CCSA Workforce & Skills Position Paper

July 2023

CCSA

Contents

The CCSA

The Carbon Capture and Storage Association (CCSA) brings together a wide range of specialist companies across the spectrum of Carbon Capture, Utilisation and Storage (CCUS) technology, as well as a variety of support services to the energy sector. The CCSA exists to represent the interests of its members in accelerating the commercial deployment of CCUS in the UK, EU and internationally through advocacy and collaboration to achieve Net Zero emissions by 2050.

Contributors

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This position paper was produced by the CCSA and the views and recommendations in the report are those of the CCSA and are not expressly the views of the contributors to the work.

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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
EC	Engineering Construction
ECITB	Engineering Construction Industry Training Board
EDI	Equality, diversity, and inclusion
EINA	Energy Innovation Needs Assessment
EPC	Engineering Procurement Construction
ESA	Energy Skills Alliance
IDRIC	The Industrial Decarbonisation Research and Innovation Centre
IPA	Infrastructure and Projects Authority
LSIPS	Local Skills Improvement Plans
NIC	National Infrastructure Commission
NSTD	North Sea Transition Deal
OEUK	Offshore Energies UK
ONS	Office for National Statistics
OREC	Offshore Renewable Energy
OWIC	Offshore Wind Industry Council
STEM	Science, Technology, Engineering & Mathematic

Executive Summary

This position paper has been produced by the CCSA Skills & Training Task Subgroup, operating under the CCSA Supply Chain Working Group.

Its purpose is to present the CCSA's stance on and understanding of the skills and workforce challenges that are currently facing the Carbon Capture, Utilisation and Storage (CCUS) sector. It offers a high-level overview of the existing skills and training landscape for the CCUS and low carbon hydrogen workforce, encompassing jobs across the entire value chain from capture to transport & storage during the construction and operational phases. This includes an examination of the skills and training obstacles faced by the current workforce, as well as those who are currently in the education system and will constitute the future workforce.

The UK CCUS and Carbon Capture and Storage (CCS) enabled low-carbon hydrogen sector is encountering a scarcity of skilled personnel, particularly in design and engineering construction. This shortage has the potential to significantly impede the timely completion of CCUS projects and have adverse effects on the UK's Net Zero objectives. The competition for skilled labour not only exists within the CCUS sector but also extends to other large-scale infrastructure projects who require the same skilled workforce to deploy across the UK within similar timeframes. The need to replace or re-train an ageing and non-diverse workforce, along with the challenge of attracting a significant number of school and college graduates to an industry that may not be perceived as glamorous, further intensifies the urgency of attracting and training new workers.

According to the CCSA's modelling, the CCUS sector in the UK will generate over 70,000 new jobs and safeguard up to 77,000 jobs in carbon-intensive industries at risk of being relocated abroad. The development of CCUS and low-carbon hydrogen presents opportunities to create and protect employment in regions that have historically experienced economic disadvantages, thereby contributing to the Government's levelling up agenda. This would enhance the UK's prosperity through the production of goods and services necessary for establishing a new industry, as well as the establishment of robust UK CCUS supply chains, which possess significant export potential.

The position paper outlines a series of crucial recommendations that are key to ensuring the availability of resources to facilitate the transition to Net Zero through the implementation of CCUS. The CCSA acknowledges its pivotal role in supporting the sector, as well as specialised stakeholders and groups involved in skills and training development, such as OPITO, ECITB, the Green Jobs Delivery Group, and the Hydrogen Skills Alliance, to name but a few. Collaboration with these entities by the Government and industry is crucial to guarantee the success of their efforts in rapidly cultivating a skilled workforce capable of delivering the first two Track-1 clusters by 2030 and successive clusters thereafter.

Key Recommendations

Skills Area	Recommendation	Owner	Time scale
Existing workforce skills and training	Government to identify a cross-sector coordinating body (e.g. the Green Jobs delivery group) to produce a delivery plan with funding timelines for skills and training at scale and at pace.	• DESNZ • Green Jobs Delivery Group • Training providers for CCUS • Industry	2023-2024
Existing workforce skills and training	Review existing training availability and effectiveness and develop cross-sectoral mechanisms to promote easy mobility of workers between sectors and build 'local' workforces, particularly in dispersed site locations.	• Industry • Training Providers • Local Authorities (LSIP schemes) • Green Jobs Delivery Group	2023-2024
Future workforce skills and training	Broaden new entry pathways, with clarity on career rogression to stimulate greater uptake of careers in the CCUS sector and relevant professions.	• Training/Education providers • Industry • Department for Education	2024-2030
Future workforce skills and training	Simplify the Apprenticeship Levy Fund, with easier access, to ensure increased funded apprenticeship uptake and availability with a view to expand and create a fund for general skills training.	• Government	2023
Equality, diversity and inclusion	Implement targeted recruitment measures and work with third sector organisations with links into under-represented communities to reach more diverse workforce demographics, ensuring jobs and skills transferability opportunities are a central objective for future communication plans for the CCUS industry.	• DESNZ • Industry • Green Jobs Delivery Group	2024-2030
Equality, diversity and inclusion	Increase data collection to measure EDI: • Improved reporting on ethnicity and gender pay gaps • Government to mandate the collection of EDI data.	• Government • Industry	2024 onwards
International supply chain & skills	Build on previous UK capability and capacity mapping to identify CCUS supply chain export economic opportunities, including the export of training services.	• Industry • Trade associations & stakeholders (CCSA, ECITB, OPITO, Hydrogen UK) • Training providers	2024
International supply chain & skills	Develop a global roadmap to demonstrate the strengths and weaknesses of the global CCUS supply chain and skills.	• Trade associations • Industry • UK Export Finance • DIT • DESNZ	2024

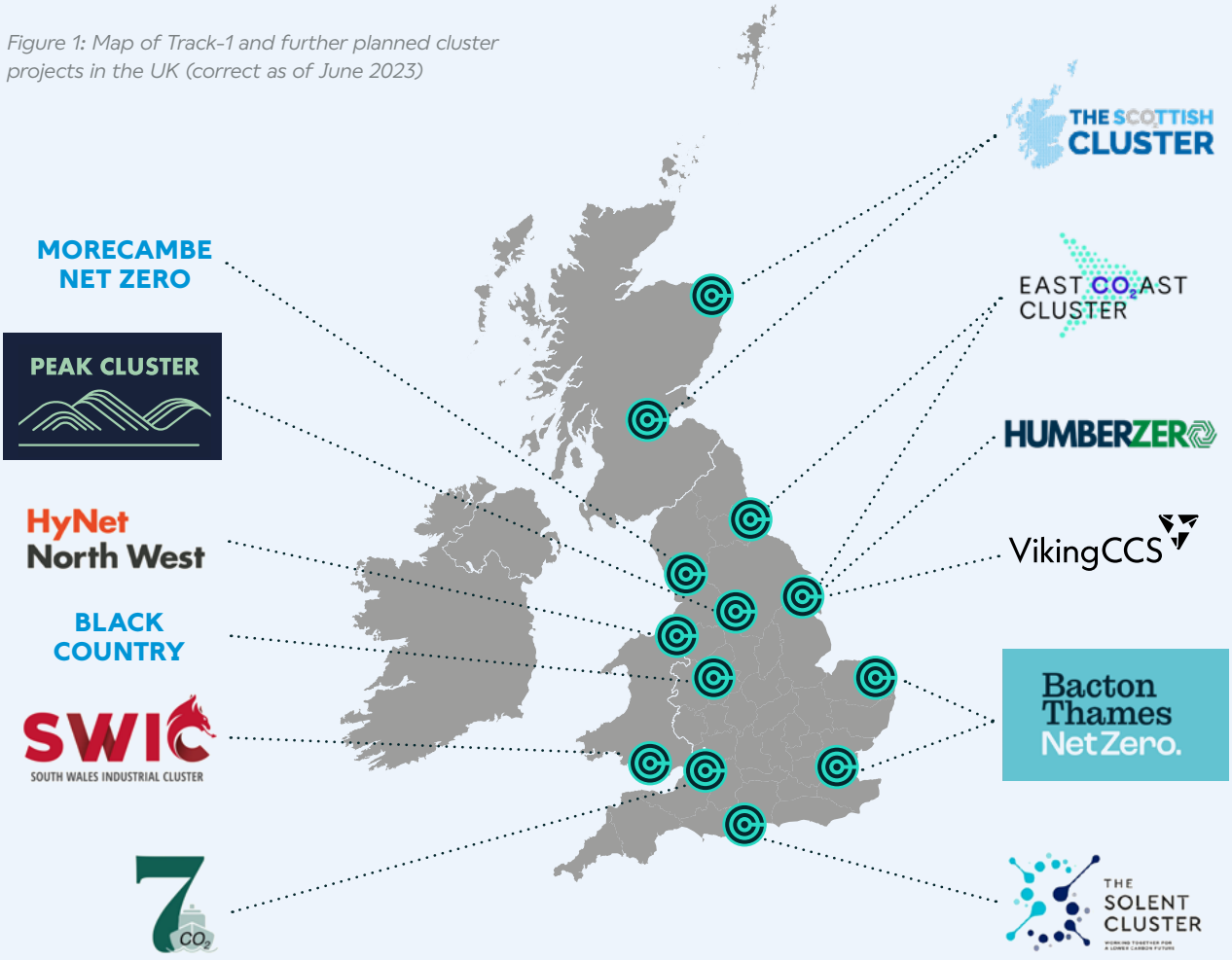
1. Introduction

The UK Government have developed a CCUS deployment programme to address industrial decarbonisation as part of the Net Zero Strategy[1].

The strategy states the UK Government ambition to capture 20-30 million tonnes of carbon dioxide a year ($MtCO_2$ /yr) by 2030, and an indicative pathway rising to over 50$MtCO_2$/yr stored by 2035. It includes 2030 targets for CO_2 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). All of which will require a skilled workforce to deploy and operate, without which the transition to Net Zero and the corresponding economic and environmental opportunities and benefits cannot be realised.

HyNet Northwest and the East Coast Cluster have been selected as Track-1 clusters, 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 (at time of publication). Further potential clusters are located at; Morecambe Bay, Peak District/Staffordshire (Peak Cluster), Grangemouth, Bacton, Thames Estuary, Southampton (Solent Cluster), and South Wales (Figure 1). In March 2023, the Government announced that £20 billion would be allocated to the funding and implementation of CCUS projects in the UK, alongside a Powering up Britain; Net Zero Growth Plan[2] and Energy Security Plan[3], which details that the Government has committed to publishing a joint government-industry Net Zero and Nature Workforce Action Plan in the first half of 2024.

Figure 1: Map of Track-1 and further planned cluster projects in the UK (correct as of June 2023)



1. UK Net Zero Strategy: Build Back Greener (2021)
2. Powering Up Britain – The Net Zero Growth Plan (2023) (p.10)
3. Powering Up Britain – Energy Security Plan (2023)

The Government also released a shortlist of eight projects which would proceed to final negotiations to access Track-1 cluster infrastructure and plans were laid out for an expansion of new/previously unsuccessful projects onto Track-1 infrastructure, and for the streamlining of the sequencing process for Track-2. With Track-1 CCUS projects moving forward to construction and operational phases there is an urgent need to understand what the subsequent demands on the UK supply chain and workforce will be, in order to deliver these projects on time.

The development of a UK CCUS and CCS enabled low-carbon hydrogen industry to realise the Government's Net Zero goals, provides a huge domestic opportunity to address the Government's levelling up agenda, by creating jobs in the UK's industrial heartlands which have more recently been disproportionately less well-performing parts of the UK. This would boost the UK's prosperity as a result of the manufactured goods and services required to deliver a new industry, as well as develop strong UK CCUS supply chains with a huge export potential opportunity (the 2019 CCUS EINA study predicts the Engineering Procurement Construction (EPC) sector alone has an exportable value of £2.1bn per annum by 2050)[4].

