobs associated with CCS, this report has focused on:

- **All relevant project phases** – that is, the commercial development, design and engineering, onshore and subsea construction, drilling, completions, commissioning, and operation of CCS facilities (covering the transportation then storage of CO₂).
- **Onshore and offshore related activities** – recognising the centrality of both to CCS development and operations.
- **A primary focus on direct jobs** – where, for the purposes of this report, this refers to roles directly employed by asset owners and tier 1 of the supply chain jobs (predominantly Engineering, Procurement and Construction [EPC] activities)
- **The workforce engaged with decommissioning brownfield assets that are being re-purposed for CCS use** – typically as part of offshore work scopes.

As part of analysis, the T&FG drew on existing project data and assumptions, extrapolated this to the CCS sector as a whole, and validated this against existing market analyses. This then produced a summary of the sector-wide workforce required. As such, this is not 'net new' analysis starting from first principles, and is constrained by the limitations of current data availability and quality.

The assessment excludes:

- **Analysis of capture projects that use CCS infrastructure, or wider supply chains associated with CCS utilisation** – whether greenfield or brownfield, as that workforce demand would be captured by analysis carried out by other T&FGs.
- **End-of-life decommissioning of any CCS infrastructure, which would occur well beyond the timescales of the analysis** – which extends from now to 2030.
- **Developers / manufacturers of CCS technologies embedded in the CCS supply chain** – which T&FG analysis had hoped to cover but surfaced limited available data. This includes advanced manufacturing (e.g., capture technology manufacturing), as well as deeper tiers of the supply chain, such as manufactured inputs used to build CCS facilities (such as steel). These activities are also highly dependent on local content assumptions.
- **Wider socio-economic benefit associated with the development of CCS transport and storage and capture projects infrastructure** – e.g., wider jobs created to serve the workforce in the area (such as hotels and other services).

More extensive data sets may become available in future, and are expected to evolve as project phases progress (including EPC contracting and mobilisation likely to drive significantly improved data availability, including in the nearer term as Track 1 clusters progress).

The CCS T&FG collaborated closely with the Hydrogen and Power and Networks T&FGs. This is given that (a) the production of 'blue' hydrogen (hydrogen manufactured through a process of natural gas reforming) requires CCS infrastructure to capture the carbon emissions from production and (b) decarbonised power projects (such as gas power with CCS) will also use CCS infrastructure.

Certain roles may fall outwith the T&FG structure and may not be included in the sector-wide projections through the GJDG forum – although efforts have been made across multiple T&FGs to ensure the Green Jobs Delivery Group analysis inputs are as holistic as possible.

The report provides:

- A context setting overview of the CCS policy and industrial landscape in the UK.
- Insights from CCS labour market assessment work.
- Analysis of the demand for particular skills and occupations.
- Identification of challenges and opportunities.
- Insights into opportunities to feed into the work of the GJDG and recommended actions for where the T&FG see opportunity for the CCS industry to continue to work collaboratively.

Throughout the report, key messages are highlighted in blue bold font. More detail on the scope of the report and the approach taken to developing the assessment is provided in Annex B.

2. Overview of the CCS landscape in the UK

CCS plays a vital role in the Government's net zero strategy to 2050 and in its target of creating a fully decarbonised power system by 2035. This is because CCS technology is integral to unlocking blue hydrogen production, decarbonising dispatchable electricity with power CCS, and supporting the decarbonisation of other hard to abate industrial sectors.

2.1 CCS plays a vital role in the UK net zero strategy

The UK Government's net zero strategy sets out the ambition to 'use Carbon Capture, Utilisation and Storage (CCUS) technology to capture and store 20-30Mt CO₂ per annum by 2030, forming the foundations for future investment and potential export opportunities'¹. This is coupled with an indicative pathway rising to over 50Mt CO₂ per annum stored by 2035.

The strategy includes 2030 targets for CO₂ capture from different sectors, to be achieved by delivery of four CCUS clusters, with at least two operating by the mid-2020s (Track 1 clusters) and another two by 2030 (Track 2 clusters). The focus is on bringing CCS

technologies together in the UK's industrial clusters in the north-east and the north-west of England, the Humber, Scotland and Wales.



The Government's 'Ten point plan for a green industrial revolution'⁵ incorporates investment in CCUS, supported by the £1bn CCUS Infrastructure Fund, to deliver projects at pace and scale. The Government has since announced a commitment of up to £20 billion for CCUS in the Spring Budget 2023, and has passed primary and secondary legislation, including the Energy Act 2023, to further solidify the transition towards net zero including CCUS.

The Government has published a long-term vision for the CCUS sector³ - with a market creation phase (comprising four clusters and getting to 20-30 megatonnes of CO₂ per annum by 2030), a transition phase, in which a commercial and competitive market emerges at speed and scale, and a third and final stage of a self-sustaining market in support of net zero by 2050. This evolution sees a move away from a government-led cluster sequencing approach to the private sector taking on the risk for new CCUS projects.

This would involve:

- Accelerated storage appraisal.
- A move towards a competitive allocation process for government subsidy, where required.
- An expansion to the CO₂ transport network, including non-pipeline transport, thereby enabling international CO₂ import networks.

¹ Net Zero Strategy, chapter 3, paragraph 25.

² The Ten Point Plan for a Green Industrial Revolution: building back better, supporting green jobs and accelerating our path to net zero (November 2020).

³ CCUS – A Vision to Establish a Competitive Market.

The CCSA Delivery Plan Update 2023⁴ has shown that the potential of the sector could outpace government ambition with the opportunities that are on offer. Since 2022, the UK project pipeline, looking to deploy between now and 2035, has grown from 73Mtpa to 94Mtpa. As shown in Figure 2-1 below, this vastly outweighs the level of capture projects currently in negotiation with government. If government and policy development can effectively stimulate the industry to achieve its ambitions, deployment of CCUS could lead to **inward private investment of around £40bn by 2030**.

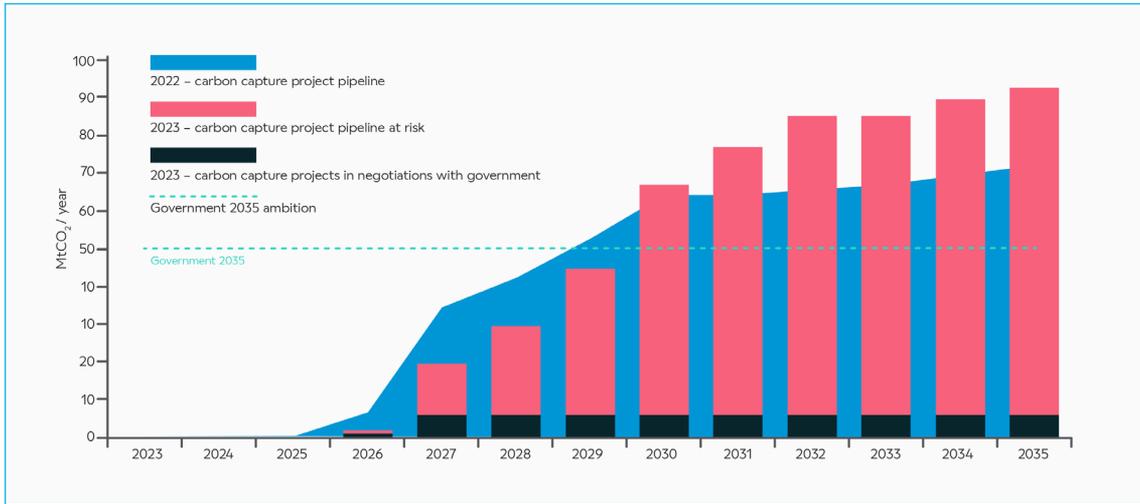


Figure 2-1: Projects in negotiation and projects at risk against government 2035 ambition (Source: CCSA)

An overview of the critical activities and milestones to developing the UK CCS sector is provided in Figure 2-2.

