
Skills and Net Zero

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Navigating this report

This report starts by setting out the Net Zero priorities for the workforce (Chapter 2), drawing on analysis in the CCC's Net Zero Workforce brief. It then characterises the current education and skills context (Chapter 3), and how this currently relates to Net Zero (Chapter 4). The report's main considerations and recommendations are then set out (Chapter 5). Readers already familiar with the skills system or Net Zero priorities for the workforce may choose to skip straight to Chapter 5.

Executive Summary

Skills are a fundamental enabler of Net Zero

This report examines the skills and education system in the context of the UK's transition to Net Zero. Written to build on the Climate Change Committee's analysis of the Net Zero workforce, and to inform future CCC work, it sets out the policy and provision of Net Zero skills across the UK and assesses how well this is aligned with current and future needs. It reveals a huge amount of activity already underway, spanning mainstreaming of climate education in schools, colleges and universities, through employer-led Net Zero training and apprenticeship programmes, to enhanced competency frameworks and professional standards. It also identifies significant risks in terms of fragmentation of the skills system and its ability to respond effectively to changing skills demands in time, space and by economic sector. The report's recommendations focus on ways in which government can better support the entirety of the skills system, coordinating and building on good practice in a way that simultaneously serves national, local and individual needs in the transition to Net Zero.

A fair transition to Net Zero will rely on every facet of the skills system

School education has an especially important role in supporting the medium and longer term transition to Net Zero and in helping to address inequalities in the workforce. Across the four nations of the UK there is already an emphasis on embedding climate and sustainability learning in school curricula. There is also an impressive array of development work underway aimed at mapping existing provision and at enhancing teacher training, professional development and educational resources for Net Zero. This work now needs further coordination and support from government, including additional investment in staff development and the embedding of Net Zero in careers guidance.

The importance of **Further Education colleges** is difficult to overstate. They are at the heart of UK skills provision for the transition to Net Zero at local and regional levels, as well as underpinning the skills and workforce needs of key economic sectors such as construction, energy and transport. While many colleges are already providing some form of Net Zero training, current investment in Further Education in the UK appears to be badly out of step with that demanded by the magnitude and pace of the transition to Net Zero. Funding for the sector should be reviewed as a matter of urgency to prevent bottlenecks in the supply of skilled workers undermining UK-wide decarbonisation and competitiveness.

Universities in the UK have international reach and together deliver world-class research and innovation to help tackle climate change. They also have a major role to play in providing the high-level education and training the workforce of the UK and other nations will need to accelerate the transition to Net Zero and to adapt to the intensifying impacts of climate change. Although most universities have committed to reducing emissions from their estates and activities, few have fully embedded Net Zero into their learning provision.

The **'wider skills and learning system'** here encompasses workplace training, independent education, and those aspects of early years, adult education and lifelong learning not specifically addressed in our examination of Net Zero skills in schools, colleges and universities. There is a diverse range of relevant education and training apparent, with many employers already working with colleges and other education providers to meet changing needs in a particular region or sector. Apprenticeships represent an important facet of this, but a lack of flexibility in the Apprenticeship Levy may be hindering their effectiveness in meeting the demands of Net Zero. Qualifications and standards are also being shaped to align with Net Zero, with various professional bodies updating their competency frameworks. Coordination of such responses, and especially the provision of in-depth Net Zero skills assessments to inform action at local and regional scales, is, however, worryingly fragmented.

Opportunities for Net Zero skills everywhere and for everyone

Below are the seven priority actions drawn from a wider set of actions detailed in this report. For full recommendations see Chapter 5 'Recommendations: Skills for Net Zero'.

In schools: Government should provide additional support to those schools and learners least able to engage with Net Zero

In further education: Government should urgently review Further Education sector support and provide investment commensurate with meeting national, local and sectoral skills needs for the Net Zero transition

In universities: All universities should update their strategic plans to address Net Zero skills and lifelong learning provision

In the wider skills & learning system: Dedicated funding should be provided by government for area-based Net Zero skills assessments in every region of the UK

In industry: All future 'Contracts for Difference' in the UK Government's scheme for supporting low carbon electricity generation should specify how skills needs will be met, with skills also being an overt part of a Net Zero Test of wider policy and procurement

Nationally: The UK Climate Change Committee should embed skills assessment into its advice to government, with government providing central coordination of Net Zero skills reporting from, and intelligence to, every region of the UK

Internationally: Talent attraction and retention schemes should be reviewed in the context of international climate action and updated to align with Net Zero skills needs in the UK

Glossary

Acronyms

AR	Allocation Round
CCS	Carbon Capture, and Storage
CESAP	Climate Emergency Skills Action Plan (Scotland)
CfD	Contract for Difference
COP26	The 26th Conference of Parties, also known as the 2021 United Nations Climate Change Conference
CPD	Continuing Professional Development
DA	Devolved Administration
DESNZ	UK Government Department for Energy Security and Net Zero
DfE	UK Government Department for Education
DSIT	UK Government Department for Science, Innovation and Technology
EAUC	Environmental Association for Universities and Colleges
EV	Electric Vehicle
FCDO	UK Government Foreign, Commonwealth and Development Office
FE	Further Education
GCSE	General Certificate of Secondary Education
GDP	Gross Domestic Product
HEI	Higher Education Institutions
LSIP	Local Skills Improvement Plan
NZEB	Nearly Zero-Energy Buildings
NZSAP	Net Zero Skills Action Plan (Wales)
Ofqual	The Office of Qualifications and Examinations Regulation (England)
PV	Photovoltaic
R&D	Research and development
SDF	Strategic Development Fund
SDS	Skills Development Scotland
SFC	Scottish Funding Council
SMEs	Small and Medium-sized Enterprises
STEM	Science, Technology, Engineering, and Mathematics
SWAP	Sector-based Work Academy Programme

Definitions

A levels	UK subject-based qualifications for students aged 16 and above, usually studied over two years, leading to qualifications recognised for entrance to higher education institutes.
Advanced apprenticeship	Also known as a Level 3 apprenticeship, a type of apprenticeship generally considered to be equivalent to two A level passes.
Apprenticeship	A paid job where the employee spends at least 20% of working hours completing classroom-based learning with a college, university or training provider which leads to a nationally recognised qualification.
Chamber of Commerce	An association or network of businesspeople designed to promote and protect the interests of its members.
Competency framework	A structure that sets out and defines each individual competency (such as problem-solving or people management) required by individuals working in an organisation.
Degree apprenticeship	A type of apprenticeship that enables apprentices to gain a full undergraduate or master's degree while working.
Early years education	Learning and training for children who are aged 5 years old or younger.
Further Education	Learning and training for people aged over 16 years old that is not part of higher education.
Gigafactory	A facility that produces batteries for electric vehicles on a large scale.
Graduate Route	A post-study work visa that allows graduates to stay in the UK to work or look for work for 2 years after the degree has been awarded (or 3 years, for Doctoral qualifications).
Higher education	Learning and training for people aged over 16 years old that includes courses that are of a standard that is higher than GCE A level, the Higher Grade of the SCE/National Qualification, GNVQ/NVQ level 3 or the Edexcel (formerly BTEC) or SQA National Certificate/Diploma.
Pedagogy	The strategy of how educators teach, in practice and theory.
Primary education	Learning and training for children aged 4-11 years old.
Returnership/ Returnship	A UK government initiative designed specifically for older workers – those returning from a career break or who are looking for upskilling or retraining.
Secondary education	Learning and training for children aged 11-16 years old.
Skills bootcamp	Free, flexible courses of up to 16 weeks, giving people the opportunity to build up sector-specific skills and fast-track to an interview with a local employer.
T levels	2-year courses taken after GCSEs, offering students practical and knowledge-based learning at a school or college and on-the-job experience through an industry placement of at least 315 hours.
Technical education	A branch of vocational education that involves STEM (science, technology, engineering, and mathematics) skills.
Tertiary education	Learning and training for people aged over 16 years old, after completion of Secondary education. This includes both Further Education and Higher Education.
Traineeship	A skills development programme that includes a work placement. It can last from 6 weeks up to 1 year, though most traineeships last for less than 6 months.
Vocational education	Education with a greater emphasis on the practical application of skills and knowledge aligned to a particular career or vocation.
Vocational qualifications	Work-related qualifications, designed to enable the learner to acquire knowledge and skills that are required by the national occupational standards (NOS) to be able to perform a particular job.

1) Introduction

Purpose of the report

From 2022 to 2023 the UK Climate Change Committee (CCC) convened an expert advisory group on workers and skills, chaired by Professor Dave Reay, to support and critically evaluate the CCC's analysis of the Net Zero labour market, culminating in a brief published by the CCC in May 2023.¹ The CCC's brief characterises the different sectors of the UK economy in terms of the role they will play in the Net Zero transition, in order to inform government and business plans for the Net Zero workforce. It is an analytical brief and does not have formal recommendations to government.

This Chair's report was written by Professor Dave Reay, with contributions from the expert advisory group, to provide additional independent advice to the CCC on what is needed specifically from the UK skills system to deliver Net Zero. It seeks to build on the evidence in the CCC's analytical brief, and beyond, to identify key actions needed from government and the CCC to ensure the UK skills system is fit for purpose for the Net Zero transition. A full list of expert advisory group members is in Appendix A.

Why skills for Net Zero matter

In 2019 the UK Government committed and legislated to reach Net Zero emissions by 2050.² The transition to Net Zero represents a huge opportunity to secure livelihoods and grow new industries, enhance social equality, and improve the nation's health and wellbeing. These opportunities are not guaranteed and if we are to reach Net Zero and secure this brighter future, a rapid and actively managed evolution in the skills of the UK workforce is needed.

The opportunity

The UK Government intends to reach Net Zero emissions in a way that creates jobs and allows us to carry on living our lives.³ At a macroeconomic level, the Net Zero transition could see GDP 2-3% higher over the period of 2020-2050, and the review of Net Zero by Chris Skidmore recently highlighted how the benefits of Net Zero clearly outweigh the costs.^{4,5}

While job estimates vary, increasing activity as a result of Net Zero could support from 135,000 to close to 725,000 new jobs by 2030.⁶ The Net Zero transition is likely see significant growth in sectors such as renewable energy generation, low-carbon hydrogen, Carbon Capture Utilisation & Storage (CCS), building construction and retrofit, waste management and electric vehicle manufacturing, among others.

A range of wider positive impacts could result from the Net Zero transition, including improved health and wellbeing as a result of a reduction in air pollution, healthier diets, more comfortable homes and more active travel, as well as substantial benefits to biodiversity.⁷

The array of national, regional and local opportunities presented by the transition to Net Zero can underpin enhanced social equality and inclusion in every part of the UK. This could be seen through increased access to good quality jobs at both a national level (for example through increased demand for home retrofit) and at a regional level (for example through a growth in location-specific sectors such as afforestation, low-carbon hydrogen production and CCS), with the potential to support greater social equality with careful targeting.