However, there are risks of a design and EPC skills bottleneck occurring within the UK skills landscape that must be mitigated if we are to ensure a sufficient supply of adequately skilled workers to deliver CCUS projects on time and capitalise on the ability of the UK to capture the economic opportunity the CCUS industry presents. This is both in terms of maximising local content versus importing of goods and services, as well as exporting UK CCUS services, which will hinge on the sector's global competitiveness and competitiveness of its workforce. Whilst the UK has a strong base of skilled workers in construction and design services across a range of complex infrastructure classes, there are significant concerns among capture project developers regarding a lack of volume of skilled labour for use in CCUS and low carbon hydrogen projects needed to achieve the Government's 2035 CCUS ambitions.

This is not only due to competition between CCUS projects, but also against other large infrastructure projects which will draw on the same skills and competencies occurring over the same timeframes. This is compounded by an urgent need for the engineering construction industry to replace or re-train an ageing and non-diverse workforce in time to meet demand, which will require attracting tens of thousands of new and re-skilled people into extensive training programmes.

Expected CCUS jobs demand

The CCSA undertook modelling to provide national figures on jobs created and jobs protected and estimate that CCUS will create a peak of over 70,000 new jobs, as Opex and Capex is spent in cluster regions and their supply chains[5]. Carbon capture technology will help protect up to 77,000 jobs in carbon-intensive trade-exposed industries, which are at risk of offshoring as carbon prices rise. The largest shares of which are in Yorkshire & Humber (21%), Wales (17%) and the Northwest of England (15%)[6].

The East Coast Cluster state they are aiming to create and support an average of 25,000 jobs per year between 2023 and 2050. With 21,700 direct and indirect jobs in construction per year and 15,500 direct and indirect jobs in operations per year[7]. The same situation is reflected in the HyNet North West cluster, who estimate the cluster will support 75,000 jobs across the UK by 2035 with 6,000 of these being local permanent jobs in the region[8].

Whilst these numbers may differ, what they do demonstrate is that the skills challenge facing the CCUS sector is considerable. Yet with concise realisation of the challenges and timely action, the UK can still adequately resource the transition to reach Net Zero.

4. Energy Innovation Needs Assessment: Sub-theme report: Carbon capture, utilisation, and storage (2019)
5. Public First updated the estimates on economic benefits (jobs created; direct, indirect, and induced) and increased GVA as a result of investing in these projects and jobs. These numbers were sense-checked with clusters, individual projects, and DESNZ.
6. Public First analysis of the Business Register and Employment Survey. Energy-intensive trade-exposed industries were defined as including manufacture of refined petroleum, iron and steel, cement, industrial gases, petrochemicals, synthetic rubber, man-made fibres, and glass.
7. East Coast Cluster webpage [accessed 11th May 2023]
8. Hynet North West webpage [accessed 11th May 2023]

2. Key challenges to date

The challenges set out below are summarised from several recent key reports (appendix 4) on the UK skills landscape.

Many of the reports use different methodological approaches to develop job number forecasts across the UK, making an overall assessment of the current skills landscape and job requirements a significant challenge. They do, however, provide a good overview of the key issues and challenges the UK workforce is currently facing:

- **An ageing workforce** – The engineering construction industry has highlighted that they are facing an ageing workforce challenge with many employees retiring; thereby taking key knowledge, experience, and skills with them and creating a strain on industry to rapidly attract and train enough of the upcoming younger workforce to fill the gaps[9].
- **Competition for workforce** – Multiple sectors including nuclear, hydrogen, offshore wind and the oil and gas sector are looking to build and operate large infrastructure projects as part of the transition to net zero along very similar timelines. With workforce shortages across the engineering and construction industry already, competition for the same workforce will likely create a skills bottleneck, where projects simply will not be able to keep to planned deployment timelines due to the strain on resources.
- **Lack of job opportunity awareness** – The relative 'newcomer' status of the CCUS industry to the UK economy and public information space means there is a lack of awareness of the available job opportunities, from early education settings through to professional employment institutions.
- **Need for training** – In order to meet the level of workers needed to deploy across large infrastructure projects up to 2030 and beyond, training and retraining of the existing workforce will be required. This will require sufficient levels of skilled educators and facilitators who can carry out the training courses required. In addition, current trainers will need to be retained in the education sector as some are choosing to go back into industry for more lucrative opportunities.
- **No standardised methodology for forecasting job requirements** – Different modelling techniques, timescales and derived figures for reporting future job number forecasting have resulted in incomparable job figures both within the CCUS sector and between competing industry sectors, preventing a clear regional/national view of job requirements. In addition, the proportion of new future jobs compared to existing jobs retained, and replacement jobs (for those leaving the sector through retirement) are not always stated. Without a standardised methodology for job calculations and clear definitions of what job roles are being included in modelling, CCUS and other Net Zero sectors are in danger of miss calculating the number of skilled workers needed and will thus not have enough to deliver on key projects[10].

9. Enabling Skills for the Industrial Decarbonisation Report (2022) IDRIC

10. Work to address this is being progressed by the CCSA and CCUS Supply Chain Council in a workstream under the CCUS Supply Chain Strategy – see appendix 2

3. Existing workforce skills & training

3.1 Workforce Demographic

In order to assess the current technical workforce skills and the training required to deploy a CCUS industry and fulfil government ambitions, it is first necessary to define the job roles and demographic of the workforce required, to ensure that industry can accurately compare jobs/skills datasets which will underpin roles and training.

Work has been initiated through the North Sea Transition Deal (NSTD) Integrated People and Skills Strategy, supported by OPITO and Engineering Construction Industry Training Board (ECITB), to develop a 'common taxonomy' for jobs roles and job families across offshore energy transition industries (including CCUS and hydrogen). This is part of a series of developed 'Action Plans' on skills[11]. Appendix 3 shows how through this project the workforce demographic has been sorted into a number of different 'job families' and subgroups which breakdown roles into categories, for example, technical, commercial, management, health & safety, and their subsequent approximate skill levels.

A similar exercise for the onshore element of CCUS projects is yet to be completed, but once completed it would be beneficial to combine these pieces of work across both onshore and offshore elements of CCUS projects, as well as across other energy transition industries which utilise the same workforce. This will help to give a better overview of where cross-sectoral skills apply and where demands on cross-sectoral jobs may occur.

For this paper, we have undertaken a high-level review of the technical and commercial workforce (i.e., onsite and desk jobs) for both onshore and offshore CCUS and related sectors (i.e., engineering) as a whole, referring to both demographics when using the term 'workforce'. Table 1 below gives a simplified view of the different categories of jobs which may be required throughout the different phases of a CCUS project.

Project Phase	Job categories
Preconstruction	Specialist Advisory
	Strategic Client
	Pre-construction
Construction	Construction professionals
	Construction trades people
	Administrative support professionals
	Cleaning and security
Operation	Operational professionals
	Operation technical professionals
Skills development	Education and training specialists

Table 1: Simplified job categories required per project phase (edited from: Enabling Skills for the industrial Decarbonisation Supply Chain report 2022)

11. North Sea Transition Deal Meeting Future Skills Demand Action Plan 2022

3.2 Existing workforce training opportunities

The CCSA estimate CCUS will create a peak of over 70,000 new jobs between now and 2035 as Opex and Capex is spent in cluster regions and their supply chains. In addition, carbon capture technology will help protect up to 77,000 jobs in carbon-intensive trades. This predicted growth requires a concerted and unified collaborative approach to workforce training and will rely on both those already in the workplace, as well as those currently coming up through the UK education system.

The transport and storage elements of CCUS are well-suited to the specialist technical expertise and skills of the UK oil and gas workforce, whilst the onshore capture elements of CCUS are most closely aligned to skills existing within the chemicals industries. It should be noted that there is a degree of uncertainty in this assessment, as there will be a degree of 'skills identification' as the CCUS industry and individual projects develop from planning to operational phases. However, upskilling, reskilling, training, and transitioning of the existing workforce is the fastest route to address skills bottlenecks in the short term.

To ensure action is taken now to attract and train an "energy workforce" lessons can be taken from more mature industries, such as oil and gas or nuclear, and adaptations to technician apprenticeship frameworks can deliver the current and future needs for emerging sectors like hydrogen and CCUS[12]. As a first step to close the gap on training, OPITO (leading on behalf of the Energy Skills Alliance (ESA)) has launched a suite of energy transition qualifications which build base level awareness and key knowledge of emerging Net Zero specialisms in CCUS, hydrogen, wind power, and oil and gas. They are designed to provide a knowledge-based introduction to the emerging net-zero specialisms for trainee technicians, existing technicians and others looking to cross-skill or transfer sectors. Whilst these levels of courses are introductory and will therefore likely still require participants to complete further higher-level training in order to operate on CCS sites, these qualifications are in place now, credit rated, and are an excellent start to supporting existing and new energy sector workers who can contribute to Net Zero focused areas of operation[13].

OPITO has also been leading on a piece of work to map and consolidate the current qualifications landscape across the energy industry. This framework template provided in table 2, shows a snapshot of some of the current qualifications which are relevant to CCUS. It focuses on qualification types and some key technical area sub-categories (the main and accepted qualifications available and in use were considered in its generation, but not the more granular examples). What this mapping highlights is a residual gap where more modular/top up qualifications are needed to bridge these training gaps. Without more modular qualifications it becomes harder for workers to transition without having to complete entirely new qualifications from scratch.

New & Renewable Energy	Apprenticeships	T-Levels	SVQs	NVQs	University level
• CCUS (NRE2) • OPITO's 'Introduction to CCUS' knowledge-based qualification	• Energy Apprenticeship programme (OGTAP) • Maintenance and operations engineering technician - MOET (L3) • Engineering technician (L3) • Welder (L2) • Welder (L3) • Electrical power protection and plant commissioning engineer • Project controls technician (L3)	• Maintenance, Installation and Repair for Engineering and Manufacturing • Engineering, Manufacturing, Process & Control • Design and Development for Engineering and Manufacturing	• No SVQs specific to CCUS in the energy sector located at stage 1 mapping • There are national certificates, diplomas, PDAs etc relative to CCUS knowledge and awareness which fall out with activity 5 mapping scope	• No NVQs specific to CCUS in the energy sector located at stage 1 mapping • There are certificates, awards, diplomas etc relative to CCUS knowledge and awareness which fall out with activity 5 mapping scope	• Engineering degree • Geoscience/ geology degree • Chemical Engineering degree

Table 2: Initial mapping exercise, qualifications relevant to CCUS[14]

12. North Sea Transition Deal Meeting Future Skills Demand Action Plan 2022
13. Introductory Energy Transition Qualifications promotional brochure
14. North Sea Transition Deal Meeting Future Skills Demand Action Plan – North Sea Transition Deal integrated people and skill strategy. Strategic priority 5 in the 'Meeting Future Skills Demand' action plan: Develop an offshore energy vocational education framework covering Apprenticeships, T-Levels and National and Scottish Vocational Qualifications (being developed)

3.3 Challenges for the existing workforce

There are a number of challenges to overcome to ensure the existing technical work force can meet the skills demands of both the Track-1 clusters and successive clusters thereafter, including but not limited to; mobility barriers for the workforce, skills transferability, dispersed site challenges, competition for skilled workers with other large infrastructure projects, and an ageing workforce resulting in knowledge being lost from industry when skilled workers retire.

Mobility barriers

Workforce mobility challenges exist in two strands:

1. The transferability of skills from one industry to another.
2. The geographical movement of workers from one site to another.

It is essential that the potential for skills transferability between sectors is explored and that barriers are overcome to meet the aims of Net Zero. Renewable sectors, small scale nuclear, hydrogen and CCUS are expected to grow exponentially, whereas traditional industries such as oil and gas are facing a gradual decline (due to a number of energy security and other impacting factors). A large transition of the current oil and gas workforce (comprising 118,400 direct and indirect jobs in 2021) to other sectors of the offshore energy industry is expected, which opens a significant pool of skilled workers to recruitment into emerging industries like CCUS.

Skills transferability

Currently, the career pathways and transitional opportunities between decarbonising sectors (including CCUS) are unclear and fragmented. This results in workers regularly having to repeat training when transitioning between sectors, incurring substantial financial costs (often, at personal expense), creating duplication, and requiring a considerable time commitment from attendees.