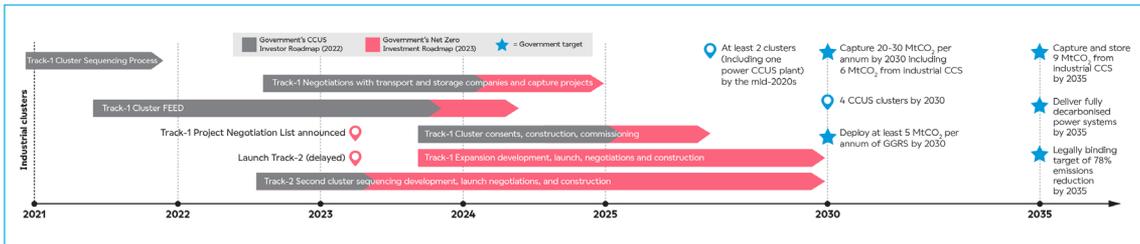


Figure 2-2: Critical milestones in developing the UK CCS sector (Source: CCSA)

⁴ CCSA – CCUS Delivery Plan Update 2023

2.2 What is happening now? Track 1 projects and other CCS projects in the pipeline

HyNet Northwest and the East Coast Cluster have been selected as Track 1, with the Scottish Cluster selected as Track 1 reserve cluster. Both the Scottish and Viking clusters have been flagged by the Government as suitable for Track 2 selection and have since been confirmed as the most viable projects for Track 2. Further potential clusters are located at Morecambe Bay, Peak District/Staffordshire (Peak Cluster), Grangemouth, Bacton Thames Estuary, Southampton (Solent Cluster), South Wales, 7CO2 and Black Country (see Figure 2-3).



Figure 2-3: Track 1 and further planned cluster projects in the UK (Source: CCSA)

2.3 Looking to the future

Eight capture projects, which would connect to the Track 1 cluster infrastructure of HyNet and the East Coast Cluster, are currently in negotiation with government for agreement and support to move towards deployment. In December 2023, the Government also launched a process to expand the number of capture projects connecting to the HyNet Cluster (known as the Track 1 expansion process) to fill surplus storage capacity. Further information on the expansion of the Track 1 East Coast Cluster project and the process for capture projects to connect to Track 2 infrastructure will be provided in 2024.

In March 2023, the Government announced that £20 billion would be allocated to the funding and implementation of early CCUS deployment in the UK, alongside a Net Zero Growth Plan⁵ and an Energy Security Plan⁶, which details the commitment to publishing a joint government-industry Net Zero and Nature Workforce Action Plan in 2024. The policies and ambitions committed to in the Net Zero Strategy and the British Energy Security Strategy aim to support up to 480,000 jobs in 2030.⁷ While jobs in CCS will represent a small fraction of this total, they remain important as an enabler of the broader energy transition.

With Track 1 projects set to move to construction and operational phases from the mid-2020s, there is a need to understand what the demands on the UK supply chain and workforce will be to enable these projects to be delivered on time and to provide for future projects thereafter.

⁵ Powering up Britain: A Net Zero Growth Plan (April 2023).

⁶ Powering up Britain: Energy Security Plan (April 2023).

⁷ 'Energy security matters' section of the Energy Security Plan (April 2023).

3. Our Approach

The T&FG took an inclusive approach in conducting the work, engaging participants from across the CCS value chain throughout the analysis and when developing the conclusions and recommendations.

For CCS, the T&FG developed its approach in line with other T&FGs where possible, including drawing on skills value chain approaches. This included, **convening** the right stakeholders to understand the need, **curating** the right resources and offers (and understanding where there is a need to create new offers), and **catalysing** the delivery and diffusion of skills interventions.

Core activities as illustrated in Figure 3-1, included data gathering, analysis, research, discussion through workshops, roundtables, informed by separate workstreams. This involved:

- Calculating the scale and nature of overall CCS workforce demand and identifying occupational pinch points or skillsets of particular importance.
- Considering standards, routes to competence and occupational pathways.
- Identifying challenges, constraints, opportunities and enablers.
- Developing and agreeing recommendations for industry, government and other stakeholder action.



Figure 3-1: Overview of our approach

Annex A provides more detail on our approach.

4. CCS Sector labour market assessment

Our analysis provides a sector-wide view of CCS labour demand and supply, with a primary focus on direct roles in CCS transport and storage. It describes the scale of CCS workforce demand, as well as highlighting skills gaps, occupational pinch points, and challenges to supplying sufficient skills.

4.1 Overall demand

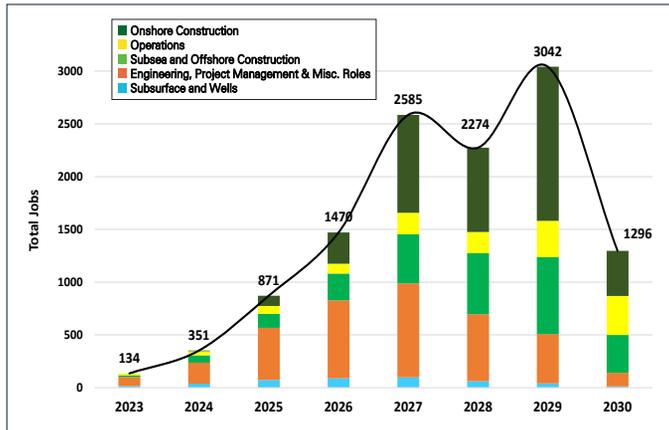
4.1.1 Total demand

The T&FG conducted a labour market analysis across roles in CCS transport and storage, from 2023-2030, with assumed phasing of projects throughout the period in alignment with section 2 (Overview of the CCS landscape in the UK).

T&FG analysis was primarily focused on direct roles associated with asset owners and tier 1 of the supply chain (most notably EPC contractor workforces). This was informed by available workforce data from planned cluster projects – specifically for transport and storage. Given the relative nascency, both of the sector and of several of the projects, complete data was not available. The T&FG therefore developed archetypes, accounting for the difference between brownfield and greenfield projects, and extrapolated those based on anticipated number and scale of projects in the UK Government plans.

The analysis suggests that the direct workforce (asset owners and tier 1 supply chain, for transport and storage only) could peak at approximately 2,500-3,000 roles, in the period to 2030. This is based on current government plans and is informed by the T&FG's analysis and archotyping rooted in current assumptions and project data.

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Process and assumptions underpinning the data gathering and modelling.

Projections were built using Track 1 project workforce data, further enhanced with inputs from other cluster projects. This was followed by building 'archetypes' for greenfield and brownfield CCS projects, which were used to extrapolate sector-wide demands. Data was then validated against other sector-wide demand calculators and workforce demand tools.

Through 2023-2030, we have assumed four cluster projects progressing through construction and operations phases, with an additional project entering early FEED stages at the end of the decade. Relative phasing aligns with current best available estimations.

Projected data is inclusive of direct CCS transport and storage roles (asset owner and tier 1 of the supply chain, notably across the EPC contractor workforce).

T&FG specific analysis excludes capture/power projects (which are captured by other groups) and manufacturing / deeper supply chain roles that enable CCS, due to a lack of available data and high variability levels in relation to levels of UK content.

Figure 4-1: Sector modelling outcomes, process and assumptions

Analysis also indicated that direct roles in CCS transport and storage reflect approximately 20-30% of the total, direct, labour demand for the sector. This was based on cross-referencing transport and storage data and ratios, with wider data sourced directly from cluster projects and through publicly available information (also covering deeper tiers of the supply chain and capture projects, for example).

This suggests that direct roles within the wider CCS sector (i.e., including deeper supply chain jobs and associated cluster projects), could therefore peak as high as ~15,000 direct roles by 2030.

This extrapolation and analysis is based on assumptions of four active cluster projects by 2030, with a median projection of capture projects associated with each cluster. It should be noted that the jobs in scope of this analysis are not representative of the true scale of opportunity across the wider CCUS sector as the modelling does not incorporate wider socioeconomic impact, manufacturing supply chains and indirect job generation.

Scope was determined to avoid overlap with other Task & Finish Groups, as capture projects that use CCS infrastructure are captured in other groups and based on the most accurate, available data, which largely pertained to direct jobs.