The shift in labour market composition could be harnessed to enable a more diverse pool of workers to access certain careers, in particular for sectors relevant to the Net Zero transition which currently lack diversity, including construction, finance, engineering and farming.⁸

The skills challenge

No policy aimed at realising Net Zero can succeed without having people in place with the right skills to deliver on it. Across every sector of our economy, the transformation required necessitates proactive skills and workforce planning. The competencies of the UK workforce must align in both time and space with the changing needs of employers; spanning immediate UK-wide requirements, such as rapid upskilling of engineers and installers for roll-out of low carbon heating, through to longer term and more regionally-specific demands such as building capacity to deliver carbon capture and storage for industrial clusters. Without this alignment, progress towards Net Zero will be hindered, both within specific sectors and regions, and for the UK as a whole; the opportunities to improve social equality and economic growth through Net Zero will also be lost.

Skills and education policies are inextricably linked with delivering Net Zero and represent a fundamental enabler of the transition at every level. A commonly-used definition of so-called ‘green skills’ is *‘the knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society’*.^{9,10} Here, we aim to examine skills and Net Zero in the UK within this same inclusive context, focussing on the impacts of the Net Zero transition on skills needs, and on the ability of the UK skills system to meet these needs.

- For the existing workforce – comprising 80% of the people who will deliver the progress towards Net Zero needed by 2030 – skills policy must be sufficiently well informed, responsive and joined up to allow all workers to easily upskill as required competencies change in their current jobs, or to reskill where they are moving between roles and sectors.¹¹
- For the future workforce, learning provision in schools, colleges and universities will play a decisive role in ensuring that the skills of new workers meet the emerging needs of Net Zero across different sectors of the economy. Education policy that is informed by and integrated with the Net Zero transition can help to avoid future workforce shortages in rapidly expanding areas of the economy, such as in renewable energy. It can also serve to reduce the amount of upskilling required for new starters and provide school leavers and graduates with the transferrable skills needed to more easily change roles within and between sectors.
- For those who have left the workforce, education and skills policies can help provide the pathways and support needed to attract them back to the workplace. As with existing and future workers, good Net Zero-alignment of learning and training provision for those returning to the workforce has the potential to address skills shortages that would otherwise undermine the transition.

Whether aimed at existing, future or returning workers, the success of education and skills policies in delivering a fair and sustainable transition to Net Zero rests on how well they collectively support access to, and success within, career pathways for everyone in the UK. As such, their success is also contingent on the wider policy landscape, ranging from the benefits system and healthcare provision, to transport planning and devolution. While this report is focussed on the central role of skills and education provision in realising the UK’s Net Zero goals, it should be acknowledged that only an integrated policy approach to Net Zero across all parts and levels of government will suffice.

2) Net Zero priorities for the workforce

This chapter summarises the shifts in the UK workforce that will be needed for the Net Zero transition, as set out in more detail in the CCC's analytical brief.¹²

Every job will in some way play its part in the Net Zero transition.¹³ Different sectors and regions will need to be enabled by the skills system in different ways, pointing to the need for a multi-level and targeted approach to building Net Zero skills. About **20%** of workers are currently in sectors that will have a **core** role to play in the Net Zero transition, by **growing, phasing down, or redirecting** their processes towards low-carbon. Below we provide some examples of these sectors and implications for the skills system, recognising that many other sectors, such as transport and waste management, will also experience significant shifts in workforce and skills needs for Net Zero.

- **Building construction and retrofit.** The Net Zero transition will require much of our housing stock to be insulated and upgraded to low-carbon heating, such as heat pumps. This will require a rapid growth in the workforce, spread across the country. Those most likely to deliver this are small and medium-sized businesses (SMEs). These businesses are currently male-dominated.
 - **Key skills system implications:** There is a need to rapidly ensure enough of the workforce are skilled in home retrofit, including reskilling the existing workforce and attracting new entrants across the country. There is an opportunity to create new jobs nationally, and to attract a more diverse pool of workers.
- **Energy supply.** A rapid increase in renewables, hydrogen and CCS will be needed for the Net Zero transition. So too will a greatly enhanced energy transmission system. This could require additional high-quality jobs nationwide, as well as in particular regions of the UK that are appropriate for low-carbon power generation, potentially focussed in areas that are priorities for addressing socioeconomic inequalities. Currently the energy supply sector predominantly employs workers who are white and male. It may be that workers previously employed in the oil and gas industry can retrain to provide this workforce, but it is possible these numbers will be insufficient to fill all the jobs. The North Sea Transition Authority will therefore have an important role in realising a fair and sustainable transition to Net Zero.¹⁴
 - **Key skills system implications:** There is a need to ensure departing oil and gas workers are supported to reskill and enter these industries. There may also be a need to build an expanded future pipeline of workers to deliver renewables, CCS and hydrogen. There is an opportunity to create new jobs nationally, and to attract a more diverse pool of workers. Importantly, the necessary changes and enhancements to the energy transmission system across the UK will also have major workforce and skills implications.¹⁵
- **Agriculture and land use.** The Net Zero transition will require a shift from high-carbon to low-carbon agricultural practices, and a reduction in the use of land for livestock agriculture to free up land to be used for creating woodland and restoring peatlands. This could involve those working in livestock production shifting their practices, but it could also see a decline in jobs in livestock agriculture and an increase in employment in crop production, afforestation and peatland restoration. However, there is uncertainty around the extent to which jobs in livestock agriculture will reduce. Livestock agriculture is largely comprised of very small businesses, and two-fifths of workers in the agriculture, forestry and fishing sector are over the age of 55. As a sector livestock agriculture it is particularly concentrated in North-West England, Wales and Scotland.
 - **Key skills system implications:** Farmers may need support to develop knowledge and understanding of the array of low-carbon farming and carbon sequestration practices needed. This may need to be delivered through less formal pathways, such as peer-to-peer networks, in addition to enhanced farm advisory services. Place-specific support may also be needed to help livestock farmers diversify

their skill sets or transition into other careers. This could include helping them develop skills in afforestation or peatland restoration, and ensuring the shift in work is attractive and financially viable for them. Agricultural colleges and other land-based skills providers will need to adjust their curricula to ensure the future agricultural workforce understand the requirements of Net Zero and have the skills, such as use of remote sensing data for precision farming, to deliver them.¹⁶

- **Vehicle and battery manufacturing.** The Net Zero transition will rely on rapid growth in battery manufacturing, either in the UK or overseas. Whether firms and additional jobs are based in the UK will be shaped by where gigafactories (large battery manufacturing facilities) are developed. Manufacturing could be developed in a way that simultaneously helps to onshore supply chain jobs and address regional inequalities in the UK.
 - **Key skills system implications:** Policy support for the development of gigafactories may be needed. Although this may be predominantly through incentives and favourable conditions for industry, rather than changes to the skills system directly, for firms to choose to locate in the UK, there will need to be a sufficient supply of skilled workers in places where gigafactories could be based.
- **Energy-intensive manufacturing.** The manufacturing sector will need to undergo a deep transformation to reduce emissions through fuel switching (e.g. electrification, use of hydrogen), application of CCS and other measures, which will require the adoption of new skills. Employment will depend on the maintenance of competitiveness, which will somewhat depend on development abroad – noting that the United States and European Union have already implemented policies to decarbonise and protect industry domestically. There is the potential for new jobs to be created by energy-intensive manufacturing, if export markets are captured.
 - **Key skills system implications:** Policy support for the maintenance of competitiveness may again be needed via incentives and favourable conditions for industry. As with vehicle and battery manufacturing, for firms to choose to remain or locate in the UK, there will need to be a sufficient supply of skilled workers in places where energy-intensive manufacturing would be based.

A further **20%** of workers are in sectors with a role to play by **enabling** others to support the transition to Net Zero.

- **Enabling sectors.** Sectors such as education and training, finance, research and accounting services will all play a key role in enabling the Net Zero transition, without directly changing the core of what work in these sectors involves. The skills and education systems will need to evolve to ensure workers have the right skills and knowledge to effectively transition to Net Zero sectors while also creating opportunities for new entrants. The finance sector will have a role in bolstering green finance and updating market structures with strong standards for investment that supports Net Zero targets. The accountancy sector will have a role in ensuring robust emissions accounting and practices by organisations. Innovation is a fundamental component in the transition to Net Zero, which will require advances in the development and scale-up of new methods, services and technologies. Research into how Net Zero can be delivered effectively and fairly will play a role in informing how the transition is achieved.
 - **Key skills system implications:** Workers in enabling sectors will need to digest and understand the requirements of the Net Zero transition, so these can be integrated into their core service delivery. This may require employee training, specific Net Zero qualifications or standards, and strategic oversight to ensure knowledge and understanding within these sectors is up to standard and in step with the UK's Net Zero pathway.

For the estimated **two-thirds** of workers who are in sectors which have a more **peripheral** role to play, the skills they do or don't have will still be important in shaping the Net Zero transition.

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- **Peripheral sectors.** For some peripheral sectors, workers will only experience a minor adaptation to the Net Zero context, for example chefs might prepare food cooked on induction rather than gas hobs, and postal workers could drive electric mail vans. Other roles may be more significantly shaped by Net Zero over time, such as those working in real estate needing to adjust the information they consider in relation to properties, to reflect any new regulations or policies relating to low-carbon heating, insulation and climate resilience. Workers in some peripheral sectors also have the potential to play a more proactive role in supporting the Net Zero transition, through their influence on other organisations and actors. For example, employment and careers agencies can play a role by directing people to Net Zero opportunities and consider Net Zero skills needs, and those working in the media and advertising sectors have the potential to shape and influence consumer awareness and demand for both high and low-carbon products.
 - **Key skills system implications:** For many workers in sectors peripheral to Net Zero, no significant shift to the skills system will be needed, as workers will adjust to changes to the technology they use, or the regulations they must abide by, on the job. For some workers in other outwardly peripheral sectors - such as marketing or tourism- skills requirements may still change substantially, albeit indirectly, in response to the Net Zero transition. For instance, changing regulation and consumer preference may require greater knowledge of carbon footprinting, climate change risk assessment, and emissions reporting.¹⁷ Maintaining an active dialogue with these sectors, to identify whether new priorities for upskilling are emerging, will therefore be needed. This can then help to inform any required adjustments to the skills system in time and space, although this is likely to be lower priority than the other sectors discussed.