Research carried out by ECITB has demonstrated that employers see opportunities in the concept of skills transferability, particularly in engineering and craft-skills related roles, as well as project management and ICT[15]. There is a consensus between employers and stakeholders that skills transferability could assist in areas of skills shortages and would enable 'instant' feet on the ground workers. However, few employers have proactive strategies to attract and recruit workers from specific sectors, favouring general recruitment, upskilling, or retraining of existing employees, which whilst also necessary, will take time to implement training.

As highlighted by the NSTD Aligning Offshore Energy Standards Action Plan[13], to enable workers to move between sectors there is also a crucial need to integrate existing technical, safety and survival training standards. The lack of a robust, integrated framework results in siloed working and creates barriers that inhibit the opportunity for the existing workforce, particularly those in technical roles, to work between different sectors. The mapping of existing standards and development of an integrated framework across the energy industry, is currently being undertaken by OPITO in collaboration with other skills bodies. This will enable the different stakeholder groups to confirm different areas of overlap for standards within the existing sectors. It is imperative to success that all industry skills representative bodies and related strategic stakeholders remain committed to supporting a collaborative approach such as that seen in the development of The Energy Skills Passport development.

The Energy Skills Passport

The Energy Skills Passport is a digital tool that will focus on technical qualifications, safety and survival, and specialist emergency response training, to support the transition of the workforce between sectors. It aims to assist the workforce to identify future roles in different sectors and the training necessary to be qualified to fulfil those roles. It does this by displaying which qualifications and certificates are recognised by different sectors and required for individual roles, as well as highlighting future career pathways and helping prevent the workforce repeating qualifications when transitioning between sectors (making the transfer more efficient and equitable).

In the long term, an integrated framework is also to be developed for future needs that can be expanded to accommodate technical roles in emerging sectors, like CCUS and blue hydrogen, and will help future-proof both the mapped qualifications and the associated Energy Skills Passport functionality, whilst also establishing an ongoing process for annual and scheduled updates to standards.

15. Skills Transferability in the ECI; Pye Tait on behalf of ECITB, 2020
Skills Transferability in the ECI - ECITB

An industry-wide approach in terms of cross-sectoral technical skills recognition would be a strong way to address barriers to skills transferability. It is also important for there to be leadership, a clear sense of shared purpose and resource, to facilitate a collaborative approach to solving the shortage of skilled workers. The road map proposed through the NSTD Integrated People and Skills Strategy in conjunction with an 'Energy Skills Passport', with cross industry support and programmes such as the ECITB's Connected Competence[16], are current examples of how skills transferability barriers are beginning to be addressed in the offshore energy (including CCUS) technical sector.

However, further support still needs to be given to populations who already possess a significant level of skill but require refinement or recontextualisation before they can transfer their skills to a new sector. One example of such a programme is the ECITB's Military to Offshore Wind programme. The programme aims to attract those seeking a new career after serving in the armed forces into the engineering construction industry and is a collaboration between the ECITB, East Coast College and local employers. This is a small-scale example of how collaborative working between key stakeholders could potentially unlock new routes into industry and training for the existing or returning workforce and attract skills that may otherwise be lost. Funding should be considered to help scale and diversify such offers, which, aside from attracting people with significant skillsets, also promote collaboration between institutions and employers.

Geographical mobility barriers

Geographically the two Track-1 CCUS clusters are located in what used to be the UK's industrial heartlands but have since seen decline with workers and young graduates migrating towards cities and hubs such as London and the Southeast of England, where job opportunities are more abundant and local economies stronger. This may result in a lack of locally available skilled workers for onsite technical work in the Track-1 CCUS cluster locations and would require using a workforce which may have to travel large distances from where they are based.

The type of skills/workers needed for CCUS projects in the development/construction phase are the same as those for other large infrastructure projects developing across the UK on the same timelines. This poses geographical challenges and strains where it is not practical or possible for large volumes of workers to travel to often remote locations at dispersed sites to work on these projects. For the operational phases of CCUS projects the skills required are more specific to CCUS and so competition for construction/engineering workers across competing sites should be less by this stage but as we do not currently have enough skilled workers in the pipeline to carry out the required operational phase work, finding enough workers to meet demand will still be a critical issue.

One way to address strains of geographical movement of workers in the construction phase is to start developing a local workforce now, by upskilling and retraining the current local community. This would help to alleviate the need to import workers from across the UK or abroad and would support the UK Governments levelling up agenda[17]. How this happens at the pace and scale necessary, in the geographies local to the Track-1 clusters with current existing training infrastructure, is the critical challenge which needs addressing.

As decarbonisation projects move into deployment phases, becoming more complex, they will increasingly require a flexible and mobile workforce. This in turn will require the development of integrated frameworks of energy safety and technical training standards built on recognition, which are simple, flexible, visible, and equitable, whilst avoiding duplication of training wherever possible.

Competition for skilled workers

The scale of demand for construction workers and engineers across the UK presents a significant challenge to all large infrastructure projects currently going ahead, as well as those planned for the near future given the current labour market shortages. Modelling by the University of Chester and IDRIC predicts that 353,155 additional jobs per year will be needed across the phases of preconstruction, construction, and operation to decarbonise heavy industries by 2050 alone[3]. Alongside decarbonisation of industry, which includes the roll out of four CCUS clusters by 2050, just some of the other large infrastructure projects being carried out or planned to go ahead in the UK include:

- Hinkley Point C
- Sizewell C[18]
- Hornsea Two Windfarm
- Rolls-Royce SMR project(s)

16. Connected Competence is a competence assurance initiative. Unlike international examples of skills transferability, Connected Competence is not focused on re-integrating a displaced workforce in the engineering construction industry (ECI), but rather it aims to standardise competence testing across the oil and gas sector. Thereby, it helps employers to judge whether a competence gained in another ECI sector or project is transferable or whether additional training is required. This initiative is unique in its scale and dedicated focus to standardisation of competences and skills.
17. UK Government – Levelling up the United Kingdom White paper – 2019
18. 70,000 UK jobs created, relying on over 3000 UK based suppliers – Sizewell C webpage [accessed 11th May 2023]

All of these projects will require the use of the same workforce skilled in designing, engineering, manufacturing, and constructing. In the offshore sector, the NSTD envisages the need for 40,000 direct and indirect supply chain roles in decarbonising UK Continental Shelf production and in the offshore CCUS and hydrogen sectors. Meanwhile, Policy Exchange forecasts a net increase of 40,000 jobs connected to the North Sea energy industry by 2050 across offshore wind, hydrogen and CCUS[19].

The jobs forecast offered in Figure 2 from the NSTD integrated people and skills report shows that the offshore energy sector could support up to 350,000 jobs by 2050, 50,000 of which are CCUS jobs. This constitutes an increase of around 196,400 total jobs required (noting that forecasts, especially for the offshore CCUS workforce, start to show meaningful growth from 2025 onwards). These include skills required across all business areas, from engineering and fabrication to procurement and people management, to leadership and new digital skills, for example, in automation. They also include all workforce roles, both offshore and onshore at terminals and fabrication facilities, and onshore professional, engineering, and support roles[8].

With multiple sectors and projects predicating increasing needs and pressure on the UK labour taskforce, it is clear we are heading towards a skills bottleneck and supply chain pinch within the next 4-7 years. There is an urgent need for key bodies such as the Department for Energy Security and Net Zero (DESNZ), the Government Infrastructure and Projects Authority (IPA), the National Infrastructure Commission (NIC), Department for Education (DfE) and Department for Work and Pensions (DWP) to work together with industry to review the timelines of planned UK infrastructure projects and how to help provide the required skills. If the UK skilled labour workforce is not scaled up rapidly from now onwards, it will become necessary for the Government to de-prioritise and stagger the delivery of future infrastructure projects. Which will inevitably negatively affect certain sectors and or Net Zero targets.

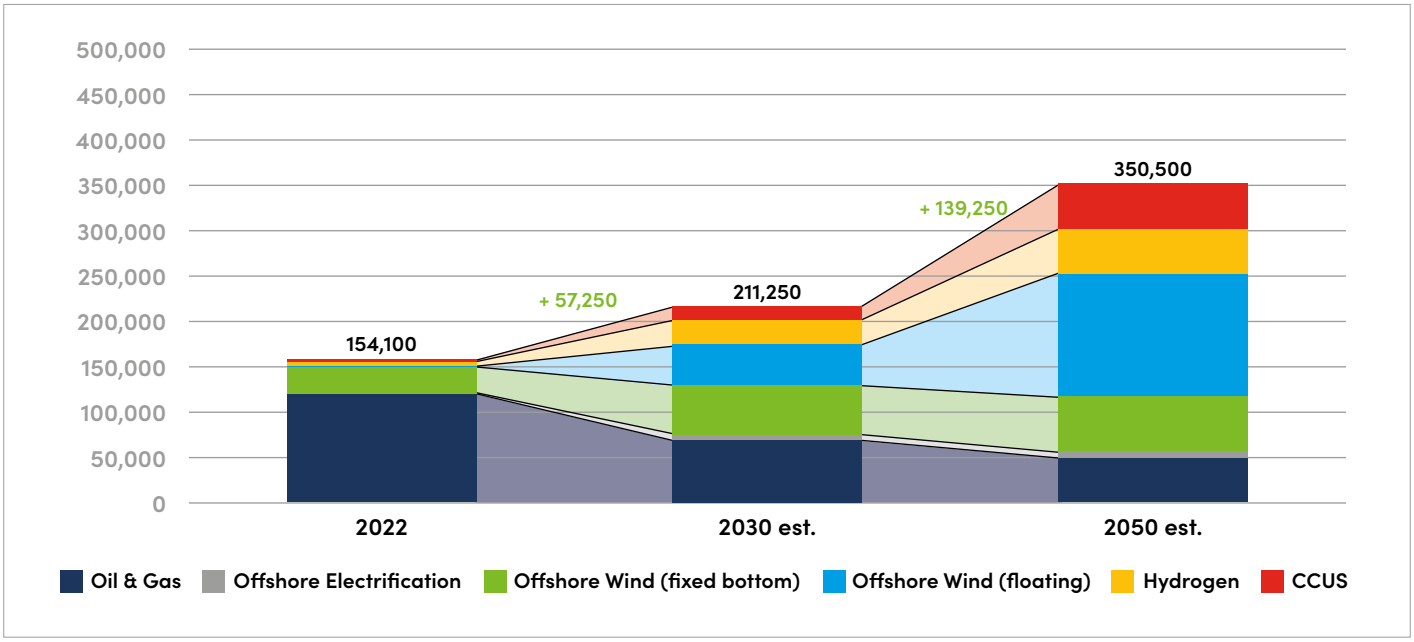


Figure 2: Offshore Energy sectors: 2022 to 2050 Job estimates by sector - Direct and Indirect Employment (NSTD Integrated People and Skills strategy report 2022)

19. The Future of the North Sea – Policy Exchange (2020)

Training of the trainer challenges

Engineering and infrastructure industries are experiencing increasing issues with an ageing workforce and few new entrants coming in to fill the gaps. In engineering construction (EC) alone, nearly 40% of the total workforce is over the age of 50 and only 5% are under the age of 25[20]. Although less data is available, there are indications that the situation amongst trainers is similar, with those retiring from industry taking 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.

The lack of diversity both in industry and in trainer roles (86.2% of the EC workforce identify as men), restricts the talent pool and the possibility of bringing more people into training positions. More efforts need to be made to make the training sector more attractive to a wider range of people, allowing the flexibilities and cultures that attract beyond the current demographic (this is discussed in further detail in section 5).

3.4 Recommendations

1. Identify a coordinating body to look across sectors to produce a delivery plan for skills at scale and at pace (e.g. this could be delivered by the Green Jobs delivery group). Including proposed funding timelines and plans for training schemes.
2. Review current training availability and effectiveness with a view to developing cross-sectoral mechanisms to allow easy mobility of workers between sectors.
3. Work with local authorities (LSIPS) to increase training availability/awareness to build the 'local' workforce particularly in dispersed site locations where opportunities are less visible than in cluster settings.
4. Increase train the trainer opportunities and awareness, with dedication to decarbonisation challenges.
5. Review and improve contract specifics and wage levels for the current pool of trainers/educators, to ensure these individuals are not unnecessarily lost to higher paying sector roles.
6. Target funding towards broader measures than just training, as non-training costs incurred can be a barrier for small employers.
7. Collaboration across government, the IPA, DfE, the NIC, and industry, to work together to review the timelines of planned UK infrastructure projects and how to skill these to avoid bottlenecks.