As such, our projections are consistent with other market forecasts – including CCSA’s estimations that the deployment of CCUS could create 70,000 new jobs across the UK’s industrial clusters and their supply chains. Differences in the scale of analysis can be attributed to the T&FG analysis focus on direct roles in CCS – rather than broader job creation and socio-economic impact analysis, deeper into the supply chain and local communities. **The T&FG also compared its analysis with analyses provided by Robert Gordon University, Opergy Group and X-Academy, all of which demonstrate positive alignment,** with variations that did surface explainable given differences in methodology and scope.⁸

4.1.1.1 Identifying and understanding the challenges

Occupational data analysis highlighted the difference between demand in brownfield and greenfield projects. With all other factors being the same, the workforce associated with a brownfield project is typically about one-third larger than that of a greenfield project – an observation consistent with existing modelling associated with oil and gas assets in the North Sea – where late life assets also require a larger workforce for continued operation.⁹

4.1.1.2 Phasing and anticipated demand peaks

Based on current assumed phasing (as per the UK Government’s CCUS vision), two peaks of workforce are expected in 2027 (approximately 2,600 roles) and 2029 (approximately 3,000 roles). This is illustrated in Figure 4-1. The difference in the scale of the peaks is accounted for by the Northern Endurance Partnership (one of the two Track-1 clusters) being a greenfield project with lower workforce estimates than brownfield projects.

These peaks highlight the importance of co-ordinated project phasing to enable demand to be met and the need for training and upskilling now, given that training interventions take time to translate into actual jobs, filled by a workforce with the required experience and competencies.

4.1.2 The nature of the work / jobs

The bulk of CCS workforce demand is in the onshore construction sector. The most notable area of demand lies in semi-skilled and craft labour, such as welders and pipefitters – which are projected to face constrained capacity as per ECITB’s labour forecasting tool.

Broadly, the split of the onshore construction workforce will not change significantly across greenfield and brownfield projects – although brownfield projects will likely drive more job creation in roles such as decommissioning, quality assurance and Health, Safety and Environment (HSE) functions.

In the development phases of CCS projects, many of the jobs will be transitory and labour market mobility may therefore be an important requirement of the workforce. That is to say, many of the jobs will not remain during operations phase, and therefore that skill is likely to be redeployed onto other projects (CCS or otherwise).

As wider Green Jobs Delivery Group conversations have illustrated, construction roles will also be required to support delivery of wider net zero infrastructure projects beyond CCS, and other infrastructure projects. This reinforces the need for co-ordinated infrastructure and project planning across the engineering construction sector to satisfy the cumulative demands in the UK, and the need to consider demand for skills relevant to CCS across the economy as a whole.

There is also notable demand in offshore sectors, such as subsea construction and offshore drilling activity. The T&FG believe this may not have been captured fully in previous projections, which have not gone into as much detail on CCS offshore activities. Most projects will have a notable demand for offshore skillsets (particularly greenfield) as well as core engineering and project management disciplines onshore.

Our analysis shows occupational activity sets which highlight key ‘job families’. This builds on, and reinforces, earlier work carried out under the North Sea Transition Deal (NSTD), supported by Offshore Petroleum Industry Training Organisation (OPITO) and ECITB, to develop a common taxonomy for job roles and job families across offshore energy transition industries.¹⁰

⁸ The RGU study, ‘Powering up the workforce’ states the total number of offshore energy sector roles could be as high as 75,000 between 2023-2030, with CCS providing a small portion of this demand relative to wind and hydrogen. Analysis of more than 70 workforce forecasts has informed the X-Academy’s combined forecast of growth of 22%, or approximately 73,000 jobs, in the energy sector by 2030 (‘UK Energy Jobs: Seize the Opportunity’).

⁹ See ‘Powering up the workforce’ (RGU).

¹⁰ NTSD Integrated People and Skills Strategy.

4.1.3 Occupational reviews

The T&FG conducted occupational reviews to identify challenges in the supply of CCS labour. This thorough process – led by ECITB, with quantitative inputs from their Labour Forecasting Tool and census data – developed easily comprehensible visualisations of skills pinch points. The reviews involved analysis with experts and group discussion with T&FG members.

4.1.3.1 Occupational heatmap approach

The first step of the heatmapping approach involved understanding which occupations faced the greatest pinch points. This was based on perceived difficulty to recruit (the y axis: based on the ratio of recruitment requirements in ECITB data to job counts in project data, with a logarithmic scale for clarity) against the level of demand (the x axis: calculated as a percentage of job counts in overall project data).

The heatmapping process (described in more detail in Annex C), and its outcome (shown in Figure 4-2), helped to identify key occupational job families to provide a structure to explore barriers to entry, wider enablers, and potential interventions.

4.1.3.2 Occupational heatmap outcomes

The heatmap (pictured below) and subsequent discussion among T&FG members identified job families where particular challenges arise from the level of demand and/or difficulty in recruiting.

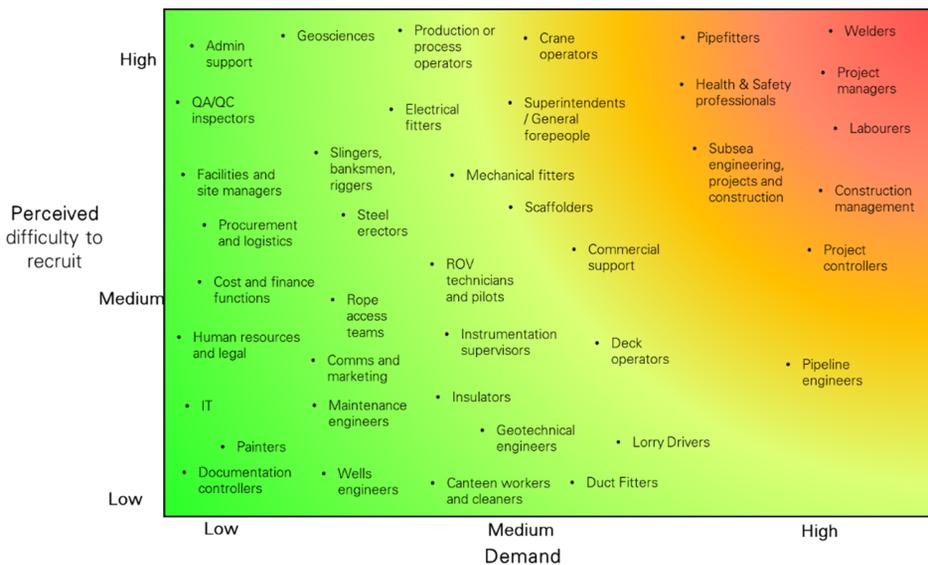


Figure 4-2: CCS sector heatmap

This included four principle occupations, with rationale for each captured below:

Welders

Welders represented the highest priority role based on demand and the perceived difficulty to recruit.

Pipefitters

Pipefitters were also a high volume role with a high perceived difficulty of recruitment.

Geoscience disciplines

Geoscience skills map to a variety of job families across the CCS lifecycle and heatmap. This is an area of advanced skills and qualifications, potentially requiring master's or PhD level talent. While this population includes just a small number of qualified people, they tend to be well-qualified, aged over 50, and can often compete for jobs internationally. Qualified geoscientists therefore represent a small but exposed segment of the labour market.

Civil engineering

While not directly covered on the heatmap, civil engineering roles are of importance because they map to many medium and high priority roles in construction, project management, and pipeline engineering.

Similar to geoscience disciplines, there is high potential transferability of existing talent and resource from the oil and gas sector.

4.1.3.3 Occupational deep dives

Analysis involved collating a baseline for each occupation, existing structures to capture information on current standards, employer requirements, barriers to competence, pathways into the occupation and training requirements. The T&FG then held focus group sessions with subject matter experts and relevant stakeholders which examined each occupation and considered gaps, differences, and opportunities in the context of the CCS sector.

The process resulted in insights and recommendations associated with each occupation, which were subsequently reviewed by the wider T&FG. Potential blockers to success, such as scalability, human factors, and investment requirements, were identified. Use of this agreed template enables data to be analysed in a consistent way and supports cross-sectoral aggregation.

Given the time-bound nature of the T&FG activity, we only completed deep dives into welding and pipefitting, and geosciences; additional deep dives may be of value beyond this initiative. For example, civil engineering would be an important priority for future analysis, as well as additional areas such as subsea engineering, HSE and regulatory skills/competencies.