Adaptation to the impacts of climate change. While not the primary focus of this report, the transition to Net Zero will take place within a context of further warming, and intensifying climate change impacts, globally. Adaptation to these impacts and enhancing resilience of business operations and supply chains in the UK will therefore be required. Outside of specific roles and skills needed for UK-wide climate change risk assessments (e.g. climate researchers), many organisations, and especially those with complex and international supply chains, are likely to need increased capacity to interpret climate change projections, assess risks to their own operations, and implement responses. The implications of this for the education and skills needs of UK workers could include, for example, improved training and awareness around heat stress, vector-borne disease and mental health risks in the workplace.

3) The education and skills context

This chapter briefly sets out the current skills system landscape across the UK, as a key context for and facilitator of the Net Zero transition.

The UK education and skills system

Skills

A range of skills are needed for workers to contribute effectively. Typically, skills range from basic functional skills through to skills at the level of a doctorate or equivalent. In England, for instance, there are typically nine qualification levels ranging from 1 to 9 corresponding to this range of skills. A levels, T Levels, advanced apprenticeships and vocational qualifications are typically Level 3 for example, while honours degrees or degree apprenticeships are Level 6.¹⁸

Skills are also sometimes divided into core skills (those essential for young people to be prepared for life and work in a global economy, such as communication, numeracy, literacy and ICT skills); employability skills (those necessary for being in a job, such as teamwork, problem solving, organising, self-management); and vocational skills (empirical skills needed for a specific area of interest, usually from hands-on experience, such as skills needed to be a nurse, mechanic or chef).¹⁹

Education and skills provision

Individuals can gain skills via each of the main stages of **mainstream UK education**^{*}, with some variations in specific ages and durations across the Devolved Administrations.

- Early years education and primary education typically provide education for children up to the age of 11 or 12, providing basic literacy and numeracy, and the foundations in other subjects.
- Secondary education typically seeks to help students aged up to 18 years old reach Level 1 -3.
- Further education includes all non-advanced courses taken after the period of compulsory education ends, and is distinct from higher education, which is at a higher (i.e. degree) level. Further Education is often seen as a core part of the wider learning and skills sector in the UK, alongside provisions such as workplace education.
- Higher education usually includes courses at or above Level 6 and can span bachelor's degrees, taught and research-based Masters, as well as doctoral study.

^{*} 'Mainstream education' is here defined as encompassing formal school, college and university provision focussed on taught qualifications. Clearly, the learning and skills sector in the UK extends far beyond such a definition, with many schools, colleges and universities themselves being leading providers of wider learning and training.

Individuals can also gain skills outside of mainstream education via the **wider learning and skills sector**[†]. This could be through being supported by their employer to engage in training, through taking part in funded adult learning programmes, or through pathways such as apprenticeships, traineeships or informal self-directed learning.

- Work experience and work-based placements are a common facet of school and tertiary education provision in the UK. Work experience tends to be for secondary school age and above, with work-based placements commonly featuring as part of further and higher education programmes.
- Apprenticeship provision likewise centres on secondary school, further and higher education stages. For instance, the ‘Foundation’ (final 2 years of secondary school), ‘Modern’ (16+ year olds), and ‘Graduate’ (leading to a degree level qualification) apprenticeship schemes in Scotland.
- Many adult and lifelong learning programmes in the UK include both formal ‘mainstream education’ elements, and those drawing on the wider learning and skills sector. Skills Bootcamps in England, for instance, are short training courses open to adults (19+), which have an emphasis on technical skills, and are co-designed or shaped by employers based on perceived needs. They can be hosted by further and higher education institutions, as well as by independent providers, and encompass those already in work as well as those looking for new work.
- Also in England (and in Scotland), the ‘Sector-based Work Academy’ (SWAP) programme aims to provide training and work-based placements for those in receipt of unemployment benefits. The sectoral focus and programme flexibility is designed to better match skills and learning provision with the needs of the participating employers.
- Research from the Learning and Work Institute shows that, although adult participation in learning has increased in recent years, levels have thus far only returned to those seen in the early 2000s, following a decade of declines in the 2010s. Large inequalities in participation in such adult learning persist, with those who are in higher socio-economic groups, already qualified, or in work, much more likely to participate. Participation rates are also seen to decrease with age.²⁰
- The UK government has recently launched its ‘returnerships’ initiative, aimed at encouraging those over 50 back into work. This again draws on apprenticeships, skills boot camps and the sector-based work academy programmes in terms of skills and training provision.
- Many employers themselves provide in-house or funded external training for their workers, with large businesses and institutions commonly having Continuing Professional Development (CPD) programmes for all employees, in addition to induction processes and role-specific training.

Education and skills governance

In terms of **mainstream education** in England, the Department for Education (DfE) is responsible for children’s education, in addition to further education policy, apprenticeships and much of the higher education and wider skills system in England. Equivalent government departments oversee the bulk of education policy in the Devolved Administrations.

[†] The ‘wider skills and learning sector’ in the UK is here defined as all education and training occurring beyond mainstream education. As such it encompasses workplace training, informal education, and aspects of early years, adult education and lifelong learning not covered within our definition of mainstream education. In reality, many providers simultaneously deliver under both categories and every worker will also experience both.

For universities, the independent Office for Students is the regulator of higher education in England, with the Scottish Funding Council having this role in Scotland, and the Welsh Government intending to establish the Commission for Tertiary Education and Research (CTER) to provide oversight and funding for further and higher education in Wales, alongside adult education and apprenticeships. Universities in Northern Ireland have no specific funding council and are overseen by the Department of Economy.

Governance of the **wider skills and learning sector** includes government, training providers, local bodies and individuals. Employers also have an important role in shaping the skills system, and in actively developing the skills of their own workforce. This can be through investing in their own training, supporting staff to engage in funded training opportunities provided by others, and by rewarding those with particular skills.

- In 2021 the UK Government published its Skills for Jobs White Paper, which outlined plans for reforming post-16 technical education and training.²¹ Building on this, in 2022 the Skills and post-16 Education Act placed a legal requirement on colleges and other providers to work with employers to develop local skills improvement plans (LSIPs). The Strategic Development Fund (SDF) provides capital and funding for FE providers to support changes to meet the needs of employers identified in LSIPs.
- The Skills & post-16 Education Act also introduced a lifetime loan entitlement, committed to prioritise green skills, and sought to ensure pupils met with providers of technical education, to make them aware of the range of career routes and training available to them, beyond traditional academic routes.²²
- In the Devolved Administrations, mainstream education and the wider skills and learning sector are likewise represented and governed by a mixture of government, employers, training providers and local bodies. In Scotland, Skills Development Scotland (SDS) play a leading role in delivering skills policy nationally, with 'Education Wales' in Wales and the Department for the Economy in Northern Ireland having similarly central roles for skills policy in their respective nations.
- National Occupational Standards (NOS), together with the Institute for Apprenticeships and Technical Education (IfATE) in England, determine what standards and frameworks are needed and where. Once developed and quality assured, standards describe the learning content for each unit in a qualification at all levels, from certificates and diplomas to degrees and master's qualifications.

Education and skills policies

A number of strategies, reports and white papers have been published in the last 5 or so years which relate to the UK education and skills system. These include:

- The **Industrial Strategy** (2017) outlined an ambition to ensure everyone could build skills over their lifetime to increase wages and quality of jobs they had access to.²³
- **A Plan for Jobs** (2020) was a policy paper outlining plans for recovery from COVID-19. It outlined plans to expand support for skills, including support for apprenticeships and traineeships.²⁴
- **Skills for Jobs** (2021) outlined plans to reform the further education system, including being more employer-led.²⁵
- **Levelling Up the UK** (2022) set out government plans to distribute opportunity more equally across the UK, including increasing people completing skills training.²⁶
- The **Skills and Post-16 Education Act** (2022) implemented reforms in the Skills for Jobs white paper, including establishing LSIPS (as described above).²⁷
- The **Developing workforce skills for a stronger economy** (2022) report from the National Audit Office examined the effectiveness of the UK Government's approach to enhancing skills. It identified significant challenges, including reductions in spending by employers on worker training, a decline in participation in adult education, and major impacts on skills and workforce needs resulting from the transition to Net Zero.²⁸
- The Devolved Administrations have also developed a range of strategies and plans relating to the education and skills systems of their nations, including the recent **National Strategy for Economic Transformation** (NSET) in Scotland (2022), **Stronger, fairer, greener Wales** (2021) and the **New Curriculum for Wales** (2022) from the Welsh Government, and the **Skills for a 10x Economy** skills strategy for Northern Ireland (2022).²⁹³⁰³¹

4) The Net Zero skills system today

Before considering in Chapter 5 how fit for purpose the UK skills system is to deliver Net Zero, this chapter sets out how the skills system is currently evolving to support the Net Zero transition, both in terms of UK and Devolved Administration policies for mainstream education and within the wider skills and learning sector. It then outlines the current status of Net Zero-specific qualifications and funding provisions.

Current Net Zero-specific education and skills policies

Overarching strategies

- **The Net Zero Strategy** (2021) set the UK Government's ambition to support up to 440,000 jobs[‡] across Net Zero industries in 2030, and to enable workers, industries and places to transition to a Net Zero economy.³² At a high level it set out to do this by reforming the skills system to make it more responsive to the needs of employers, ramping up support for workers in high carbon economy to transition to green jobs, working with businesses to ensure people from all backgrounds can access opportunities in the green economy, and supporting children and young people with education and training for green careers.
- Scotland's **Climate Emergency Skills Action Plan (CESAP)** was produced by Skills Development Scotland and covers the period 2020-2025.¹⁹ The publication of the CESAP was timed to align with the Scottish Government's Climate Change Update Plan in December 2020. Developed with Industry Leadership Groups and an Expert Group comprising education providers enterprise agencies, government departments and agencies, the plan identified five priority sectors (energy, construction, transport, manufacturing and agriculture & land use) for Net Zero. It set out the high-level implications for skills within each, recognising the need for both technical and wider skills. Across all sectors, it highlighted six priority areas, including developing the future workforce for the Net Zero transition (Priority 3) and ensuring fairness and inclusion in the skills system as part of the Net Zero transition (Priority 5). The CESAP is in the process of being updated through the CESAP Implementation Steering Group and by the Scottish Government. In Appendix B we summarise progress to date against the CESAP.
- In March 2023 Wales published a **Net Zero Skills Action Plan** which provides a high-level summary of planned actions to ensure a just transition and grow Net Zero skills. It includes actions to help better understand Net Zero skills needs, to improve engagement with employers on the role of Net Zero qualifications and skills, and actions to strengthen the skills system itself.³³
- Also in March 2023, the UK Government said the outputs from the Green Jobs Delivery Group would be brought together into an overall **Net Zero and Nature Workforce Action Plan** in 2024.³⁴ The plan will outline headline actions and solutions the group and its sub-groups are currently identifying, with the co-chairs of the group also due to publish bi-annual updates from Spring 2023 onwards.