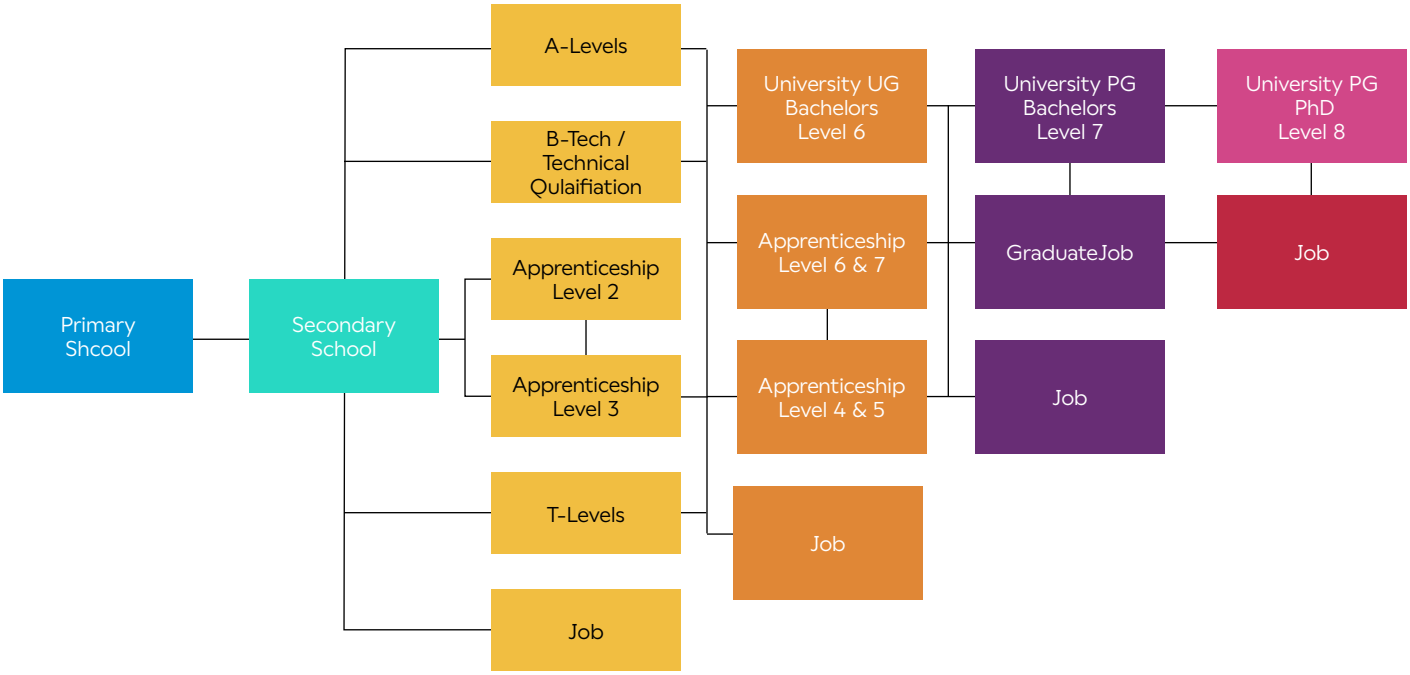
20. ECITB Workforce Census 2021, Overview of the Engineering Construction Industry

4. Future workforce skills & training

4.1 School & University Level

The current UK education pathways are detailed in Figure 3. England, Wales, and Northern Ireland use A-levels and T-levels[21] (England only), whereas Scotland uses Scottish Highers as the precursor to further and higher education.

Work carried out by the University of Chester and partners have aligned stages of the education pathway and at what age information on climate issues and decarbonisation are best introduced in the educational system (Figure 3 & 4).



Age 4 to 11

Necessary Action:

- Three Rs
- Greenhouse gases
- Biodiversity
- Biomes
- Climate change and weather changes

Age 11 to 16

Necessary Action:

- Impacts of climate change
- Adaptation & mitigation
- Field trips with inustries
- Understanding direct & indirect climate jobs
- Skills to solve CC

Age 16 to 18

Necessary Action:

- Dangers of CC
- Specific skills at their levels to solving CC in their roles/course
- Work with industry to develop courses/ A-Levels to be climate first
- Meet the employer opportunites

Age 18+

Necessary Action:

- Opportunities to put into practice CC solutions
- Industry developed courses
- Placement opportunities
- Teach innovation not textbook

Age 18+

Necessary Action:

- Students working day-to-day with industry on research and real solutions
- Industry placement opportunities as standard

Figure 3: UK Education pathways (Enabling Skills for the industrial Decarbonisation Supply Chain report 2022)

21 T-Levels: an alternative In England to A-Levels, apprenticeships and other '16 to 19' courses. Equivalent in size to 3 A-Levels, a T-Level focuses on vocational skills and can help students enter skilled employment avenues, higher study, or apprenticeships

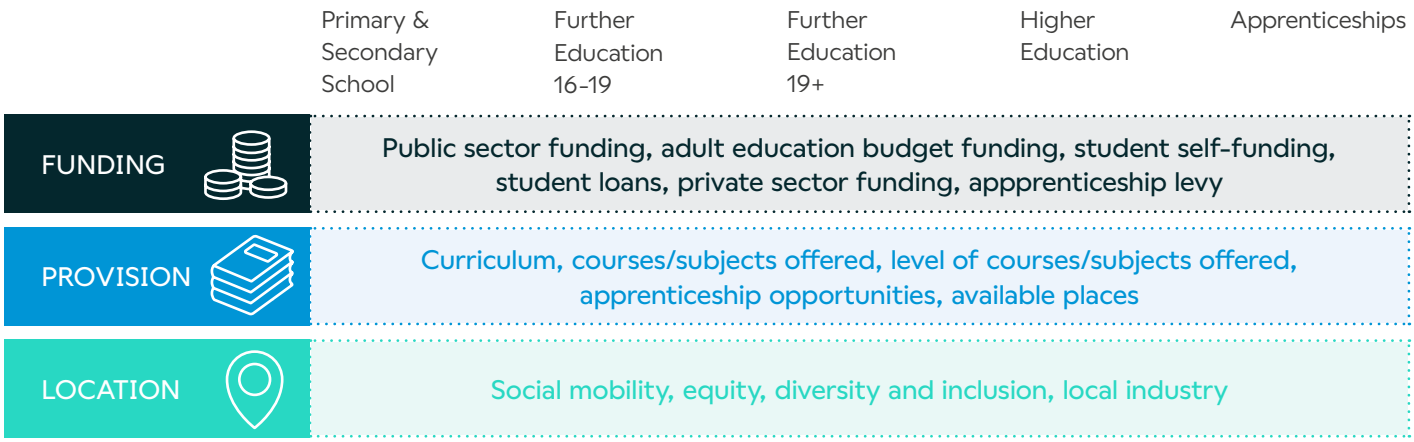


Figure 4: Funding, provision, and location across stages of UK education (Enabling Skills for the industrial Decarbonisation Supply Chain report 2022)

They have deduced that there are three components to UK education that cut across each stage of skills development. 'Funding (individuals and institutions), provision (available places and courses), and the location of educational facilities. By supporting all three of these components, the UK educational system has the framework in place to deliver the skills required for decarbonisation of industry, development of a skilled CCUS sector and delivery of Net Zero, but this will require certain interventions to deliver to the necessary timelines[3].

High quality and properly funded careers advice from 16-19 years of age is essential to ensure young people are aware of the possibility of careers in CCUS, and that they understand the pathways that will take them there. There is consensus that, ideally, CCUS careers advice and guidance should also be embedded into other forms of personal, social and health learning, with regular careers check-ins both as a peer group and also on a one-to-one level. Careers advice and guidance should not only focus on an occupational level, but also on industry levels, allowing young people to understand which industries an occupation can function in and how to move between industries if they should choose to do so.

The NSTD Integrated People & Skills Strategy priority activity recommendations have begun to outline how this could be addressed in relation to offshore energies, including CCS. Key recommendations are:

- The industry could take a more strategic, standardised, and formalised approach to addressing skills shortages.
- Industry skills bodies support the NSTD People & Skills Strategy activities to understand what skills are needed, when and in what numbers, and commit to them.
- Improve industry and college collaboration where technical appreciation and skills are required.
- Encouraging industry investment into the wider talent pool in a coordinated manner.
- Seek/promote better synergy and alignment between UK devolved authorities to improve problematic areas.
- More emphasis could be placed on science, technology, engineering, and mathematics (STEM) subjects up to Level 7 and on pre-work with schools and colleges.
- Avoid duplication of effort by ensuring any people and skills developments and tangibles feed into central, integrated solutions, e.g. a central portal that also covers labour market information, the skills energy passport, etc.

4.1a Challenges for the future workforce

New entrant pathways

As subsets of the energy sector diversify and evolve, clarity around education frameworks and qualification pathways that support the wider industry become essential. Emerging technologies bring new roles and qualifications into the market, making the skills landscape busier, therefore progression pathways and career progression opportunities must be made clearer.

Understanding the differences between, and the complexities arising from, regional qualification requirements and devolved funding streams will simplify and facilitate movement of workers to the benefit of companies operating across all UK regions. It is necessary to develop the right mechanisms to accurately and clearly direct both new entrants to the industry from a school leaver or university level, and those wishing to cross sector boundaries or upskill into different roles.

New entrant programmes need to be expanded and look beyond formal education routes, particularly to capture those individuals who may have been traditionally incorporated by these. The ECITB runs a scholarship programme[22] which aims to provide a sustainable pipeline of new talent for industry by providing a grounding in the industrial knowledge and skills that are in demand in their region. 112 scholarship places were announced across the UK in September 2022, including 52 ECITB Energy Transfer Technician Scholars, on pathways specifically focused on supporting the delivery of the energy transition. The ECITB Scholarship has already prepared 260 scholars for careers in the engineering construction industry since its inception in 2020, to help employers withstand the economic impact of the Covid-19 crisis. The programme, which lasts 1 or 2 years, delivers training focused on regional skills shortages. The vast majority of ECITB scholars are young people who have not been able to secure an apprenticeship. Tailoring programmes to these populations will help to create opportunities that might otherwise have been missed. Scholars who complete the programme possess the foundation skills to move into apprenticeships in industry, or in some cases, directly into employment.

Training availability

Industry, training providers and the DfE need to look at training provisions in all areas, especially T-Levels, to understand if there are any cold spots where provision is insufficient. This refers to both teaching of particular subjects but also, for example, the availability of work placements.

In addition, employers must be given more support and resources to be able to take on T-Level students on a work placement, and further flexibility must be considered to allow employers the opportunity to offer these. Requests for flexibilities, such as the use of the training providers simulated environment (effectively the same site as learning) for part of the placement, must be seriously considered if the option of a placement in certain industries is to be a reality. Ensuring that the right training is available in areas of the country closest to the Track-1 CCUS cluster projects and successive clusters thereafter will be crucial to attracting the potential incoming workforce from schools and universities. Parallel to this, support must be given to both education providers and employers to connect with each other and offer opportunities to those completing their studies. A coordinated approach is required to increase the impact of those already working in silo.

There has been a notable decline in the uptake of earth science degrees and masters courses, which would lead to geoscience careers in the carbon storage sector. As noted in research by the exploration taskforce group; 'school teaching of geology has collapsed with A level student numbers around a quarter of their 1980's peak. First year undergraduate student numbers almost halved between 2014/15 and 2018/19, whilst master's level geoscience courses are closing, with an average of just three home students (compared to international students) per course in 2022/23. The highly successful Centre for Doctoral Training/Geo Net Zero initiative is unfunded going forward. Contributing factors include a lack of awareness of geology as a university subject, dated perceptions of geology as "old men tapping rocks", negative public perceptions of the extractive industries and uncertain energy transition career pathways.'[23] Whilst there may be alternative pathways into the engineering and construction sector, for more specialist desk-based roles, such as a CCUS subsurface geoscientist, it is often the case that the only route to full qualification is via higher education.