4.2 CCS sector labour market supply

Several challenges and themes were captured through the workforce assessment process and resurfaced during the occupational reviews, which inform our recommendations. These are captured under two headings:

- **The dynamics of skills availability.**
- **Challenges related to the solutions for skills provision.**

Annex C ('Occupational review findings') provides more contextualised examples of how these themes surface in specific occupations – namely pipefitting and welding, and geosciences.

4.2.1 The dynamics of skills availability

Deep dives into these occupations helped elaborate the impact of, and what drives, these skills challenges.

This sub-section sets out the factors raised.

Easing skills supply shortages is critical to managing labour cost inflation which in turn, could impact the competitiveness of CCS projects and the costs to CCS users (as evidenced by recent NAECI rate increases).¹¹

The crossover of skills with other sectors exacerbates pinch points – particularly with construction skills also needed for other net zero projects and wider infrastructure. CCS projects face competition for labour from other energy initiatives, influenced by, and influencing, the timing and phasing of projects.

Advanced skillsets, although small in volume, will play a critical role in capturing high value parts of the CCS economy, including in disciplines like geosciences. Regional competition for scarce resources in the UK, as well as international competition, particularly among skilled workers who might be attracted to other locations, is also a factor.

Transferability in practice will be driven by the pace of hydrogen and offshore wind projects, the rate of oil and gas asset decline, and the extent of local content and supply chain development.¹² Given the potential attractiveness of experienced oil and gas workers in other areas of low-carbon energy, it will be necessary to make a concerted effort to highlight the opportunities in CCS to attract existing workers and new entrants to careers in CCS as part of efforts to achieve a just transition.

Making the move

In 2023, the ECITB, East Coast College and local employers piloted a new 'Military into Offshore Wind' programme targeting those seeking a new career after serving in the armed forces.

The syllabus for the collaborative programme, which was co-funded by the ECITB and East Coast College through Growth Deal Funding, included Global Wind Organisation basic safety training, Energy Institute wind turbine safety rules, crane and service lift maintenance and working at height.

Following the programme, the learners moved into full-time roles as wind turbine technicians.

¹¹ NAECI 2024 and beyond Pay Update

¹² Modelling by RGU shows the relationship between jobs in oil and gas and renewables from 2020-2030, in three scenarios. In a successful and co-ordinated transition, 'new' renewables jobs are forecast to significantly outnumber those lost in the oil and gas industry. However, a more rapid decline in the oil and gas sector, combined with slower growth in the renewables sector, will mean the reverse is the case.

Although transferability from sectors like oil and gas may help, it should not be overestimated, particularly given continued demand in the UK and globally in oil and gas, and additional demand from work like decommissioning.

Equity, diversity and inclusion also needs to be prioritised as the sector builds its CCS workforce. There is a lack of gender diversity, where women currently account for 18% of the current energy sector workforce, compared to 40% across the economy as a whole.¹³ This requires both finding ways to enable the diversity of new entrant cohorts – including through well-proven interventions such as STEM education and outreach work – as well as attract diverse talent into the sector from other industries.

With an ageing workforce and anticipated attrition, action is critical – with more skills development work needed just to keep supply of skills flat. Approximately 35% of the current workforce in the oil and gas sector is aged over 50, and in particular fields, such as welding, it is thought that up to 2,000 welders could leave the workforce on an annual basis.¹⁴ Action and investment taken now is likely only to maintain that workforce rather than increase it to support growing demand – with a clear need to scale up action now to train new workers, as the ageing workforce gradually leaves the labour market and as demand grows.

4.2.2 Challenges relating to the solutions for skills provision

The occupational deep dives demonstrated that, on the most part, existing skill standards meet the needs of the CCS sector. As such, the primary challenge is around scaling up largely existing provision and standards, rather than designing new qualifications and offers.

In this context though, a number of challenges were identified that need to be taken into account while scaling up. These reflect factors that inhibit scale-up and growth of skills supply.

Making anticipatory investments into skills development

The trigger for training providers and candidates lies in the creation of a job opportunity with an employer, such as an apprenticeship vacancy, with opportunities being ‘locked in’ as the industry develops. This engenders motivation for candidates and provides incentive for training providers to expand and grow provision.

These things will not happen, however, without supply chain/contractors taking the step of expanding their workforce, which they will not do until they win contracts from operators or EPCs. Confidence in the future will help to ease these constraints and unlock opportunities.

Against this context, investment certainty within the CCS sector is critical to unlocking both jobs and skilling opportunities. Many of the skills challenges are exacerbated by a lack of certainty in policy and investment risking the job creation benefit if projects do not happen, with a lack of confidence impacting the willingness of training providers to scale up, and candidate appetite for courses.

All those involved require long-term policy certainty to create an environment in which there is confidence that a pipeline of investments, projects, and training initiatives can be embarked upon, with risks mitigated and managed to an acceptable level.

Several wider factors also inhibit the ability of businesses to make anticipatory investments into skills. Businesses face the financial risk of providing training before projects are confirmed and progressed through financial investment decision (FID), and the operational risk of employing individuals to learn on-the-job before they are fully trained and competent – often with added challenges around the number of individuals that can be absorbed on site before they are fully competent. With the long lead times often associated with skills development, combined with the urgency of moving quickly once FIDs are reached, recommendations need to consider the anticipatory nature of the investment required into skills, and how to best unlock that.

¹³ Recommendation 4: Pursue an inclusive culture: ‘Seize the Opportunity’ (X-Academy report).

¹⁴ Based on analysis of current workforce demographics in engineering construction (informed by ECITB census data, labour forecasting tool and experience of participants in pipefitting/welding deep dive).

Attracting people into the sector

Several factors also shape the willingness on the candidate / employee side to consider opportunities in the CCS sector.

There are misconceptions around what constitutes a green job and low levels of awareness about opportunities in the CCS industry among educators, industry and government. The relative newness of the sector results in unfamiliarity about what roles and skills are required and the opportunities available now and that might exist in future.

These misconceptions also exist amongst teachers, careers advisors, and the wider community.

This, in turn, shapes students' willingness to consider new entrant opportunities in the sector and the willingness of the existing workforce to transition into CCS. Driving greater public awareness around CCS would be beneficial to attracting talent, as well as enabling community understanding and acceptance of the projects themselves.

Individual disciplines also see challenges around perceptions and the 'falling attractiveness' of their subjects, including geosciences. These are sometimes perceived as declining skills in lower demand and therefore often not considered an appealing academic and career pathway among young people. More work needs to be done, both to revitalise their perception, and also be clear on how these skills apply to areas like CCS, as well as the oil and gas industry.

For new entrants particularly, there is often an insufficient volume of work experience placements in industry, and a shortage of apprenticeships. This is driven in part by the challenges about around the anticipatory nature of skills investments – with more opportunities to think about where we can skill up new entrant talent in other sectors and then transition them into CCS when the opportunities arise.

For the existing workforce looking to transition, their willingness to do so may be shaped by expectations around, and the attractiveness of, compensation and total packages. Whilst the transferability of core skills across oil and gas to carbon capture and storage is well defined, there is competition for skilled workers from other areas (including hydrogen and offshore wind, continued oil and gas activity, and decommissioning work). If CCS cannot meet employee expectations, the sector may see labour opt for other opportunities outside CCS, despite having relevant skills.

Student perceptions

Recent research by IDRIC among 830 pupils aged 11-18 from six schools and institutions across South Humber and Lincolnshire found a substantial lack of awareness of net zero among young students:

- 36% expressed interest in climate change.
- 49% expressed concern about the impact of climate change on their lives.
- But 67% did not want to pursue a career that would tackle climate change and many were unable to name a career that would tackle climate change.

Scaling up the provision of CCS skilling initiatives

Although current standards themselves largely meet the technical requirements for roles in CCS, the delivery approach can mean it takes several years before the industry sees benefit. Full end-to-end apprenticeships, for example, with significant amounts of off-the-job learning, mean that it takes time before employees are on site and adding value to projects.

There may be more opportunity to explore innovative, flexible training programmes. T&FG members noted strong interest in 'pooled apprenticeship' models here as well.