Over recent years there has been an increasing number of publications addressing skills for Net Zero which are not government strategies. These range from those aimed at specific businesses and locations, through sectoral and regional assessments, to UK and economy-wide analyses. Recent examples of the latter include:

- **The Green Jobs Taskforce** published their report in 2021 setting out recommendations for how to capture the opportunities of the Net Zero transition, and support workers in high carbon sectors to transition. It recognised certain sectors will need to be prioritised if we are to ensure we are able to effectively meet our Net Zero targets

[‡] Ambition has since increased to 480,000 jobs.

(Power; Business and industry; Homes and building; Transport; Natural resources; Enabling decarbonisation; Climate adaptation).³⁵

- **Aldersgate Group** published the ‘Upskilling the UK Workforce for the 21st century’ report in 2020 which centred on the role of green jobs and skills in realising a sustainable recovery from COVID-19. Its core recommendations focussed on collaboration across government, business and education providers to secure skills supply, grow the low-carbon supply chain, and enhance local engagement and funding.³⁶
- **Green Alliance** published the ‘Closing the UK’s Green Skills Gap’ report in 2022 that highlighted the huge potential for the Net Zero transition to simultaneously address social inequalities across the UK. Its key findings and recommendations included that every major sector in the UK needs to close a significant skills gap to reach Net Zero, that a UK-wide body and framework for green jobs is needed, and that local skills plans should link business with universities and colleges.³⁷
- **UK100** published the ‘Skills for Local Net Zero’ briefing in 2022, focussed on the role of local authorities in overseeing the development of skills for Net Zero in a place-based context. This highlighted issues such as underfunding of Further Education and recommended actions including embedding Net Zero skills provision into local authority funding settlements and introducing a national strategy for home energy efficiency led by local authorities and including skills development.³⁸
- **The ‘Green Edge’** was launched in 2021 to collate, review and synthesise the fast-expanding array of green workforce and skills reports emerging from across the UK economy and internationally. It has since become a comprehensive and up to date source for green jobs and skills-related publications in the UK.³⁹
- **Mission Zero**, an independent review of Net Zero, was led by Chris Skidmore and published in 2023. The review covers all aspects of the UK’s Net Zero transition, including skills and workforce implications.⁴⁰
- **Internationally**, there exists a raft of governmental and independent plans and publications that also address skills for Net Zero. Notable frameworks and reports of relevance to the UK’s own skills system include the European Sustainability Competence Framework, the ‘Skills for Green Jobs’ and ‘Apprenticeships for Greener Economies and Societies’ reports, and sector-specific initiatives such as the Alliance for Batteries Technology, Training and Skills (ALBATTs).⁴¹⁴²⁴³⁴⁴

As summarised in Appendix D, a range of policies and plans have been or are being developed which relate to Net Zero skills across the four nations of the UK. With varying devolved powers and differing opportunities at national and sub-national scales, there is a concern that synergies and antagonisms between skills policies might be overlooked, and so progress on delivery of skills for Net Zero at the whole of UK level will be undermined. To ensure that this does not happen, there is a need for the UK Government in partnership with the Devolved Administrations to consider how these policies and plans will be monitored and managed in a coordinated way, so that efficiencies can be realised and potential antagonisms avoided (required actions are discussed in more detail in Chapter 5 ‘Recommendations: Skills for Net Zero’). Throughout this report we aim to provide recommendations of use to the UK Government as well as to the Devolved Administrations, however all must be underpinned by active intergovernmental communication and collaboration on skills and Net Zero policy.

Mainstream education

Mainstream education in schools, colleges and universities will play a central role in realising the skills and training provision needed for the UK’s Net Zero transition, both in terms of the existing workforce and the workforce of the future. The economy-wide nature of the Net Zero transition means that it will increasingly shape education needs at every level and in every region of the country. Mainstream education must also help to provide the core skills and learning required to allow workers to more easily transition within and between sectors as demands change.

For sectors such as building construction & retrofit, energy supply and transport, the sheer magnitude of the skilled workforce required to deliver Net Zero will necessitate large expansions and realignments of provision by education providers. In particular, the further education sector will require significant additional investment and support if the progress towards meeting international climate change commitments is not to be undermined by domestic skills shortages.

Schools

Why it matters

School education has an especially important role in supporting the medium and longer term (2030-2050) transition to Net Zero. While a proportion of the current school-age population will enter the workforce within the next 5 years, the majority will either still be in school or in some form of tertiary education and training by 2030. As such, there is an opportunity for strategic alignment of learning provision and outcomes in schools that is overtly informed by the complete journey to Net Zero by 2050 for the UK. Such phased alignment can ensure school leavers are equipped with the changing skills the transition will require over time. School education also represents a defining element of lifelong career choices for many, so can take a leading role in creating and expanding career pathways that avoid skills gaps in the future and that help to address current inequalities in the workforce.

Current Net Zero policy

The UK Government has started to set out how it intends to integrate Net Zero into primary and secondary education through a variety of strategies and action plans, including:

- **The Net Zero Strategy** (2021) included a commitment to bring forward a new strategy for children's services, education and skills system that supports the UK's Net Zero transition (below) and a goal of *'providing children and young people with the high-quality education they need to work in a future green career'*.⁴⁵
- **Sustainability and climate change: a strategy for the education and children's services systems** (2022) included as one of its four strategic aims *'Excellence in education and skills for a changing world: preparing all young people for a world impacted by climate change through learning and practical experience'*.⁴⁶

Supporting plans for this outcome in schools included:

- Providing Continuous Professional Development for science teachers on climate change
- Developing a Primary Science Model Curriculum, with an emphasis on nature to ensure all children understand the world around them
- Providing teachers with free access to high-quality curriculum resources, through organisations such as the Oak National Academy (an independent public body in England supporting curriculum development and delivery) and the National Education Nature Park online hub
- Shared carbon literacy training for all staff (teaching, leadership and support) through schools' sustainability leads
- The National Education Nature Park Pilot
- Sharing university climate expertise and learning opportunities with colleges, schools and nurseries.

Building on the Department for Education's sustainability and climate change strategy, a national climate education action plan was developed independently of government:

- **The National Climate Education Action Plan** is coordinated by the University of Reading, who brought together young people, scientists, teachers and educationalists, policymakers and campaigners at a Climate Education Summit to create this action plan for better climate education in schools and colleges in the UK.³⁰ Its recommendations include:
 - Every school and college should identify a senior staff member to lead on climate education and provide them with support and funding
 - A structured programme or climate award for schools, colleges and youth organisations should be developed, providing a national focus to a range of extracurricular activities and supporting resources to aid delivery
 - A national scheme of quality assurance of teaching resources for climate education should be developed and professionals working in climate research and policy, from science and non-

science disciplines, should pledge a proportion of their working time to providing help to teacher-led climate education initiatives.

In the Devolved Administrations, there are similar commitments to embed climate and sustainability learning into school curricula. In Scotland, for instance, this is most prominent in the 'Learning for Sustainability' entitlement for all learners, based on the 'Vision 2030+' strategic plan and the professional standards of the General Teaching Council for Scotland.⁴⁷⁴⁸

While there remains an emphasis on the mainstreaming of climate education and sustainability into existing school-level subjects, there are also qualifications emerging that have a more specific focus. These include the 'Reducing Carbon Footprints Through Environmental Action' qualification already available at level 2 (GCSE-equivalent) in Northern Ireland and a GCSE in Natural History due to be available in England and Wales from autumn 2025.

Beyond Net Zero-relevant learning in the formal school curriculum, 'Eco-Schools' (Keep Britain Tidy), the Climate Change Education Partnership (STEM Learning UK) and a host of learned societies and NGOs also deliver environmental awareness and education programmes for schools across the UK. Many of these include an emphasis on careers advice and support, with the Sustainable Futures programme and National Green Careers Week both focussed on enhancing the awareness of, and support for, green career pathways in schools.⁴⁹⁵⁰

Further Education

Why it matters

Further Education (FE) in the UK will play a pivotal role in delivering Net Zero, through supporting both future workers and those in employment to develop the skills they will need to secure or retain employment, or to transition into new roles. Over 80% of the workforce of 2030 is already in work today, highlighting the defining role FE will play in upskilling and reskilling working-aged people.⁵¹ As noted previously, the FE sector is arguably the most important facet of the entire UK skills system in terms of meeting the very large skilled workforce demands of Net Zero in sectors such as built environment, energy and transport. The tight labour market and increase in people aged between 50 to 64 who are not engaged in paid work mean FE-facilitated pathways for supporting people to return to work will also be important in avoiding skills bottle necks for Net Zero delivery.⁵²

Current Net Zero Policy

Most large-scale policy initiatives around skills and training in the UK have FE providers at their core. Where these have Net Zero-focussed elements it is therefore colleges that are most often relied upon to create new courses or enhance existing ones. Many colleges have already responded to wider Net Zero policy and its impacts through creation of courses to meet the specific sectoral or regional demands being driven by rapid decarbonisation. The Energy Skills Partnership, for example, works with colleges across Scotland to adapt learning provision to the emerging needs of employers in key sectors such as renewable energy generation.⁵³

In England, 'Local Skills Improvement Plans' (LSIPs) represent another major avenue through which groupings of colleges can work with employers in their area (usually via Chambers of Commerce) to develop and deliver skills provision based on local priorities and capacity. Given the significant skills shortages already apparent in sectors like construction, and a history of fragmented engagement by employers (especially SMEs) with colleges on training needs, LSIPs have the potential to play a leading role in addressing local and national skills needs for Net Zero.⁵⁴

All LSIPs are required to consider Net Zero as part of their development⁵, providing an opportunity to make timely, placed-based decisions that can meet immediate and forthcoming skills needs for Net Zero. However, such consideration will need both employers and partner colleges to have a high level of intelligence in terms of changing demand and timescales, with clarity and consistency in central government actions for Net Zero (such as investment plans and technology choices for decarbonisation) being paramount in this.

This major role of the UK Government policy in supporting the FE sector to deliver on Net Zero is highlighted in the 'Green College Commitment' from the Association of Colleges.⁵⁵ This sets out 15 recommendations to the government, many of which relate directly to skills provision, including the priority actions of:

- Make climate and environmental education a compulsory part of all study courses
- Provide the Lifelong Loan Entitlement** for training in priority green sectors
- Invest through the National Skills Fund to meet demand in growth sectors, such as renewable energy and low carbon heating
- Invest in the college workforce to ensure they have the resources and knowledge to train those moving into new developing growth sectors

In terms of the piloting of 'trailblazer' LSIPs and their England-wide roll out over the coming years, variations in the availability and use of labour market intelligence, and the extent of alignment with Net Zero needs, is already apparent. While some initial plans, such as those for West Yorkshire and Sussex, have made use of market intelligence and have overt Net Zero components in the training colleges would provide, others appear to contain little direct consideration of Net Zero needs.⁵⁶ Well-informed LSIP development, both through funded research on future skills needs for Net Zero at the local scale and through clear Net Zero policy and advice at central government level, is therefore a must.