22. ECITB Scholarships - ECITB

23. Subsurface Taskforce: Geoscience skills and careers in crisis report 2023

Public perception of CCUS

To date, public awareness and understanding of the CCUS industry is generally low. Government commissioned research looking at public attitudes towards CCUS has found that acceptance and support of the technology increases only with sufficient information being provided by trusted sources (i.e. academics and impartial sources)[24]. Whilst not the focus of this paper, it is crucial that increased and wider reaching dissemination of CCUS information is carried out to develop supportive public perceptions of CCUS, which in turn would encourage the upcoming workforce to choose this industry as a career path. This will require an increased pool of informed communication experts, trusted academics, and impartial bodies in order to undertake this task.

A better understanding regarding how industry is viewed by young people will also ensure the success of attraction and retention policies. The ECITB is currently conducting research into the career motivations of young people both on a path into industry and those looking at other industries, in order to better understand the motivations behind these choices.

Cross-sectoral synergies

In the context of future people and skills needs, there is also a fundamental lack of consistent and comparable data across relevant cross-sectoral industries. Addressing this deficit will unlock a range of targeted interventions to support the future and inclusive growth of the workforce, based on strategic and actionable insights backed by robust data and evidence.

In CCUS, whilst there are skills growth demand forecasts, work is yet to be completed[25] on gathering specific data and intelligence on future people and skills needs that use a common nomenclature (taxonomy), applied across several sectors. However as mentioned in section 3, steps towards developing a common taxonomy for skills across offshore sectors (wind, hydrogen, CCUS, oil and gas) have been made by the Energy Skills Alliance group, OPITO and ECITB through the NSTD, who are developing the Energy Skills Intelligence Hub[26].

This will be a free-to-access cloud-based platform that will provide reports and valuable insights on workforce data (subject to further investment). A single common taxonomy for job roles used across multiple different sectors will assist in developing the necessary training requirements for the technical workforce, support greater mobility of skilled workers across and between sectors as well as help with calculating number of jobs needed for the energy transition. It will also help to provide clear career pathway opportunities, helping the future workforce to see in what roles and industries their skills can be applied. Similar work is also being carried out for the Offshore Wind Industry Council (OWIC) and the Offshore Renewable Energy Catapult (OREC)[27] but further work will still be required.

4.2 Apprenticeships

Apprenticeships are one of the main routes into industry for young people from an engineering construction perspective and help to provide a bridge between classroom based learning and practical, technical on-site learning. At present there are several different entry points and support schemes for both students enrolling on apprenticeships[28], to employers shaping training[29] and accessing support to facilitate apprenticeship spaces in the workplace[30], such as the Apprenticeship Levy.

Apprenticeships hold huge potential for addressing workforce skills shortages. A study by the University of Chester and IDRIC estimates that an additional workforce of around 350,000 people across the stages of pre-construction, construction and operation is needed for industrial decarbonisation. Many of these jobs will be in engineering and an estimated ~70% will be at a technician level, of which apprenticeships could address a significant proportion of these requirements. However, that is not to say apprenticeships alone can hope to meet the substantial demand for future skills requirements. Developing various alternative pathways and entry routes will be essential in responding rapidly, flexibly and at scale to the evolving needs of decarbonising, and energy transition sectors.

4.2a Challenges for apprenticeships

Currently, there is a fragmented approach to the funding of apprenticeships via the UK wide Apprenticeship Levy, with variations across the four nations of the UK in terms of procedures for accessing the Apprentice Levy funding and other support. Apprenticeships are a devolved policy and authorities in each of the UK nations manage their own apprenticeship funding. This element alone adds complexity to the Apprenticeship Levy. Funds are accessed via the Apprenticeship Service Account to spend on training in England. Scotland, Wales, and Northern Ireland have separate funding arrangements whereby the funds are allocated to universities and colleges to deliver apprenticeships. Employers can access these courses without paying the university. Graduate programmes can be established by linking with a funded university. The levy funding is underutilised because of the complexities around the devolved approach, with many in industry calling for a reform of the levy, wanting

24. Carbon Capture Usage and Storage Public Dialogue. 2021 Traverse, BEIS, UKRI, Science wise
25. Correct at time of going to press
26. Energy Skills Alliance Press Announcement (November 2022)
27. North Sea Transition Deal Improving Skills Data Intelligence Action Plan 2022
28. https://www.apprenticeships.gov.uk/
29. Institute for Apprenticeships & Technical Education (IFATE)
30. Flexi-job apprenticeships Government Webpage [accessed 11th May 2023]

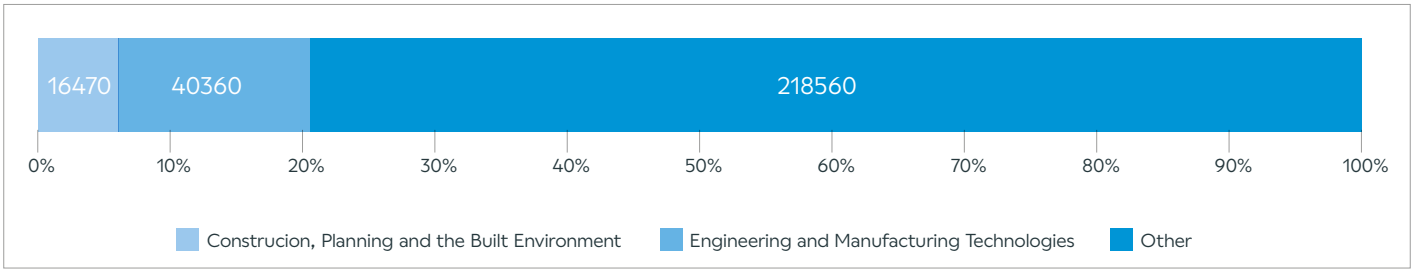


Figure 5: Number of apprenticeships stated in 2022 (ONS data) (Enabling skills for the industrial decarbonisation supply chain report (2022)

more flexibility on how it can be used, changes to what can be funded using the levyand pre-requisites such as GCSE level math's and English to be added as pre-requisites. Furthermore, not all employers meet the criteria to become levy fund contributors which adds additional complexity. A simpler approach with easier access would ensure increased apprenticeship uptake and availability.

Currently there is a lack of interest in young people wanting to pursue apprenticeships, with the view that employers are more likely to respect degree qualifications. The Office for National Statistics (ONS) data from 2022 in Figure 5 below demonstrates this lack of interest in enrolling in construction/planning and engineering and manufacturing apprenticeships, with only 20% of apprenticeship starts choosing these crucial subjects. It is imperative that apprenticeship enrolment increases to meet the net demand for skills, and those relevant to the CCUS sector. Skills replacement is not happening at the required speed as industry battles with an ageing workforce and increased numbers of workers approaching retirement. To address this, recognition of prior learning needs to be simplified and employers need to be given confidence that funding will not affect the additional training needed to bring a learner to competence.

Moving between different programmes of study needs to be a viable option, with simple rules and pathways that both employers and learners can understand. The option of moving from T-Levels to a level 3 accelerated apprenticeship is a welcome flexibility, but exactly how this would work in terms of recognising prior learning needs to be clarified, with extensive mapping work. Similarly, consideration needs to be given to the fact that this may lead to employers working on 2 apprenticeship strands for the same standard. Solving this barrier will require creative thinking from both government and industry and is essential in opening T-Levels as a potential route into industry on a large scale.

4.3 Recommendations

1. Broaden new entry pathways, with clarity on career progression and where skills can be used, to stimulate greater uptake of careers in the CCUS sector and relevant professions.
2. Reform a simplified approach to the Apprenticeship Levy Fund, with easier access, to ensure increased apprenticeship uptake and availability with a view to expand and create a fund for general skills training.
3. Review provisions in all areas, especially T-Levels, to understand if there are any cold spots where provision is insufficient.
4. Implement greater knowledge and visibility of long-term career pathways during early education, including increasing public perception of CCUS and Net Zero careers through more material in Key Stage 3 of the curriculum.
5. Design policy incentives to encourage employers who are not willing or lacking resources to take on apprentice learners.
6. Ensure cross-sectoral synergies and centralised skills sets through the development of a standardized job category taxonomy – this will help to facilitate clear pathways for entering the workforce.
7. Ensure suitable training/T-Levels/placements are available in relevant locations closest to CCUS projects.
8. The DWP to improve apprentice wages and benefit retention whilst training – creating affordability of training both for the training institute and student.
9. Recognition of prior learning needs to be simplified and employers need to be given confidence that funding will not affect the additional training needed to bring a learner to competence.
10. Implement better co-ordination across STEM subjects with follow-up to understand success of activity and how it can support careers and future training plans.

5. Growing a workforce which promotes equality, diversity, and inclusion

It has long been understood that career choices are affected by stereotyping and expectations of suitable gender/ethnicity roles.

It is also becoming increasingly clear that this process begins earlier than previously thought, with primary aged children for instance demonstrating biases and negative self-thought regarding specific subjects. The Environment Audit Committee in its Green Jobs report[31], highlights that only 3.1% of environmental professionals identify as ethnic minorities and just 9% of engineers are women, with diversity and inclusion among the key themes it encountered. Countering gender and ethnicity biases is important to ensuring long-term career propositions for the CCUS sector are successfully realised by the incoming workforce. Moreover, targeted interventions to address these issues need to come sooner rather than later.

Equality, diversity, and inclusion (EDI) in the workplace not only encourages diverse employment but is critical to creating an inclusive culture and unlocking workers full potential, ultimately helping retainment of employees from all backgrounds. Having successful EDI and environmental, social and governance practises in place is increasingly effecting companies' ability to do business, as the importance and awareness of such considerations gains a higher profile with workers wanting to work with businesses who demonstrate greater authenticity. The CCUS sector needs to look both inwards, to recognise any attraction biases, and outwards for inspiration to develop policies to address these issues. Building an inclusive environment by establishing policies and working best-practices specifically designed to attract and retain a diverse workforce needs to be seen as a core objective of the CCUS sector and the wider energy transition if the predicted skills shortages are to be suitably addressed.

5.1 Challenges for equality, diversity, and inclusion

EDI Data availability

While progress is being made across the energy sector, and companies are beginning to put in place measures to improve diversity and inclusion, there is a widespread lack of robust data and intelligence gathering on current levels for ethnicity, disability etc, in part due to low levels of data collection. This needs to be resolved swiftly to ensure informed decisions can be made. Through robust data collection procedures, changes can begin to be made to improve representation of under-represented groups in the workplace.

Whilst there is a lack of available data for the CCUS sector, in part due to its nascent nature, there is now an opportunity to set clear targets from the outset, which can be collaboratively worked towards, embedding robust policies and practices early on. Employers could consider using the existing Equality Impact Assessments Framework[32] as a way of establishing a baseline EDI approach and data collection. Whilst the Government do provide some guidance on how companies should be addressing EDI[33], further steps still need to be taken to convert this into standardised practises.

Geographical biases

As highlighted by the University of Chester's Industrial Decarbonisation report, geographical elements can also play a part in reducing workplace diversity. 'The location of educational institutions, facilities and the industries where apprenticeships are offered influences who can access such resources.' The geographical distribution of these resources will shape the inclusion and diversity of those who can access them and therefore benefit from the opportunities they provide. Addressing geographical barriers for the workforce (as mentioned in section 3.3), would open up roles to broader demographics, outside of local areas.

Industry and training boards/skills bodies need to take positive, sustained action to reach these broader demographics than they traditionally have. Noting that whilst encouraging diversity in training may not necessarily translate into careers. Thus, it is important to carry this through into the workplace. An example of where this is beginning to take place is within the offshore energy sector, where Offshore Energies UK (OEUK) are establishing inclusive recruitment practices via the establishment of a Diversity & Inclusion Task Group[34]. The aim of which is to address and review actions from collected diversity and inclusion survey data from across industry and use this to broaden EDI practices in offshore energy companies[35].