Workforce assessments and anecdotal evidence also point to the shortage of available trainers for key occupations related to CCS. This was raised in the previous CCSA Workforce Skills and Position Paper and suggests the need for a drive to attract more people into trainer roles.

There is a growing risk of fragmented responses, both by sector and in location, as many skills shortages cut across sectors, with challenges often differing on a place-by-place basis. OEUK research has identified a proliferation of skills initiatives just in the offshore space.¹⁵ Although Local Skills Improvement Plans (LSIPs) are welcomed as a means of driving better co-ordination – more is needed to truly join up employer efforts. There is a continued risk that the impact of individual skills programmes are diminished and the sector misses opportunities to pool effort into bigger and bolder initiatives.

'Those retiring from industry often take the knowledge with them, rather than passing it on to potential new teachers and trainers. In addition, younger people involved in training are often enticed by the offer from industry, as poor wages persist in the further education and technical and vocational education and training sectors'.

CCSA Workforce Skills and Position Paper.

5. Recommendations and next steps

The T&FG mapped out recommendations which focus on what is needed to respond to the skills challenge facing the CCS sector. They reflect opportunities for industry, government, and the skills sector to work collectively to move with urgency and unlock the CCS opportunity.

5.1 Overview

Responding to the challenges of the CCS sector and the need to urgently begin building the workforce that will be required to maintain the critical path towards delivery, the T&FG have set out three themes of recommendations. These anchor on:

- **Decisive, collaborative action and investment by industry:** involving joint initiatives that raise awareness of opportunities in CCS and galvanise action on training and skills development.
- **Enabling structure and policies around the industrial clusters to foster skills development:** involving the creation of a policy environment that supports appropriate investment in training and skills development and addresses broader factors to deliver the right workforce, in the right place, at the right time. Efforts to address skills challenges need to take more of an outcome focus, rather than a sector-specific focus, because so many of the challenges can best be addressed with a cross-sectoral approach. Greater co-ordination of place-based skills investment is key to maximising impact.
- **Long-term policy certainty with focused governmental support:** involving skills and training measures that reduce risk, in the context of a clear and long-term commitment to CCS projects.

These recommendations are informed by existing research and the expertise of those already in the sector.

This includes experts on the T&FG, good practices and examples from other T&FGs, and well-established models. The hope is to achieve greater impact by harnessing existing knowledge and efforts, building on existing initiatives wherever possible, as opposed to creating net new ones.

Recommendations under each of the three themes are set out in the table right. Each numbered recommendation summarises its intent, indicates existing initiatives or research that can provide a starting point for future action, and sets out proposed timescales and who may be best placed to drive particular actions.

Further action planning will take place following the finalisation of the T&FG report. Therefore the table right should not be interpreted a definitive commitment of specific actors to drive delivery at this stage.



5.1.1 Decisive, collaborative action and investment by industry

Recommendation 1: Support for a national charter to galvanise industry and accelerate existing actions.	
Intent	<p>A cross-sectoral Green Jobs Pledge and potentially sector-wide charter for signatories to demonstrate commitment to developing domestic jobs, skills and diversity.</p> <p>Ultimately encourages the sector to continue to drive and to scale proven interventions (STEM and education outreach, apprenticeships, training partnerships, investing in employee development and progression).</p>
Who should lead?	<p>Government (Green Jobs Pledge).</p> <p>The CCS sector, enabled by previous CCSA and OEUK work (sector-specific action amplification and measurement).</p>
Timescales	Mid-2024 onwards.

Models and examples

'Investors in People': as a standard offering accreditation to organisations that adhere to its provisions.

Existing industry best practice: including potential to model off CCSA's initial 'Supply Chain Good Practice Guidance' in addition to advocacy and support of the Green Jobs Pledge.

Recommendation 2: Bring CCS opportunities to life through public information campaigns.	
Intent	<p>Drive co-ordinated public information campaign(s) to increase understanding of and engagement of career pathways in STEM, particularly in the context of Net zero and evolving opportunities (i.e., engineering, construction and geosciences). Broadening the diversity of the prospective workforce and building awareness of short and long-term career opportunities in the sector.</p> <p>Campaigns should target both blue collar and white collar workforce, and both new entrants as well as the existing workforce that may transition into CCS.</p>
Who should lead?	Employers, skills providers and industry collaborations, backed by a co-ordinating government campaign. Involvement of key dissemination partners will be crucial to delivery.
Timescales	Strategies could be formed in 2024 to inform concerted action from 2025 onwards.

Models and examples

'This is Engineering' campaign :

A multi-year campaign, first launched in 2018, led by the Royal Academy of Engineering in partnership with Engineering UK and major engineering organisations to encourage more young people, from all backgrounds, to consider engineering careers.

The campaign has helped to increase the number and diversity of future engineers, by repositioning engineering careers to young people (aged 13-18) and their influencers. It has shown young people what engineering really looks like, how it could be an exciting and rewarding career, and how to get there.

Recommendation 3: Co-design and launch of innovative training programmes.	
Intent	<p>Launch of pilot training programmes, initially to address Track 1 project pinch points but with a view for future scalability.</p> <p>This could seek to attract new learners into the industry and provide pathways for employees to develop and remain within the industry.</p> <p>It would involve sharing technical expertise, best practice and training materials cross-sector to support:</p> <ul style="list-style-type: none"> flexible apprenticeship programmes for high demand skillsets (i.e., welding). compressed training programmes and on- the-job learning for groups of redeployed labour (i.e., ex-military into pipefitting). individualised pathways to upskill transferable talent (i.e. traditional STEM graduates into geosciences).
Who should lead?	Asset owners, training providers, with input from DfE and wider government.
Timescales	From 2024 onwards, initially through pilots, with a view to scale rapidly from 2025.

Models and examples

CATCH training facility: the CATCH training facility stands as an archetype for industry/training provider collaboration, designed with the intent of a scaling of provisions for a variety of new entrants to industry through routes which include: apprenticeships, ECITB scholarships, adult reskilling, ex-forces upskilling, unemployed introduction programmes and ex-offender reintroduction programmes.

ECITB scholarships: equipping the next generation of engineers with the skills for net zero and beyond. Entering its fifth year, more than 500 learners have enrolled to date and a further 100 are due to join the programme in autumn 2024. Scholarships supply a sustainable pipeline of new talent to industry by providing a grounding in the industrial knowledge and skills that are in demand.

Apprenticeship levy flexibility and pooled apprenticeship schemes: see recommendation #8.

5.1.2 Enabling structures and policies around clusters to enable skills

Recommendation 4: Bring together jobs and supply chain data to better signal need to training providers and suppliers.

Intent	To create a one-stop-shop for careers information on green jobs: due to a current lack of transparency and awareness of the actual opportunities by geography, discipline and timeframe. To enable and inform career choices of prospective candidates and to appeal to new and more diverse groups.
Who should lead?	Government, training providers, industry, third-sector organisations – collaboratively if possible.
Timescales	2024 onwards.

Models and examples

Building on the Green Jobs Pledge: there is opportunity to build on the base of existing governmental and private platforms to launch a cross-sector initiative, with potential to link employer participation through the Green Jobs Pledge.

OEUK Decommissioning Insights: OEUK's Decommissioning Insight reports offer comprehensive, annual breakdowns of the challenges and market opportunities emerging within the decommissioning sector. The documentation style and methodology acts as a best practice example of a one-stop-shop document, collating inputs from various parties to suit a broad audience within a specific sector.

Recommendation 5: Government sequencing to consider coincident construction risks.

Intent	To address the challenge of labour supply, by smoothing regional and national peaks in demand – reviewing project planning for coincident construction that risks exacerbating workforce demand. In turn, develop a clear strategy to respond, including reshaping timelines to smooth demand and / or considering alternative approaches, such as reviewing the reserved occupation list.
Who should lead?	Government, with inputs from and consultation with, asset owners and wider industry.
Timescales	From 2024.

Models and examples

T&FG labour market assessments: supplemented by ECITB census data, labour forecasting and other external market analyses (i.e., Opergy Group and RGU).

Learnings from existing large scale infrastructure projects: such as Hinkley Point workforce development.

Recommendation 6: Consider a whole-government approach to address wider factors beyond skills provision.