Initiatives like the Energy Skills Partnership in Scotland sit within the context of broader aims for delivery of skills for Net Zero by the college sector. The Climate Emergency Skills Action Plan (CESAP) includes a priority for all colleges in Scotland to assess how well their existing provision aligns with Net Zero needs, with the Scottish Funding Council (SFC) now undertaking in-depth 'Regional Tertiary Pathfinders' focussed on skills needs and provision assessments.⁵⁷ The two pilot regions for this work - the North-east of Scotland and the South of Scotland - are regions where the workforce and skills impacts of the transition to Net Zero may be especially pronounced.⁵⁸ Indeed, a very significant dimension of Net Zero skills policy in Scotland is that of it enabling a 'Just Transition', whereby the transition '*supports a Net Zero and resilient economy in a way that delivers fairness and tackles inequality and injustice*'.⁵⁹ The Scottish Government's draft Energy Strategy & Just Transition Plan, as well as the forthcoming just transition plans for the transport, built environment, and land use & agriculture sectors, therefore have a strong emphasis on the role of skills and education provision in delivering Scotland's Just Transition Outcomes.⁶⁰⁶¹

In Wales, the new Net Zero Skills Action Plan includes an emphasis on college education through the use of green Personal Learning Accounts (PLAs), with an aim to support new and emerging Net Zero skills in targeted sectors such as energy and construction.⁶² Through approval via an expert industry panel, the network of FE colleges in Wales then

⁵ 'The LSIP should describe how skills, capabilities and expertise required in relation to jobs that directly contribute to or indirectly support Net Zero targets, adaptation to Climate Change or meet other environmental goals have been considered.'

** The Lifelong Loan Entitlement (LLE) is a UK Government programme designed to provide loans equivalent to the cost of 4 years of full time post-18 education. They have recently been revised to also allow students to study at and equivalent or lower level than they had studied previously.

provides courses designed to meet industry needs - already approved courses include heat pumps, wind turbine maintenance, and installation of domestic EV chargers.

Finally, in Northern Ireland, individual colleges are also responding to wider Net Zero-related policy and its impacts on employers and their workforce needs. South West College, for example, launched the 'Net Zero NI Skills Programme' in 2022 aimed at developing curricula in partnership with industry to provide new courses and training in areas such as hydrogen production and sustainable construction.³⁸⁶³

Higher Education

Why it matters

Higher Education Institutions (HEIs) have a direct role in supporting economy-wide progress towards Net Zero through the learning, skills and attributes of their graduates. This spans graduate-level workforce needs in all sectors at the core of the transition (such as built environment, energy, transport and land use), through postgraduate provision to deliver higher level skills in specific areas (such as carbon management, accounting and finance), to doctoral training programmes and the underpinning of future R&D capacity for Net Zero.

Many HEIs also have a significant indirect role in the UK's Net Zero skills system through their training of existing and future teachers and college lecturers and can likewise serve as institutional hubs for coordination and support of Net Zero skills provision and green career pathways in schools and colleges in their area. The international scope of most HEIs, in terms both of their student populations and of their often extensive overseas research and capacity-building work, represents an important route through which UK HEIs can help to enhance the skills base for the global transition to Net Zero too.

Current Net Zero policy

Whilst most HEIs have committed to Net Zero targets and have developed plans for decarbonisation of their estate and activities, few have overtly aligned their teaching and learning provision with the transition to Net Zero. Universities UK - representing 140 universities across the four nations of the UK - have committed to six high level climate and sustainability goals over the next decade.⁶⁴ These range from setting targets on direct and indirect emissions reductions, through clear communications of commitments, to embedding elements of UN's Sustainable Development Goals accord into reporting. However, they do not include an explicit commitment to provide the skills and learning needed for the Net Zero transition.

More recently the '*Accelerating the UK Tertiary Education Sector to Net Zero*' report led by the Royal Anniversary Trust set out ways in which universities and colleges can support the Net Zero transition and provided a range of recommendations to government on how this could best be achieved.⁶⁵ Again, the emphasis here is on emissions reduction in the operations and supply chains of Further & Higher Education Institutions. While some recommendations do relate to skills and learning provision - such as around talent attraction and retention within the sector - the fundamental role of the tertiary education sector in providing the skilled workforce needed for a sustainable transition to Net Zero at local, national and international scales is not a focus.

The platform of COP26 in Glasgow in 2021 did lead to some universities announcing new skills and learning-focused aspects to their climate change commitments, such as through additional scholarship funding and bursaries for students studying climate and sustainability topics.⁶⁶ Many others individual institutions and university networks (e.g. U7+ and Universitas21) are also in the process of assessing current learning provision and how well, or not, it meets the needs of learners and employers in the context of the Net Zero transition.

In their briefing paper *'Mainstreaming Climate Education in UK Higher Education Institutions'* the UK Universities Climate Network (UUCN) highlighted the demand from students and employers for Net Zero learning provision, and the ways in which universities can embed climate education across curricula.⁶⁷ This assessment included case studies of existing climate education in universities, highlighting the patchy nature of provision across the UK. Recommendations for the sector included investment in internal capacity to embed and deliver climate education, and institutional strategies that bolster national and global climate action through learning provision.

The greater autonomy common to most UK universities (those in England have an independent regulator) compared to the Further Education sector and schools, means that much of the governmental policy relating to Net Zero skills provision is either very high level or indirect. The Department for Education's Sustainability & Climate Change Strategy, for instance, centres on actions in schools, colleges and across the wider skills system, with universities tasked primarily with sharing good practice, providing climate change expertise, and helping to facilitate programmes such as Skills Bootcamps.

In Scotland, the Climate Emergency Skills Action Plan (CESAP) likewise recognises the important role of universities in delivering skills for Net Zero. It includes an aim for every university in Scotland to *'review existing provision and its alignment with the Net Zero transition, and to develop a 10-year strategy for addressing gaps and provide dynamic alignment with changing skills and jobs needs'*. A significant enabler of such actions for universities in Scotland and across the whole of the UK is that of funding council agreements. The Scottish Funding Council (SFC) has already moved towards a more direct approach on Net Zero skills provision and outcomes in universities, with its recent Net Zero & Sustainability Framework for Action committing to review *'all engagement with the sector including funding guidance and partnerships to ensure all SFC levers fully incentivise Net Zero'*.⁶⁸

Professional bodies and membership associations also play a major role in convening tertiary education providers around the Net Zero transition, and in informing responses through curricula and qualifications (see below). The Alliance for Sustainability Leadership in Education (EAUC), for instance, has a leading role in supporting and recognising sustainability initiatives in colleges and universities, including those focussed on learning and skills.⁶⁹ Ultimately, learning provision in all universities will have to evolve in response to Net Zero needs and policies at multiple levels, including international. Changing student demand and graduate employability in the Net Zero transition will also therefore demand enhanced provision for Net Zero if UK universities are not to become less competitive globally.

The Wider Skills and Learning Sector

Why it matters

The mainstream school, college and university education provision discussed above is all part of a much wider skills and learning sector in the UK. Alone, such formal education providers can meet neither the size nor the diversity of the skills demands posed by the Net Zero transition. The wider skills and learning sector - spanning apprenticeships, in-house training by employers and independent providers, right through to the extensive learning opportunities made available to communities across all parts of the UK by libraries, museums and galleries - is therefore indispensable when it comes to realising a sustainable and just transition to Net Zero in every part of the country. For sectors that may phase down their workforce as a result of Net Zero, such as oil and gas, or redirect activities, such as livestock agriculture and manufacturing, the wider skills and learning sector has a role to play in ensuring these workers can develop skills for new employment or the changing demands of their work. For sectors that need to rapidly grow for Net Zero, such as building construction and retrofit and electric vehicle manufacturing, the wider skills and learning sector will need to have the capacity to offer attractive and affordable skills pathways into these sectors, in the right places at the right time.

Current Net Zero policy

At the national scale, all Net Zero skills policies from the UK Government and the Devolved Administrations include elements that tacitly or overtly rely on the wider skills and learning sector. For England, implementation of the DfE's Sustainability & Climate Change Strategy includes leadership by the Natural History Museum in delivery of a National Education Nature Park and of the accompanying 'Climate Action Awards' which aim to help children and young people develop skills in biodiversity and sustainability.⁷⁰ Many independent training providers are also playing a major role in the development and delivery of Net Zero-related learning in schemes like LSIPs and Skills Bootcamps.

Similarly, in the Devolved Administrations the CESAP in Scotland and the Net Zero Skills Action Plan in Wales aim to integrate formal education in schools, college and universities with training and skills development nation-wide.^{71,72} An important facet of this integration is providing comprehensive advice on Net Zero career pathways and the combinations of mainstream education and wider skills training available to realise them. Scotland's 'Green Jobs Workforce Academy', for instance, provides green skills, training and careers advice as part of the wider My World of Work careers portal.⁷³

For apprenticeships, the rapidly changing skills and workforce needs of some key sectors in the transition to Net Zero are already resulting in altered employer demands. In England, the Institute for Apprenticeships and Technical Education (IfATE) has convened a Green Apprenticeships & Technical Education Advisory Panel (GATE-AP) to work with employers to align apprenticeships to Net Zero objectives and to endorse existing apprenticeships which support green career pathways specific to the environmental sector.⁷⁴ This remit includes a requirement to map existing apprenticeship standards against green occupations and identify opportunities to create new standards (see also 'Net Zero Qualifications' section below).