31. Environment Audit committee green jobs report (2021)
32. Equality impact assessments: A definitive guide | Inclusive Employers
33. Diversity and Inclusion - GOV.UK (www.gov.uk)
34. Home - Diversity & Inclusion in Energy (diversityandinclusioninenergy.co.uk)
35. Diversity & Inclusion - Offshore Energies UK (OEUK) meaning

5.2 Recommendations

1. Implement targeted recruitment measures to reach more diverse workforce demographics. Starting with coordinated working with third sector organisations that have links into under-represented communities.
2. Increase data collection to measure EDI.
   - Including greater industry reporting on ethnicity and gender pay gaps.
   - Government to consider adjusting legislation to mandate the collection of EDI data.
3. Ensure that jobs and skills transferability opportunities are a central objective for future communication plans for the CCUS industry (possibly through the Green Jobs Delivery Group). Such a strategy should take note of emerging communication pathways to reach as wide and diverse an audience as possible.
4. Ensure the Careers and Enterprise Company (CEC) and other careers engagement bodies, positively cover industrial decarbonisation as a key vehicle to achieving Net Zero.
5. Focused careers messaging should be filtered from national to local government, in line with local capacity work being carried out by the Green Jobs Delivery Group local capacity task and finish groups – (work is ongoing with publication of the Net Zero & Workforce Action plan expected in early 2024).
6. Ensure targeted early intervention in schools to encourage under-represented groups into STEM subjects. This will be essential to close the gender gap and widen EDI in jobs roles which will be critical for CCUS, including engineering, construction, chemical and geological based professions.
7. Make information on work opportunities for those with no connection to engineering and the industrial clusters more readily available and easy to access.

6. International Supply Chain & Skills

Capturing the domestic and international CCUS supply chain presents a huge opportunity for the UK economy.

The UK Government have a clear ambition to take advantage of this opportunity, stating in the 2021 'CCUS Supply Chain Roadmap' that government aspirations are; *"Innovative and efficient UK CCUS supply chains, driving growth and seizing the commercial opportunities both domestically and abroad"*[36]. In order to capture this export opportunity there is an element of first mover status, whereby those who move into the CCUS space first will gain the invaluable lessons learnt and skills/knowledge, which can be exported as a valuable training opportunity.

Figure 6 shows the number of planned and operational CCUS projects globally in 2022[37]. According to the Global Status of CCS report (2022), a new CCS project was announced each month last year, with a growth of 44% in number of CCS facilities since 2021. This highlights the continued upward momentum of CCUS development globally and size of the opportunity for exporting goods and services if the UK were to capture just some of those planned projects.

6.1 Challenges

Exporting supply chains and skills

With the initial selection of CCUS projects for Track-1, and the pipeline of Track-1 expansion and Track-2 projects down the line, ensuring the resilience of the UK supply chain to service multiple developing CCUS projects could become challenging and lead to severe constraints in all parts of the supply chain. This also applies to competition with other infrastructure and industries, exacerbating the pressures on the skilled workforce in the UK. Opportunities to export UK supply chains and skills abroad need to be carefully considered, so that domestic CCUS projects are not inhibited.

The UK is internationally recognised for providing excellent training programmes. If well managed, this provides an opportunity to export training services abroad and benefit the UK economy. However, as mentioned previously, incentivising trainers to stay in teaching roles rather than move into industry themselves, and retaining enough trainers to meet demand are challenges which need to be met in the UK in order to realise any export opportunities. Support in the form of bodies such as UK Export Finance should help UK companies win, fulfil, and get paid for export contracts. In 2020–2021 alone they provided £12.3bn in support of export contracts and supported an estimated 107,000 UK jobs[38].

Importing skills

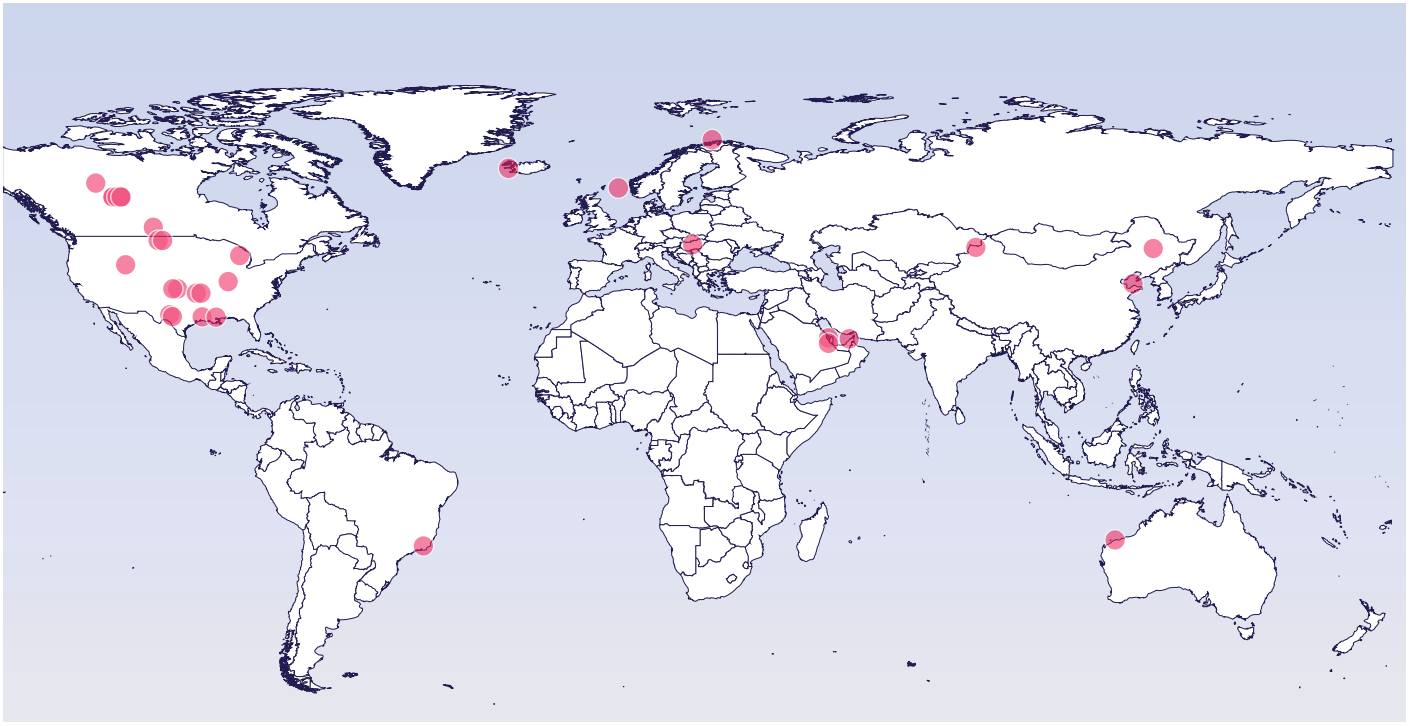
The importation of skills is a very real prospect, as the UK currently does not have the number of domestic skilled workers that will be required to work on planned large infrastructure projects, particularly in the upcoming construction phases of CCS projects. However, current UK immigration policy often makes it challenging and time intensive to import people. Moreover, numerous countries, including historical sources of labour such as Eastern Europe, have similar challenges and aspirations. As Figure 6 demonstrates, the European union has plans to develop its own CCUS industry, increasing the competitiveness and congested nature of the market, where importing skills to the UK will be increasingly challenging.

It is also important to ensure that any skills importation is from quality markets that are qualified to the same standard as UK regulations require, or that suitable training programmes are readily available and established for incoming workers. This will reduce any foreseen strains on training facilitators in the UK. Crucially, any importation of skills needs to be done in a coordinated way to ensure that skills gaps that cannot realistically be fulfilled by the current UK workforce are identified and concerted measures are put in place recruit from international pools in a timely manner.

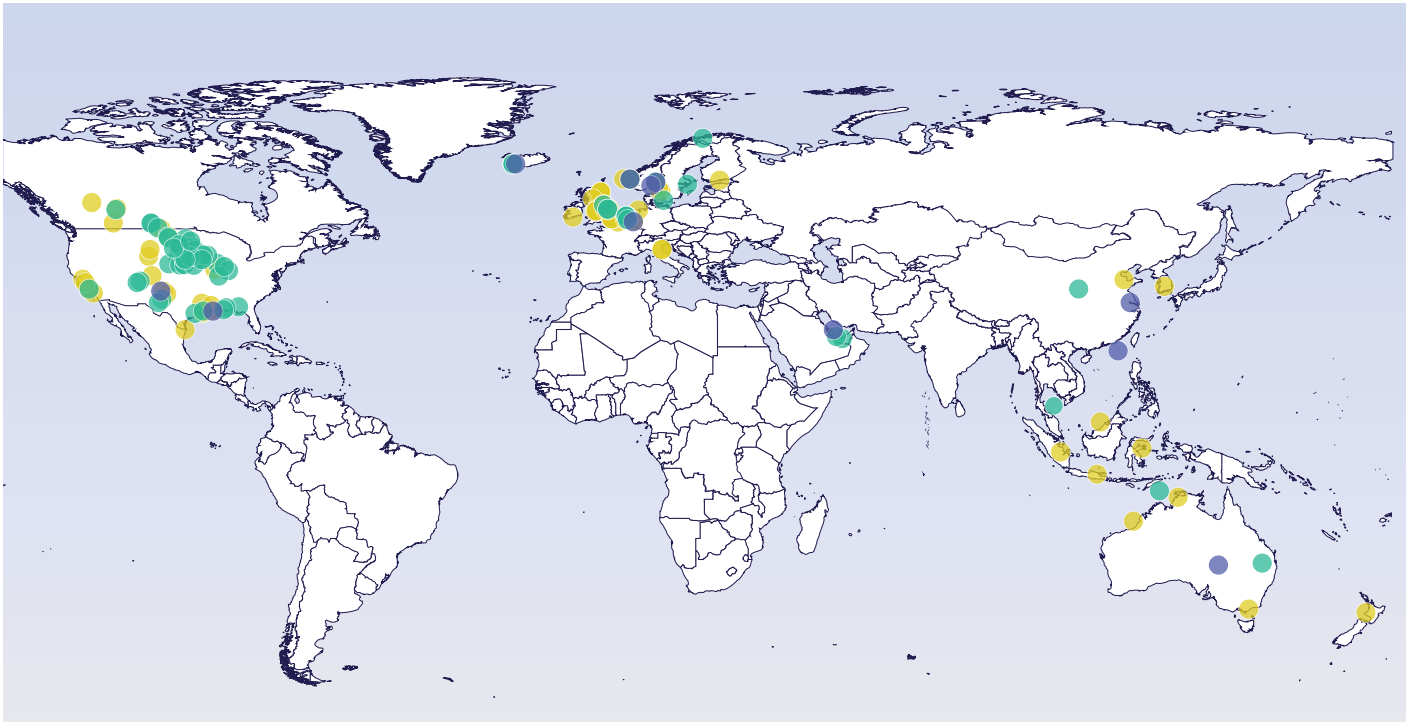
6.2 Recommendations

1. Determine the areas where the UK has surplus capacity in the CCUS supply chain with an export potential.
    - Build upon previous UK capability and capacity mapping to identify these export potentials, including the export of training services.
    - Set clear goals for the sector by identifying and publishing ambitions for export opportunities – aligning with industry identified export opportunities
2. Working with international partners and countries leading the way in CCUS deployment, a roadmap should be devised to demonstrate the strengths and weaknesses of the global CCUS supply chain.
    - Key trade associations could form a forum to discuss global opportunities and feed back to the Government and local industry to identify opportunities/gaps, and where collaboration would be mutually beneficial to global CCUS deployment.

36. CCUS Supply Chains: A roadmap to maximise UK potential – BEIS May 2021
37. Global Status of CCS 2022 report. Global CCS Institute
38. UK Export Finance
39. Any review of export potential should however take strong note of the timelines of planned UK infrastructure and CCS projects. The export of goods and services could be prioritised over exporting personal, capacity or training services to prioritise domestic project timelines over international needs.