Intent	Influencing the attractiveness of jobs near industrial clusters, and skills supply, with greater analysis of factors that make the industrial clusters an attractive place for workers – both addressing gaps and marketing the benefits of locations to employees. Additionally, the group will collaborate to ensure that policy and infrastructure can support mobile and flexible workforces, recognising that some skills will not be built locally.
Who should lead?	Government, with inputs from and consultation with, asset owners and wider industry.
Timescales	From 2024.

Models and examples

GJDG approach and structure: with more of a focus on supply chain and EPC engagement.

Ring of Fire Project, Ontario Canada is a rich mineral resource area but, due to its remote location, posed infrastructure and workforce challenges. Collaborative efforts among government, Indigenous communities, and mining companies, have been focused on building all-season roads, expanding railways, and enhancing energy and telecommunications infrastructure – aiming to unlock economic potential, create jobs, and foster sustainable growth in the region by overcoming logistical barriers and attracting investment.

Recommendation 7: Better co-ordination of place-based skills investment: e.g., through government-backed regional coalitions consolidating activities.	
Intent	Continue to harness Local Skills Improvement Plan (LSIP) processes, while also seeking to establish, with government backing, regional coalitions to bring together key stakeholder groups, with the intent of minimising duplication of activity and consolidating funding into flagship initiatives based on local demand.
Who should lead?	Skills providers and industry collaborations.
Timescales	From 2024 onwards.

Models and examples

TechHire Initiative: launched by the U.S. Government, aimed to bridge the growing gap in technology skills within the job market. Focused on innovative training models, such as coding bootcamps and apprenticeships, the programme sought to quickly equip individuals with the necessary skills for well-paying technology jobs.

Emphasising collaboration with employers, TechHire identified specific industry needs and tailored training programs accordingly. Implemented at the local level, the initiative allowed for a community-based approach, fostering flexibility and adaptability to regional requirements. Additionally, TechHire aimed to expand opportunities for under-represented groups, including minorities, women, and veterans, in the technology workforce.

Maximising impact through existing infrastructure - (i.e., GIGA LSIP/LSIFs, GJDG / T&FG structures).

5.1.3 Long-term policy certainty, with focused governmental support

Recommendation 8: Continue focusing on policy certainty around CCS projects themselves.

Intent	Continue to prioritise government funding decisions and enable projects to progress to FID – ultimately helping to provide confidence in job demand, enabling the skills sector to respond in a manner which meets the urgency of the challenges, while maximising the potential opportunity for the UK. Harness certainty as it arises, to provide market signalling around future demand – see recommendation #4
Who should lead?	Government.
Timescales	From 2024 onwards.

Models and examples

Offshore Renewable Energy (ORE) Catapult: established in 2013 with support from the UK government and industry partners, the Catapult was created to accelerate workforce development and the commercialisation of offshore renewable energy technologies. Leveraging funding and partnerships, the Catapult implements specialized training programs and research initiatives tailored to the offshore wind industry's needs. One notable initiative is its "Future Industry Leaders Programme," which equips emerging professionals with the skills and knowledge required to drive innovation and growth in the sector. Through initiatives like these, the ORE Catapult ensures the UK remains a leader in offshore wind innovation and expertise, driving sustainable growth and economic prosperity.

Recommendation 9: Adjust levy rules to support regional, pooled apprenticeship schemes.

Intent	Explore opportunities to enable apprentice levy to be deployed for anticipatory skills investments, before the employer is known (e.g., pre-FID or pre-EPC contracting), such as by transferring levy directly to educational providers to scale offers. Building on early employer-led efforts to find ways to more flexibly deploy apprentices.
Who should lead?	Government.
Timescales	From 2024 onwards.

Models and examples

CATCH Flexi-Job Apprenticeships: the CATCH training facility is planning to launch a flexi-job apprenticeship group in Q4 2024 which will allow employers to increase the numbers of apprentices in the marketplace, without having to directly recruit an additional apprentice themselves. This initiative allows employers to utilise an apprentice on their site for a proportion of their apprenticeship rather than commit to the whole apprenticeship. It is also an avenue to engage more SMEs with apprentices lower down the supply chain who cannot commit to the three to four year lifecycle of an apprenticeship due to lack of certainty of contracts.

Recommendation 10: Explore reskilling fund provisions.

Intent	To enable those out of work to access funding for reskilling, or to bridge salary gaps while people step out of the workforce for reskilling. For example, harness Green Industries Growth Accelerator funding to also address emerging skills challenges within the supply chain, through direct funding into training providers, pooled apprenticeship programmes and design/delivery of innovative training initiatives.
Who should lead?	DfE and wider government, including DWP, DESNZ and DBT.
Timescales	From 2025.

Models and examples

Scotland Just Transition Fund: projects are supporting skills development, including pilot training courses provided free of charge to participants. The Energy Transition Skills Hub successfully launched in September 2023. The aim is to help ensure the region is equipped with the skills and training needed to support the net zero transition.

5.2 NEXT STEPS

The conclusion of the Task and Finish Group for the CCS sector marks a positive step forward – creating much greater clarity around what the sector needs. The T&FG chair and secretariat thank the collaborative efforts of all involved.

Continued engagement will be imperative over the coming months to consolidate next steps. The T&FG have therefore identified a number of next steps to continue building on this collaborative momentum, including:

- **Providing industry input to the Green Jobs Pledge discussions** – drawing on the experiences and needs of the sector, through consultation and consolidation of feedback, as a Task and Finish Group.
- **Development of sector-specific reporting mechanisms and KPIs** - leveraging previous work and best practice from OEUK and CCSA (i.e., OEUK's CCS Supply Chain Report and CCSA's CCUS Supply Chain Good Practice Guidance) to develop collective ownership as a sector, with standardised reporting mechanisms and KPIs defined for measurement of progress.
- **Scheduling of regular cadence as a sector, to work through collective challenges and opportunities, whilst feeding into government fora** – working under the initial proposal of quarterly Task and Finish Group meetings, with ad-hoc cadence to feed into specific government fora, with the CCUS council acting as the primary platform for sector to government engagement.
- **Driving action in line with sectoral recommendations:** with the aforementioned activity forming the basis of how the CCS T&FG will continue to corral the sector in driving actions across jobs, people and skills.

Many of the actions set out are either strongly owned by industry or need a strong industry voice. Establishing these mechanisms helps maintain momentum. This moment marks the need for a shift from action planning into action but as the CCS sector does so, remaining connected and co-ordinated will help maximise the impact of the sector's work on skills.

Annex A. Task and Finish Group members

With thanks to the extensive contributions from those working within and in support of the CCS sector – without which this work would not have been possible.

- Air Products
- Bechtel
- bp
- CCSA (Carbon Capture and Storage Association)
- Centre for Energy Policy, University of Strathclyde
- Cogent Skills / Hydrogen Skills Alliance
- CATCH-UK
- ECITB (Engineering Construction Industry Training Board)
- EnterGeo Alliance
- ENI
- EUSkills
- Exxon Mobil
- GMB
- Harbour Energy
- IDRIC
- Ithaca Energy
- NSTA (North Sea Transition Authority)
- NCCUK (National Composites Centre UK)
- Net Zero Industry Wales
- Storegga
- Subsurface Taskforce /Soliton Resources
- OEUK (Offshore Energies UK)
- OPITO
- Opergy Group
- Phillips 66
- Progressive Energy
- Robert Gordon University / Energy Transition Institute
- Soliton Resources
- SD Analytica Ltd
- SDS (Skills Development Scotland)
- Spirit Energy
- TeesValley Combined Authority
- TUC
- University of Chester
- X-Academy
- 2JCP
- 7C02

Annex B. Data analysis and heatmapping

The objectives of the data collection and analysis were to produce a sector-wide view of CCS demand. This was intended to feed into the GJDG process to represent CCS transport and storage (thus avoiding duplication across groups), highlighting differences between project archetypes and workforce shaping by job family.

The T&FG also sought to identify a set of 'occupational pinch points', using the method and presentational approach to heatmapping established in T&FG analysis carried out by the Power & Networks T&FG. The intention was to drive understanding of skills gaps in the sector in a manner consistent with the approach taken by other T&FGs, to provide a structure that helps explore current blockers to entry, wider enablers and potential interventions.