A leading sector in shaping such apprenticeship provision for Net Zero, and in terms of employer-led training and investment in capacity building more widely, is that of renewable energy generation. Offshore wind energy company Ørsted, for instance, already has a well-established apprenticeship scheme for wind turbine technicians⁴⁷. It also provides funds for STEM-related training and skills as part of its community engagement programme in coastal regions of the UK adjacent to large offshore wind energy developments.⁷⁵

In Scotland, initiatives like the National Energy Skills Accelerator (NESA) aim to connect education and training providers directly with businesses to meet the emerging skills needs of energy decarbonisation.⁷⁶ Importantly, renewable energy developers are increasingly being required to assess the workforce impacts of proposed projects, and to actively support the response of the skills system to these new demands. The ScotWind leasing process for construction of windfarms in Scottish waters provides an example of this, with the 'Supply Chain Developer Statements' from applicants providing a means to assess the wider investment impacts, potential job creation, and skills needs of offshore wind projects.⁷⁷ This has led to some developers including overt commitments to funding apprenticeships⁵¹, with four of the ScotWind developers also committing to an investment of 1 million Euro to allow the University of Highlands and Island (UHI) to extend its STEM outreach programme to schools beyond the Highland Council area.⁷⁸

Industry-led responses to skills needs for Net Zero are also apparent in the wider energy and utilities sector in the UK. The Energy Utility & Skills Partnership (EUSP) is leading work on assessing and meeting skills needs, including those of Net Zero, across energy, water and waste management infrastructure. Their 'Workforce Renewal & Skills Strategy 2020-25' set out renewed priorities around enhancing workforce diversity, maximising investment in skills, and in targeting training to meet changing market demands.⁷⁹ Likewise, organisations such as the Engineering & Construction Industry Training Board (ECITB) are partnering with education providers to meet emerging Net Zero demands in the sector - the Energy Transition Leadership Programme at the University of Strathclyde, for instance, aims to introduce engineers to the technologies, strategies and business models that underpin Net Zero.⁸⁰

Other major enablers of Net Zero policies in the wider skills and learning system include the capacity, or lack thereof, in local authorities and public bodies to coordinate skills initiatives.⁸¹ At local scales community-led groups and public

services such as libraries, museums and job centres can likewise underpin skills development and provision, with trade unions, student associations and the third sector together having a crucial role to play in creating the conditions needed to transform the skills system nationwide. In their ‘Voice and Place’ report the Trades Union Congress (TUC) set out ways in which to achieve a just transition to a net zero economy across the regions and nations of the UK.⁸² Among its headline recommendations was a need for an integrated skills strategy and for government and employers to actively engage with unions to ensure workers have a strong voice in skills and workforce planning. The response to skills shortages in the Belgian construction sector (following strengthening of building energy efficiency standards) is a good example of such engagement. There, the three main trade unions collaborated with employers to assess needs and develop new training on green buildings that was then provided by government agencies.⁸³

Net Zero qualifications and standards

Why it matters

Rapidly changing skills and workforce needs in many sectors mean that some existing roles will require new skills and competencies. Other roles (such as those in emerging low-carbon sectors, like CCS and hydrogen) may have no clearly defined standards as yet. Without formal and consistent recognition of skills and competencies for Net Zero there is a risk of creating artificial barriers to workers wanting to transition within and between sectors, as well as to new entrants to the workforce. This risk was highlighted by Chris Skidmore in his review of the UK’s Net Zero transition, with a ‘Net Zero skills passport’ being suggested as a way to streamline worker mobility and enhance retention.⁸⁴

Current Net Zero qualifications and standards

A large number of Net Zero-related qualifications and standards already exist across the UK. The Office for Qualifications & Examinations Regulation lists over 500 available qualifications, spanning areas including renewable energy, energy efficiency, zero emission vehicles and waste management.^{85,86}

Professional bodies, such as the Institute of Environmental Management & Assessment (IEMA), also play a significant role in developing competency frameworks and accreditations that address Net Zero needs within key sectors of the UK economy. The Royal Institute of British Architects (RIBA)’s ‘Climate Literacy Knowledge Schedule’ (2021), for example, sets out mandatory competencies in climate literacy for their chartered architects, including planning for climate extremes, whole-life carbon assessments, and carbon offsetting.⁸⁷ The latest CPD framework of the Institute for Chartered Engineers (ICE) has climate adaptation and decarbonisation as core topics.⁸⁸ Such Net Zero knowledge requirements can shape learning outcomes and qualifications in colleges and universities too, with degree and masters programmes seeking to gain Chartered Engineer accreditation from the Engineering Council needing to show that learners are able to ‘Evaluate the environmental and societal impact of solutions to complex problems and minimise adverse impacts’.⁸⁹

Whether through revised professional and apprenticeship standards, new competency frameworks, or school, college and university qualifications focussed on Net Zero, development and approval of qualifications in a way that meets learner, educator and employer needs can take a considerable amount of time (typically 18-24 months).⁹⁰ Where skills and workforce demand changes rapidly - such as occurred during implementation of the Energy Performance of Buildings Directive in the EU - the responsiveness of the qualifications and standards system will also need to be rapid.

In 2021, the Institute for Apprenticeships & Technical Education (IfATE) published an environmental and climate change skills strategy that aims to enhance such responsiveness in the UK.⁹¹ The focus of the strategy is to ensure that apprenticeships and technical qualifications address evolving demands for environmental and climate change skills. This includes ensuring that T Levels and Higher Technical Qualifications ‘play their part in helping learners prepare for and find green jobs and apprenticeships’. IfATE is working with the Green Apprenticeships and Technical Education Advisory Panel and with ‘Trailblazer’ groups (>5,000 employers) to analyse its standards. It has so far identified 100 standards as already having the environmental and climate change knowledge, skills, and behaviours needed. By the

end of 2024 IfATE aims to have reviewed, and where necessary revised, all 228 standards within the scope of this work.

Net Zero skills funding

Why it matters

To realise the skilled workforce needed to deliver the transition to Net Zero across all sectors of the economy and in all regions of the UK will require significant new investment. This will need to be combined with reprioritisation of existing funding and address both the capital and resource budget needs of providers. Directed capital investment, such as that provided for Scotland's Renewables and Energy Efficiency Training Centres, is needed to ensure the capacity and quality of the learning environments meets delivery needs.⁹² Well-directed revenue funding is arguably even more crucial as an enabler of education and training providers across the UK integrating Net Zero into existing courses, expanding staff capacity to meet growing teaching demands, and in rapidly developing new courses and learning resources in response to employer needs. Ensuring accessible and well-funded financial support for learners will likewise be crucial in attracting and retaining the very large numbers of people who will need to gain some degree of training via the UK education and skills system as part of the Net Zero transition.

Current Net Zero policy

In terms of capital funding, many existing funds don't explicitly include Net Zero considerations or, if they do, it is with limited guidance. For example, the £1.5 billion Further Education Capital Transformation Fund to upgrade the estate of FE colleges and other institutions in England has no overt Net Zero element. The capital fund for ensuring industry-standard equipment and facilities are available for those taking new technical courses does mention Net Zero, but there is no guidance on how the fund should be used to develop Net Zero infrastructure and resources. Finally, the Strategic Development Fund (SDF)'s funding guidance does not mention Net Zero.

For revenue spending in the wider skills and learning sector, whilst there is significant investment in training provision nationally, it is difficult to assess the extent to which this is currently supporting Net Zero priorities. At UK government level the various funds are split across at least five departments, with limited evident evaluation of overall value for money or delivery against Net Zero. The Local Government Association estimated that around £20 billion is spent annually across England on 49 national employment and skills related schemes or services. This is made up of 22 nationally contracted programmes and 27 other national programmes.⁹³ As summarised in Appendix C, there is a wide range of funding initiatives that might already be expected to include Net Zero components. While it can be established, at a high level, that some of these do indeed include Net Zero, it is not possible to break down to a granular level how much support is being directed specifically to Net Zero skills development and delivery within these.

We mapped which Net Zero sectors have been included in Strategic Development Fund funding across different regions in England. From a review of published information on almost £100 million of SDF funding, we identified several Net Zero sectors that were included within the funding: Electric and Hybrid Vehicles, Green Energy, Green Construction, Modular Housing and Carbon Capture. However, in many cases, Net Zero sectors were not included.

The Apprenticeship Levy has operated since 2017 as a means of combining employer and public funding for apprenticeships. Employers with annual wage bills of over £3 million are required to pay a levy equivalent to 0.5% of payroll to finance apprenticeship training.⁹⁴ As with other funding schemes, it is difficult to gauge precise levels of support for Net Zero through the levy, though the work by IfATE to map standards against environmental and climate change skills (see earlier) should help with this. Given the magnitude of the Apprenticeship Levy - raising around £2.5 billion each year - it has the potential to play a central role in meeting skills needs for Net Zero for the whole of the UK and across all sectors of the economy.⁹⁵⁹⁶⁹⁷ The effectiveness of the Levy has been questioned, however, with over £3 billion going unspent by employers between May 2019 and March 2022.⁹⁸

The funding landscape for skills is a complex one. New initiatives, including an increasing number aimed overtly at addressing Net Zero needs, are emerging all the time - in March 2023, for instance, the UK Government announced an additional £5 million to support low carbon heating training, expected to support around 10,000 training opportunities.⁹⁹ Government is also providing funding to support engineers to take up training through the Home Decarbonisation Skills Training competition which launched in September 2022.¹⁰⁰ This £9.2 million competition is funding training for people working in the energy efficiency, retrofit and low carbon heating sectors in England.

UK-wide funding for Net Zero skills will need to better align in magnitude and clarity of purpose with the major changes in skills and workforce demand the UK will experience between now and 2050. While a significant proportion of this funding will have to come from public investment, the private sector is already playing a major role in delivering such training and will likely need to play an ever-greater role given the highly constrained nature of public finances. Ensuring this even more complicated array of funding streams delivers the support that is needed in an efficient and timely way for the whole country represents a major coordination task for government.

5) Recommendations: Skills for Net Zero

This chapter builds on the information from all previous chapters to highlight the key risks and opportunities in the skills system currently in relation to Net Zero, and based on these to outline a set of recommendations. It utilises the same structure as previous chapters (schools, universities, further education, and wider skills & education system), although several of the risks, opportunities and recommendations inevitably cut across several areas.

Schools

In all four nations of the UK, an increasing emphasis in recent years has been on mainstreaming climate and sustainability learning into existing provision. Indeed, the 'Climate Education Bill' - a private members' Bill in the House of Commons would '*require matters relating to climate change and sustainability to be integrated throughout the curriculum in primary and secondary schools and included in vocational training courses; and for connected purposes.*'¹⁰¹

While, in theory, mandating such mainstreaming could be transformational in supporting net-zero-alignment of learning and skills development, in practice it may be severely limited by resource and capacity constraints in schools themselves. With an already packed curriculum, and 75% of teachers saying they have an insufficient understanding of climate change to confidently lead a lesson on it, there is a risk that this will be both too patchy and too slow to meet Net Zero transition needs UK-wide.¹⁰² Updated teacher training, Continuing Professional Development and learning resources that embody the skills and learning needs of the Net Zero transition will therefore be crucial.

A host of initiatives and collaborations are already helping to address these issues. For teacher training and development these include new frameworks for Initial Teacher Education (ITE) (e.g. National Climate Education Action Plan, University of Reading), enhanced professional development (e.g. Learning for a Sustainable Future, University of Edinburgh), and extensive research around good practice and pedagogies for climate education, and for addressing climate anxiety in students (e.g. Centre for Climate Change & Sustainability Education, University College London).