OPERATIONAL



EARLY DEVELOPMENT ADVANCED DEVELOPMENT IN CONSTRUCTION

Figure 6: Map 1 – pink dots indicate number and location of operational CCS projects globally in 2022

Map 2 – indicates number and location of early CCS development, advanced development and in construction projects globally in 2022 (Global CCS Institute)[1]

7. Conclusions

The CCUS and CCS enabled low-carbon hydrogen industry is currently heading towards a bottleneck in skilled personnel in the UK workforce, with design and engineering construction being particularly affected.

Without preparation now to scale up the CCUS supply chain and skilled workforce at pace and scale, industry faces significant obstacles to the timely completion of CCUS projects, thereby undermining the achievement of the UK's Net Zero objectives. The review of skills and training challenges in this paper has highlighted that challenges for the existing workforce remain around:

- Enabling the movement of the existing workforce from other sectors into CCUS. We need to ensure there are clear pathways for skills transferability from one industry to another with information readily available on which skills are relevant for use in the CCUS sector.
- The type of skills/workers needed for CCUS projects in the development/construction phase are the same as those for other large infrastructure projects developing across the UK on the same timelines. This poses geographical challenges and strains where it is not practical or possible for large volumes of workers to travel to often remote locations at dispersed sites to work on these projects. To address this, a local workforce relevant to the two Track-1 CCUS clusters needs to begin being developed now, by upskilling and retraining the current local community in preparation.
- Retaining teachers in training positions is becoming problematic as many are retiring from the sector or being enticed by higher paying industry roles, resulting in a lack of qualified trainers.

The recommendations in the table below set out the key actions outlined in this paper. Of topmost priority is the need to develop a coordinating body identified by the Government, tasked with looking across all sectors utilising the same workforce for large infrastructure project development in the UK with the aim of producing a delivery plan for the development of a skilled workforce at scale and pace. This includes proposed funding timelines and plans for training schemes.

In order to develop a strong pipeline of workers to deliver on CCUS projects, decarbonise industry, and deliver on Net Zero goals, we must ensure the upcoming workforce (those currently in the education system), are aware of the career opportunities in the CCUS sector and have access to new broadened training and education pathways.

It is critical that whilst building the workforce at scale and pace we are also championing EDI to ensure the workforce composition better reflects society. Overall, there remains a lack of robust EDI data collection across industry which needs to be resolved swiftly to ensure more informed decisions can be made, which will improve representation of under-represented groups in the workplace (as noted in the recommendations table below). Industry and training boards/skills bodies need to take positive, sustained action to reach broader demographics, particularly where geographical distribution of resources may shape the inclusion and diversity of those who can access them. For example, apprenticeships need to be located and offered close to the Track-1 cluster locations which could then support transition into a job role within the CCUS clusters.

Finally, challenges and opportunities for exporting and importing supply chains and skills exist internationally. The import of skills is a very real prospect, as the UK currently does not have the number of domestic skilled workers that will be required to work on planned large infrastructure projects, particularly in the upcoming construction phases of CCS projects. Moreover, many other countries, including historical sources of labour such as Eastern Europe, have similar challenges and aspirations. The UK is internationally recognised for providing excellent training programmes. If well managed, this provides an opportunity to export training services abroad and benefit the UK economy. If we can first incentivise trainers to remain in teaching roles rather than move into industry themselves and build our domestic trainers and skilled workforce to meet UK demand, we can then unlock the export potential of these services further down the line.

The skills challenge facing the CCUS sector is considerable. Yet with concise realisation of the challenges and timely action on the recommendations outlined in this position paper, the UK can still adequately resource the transition to reach Net Zero.

7.1 Recommendations action plan table

The key recommendations from the report are detailed below. Please see appendix 1 for a full list of all recommendations made in this report.

Skills Area	Recommendation	Owner	Time scale
Existing workforce skills and training	Government to identify a cross-sector coordinating body (e.g. the Green Jobs delivery group) to produce a delivery plan with funding timelines for skills and training at scale and at pace.	• DESNZ • Green Jobs Delivery Group • Training providers for CCUS • Industry	2023-2024
Existing workforce skills and training	Review existing training availability and effectiveness and develop cross-sectoral mechanisms to promote easy mobility of workers between sectors and build 'local' workforces, particularly in dispersed site locations.	• Industry • Training Providers • Local Authorities (LSIP schemes) • Green Jobs Delivery Group	2023-2024
Future workforce skills and training	Broaden new entry pathways, with clarity on career progression to stimulate greater uptake of careers in the CCUS sector and relevant professions.	• Training/Education providers • Industry • Department for Education	2024-2030
Future workforce skills and training	Simplify the Apprenticeship Levy Fund, with easier access, to ensure increased funded apprenticeship uptake and availability with a view to expand and create a fund for general skills training.	• Government	2023
Equality, diversity and inclusion	Implement targeted recruitment measures and work with third sector organisations with links into under-represented communities to reach more diverse workforce demographics, ensuring jobs and skills transferability opportunities are a central objective for future communication plans for the CCUS industry.	• DESNZ • Industry • Green Jobs Delivery Group	2024-2030
Equality, diversity and inclusion	Increase data collection to measure EDI: • Improved reporting on ethnicity and gender pay gaps • Government to mandate the collection of EDI data.	• Government • Industry	2024 onwards
International supply chain & skills	Build on previous UK capability and capacity mapping to identify CCUS supply chain export economic opportunities, including the export of training services.	• Industry • Trade associations & stakeholders (CCSA, ECITB, OPITO, Hydrogen UK) • Training providers	2024
International supply chain & skills	Develop a global roadmap to demonstrate the strengths and weaknesses of the global CCUS supply chain and skills.	• Trade associations • Industry • UK Export Finance • DIT • DESNZ	2024

7.2 Next Steps

- A joined-up approach across the energy industry to tackle the skills challenge is essential to facilitate the energy transition. CCUS represents an emerging sector with a significant cross-over of skills requirements with other competing sectors.
- Recommendations and work suggested in this position paper should be presented to the CCUS Council and Green Jobs Delivery Group, and the CCSA and other key stakeholders should work alongside these groups to enact the most urgent tasks highlighted.
- This position paper should be reviewed on a regular basis to keep appraised of the emerging challenges and developments in skills and training.

Appendix 1

Skills Area	Recommendation	Owner
Existing workforce skills and training	Government to identify a cross-sector coordinating body (e.g. Green Jobs delivery group) to produce a delivery plan with funding timelines for skills and training at scale and at pace.	• DESNZ • Green Jobs Delivery Group • Training providers for CCUS • Industry
	Review existing training availability and effectiveness and develop cross-sectoral mechanisms to promote easy mobility of workers between sectors and build 'local' workforce, particularly in dispersed site locations.	• Industry • Training Providers • Local Authorities (LSIP schemes) • Green Jobs Delivery Group
	Increase training availability/awareness to build the 'local' workforce particularly in dispersed site locations where opportunities are less visible than in cluster settings.	• Local Authorities • Industry
	Review and improve contract specifics and wage levels for the current pool of trainers/educators, to ensure these individuals are not unnecessarily lost to higher paying sector roles.	• Department for Work and Pensions
	Target funding towards broader measures than just training, as non-training costs incurred can be a barrier for small employers.	• Government
	Review the timelines of planned UK infrastructure projects and how to skill these to avoid bottlenecks.	• Government • Infrastructure & Projects Authority • Department for Education • NIC • Industry
	Collaboration across government, the IPA, DfE, the NIC and industry, to work together to review the timelines of planned UK infrastructure projects and how to skill these to avoid bottlenecks.	• Government • IPA • Department for Education • NIC • Industry
Future workforce skills and training	Broaden new entry pathways, with clarity on career progression to stimulate greater uptake of careers in the CCUS sector and relevant professions.	• Training/Education providers • Industry • Department for Education
	Simplify the Apprenticeship Levy Fund, with easier access, to ensure increased funded apprenticeship uptake and availability with a view to expand and create a fund for general skills training.	• Government
	Review provisions in all areas, especially T-Levels, to understand if there are any cold spots where provision is insufficient.	• Department for Education • Educational institutes • Training institutes
	Implement greater knowledge and visibility of long-term career pathways during early education, including increasing public perception of CCUS and net zero careers through more material in Key Stage 3 of the curriculum.	• Department for Education • DESNZ • Industry
Future workforce skills and training	Design policy incentives to encourage employers who are not willing or lacking resource to take on apprentice learners.	• Government
	Ensure cross-sectoral synergies and centralised skills sets through the development of a detailed standardized job category taxonomy – this will help to facilitate clear pathways for entering the workforce.	• Industry

Skills Area	Recommendation	Owner
Future workforce skills and training	Ensure suitable training/T-Levels/placements are available in relevant locations closest to CCUS projects.	• Industry • Training providers
	Improve apprentice wages and benefit retention whilst training – creating affordability of training both for the training institute and student.	• Department for Work and Pensions
	Recognition of prior learning needs to be simplified and employers need to be given confidence that funding will not affect the additional training needed to bring a learner to competence.	• Industry • Training providers
	Implement better co-ordination across STEM subjects with follow-up to understand success of activity and how it can support careers and future training plans.	• Department for Education • Training providers • Further/higher education providers
Equality, diversity and inclusion	Implement targeted recruitment measures and work with third sector organisations with links into under-represented communities to reach more diverse workforce demographics, ensuring jobs and skills transferability opportunities are a central objective for future communication plans for the CCUS industry.	• DESNZ • Industry • Green Jobs Delivery Group
	Increase data collection to measure EDI: • Improved reporting on ethnicity and gender pay gaps • Government to mandate the collection of EDI data.	• Government • Industry
	Ensure jobs and skills transferability opportunities are a central objective for future communication plans for the CCUS industry. Such a strategy should take note of emerging communication pathways to reach as wide/diverse an audience as possible.	• Government • Industry
	Ensure the Careers and Enterprise Company (CEC) and other careers engagement bodies, positively cover industrial decarbonisation as a key vehicle to achieving Net Zero.	• Careers and Enterprise Company • Industry • Careers engagement bodies
	Focused careers messaging filtered from national to local government, in line with local capacity work being carried out by the Green Jobs Delivery Group local capacity task and finish groups - (work is ongoing with publication of the Net Zero & Workforce Action plan expected in early 2024).	• Green Jobs Delivery Group • Industry • National & Local Government
	Ensure targeted early intervention in schools to encourage under-represented groups into STEM subjects, in order to close the gender gap and widen EDI in industries which will be critical for CCUS such as; engineering, construction, chemical and geological sectors.	• Department for Education
	Make information on work opportunities for those with no connection to engineering and the industrial clusters more readily available and easy to access.	• Industry
International supply chain and skills	Build on previous UK capability and capacity mapping to identify CCUS supply chain export economic opportunities, including the export of training services.	• Industry • Trade associations & stakeholders (CCSA, ECITB, OPITO, Hydrogen UK) • Training providers
	Clear ambitions and goals for the CCUS sector to be set by publishing ambitions for export opportunities – aligning with industry identified export opportunities.	• DESNZ
	Develop a global roadmap to demonstrate the strengths and weaknesses of the global CCUS supply chain and skills.	• Trade associations • Industry • UK Export Finance • DIT • DESNZ

Appendix 2

The CCSA has been working with Industry and the Government, through the CCUS Supply Chain council working group to address this issue through the formalisation of a UK Supply Chain Strategy Document.

This would act as a supply chain best practise guidance/charter document (not in breach of competition/trading law) for projects to follow, which provides certainty and commitment to drive local content in the CCUS supply chain for Track-1 CCUS clusters, and successive clusters thereafter.

As part of this guidance the CCSA are developing an agreed methodology for defining, measuring, and reporting number of UK jobs needed/committed within the Clusters. This will ensure projects report jobs number data consistently, by developing an industry wide benchmarking and progress tracking methodology which can be used by all. Publication of the strategy is expected in July 2023.