The data gathered is subject to a number of uncertainties and limitations. This reflects, in part, the nascency of the CCS sector and the lack of clarity around which cluster projects will progress and at what pace. The data has therefore been collected and analysed with a view to being able to remodel it, using various scenarios.

The data analysis process involved:

- **Data collation:** Track 1 project workforce data was used to build a standard request template, which was shared with clusters for anonymised input via the CCSA.
- **Initial heatmap creation:** a pilot heatmap was created using ECITB's Labour Forecasting Tool and available Track 1 project data, initially with occupational families whilst awaiting cluster inputs.
- **Heatmap refinement:** the heatmap was refined with a more granular breakdown of high-priority job families (via project teams and EPC contractors)/oil and gas stakeholders added insights for sector specific skillsets. In parallel, multiple cluster inputs were fed into the heatmapping process to validate the approach and the selection of families for detailed breakdown.
- **Sector-wide extrapolation:** using insights from the heatmapping process, anonymised industry data and socio-economic analyses in the public domain, two archetype calculators (brownfield/greenfield) were developed and used to map wider sector demand.
- **Validation:** projections were then validated against Opergy's demand calculator and RGU's workforce modelling tool – with overall numbers, shaping and occupational breakdowns broadly aligned.

Datasets used in the analysis

The three primary datasets developed enabled different analyses and applications:

- Granular operational data, based on Track 1 project data, was used to build our heatmap and inform the occupational reviews, and to support the sector-wide extrapolation to 2030. This dataset was validated internally and was supported by cluster inputs. It enabled us to build basic archetype calculators of workforce demand in relation to brownfield and greenfield projects.
- The RGU workforce demand tool was built to cover the wider energy sector but covers oil and gas transferability into CCS, and the impact of local content generation on supply chain workforce demand in CCS.
- The CCS demand calculator, built by Opergy, provided a picture of overall levels of demand. The calculator has the capability to split out transport and storage separately, and to present regional data.

The heatmapping process

The steps taken to develop the heatmaps were as follows:

- As a starting point, selection was based on the heatmap axes: showing roles with high demand and roles with high perceived difficulty to recruit.
- An overlay of occupational pathways outlined that many high priority roles trace back to common skillsets – notably core engineering disciplines (such as civil engineering) which cut across a range of occupations.
- Analysis then sought to minimise duplication with other sectors, with a skew towards the distinct needs of the CCS market (and specifically towards geosciences).
- A review was performed to ensure coverage of a wide range of skill levels and entry points, maximising impact and the opportunity for future interventions.

As a result of this, four occupations were initially shortlisted for further analysis: welding, pipefitting, civil engineering, and geology. Following further review to ensure specific focus on distinct CCS needs, the shortlisted occupations were revised to cover welding, pipefitting, and geoscience disciplines.

Annex C. Occupational review findings

The pipefitter and welder review workshop (led by ECITB) and the geosciences review (led by OEUK) engaged subject matter experts in discussion of standards and competence, and identified a range of barriers to employment, as well as possible recommendations to overcome these.

The core themes and conclusions relevant to pipefitters and welders are set out below, followed by those relevant to geosciences.

Theme	Conclusion
<p>Routes to competence: there are many routes to competence for welding/pipefitting. Existing standards are sufficient in meeting the technical requirements of CCS.</p>	<ul style="list-style-type: none"> • There is minimal or no required revision to standards or pathways anticipated. • The competency challenge lies in the ability to scale volumes of talent using existing routes to competence. • Training is valuable but we also need to set out how to upskill people on projects, which can be expensive. Funding their development time is a significant challenge.
<p>Geographical flexibility: there is currently high demand for welders in the south, for example, where work is available, but that has posed challenges for projects in the North East.</p>	<ul style="list-style-type: none"> • Being able to relocate to where the work is available is a challenge. • Job quality is also a factor in ensuring that individuals have sufficient incentive to move to these roles.
<p>Metallurgical differences: current welding training facilities often use mild steel as the primary training material, due to low costs and availability.</p> <p>In a CCS context, there is value in training programmes that place greater emphasis on developing welding competence with stainless steel materials. Currently, based on insights and approximations from subject matter experts, the market has 100% competence in carbon steel but 20-30% in stainless, with 40-50% of the workforce likely needed to be competent for the needs of the CCS sector.</p> <p>Pipefitting involves the same materials as other sectors, with little CCS distinctiveness.</p>	<ul style="list-style-type: none"> • Welding training costs may be marginally higher to ensure adequate competence using stainless steel. • For rapid scale up of UK training provision in welding there is a need to find ways to make stainless steel available within training environments to build welding skills.
<p>Standing up new programmes/facilities: given adequate levels of funding and human resource, it would be possible to establish new welding/pipefitting programmes/facilities within a calendar year. The critical gap is (i) funding to do so and (ii) certainty of demand to provide jobs to trainees on completion of training.</p>	<ul style="list-style-type: none"> • With the right collaboration (amongst training providers, skills bodies, EPC contractors, asset owners) it is possible to deliver pilot training programmes in support of Track 1 projects. • This will require a commitment of funding directly from the asset owner and/or other available sources (i.e., government, LSIFs, training bodies, apprenticeship levy).
<p>Clear routes to employment: there is currently a reluctance amongst candidates to commit to training programmes without a clear line of sight of employment. The industry is currently unable to guarantee work, as the growth in demand is tied to project FIDs, which currently inevitably hold a level of uncertainty.</p>	<ul style="list-style-type: none"> • Demand pooling across asset owners, training providers and EPC contractors, will enable clear pathways to employment for candidates upon programme completion. On a regional basis, building confidence, irrespective of specific tendering outcomes.
<p>Innovative delivery models: given the urgency of projects, current routes to competence are prolonged and may be impractical for addressing potential skills shortages. This can be the case where there is operator and contractor hesitancy in developing competence live on-the-job, rather than drawing on experienced, fully competent candidates.</p>	<ul style="list-style-type: none"> • Flexible programmes will be required to scale volume at the pace needed to supply talent to projects – i.e., a programme can consist of six months of compressed, classroom/workshop-based training, followed by twelve to eighteen months of practical competence development through a blend of traditional workshop fabrication and direct deployment into a project for on-the-job learning, vs traditional routes of 36-48 months. • Redeploying labour from adjacent sectors – with recognition of prior learning and/or experience to provide compressed 'bootcamp' programmes for specific demographics.

Theme	Conclusion
<p>Modularisation can help address skills gaps in welding by providing environments, such as fabrication yards, where workers can be pooled together to produce single large items.</p>	<ul style="list-style-type: none"> Although learning and further experience is needed, it appears as though modularisation would be valuable for certain types of unit. More broadly, opportunities to introduce productivity and efficiency improvements should be considered when developing labour market projections and recommendations.
<p>Increased financial support for reskilling: employers /government should be prepared to further fund and support job candidates who are reskilling/upskilling, given the potential reduction in their income whilst training.</p>	<ul style="list-style-type: none"> Government / asset owners may need to fund additional bursaries to cover living expenses or the loss in income for candidates taking on reskilling opportunities. Training providers to consider on-site accommodation, training, and catering to enhance the overall support structure.
<p>Cross-sector approach: it is necessary to view the skills challenge as cross-sectoral. Establishing frameworks that connect with multiple industries facing issues with specific skills can enhance the effectiveness of initiatives.</p>	<ul style="list-style-type: none"> Solving individual skills pinch points by sector of the construction economy (i.e., CCS) is inefficient and fails to address barriers and/or amplify enablers systematically. Actions captured as part of the T&FG summary report should continue to be driven with a cross-sectoral, skills-based approach wherever practicable.

Geosciences review workshop and outcomes

The geosciences review workshop, facilitated by OEUK, engaged a range of subject matter experts in discussion which identified job types and adjacent career paths (see the figure below), as well as the education, competencies and barriers facing new entrants to the job market. Discussions also explored issues relating to educational provision in geosciences and skills transferability.