This progress is further underpinned by new resources, tools and communities of practice designed to increase the accessibility and applicability of climate change-related content. The Foundation for Education Development (FED) and 'Earth Warriors' have, for instance, developed a 'one stop shop' toolkit for teachers to allow mapping of provision in a way that facilitates easier integration of climate education and green careers elements. Likewise, the Royal Meteorological Society is leading work on where climate change currently appears in the curriculum and how this can be enhanced both within specific subjects, and as part of students' wider learning.¹⁰³ Finally, the Climate Ambassador Network (University of Reading and STEM Learning UK) and the new Climate Advisors Network (Ashden) have

promised to provide an increasing number of schools with direct access to academic and industry expertise on Net Zero.¹⁰⁴

Despite the impressive array of work already underway, there remain significant challenges around ensuring this enhanced provision is accessible and relevant to every school learner, everywhere - climate-related resources for learners with Special Education Needs and Disabilities (SEND), for instance, are still limited.¹⁰⁵ Through working closely with initiatives such as the National Climate Education Action Plan, and the swathe of education providers and organisations already attempting to enhance resources and support, government has the opportunity to remove barriers and accelerate action across all areas of the UK.

In consultation with teaching unions, DfE and DESNZ should together ensure that progress at local scales is in step with and informed by national strategies and timescales to deliver Net Zero. In particular, this UK-wide coordination role of central government should be used to identify shortfalls and to provide additional support to those schools and learners who are currently the least able to engage with the Net Zero agenda.

There is also the major challenge of ensuring that there is the awareness, leadership and capacity in individual schools to fully engage with and benefit from the transition to Net Zero. As such, another fundamental enabler of the mainstreaming of climate education in schools is that of having active leadership from the school’s management team, and via its overall governance structure. This has the potential to provide the sustained strategic approach and investment that is needed for school-wide alignment of provision with Net Zero skills needs locally and nationally, allowing clearer articulation with green career pathways, post-school training, tertiary education and Net Zero-related employment. The ‘Our City, Our World’ programme for Brighton and Hove City Council is taking such an approach, utilising training of senior leaders in participating schools to enable whole-school integration of climate change learning and action.¹⁰⁶ **Government should invest in capacity building for mainstreaming climate education through directly supporting Net Zero training of senior leaders in every school.**

Careers advice and guidance in schools must also address the Net Zero context of employment and further study for students. **The DfE in partnership with the Gatsby Foundation and the Careers Enterprise Company should enhance the existing ‘Gatsby Benchmarks for Good Career Guidance’ to embed Net Zero.¹⁰⁷ These enhanced benchmarks should then be reflected in the government’s Careers Strategy, its statutory guidance for schools, and the similar guidance provided to colleges.**

Table 2: Recommendations for Schools

Recommendation	Lead Organisation	Supported by	Timeline
Additional support for those schools and learners least able to engage with Net Zero	DfE and DA equivalents	Local authorities & education providers	Assess needs in 2023-24 academic year and respond immediately to those needs
Investment in Net Zero CPD for senior leaders in every school	DfE and DA equivalents	Teaching unions & Local Authorities	Pilot in 2023-24 academic year; roll out Autumn 2024
Embed Net Zero in Gatsby Benchmarks	DfE and DA equivalents	Careers Enterprise Company & Gatsby Foundation	Update by Spring 2024; roll out Autumn 2024

Further Education

Given the core role of Further Education in providing the skilled workforce needed to realise a sustainable and fair transition to Net Zero for all of the UK, greater investment in the sector as whole, and especially in its alignment with

Net Zero, is urgently needed. **Government should immediately review Further Education college support and consider whether funding per student should increase. This should include an assessment of the potential training costs - including capital, revenue and learner costs - to meet Net Zero skills needs at Devolved Administration and regional levels, and to inform future investment in and by the FE sector in delivering Net Zero.**

The proposed Net-Zero Industry Act for the EU includes support for the establishment of ‘Net Zero academies’ to *‘develop training and education on how to produce low-carbon technologies and to enhance the skills of the existing workforce in member states’*.¹⁰⁸ The Further Education sector in the UK would be ideally placed to replicate such provision in a way that meets regional and sectoral needs for the Net Zero transition here - such area-based approaches to skills development are already at the heart of LSIPs and their success will rely heavily on engaging and supporting colleges in their region. To realise this potential, in-depth assessments of Net Zero skills needs are needed so as provide robust mapping and timelines of demand for the area.

Granular area-based data on Net Zero skills should be used to inform regional Net Zero FE capital and revenue spending plans, outlining the funding required by colleges to deliver sector-specific skills and how plans offer value for money. Outcome agreements with FE funding councils should then reflect these needs, providing sustained investment that ensures sectoral and regional bottlenecks in skills for Net Zero are avoided.

Clarity on national and longer-term trajectories for Net Zero would also help to give colleges and other education providers in a given region the assurance they need to commit significant resource into new or enhanced provision. **Strategic plans and investment in the FE sector should be underpinned by firm policy decisions and timelines for delivery of Net Zero from central government.**

Table 3: Recommendations for Further Education

Recommendation	Lead Organisation	Supported by	Timeline
Urgent review of FE sector support and assessment of investment needs for Net Zero	DfE and DESNZ	FE Colleges	Complete by end 2023
Enhanced Net Zero skills assessment and intelligence at local scales*	Research providers, FE Colleges	DfE, Local Authorities, Chambers of Commerce	Assessments for all UK regions by summer 2024
Firm Net Zero policy decisions and timelines at national and regional scales	UK Government, Devolved Administrations	Local Authorities	Immediate and ongoing

*See also ‘Recommendations for Wider Skills and Education System’

Universities

The alignment of curricula in Higher Education Institutions (HEIs) with the skills and training needs for Net Zero in the UK and its regions is currently too limited and its rate of evolution too slow. The international scope of most HEIs, in terms both of their student populations and of their oft extensive overseas research and capacity-building work, represents an important route through which UK HEIs can help to enhance the skills base for the global transition to Net Zero, as well as that nationally and locally. This same international scope and outlook, however, poses a risk of misalignment in HEI education and training provision with the Net Zero skills needs that are specific to the UK and its regions. Given the significant lead-in times for course and capacity development common to HEIs, there is now an

urgent need for curriculum transformation across the UK HEI sector; one that mainstreams Net Zero and that better reflects the economy-wide needs identified at regional, national and global scales.

The strategic plans of all HEIs should be updated to overtly address education and skills provision for the Net Zero transition. Government and its agencies should ensure that HEIs have timely intelligence on current and future Net Zero skills needs across the economy. HEIs must likewise ensure that they put the internal structures and capacity in place to meet these needs, with funding council agreements underpinning this transition at every level (including within research degrees) and across every discipline. Net Zero-focussed staff development should be provided for all teaching staff, with individual HEIs and sector-wide bodies, such as Universities UK, enhancing their climate change commitments to overtly address Net Zero skills needs locally, nationally and internationally.

To help increase the responsiveness and accessibility of Net Zero learning in HEIs, lifelong learning provision (such as that intended for Lifelong Learning Entitlement (LLE) support in England) should be expanded to meet changing needs in a university’s region. This expanded offer should be a core component of curriculum development plans across all HEIs, with an emphasis on employer engagement and on rapid achievement of high learner uptake, inclusion and retention rates.

Table 4: Recommendations for Universities

Recommendation	Lead Organisation	Supported by	Timeline
Updated strategic plans to address Net Zero skills and lifelong learning provision in all HEIs	All HEIs	DfE, DESNZ, local authorities	Update by Autumn 2024
Net Zero CPD provision for all HEI teaching staff	All HEIs	DfE, Trades unions	Develop in 2023-24 academic year; roll out from 2024 academic year onwards
Shared commitment across UK HEIs to help meet Net Zero skills needs locally, nationally and globally	UUK	All HEIs, EAUC, DESNZ, DfE	To coincide with publication of Net Zero and Nature Workforce Action Plan (UK Government, 2024)

Wider skills and education system

Amid the array of training programmes provided partly or wholly outside of mainstream education in the UK, there remain relatively few that focus specifically on supporting the pathway to Net Zero. Initiatives such as Skills Bootcamps, SWAPs and LSIPs do have some relevant elements and courses (e.g. the West of England Combined Authority’s ‘Retrofit Academy’).¹⁰⁹ However, the magnitude and pace of change required for the Net Zero transition mean that such provision risks falling well short of the emerging needs of employers and the different regions of the UK. Indeed, the short timeframe in which some programmes must now be delivered means that training providers may already struggle to develop the courses and resources required - Skills Bootcamps focussed on retrofit of buildings, for example, saw providers call for more time and budget for the development of the learning resources.¹¹⁰

While LSIPs and their equivalents in the Devolved Administrations have the potential to match the magnitude and pace of changing skills needs at sub-national scales, they arguably require more direct support and coordination from central government if all regions are to maximise this potential. The assumption that local employer-led development

of provision is sufficient, for instance, is a dangerous one; many small businesses have very limited capacity to inform skills planning and local opportunities will themselves be shaped by national strategies and investment for Net Zero.

West Yorkshire is a fast-developing example of an LSIP where the need for in-depth assessment of skills for the Net Zero transition in the region has been identified. This LSIP already has engagement from SMEs and colleges, alongside other education providers, local authorities, employer bodies and the chambers of commerce itself, but has identified the lack of granular evidence on Net Zero skills needs (as well as those arising from internationalisation and digitalisation) as being a risk to their realising the full potential of training provision in the region.¹¹¹

Government should ensure that sufficient funding is provided as part of all LSIPs (or their DA equivalents) to allow for in-depth assessments of Net Zero skills needs in each area. In particular, engagement with Small and Medium-sized Enterprises (SMEs) should be enhanced so as to simultaneously improve data coverage and the understanding of Net Zero opportunities and risks by SMEs. These regional assessments should be underpinned by firm Net Zero policy and investment commitments from central government and should inform strategic Net Zero investments in a given region (e.g. low carbon manufacturing hubs and infrastructure).

The large amounts of Apprenticeship Levy funds that went unused by UK employers between 2019 and 2022 are indicative of the lack of flexibility in their use.¹¹² Current rules make it very difficult for employers to integrate apprenticeships with the wider training and skills development workers need.¹¹³ This represents a missed opportunity in terms of supporting employer-led responses to skills provision for Net Zero. As previously recommended by Chris Skidmore and others, **Government should review the Apprenticeship Levy and assess flexibility mechanisms - such as allowing the use of funds for essential pre- and post-apprenticeship elements of training - that could better meet Net Zero skills needs.**¹¹⁴

Low levels of awareness of ‘green skills’ in the adult population is also a significant risk to the successful delivery of new skills programmes, including apprenticeships. The ‘Reskilling for Net Zero’ briefing found that over 60% of respondents had not heard of green skills and that only one in five knew which green skills employers require.¹¹⁵ This lack of awareness was identified as the leading barrier to the pursuit of green skills development. Enhancing net-zero alignment of training programmes in the wider skills system of the UK therefore requires adult learners to know what this entails and how it will improve employability, in addition to having suitable courses and resources available.