Appendix 3

Common People & Skills Taxonomy across offshore energy sectors (Opergy 2023)

Job Family	Job Family Sub Groups	Approximate Skill Levels – England	Approximate Skill Levels – Scotland	Typical Roles
Management	Corporate Leadership	Skill Level 7/8	Skill Level 11/12	Company Board roles - Company Directors – C Suite roles etc...
	Management Corporate	Skill Level 6/7	Skill Level 9/10/11	Head of..., Senior Vice President, Director in Title etc...
	Management Operational	Skill Level 6/7	Skill Level 9/10/11	Head of..., Senior Vice President, Director in Title etc...
	Project Management	Skill Level 6/7	Skill Level 9/10/11	Project Director / Project Manager / Construction Director / Construction Manager
	Project Engineering	Skill Level 5/6	Skill Level 7/8/9/10	Project Engineer / Project Controller / Project Supervisor
	Project Support	Skill Level 4/5	Skill Level 6/7/8	Project Coordinator/ PMO / Project Planner / Project Scheduler / document controllers
Technical / Professional	Technical – Mechanical Engineer	Skill Level 6/7	Skill Level 9/10/11	Mechanical Engineer, Piping Engineer, Pipeline Engineer
	Technical – Electrical Engineer	Skill Level 6/7	Skill Level 9/10/11	Electrical Engineer
	Technical – Structural Engineer/Surveyor	Skill Level 6/7	Skill Level 9/10/11	Structural Engineer, Surveyor, Certification Engineer
	Technical – Civil Engineer	Skill Level 6/7	Skill Level 9/10/11	Civil Engineer
	Technical – Geological Scientist/ Surveyor/Engineer	Skill Level 6/7	Skill Level 9/10/11	Geotechnical Eng / Hydrographic Surveyor / Geo Scientist / Oceanographer / Geologist
	Technical – Chemical Engineer	Skill Level 6/7	Skill Level 9/10/11	Nuclear engineer, Hydrogen engineer, Battery engineer
	Technical – Process Engineer	Skill Level 6/7	Skill Level 9/10/11	Process Engineer, Data Engineer, Improvement Engineer
	Technical – Instrument Engineer	Skill Level 6/7	Skill Level 9/10/11	Instrument Eng, E&I Eng, Controls Eng, Test Eng, Fire and Gas Eng, Commissioning Engineer
	Technical – Naval Architects	Skill Level 6/7	Skill Level 9/10/11	Naval Architect
	Professional – Legal	Skill Level 7/8	Skill Level 11/12	Lawyers
	Professional – Medical	Skill Level 7/8	Skill Level 11/12	Doctors, Paramedics
	Professional – Consultant	Skill Level 7/8	Skill Level 11/12	Senior Consultants / Associate Consultants / Consultants
	Professional – Audit	Skill Level 7/8	Skill Level 11/12	Auditor

Job Family	Job Family Sub Groups	Approximate Skill Levels – England	Approximate Skill Levels – Scotland	Typical Roles
Consenting / Planning / Permissions	Senior Management, 10+ people	Skill Level 6/7	Skill Level 9/10/11	Head of..., Senior Vice President, Director in Title etc... of consenting staff
	Senior Project Consent/ Team Management <10 people)	Skill Level 6/7	Skill Level 9/10/11	Management of a team of consenting staff delivering consent activities for one or more projects
	Legal Adviser	Skill Level 7/8	Skill Level 11/12	Lawyer spending full or part time on consenting related advice
	Consent Project Management	Skill Level 6/7	Skill Level 9/10/11	Project Manager full or part time on project consenting related activities
	Senior specialist/Lead Adviser	Skill Level 6/7	Skill Level 8/9/10/11	Management or Lead for one or more Environmental Impact Assessments related topics e.g. ornithology, marine mammals, fisheries, aviation
	Specialist/Adviser	Skill Level 6/7	Skill Level 9/10/11	Specialist advice on an Environmental Impact Assessments related topics e.g. ornithology, marine mammals, fisheries, aviation
	Senior Policy/Strategic Adviser	Skill Level 6/8	Skill Level 9/10/12	Lead responsible for advising consenting related policy or strategic direction
	Policy/Strategic adviser	Skill Level 6/8	Skill Level 9/10/12	Roles supporting consenting related policy or strategic direction
	Project support	Skill Level 4/5	Skill Level 6/7/8	Administrator/Coordinator
	Planning/Scheduling	Skill Level 4/6	Skill Level 6/7/9	Project Planner / Project Scheduler
	Stakeholder Management	Skill Level 6/7	Skill Level 9/10/11	Management of engagement with public, political and statutory stakeholders
	Land Management	Skill Level 5/6	Skill Level 7/8/9/10	Negotiating and setting up agreements with landowners for access to land for surveys, construction and infrastructure
Corporate Services	Corporate Services Human Resources (HR)	Skill Level 6/7	Skill Level 9/10/11	Advisor, Partner, Manager etc...
	Corporate Services Information Technology (IT)	Skill Level 5/6	Skill Level 7/8/9/10	Helpdesk Technician, Software, Hardware etc...
	Corporate Services Finance	Skill Level 5/6	Skill Level 7/8/9/10	Accountant, Bookkeeper, General Ledger Clerk etc...
	Corporate Services Legal	Skill Level 7/8	Skill Level 11/12	General Counsel, Legal Advisor, Paralegal etc...
	Corporate Services General	Skill Level 4/5	Skill Level 7/8	Office Manager, Facilities Manger, Real Estate Manager etc...
	Corporate Services Administration	Skill Level 2/3	Skill Level 5/6	PA, Secretary, Executive Assistant etc...

Job Family	Job Family Sub Groups	Approximate Skill Levels – England	Approximate Skill Levels – Scotland	Typical Roles
HSEQ	Health & Safety	Skill Level 5	Skill Level 7/8	Advisor, Partner, Manager, Safety Engineer etc...
	Quality	Skill Level 5	Skill Level 7/8	Advisor, Partner, Manager etc...
	Environmental	Skill Level 5	Skill Level 7/8	ESG Manager, Advisor, Partner, Manager etc...
People Development	People Development & Skills	Skill Level 5	Skill Level 7/8	Trainer, Teacher, instructor etc...
	Graduate	Skill Level 5	Skill Level 7/8	Career stage - Various trades
	Trainee	Skill Level 3	Skill Level 6	Career stage - Various trades
	Apprentice	Skill Level 3	Skill Level 6	Career stage - Various trades
Commercial	Sales	Skill Level 5	Skill Level 7/8	Sales Manager, BD Manager, Sales Executive etc...
	Marketing	Skill Level 5	Skill Level 7/8	Marketing Executive, Marketing Mgr, Communications Mgr, Publicity Mgr etc...
	Commercial	Skill Level 5	Skill Level 7/8	Commercial Executive, Commercial Manger, etc...
	Procurement	Skill Level 5	Skill Level 7/8	Buyer, Procurement Officer, Supply Chain Mgr etc...
Facilities	Catering & Cleaning	Skill Level 1-4	Skill Level 3-6	Chef, Cook, Cleaner
	Facility Maintenance	Skill Level 3	Skill Level 6	Builder, plumber, painter, handyman etc...
	Air & Marine Transport	Skill Level 3/4	Skill Level 6/7	HLO coordinator, Marine Coordinator
	Logistics	Skill Level 3	Skill Level 6	Crane Driver, Forklift Driver etc...
Drilling/Wells	Drilling Superintendent / Rig Manager	Skill Level 6	Skill Level 9/10	Drilling Supervisor, Maintenance Superintendent, Offshore installation Manager
	Well / Completions Engineer	Skill Level 5	Skill Level 7/8	Workover, Drilling, Field Engineer
	Semi-skilled drilling / wells	Skill Level 3	Skill Level 6	Derrickman
	Manual drilling / wells	Skill Level 3	Skill Level 6	Roustabout, Floor hand
Construction General Operatives	Senior Construction	Skill Level 5	Skill Level 7/8	Supervisor, Shift Manager, Foreman, Chargehand etc...
	Technical Construction	Skill Level 3	Skill Level 6	Installation Tech, Welder, Plater, Pipefitter, Access Rigger etc...
	Skilled Construction	Skill Level 2/3	Skill Level 5	Forklift Driver, Driver, Crane Driver, Scaffolder, Painter, etc...
	Manual Construction	Skill Level 1	Skill Level 4	Labourer, Groundworker, Quayside Operative etc...

Job Family	Job Family Sub Groups	Approximate Skill Levels – England	Approximate Skill Levels – Scotland	Typical Roles
O&M	Senior O&M	Skill Level 5	Skill Level 7/8	Supervisor, Commissioning Supervisor, Control Room Supervisor etc...
	Technical O&M	Skill Level 4/5	Skill Level 7/8	Control Room Operator/Engineer, Turbine Technician, Statutory Inspector, etc...
	Skilled O&M	Skill Level 3	Skill Level 6	Plant Operator, Scaffolder, Rigger, Rope Access Tech, Painter etc...
	Manual O&M	Skill Level 1/2	Skill Level 5	Labourer etc...
Electrical	Senior Electrical	Skill Level 5	Skill Level 7/8	Electrical SAP etc... Senior Electrical Tech, Senior Electronic Tech
	Skilled Electrical	Skill Level 4	Skill Level 7/8	Electrical Supervisor, Level 7 Electrical Technician, Electrical Tech, Electrician, Electronic Technician
	Semi-Skilled Electrical	Skill Level 3	Skill Level 6	Cable Jointer etc...
	Manual Electrical	Skill Level 2	Skill Level 5	Cable puller etc...
Mechanical	Senior Mechanical	Skill Level 5	Skill Level 7/8	Senior Mechanical Tech
	Skilled Mechanical	Skill Level 4	Skill Level 7/8	Mechanical Supervisor, Level 7 Mechanical Technician, Mechanical Technician
	Semi-Skilled Mechanical	Skill Level 3	Skill Level 6	Fitter, mechanic
	Manual Mechanical	Skill Level 3	Skill Level 6	Manual mechanical operative
Marine	Senior Marine	Skill Level 5	Skill Level 7/8	Captain, Skipper, Mooring Master etc... OIM, DPO, SSL (Section Stability Leader)
	Skilled Marine	Skill Level 4	Skill Level 7/8	1st Officer, DPO, Marine Engineer, SSL etc...
	Semi-Skilled Marine	Skill Level 3	Skill Level 6	CRO, Crane Operator
	Manual Marine	Skill Level 3	Skill Level 6	Mate, Deckhand, Able Seafarer, Quayside Operative, facilities crew etc...
Aviation	Senior Aviation	Skill Level 6/7	Skill Level 9/10/11	Pilot etc...
	Skilled Aviation	Skill Level 5/6	Skill Level 7/8/9/10	Navigator, Senior Crew etc...
	Semi-Skilled Aviation	Skill Level 3	Skill Level 6	HLO etc...
	Manual Aviation	Skill Level 3	Skill Level 6	Groundcrew, Loading Crew etc...
Subsea	Senior-Subsea	Skill Level 5	Skill Level 7/8	Diving Supervisor, Survey Party Chief etc...
	Skilled-Subsea	Skill Level 4	Skill Level 7/8	Diver, ROV Pilot, Surveyor etc...
	Semi-Skilled-Subsea	Skill Level 3	Skill Level 6	Diver/Tech etc...Subsea Engineer
	Manual-Subsea	Skill Level 3	Skill Level 6	Deck Crew etc...

Appendix 4

- The Net Zero NW cluster plan (2021) (2023)
- Green Jobs Taskforce Report (2021)
- UK Hydrogen strategy (2021)
- Supply Chain Excellence – CCSA (2021)
- BEIS Supply Chain Roadmap – (2021)
- Industrial decarbonisation strategy – HM Gov (2022)
- NSTD Integrated People & Skills Strategy - OPITIO (2022)
- Supply chains to support UK hydrogen economy report – Wood (2022)
- The role of hydrogen in the Net Zero economy report – National engineering policy centre (2022)
- Net Zero Workforce Report - Engineering UK (2022) (includes 27 report review)
- CCSA CCUS Delivery Plan 2035 (2022)
- OEUK CCS Supply Chain Report (2022)
- Making the Switch: The future shape of the offshore energy workforce in the North-East of Scotland
- IDRIC Workforce Planning for Industrial Decarbonisation Report (2022)
- CATCH-UK Supply chain & skills plan – (2022)
- Humber Industrial Cluster Plan – (31st March 2023)
- Local skills improvement plans – (May 2023)

CCSA