Subsurface Considerations in CCUS Future Career Path			
<p>Geoscience roles</p> <p>Geologist</p> <ul style="list-style-type: none"> Reservoir Geologist Geochemist Structural Geologist Geomechanics Specialist Petrophysicist <p>Geophysicists</p> <ul style="list-style-type: none"> Processing Geophysicist Seismic Interpreter 4D Specialist Rock Physicist <p>Data Manager</p>	<p>Competency Required</p> <ul style="list-style-type: none"> Educated to MSc or PhD level (relevant thesis) Research experience Chartered Status Technical hands-on experience Specialised training courses 	<p>Technical Development</p> <ul style="list-style-type: none"> Ongoing industry experience across disciplines Further specialised training courses to diversify competencies Conference attendance and presentations Technical papers Mentoring 	<p>Key Phases of CCUS</p> <p>Exploration and Appraisal</p> <ul style="list-style-type: none"> G&G Disciplines Reservoir Engineers <p>Active Injection and Asset Management</p> <ul style="list-style-type: none"> Reservoir Engineers Geomechanics <p>Injection Monitoring and Post-Activity Monitoring</p> <ul style="list-style-type: none"> Geophysicist (4D) Geomechanics

Figure: Subsurface considerations in CCUS Future Career Path (Source: OEUK Economic Report 2023).

The themes and conclusions discussed in the rapid review workshop are summarised below.

Theme	Conclusion
<p>The nomenclature of ‘Geosciences’: given that geoscience qualifications and skills can lead to many occupational pathways, it is vital to ensure that the terminology used is not limiting (i.e., ‘geology’), as this is not representative of the breadth of associated roles (i.e., reservoir engineering, petrophysics, geochemists, sedimentology).</p>	<ul style="list-style-type: none"> • Terminology is important: demand encompasses a wide range of geoscience backgrounds, qualifications and experience, with many potential roles and career paths available in the energy sector, not just ‘geologists’. • Summary report to capture OEUK occupational mapping.
<p>A declining UK talent pipeline¹⁶: geosciences are currently witnessing a rapid decline in the talent pipeline, against a growing demand. The decline is visible across the talent pipeline:</p> <ul style="list-style-type: none"> • A-Level - Geoscience A Level uptake is at ~25% volume relative to its peak. • Undergraduates - the number of first year students studying geosciences has halved between 2014-2019. • Postgraduates: many master’s level courses are closing, with an average of just three domestic students per course in 2022/2023 and ~78% demand being met by international candidates. 	<ul style="list-style-type: none"> • This presents a significant risk to the availability of talent for the CCS sector, particularly in the context of: <ul style="list-style-type: none"> - An ageing workforce (where the current projected mean age across the geosciences disciplines is approximately 51 years old). - The collective, growing demand of geoscience skills across other sectors, including oil and gas, offshore wind and hydrogen.
<p>Several factors are leading to this decline including:</p> <ol style="list-style-type: none"> 1) Widespread misconceptions around geosciences – a lack of clarity around future demand and career pathways, perceptions of a ‘declining skillset’, and concerns of a lack of diversity within the discipline. 2) An increase in climate activism – and the negative association of careers in geosciences with the extractive industries. 3) A diminishing funding pool (private and central) for geoscience education - along with a lack of awareness of the importance of geosciences in relation to net zero (at a governmental and societal level). 	<ul style="list-style-type: none"> • Generate awareness of the geoscience skills challenge: through the T&FG summary report and GJDG process (including advocating for geosciences to be included into wider communications charter public information campaigns). • Launch a collaborative campaign focused on amplifying outreach: highlighting the breadth of current and future opportunities in the sector (particularly in enabling net zero), dispelling misconceptions of the declining importance of the skillset and showcasing the diversity and opportunity within the sector.
<p>Diversifying routes to entry: there are opportunities to broaden the routes to entry into geoscience careers, for both entry level talent and the existing workforce – enabling greater volumes of talent into the discipline while enhancing the overall diversity of the talent pool.</p>	<ul style="list-style-type: none"> • Increase the number of entry points for early talent (i.e., through apprenticeships and internships), specifically: <ul style="list-style-type: none"> - Degree apprenticeships - have recently been successful in driving increased diversity into the civil engineering sector. There is a viable model for geosciences in which experience is gained as a technical assistant whilst pursuing a degree qualification. • Create pathways for new entrants and existing talent, notably: <ul style="list-style-type: none"> - Launching upskilling programmes for candidates with traditional STEM or engineering backgrounds - due to high transferability with geosciences.

Themes and conclusions from the geosciences rapid review

¹⁶ Geoscience in crisis (July 2023): Subsurface Task Force report.

References

The following data sources were reviewed and used to inform the analysis:

1. BEIS '[CCUS Supply Chain: a roadmap to maximise the UK's potential](#)' (May 2021).
2. CATCH-UK '[Supply Chain & Skills Plan](#)' (2022).
3. CCSA '[CCUS Delivery Plan 2035](#)' (March 2022).
4. CCSA '[Supply Chain Excellence for CCUS](#)' (July 2021).
5. CCSA '[Workforce & Skills Position Paper](#)' (July 2023).
6. Engineering UK '[Net Zero Workforce report: an analysis of existing research](#)' (November 2023).
7. Green Jobs Taskforce '[Report to Government, Industry and the Skills Sector](#)' (2021).
8. '[Humber Industrial Cluster Plan](#)' (March 2023).
9. HM Government '[Industrial Decarbonisation Strategy](#)' (March 2021).
10. HM Government '[Local skills improvement plans and designated employer representative bodies](#)' (Updated August 2023).
11. HM Government '[UK Hydrogen Strategy](#)' (August 2021).
12. IDRIC '[Workforce Planning for Industrial Decarbonisation Report](#)' (December 2022).
13. National Engineering Policy Centre '[The role of hydrogen in a net zero energy system](#)' (September 2022).
14. OEUK '[CCS Supply Chain Report](#)' (2022).
15. OPITO '[North Sea Transition Deal Integrated People and Skills Strategy](#)' (May 2022).
16. RGU Energy Transition Institute '[Powering up the Workforce: the future of the UK offshore energy workforce](#)' (September 2023).
17. Robert Gordon University '[Making the Switch: the future shape of the offshore energy workforce in the North-East of Scotland](#)' (May 2022).
18. Skills Value Chain & Hydrogen Skills Alliance proposal.
19. Subsurface Task Force '[Geoscience Skills in Crisis \(energy sector perspectives and energy transition implications\)](#)' (July 2023).
20. UK Research & Innovation / Net Zero North West Partners '[The Net Zero NW cluster plan](#)' (January 2023).
21. Wood and Optimat '[Supply Chains to Support a Hydrogen Economy](#)' (June 2022).
22. X-Academy '[UK Energy Jobs: Seize the Opportunity](#)' (November 2023).

List of abbreviations

CCS	Carbon Capture & Storage
CCSA	Carbon Capture & Storage Association
CCUS	Carbon Capture, Utilisation & Storage
CEC	Careers and Enterprise Company
DESNZ	Department for Energy Security and Net Zero
DfE	Department for Education
DIT	Department for International Trade
DWP	Department for Work and Pensions
ECITB	Engineering Construction Industry Training Board
EDI	Equality, Diversity and Inclusion
EINA	Energy Innovation Needs Assessment
EPC	Engineering Procurement Construction
ESA	Energy Skills Alliance
ETI	Energy Transition Institute
FEED	Front End Engineering Design
FID	Final Investment Decision
GJDG	Green Jobs Delivery Group
IDRIC	The Industrial Decarbonisation Research and Innovation Centre
IPA	Infrastructure and Projects Authority
LSIPS	Local Skills National Infrastructure Commission Improvement Plans
NSTD	North Sea Transition Deal
OEUK	Offshore Energies UK
ONS	Office for National Statistics
OPITO	Offshore Petroleum Industry Training Organisation
OREC	Offshore Renewable Energy
OWIC	Offshore Wind Industry Council
RGU	Robert Gordon University
STEM	Science, Technology, Engineering & Mathematics
T&FG	Task and Finish Group

Disclaimer

The contents of this report represent the views of the CCS Task and Finish Group. All T&FG members had the opportunity to review the work and general consensus has been reached. The report should not be taken to represent the views of any individual organisation.