Government should develop and launch a Net Zero careers marketing campaign to raise awareness of jobs and skills for the transition, and the changing needs of employers. This campaign should be underpinned by enhanced careers services that are rooted in workplaces and that actively support those seeking new training and employment as a result of the Net Zero transition. Careers support like that being developed in Scotland via the ‘Green Jobs Workforce Academy’ provides a useful model.¹¹⁶

In the context of the UK-wide transition to Net Zero, the mandating of developer-led workforce and skills impact assessment in all sectors of economy has the potential both to increase the likelihood of success for any given project and to draw additional private sector investment into overall skills provision for Net Zero. **For the UK Government, its ‘Contracts for Difference’ (CfD) scheme for supporting low carbon electricity generation should require that the supply chain plans of applicants identify skills needs and that CfD contracts specify how these needs will be met.**¹¹⁷

More widely, the UK Government and the Devolved Administrations should consider skills and workforce implications as a core part of any ‘Net Zero Test’ applied to central government procurement and planning decisions.¹¹⁸ This skills and workforce element of the test would allow government to better identify bottlenecks in capacity and to maximise investment and support from the private sector for Net Zero skills in a way that meets with regional and national needs.

Table 5: Recommendations for the Wider Skills & Education System

Recommendation	Lead Organisation	Supported by	Timeline
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Dedicated funding for area-based Net Zero skills assessments	DfE and DA equivalents	Local Authorities, Chambers of Commerce, research providers	Immediate incorporation
Review Apprenticeship Levy	DfE, DESNZ and HM Treasury	Levy contributors and industry bodies	By 2024
National promotional campaign for careers and skills for Net Zero	DESNZ and DfE	Trades Unions	From Autumn 2023
All CfD contracts to specify how skills needs will be met	DESNZ	CfD applicants; Local Authorities	From next allocation round (AR7) onwards
Skills assessment as part of 'Net Zero Test' of procurement and planning	UK and DA Governments	Climate Change Committee	By 2024

Talent Attraction and Retention

Attempts to meet the skills needs for Net Zero in the UK are, of course, not occurring in a global vacuum. The Inflation Reduction Act (IRA) in the US and the Green Deal Industrial Plan for the EU are just two of many major overseas programmes that themselves require very large numbers of skilled workers for the Net Zero transition.¹¹⁹ While some of the Net Zero skills needs of the UK might be expected to be met by future talent attraction from abroad, there is likely to be growing competition from other nations that could limit inward migration of skilled workers, and also draw UK talent away.

Indeed, there is a significant risk that the skilled workforce required to mitigate and adapt to climate change in some countries, in particular those in the global south, is itself undermined by such 'skills importing' for domestic climate action in other nations. The Global Skill Partnership Model sets out ways in which technical skills needs and capacities can be best matched between home and recipient nations - the Suryamitra solar PV skills partnership between Germany and India being a relevant example.¹²⁰¹²¹ Such an approach for the UK could involve active in-country delivery of Net Zero training and skills development by UK agencies in those partner nations identified as having the potential to provide skilled workers to the UK, without causing detrimental effects to the home nation. Safeguarding capacity in home countries in this way is arguably a fundamental requirement of achieving a just transition to Net Zero in those nations drawing on imported workers and skills from overseas.

Similarly, the UK's universities already play a very important role in provision of net-zero-related skills and learning for overseas students. Again, where detrimental impacts to the home nation can be safeguarded against, extending and enhancing the UK's 'Graduate Route' offer for overseas students could help to avoid acute skills shortages, such as in research and development for Net Zero.

DESNZ should assess the potential impact of overseas Net Zero policy on international talent attraction and retention in the UK and, working with DSIT, DfE and the Migration Advisory Committee, provide an updated approach to schemes such as Global Talent and Graduate Route that overtly addresses the skills needs of the UK Net Zero transition and that safeguards capacity in source nations.

Table 6: Recommendations for Talent Attraction & Retention

Recommendation	Lead Organisation	Supported by	Timeline
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Assess impact of international Net Zero policy on UK talent attraction and retention	DESNZ	DSIT, DFE, Migration Advisory Committee	By end 2023
Update talent attraction schemes to align with Net Zero	DESNZ, Migration Advisory Committee	DSIT, DFE, FCDO	To coincide with publication of Net Zero and Nature Workforce Action Plan (UK Government, 2024)
Safeguard workforce and skills capacity in home nations of overseas workers	DESNZ, Migration Advisory Committee	DSIT, DFE, FCDO	Ongoing

Qualifications and Standards

The expanding number of Net Zero-relevant qualifications and standards in the UK is an inevitable reflection of fast-changing roles and skills demands in key sectors, such as energy generation and construction. However, it is highly doubtful that, without strategic coordination and investment, this expansion can translate into the level, quality and accessibility of provision required to meet the Net Zero skills needs of all sectors at the right time and in the right place.

As well as issues of lag time between demand for new qualifications and their creation, there is the risk that a multitude of new standards and qualifications emerge for specific Net Zero tasks (e.g. heat pump installation), but that these are not considered as part of an integrated ‘whole-occupation’ portfolio (e.g. encompassing energy efficiency assessments, insulation, ventilation, underfloor heating, heat pump maintenance etc). A piecemeal approach could result in redundancies in specifications and systemic inefficiencies, both for training providers and for learners.

Importantly, understanding of the wider Net Zero context of standards and an emphasis on self-management and teamwork within occupational profiles can lead to improved success in specific tasks and in greater cooperation with workers in related occupations.¹²²¹²³ This is exemplified in the varying approaches to Vocational Educational Training (VET) in EU member states and how well their construction workforce is able to respond to ‘Nearly Zero-Energy Buildings’ (NZEB) requirements.¹²⁴¹²⁵¹²⁶

Government should review learnings from implementation of the Nearly Zero-Energy Buildings (NZEB) programme in the EU and assess whether existing qualifications and standards systems in the UK are suitable to meet similar Net Zero transition needs in the UK. This should include consideration of the use of Net Zero annexes to existing standards to increase responsiveness to employer needs. A ‘whole-occupation’ portfolio approach to qualifications and standards to maximise efficiencies and to embed understanding of the Net Zero context within occupational profiles should be adopted.

Table 7: Recommendations for Qualifications & Standards

Recommendation	Lead Organisation	Supported by	Timeline
Review NZEB implementation learnings and suitability of UK	DESNZ and DfE	Ofqual, IfATE	By end 2023

qualifications and standards systems			
Consider Net Zero annexes for existing standards	DESNZ and DfE	Ofqual, IfATE	By end 2023
Adopt 'whole-occupation' approach to new Net Zero standards and qualifications	DESNZ and DfE	Ofqual, IfATE	By end 2023

Governance and oversight

The 'CESAP' in Scotland and Net Zero Skills Action Plan in Wales represent important advances in terms of setting out government and wider stakeholder actions and responsibilities for delivering on the skills needs for the Net Zero transition. **The UK Government should accelerate development of its 'Net Zero and Nature Workforce Action Plan' to enable its implementation from the start of 2024, ensuring that it aligns fully with skills and workforce plans in Scotland, Wales and Northern Ireland.**

The new plan should encompass the period from 2024 to 2050, stating how it will deliver the skilled workforce required both to meet current and future carbon budgets for the UK. It should be based upon comprehensive analysis of existing skills programmes, recognising where existing provision should be adapted to support Net Zero and where new provision is required. Overall, the plan must provide a clear roadmap of how and when the UK system will be aligned with Net Zero needs in all sectors of the economy and across all regions of the UK.

Implementation of national skills plans for Net Zero, and accountability for progress, should include a direct role for Ministers so as to ensure resources and wider policies are directed at delivery. **The CESAP and NZSAP steering groups should therefore be chaired by a government minister, as is already the case for the UK Green Jobs Delivery Group. The chairs of these groups, and their equivalent for Northern Ireland, should meet on a regular basis to ensure that a well-integrated four nations approach to Net Zero skills in the UK is taken.**

The Climate Change Committee (CCC) should embed skills assessment into all future progress reports to the UK government and the UK's Devolved Administrations. This should include assessment of policy development for education and skills for Net Zero. The use of quantitative indicators of capacity and change in workforce and skills for Net Zero (e.g. updated Office for National Statistics green jobs data) is required to underpin this; allowing the CCC to provide robust scrutiny of progress and to hold government to account where progress is insufficient.

The CCC should aim to enhance their assessments of the skills and workforce dimensions of delivery risk in their carbon budget reports, with the quantitative indicators mentioned above helping to provide greater clarity on the scale of the risks, and how such risks might vary across time, space and economic sector.

Looking beyond the CCC, coordination of data reporting on skills provision and demands at sub-national scales is needed. **Coordination should be led by the UK Government in collaboration with the Devolved Administrations, with a view to providing a responsive reporting system that informs national government strategy for Net Zero delivery³. It should also enable the provision of timely advice, intelligence and support from central government back to local government in every region of the UK.** The proposed 'Climate Intelligence Unit' in Scotland⁵⁵ is a relevant model that governments should consider for this.

Finally, the CCC consider whether additional analyses on the role of workers and skills for Net Zero are needed, such as for specific economic sectors or regions of the UK. Whether these assessments are led directly by the CCC or not, the CCC will retain a critical role in engaging and convening key stakeholders around the provision of education and skills for Net Zero.

Table 8: Recommendations for Governance & Oversight

Recommendation	Lead Organisation	Supported by	Timeline
Accelerate development of UK Net Zero & Nature Workforce Action Plan	DESNZ and DfE	Colleges, Universities, learned societies and independent education providers	Publish Q1 2024
Ministerial chairs for national Net Zero skills groups and integration across the UK's four nations	UK and DA Governments	DfE and Skills Agencies	By end 2023
Embed skills assessment into climate change advice to government	CCC	Education & Skills providers	Ongoing
Central coordination of sub-national skills reporting and intelligence provision	DfE	Devolved Administrations, Local Authorities	Updated reporting system by end 2023
Consider further sectoral and regional analyses on Net Zero skills	CCC	Industry bodies, Local Authorities	Ongoing

Appendices

A: Composition of the Expert Advisory Group

Members of the expert advisory group have expertise across labour markets, green jobs, education & skills, and also on specific sectors (i.e. construction/buildings, renewables, oil and gas, land use and agriculture, surface transport, manufacturing). They are representatives from academia, think tanks and business (including trade bodies and unions) who can provide advice on analysis and policy.

Participants	Organisations
Professor Dave Reay (Chair)	University of Edinburgh
Julia Barrett	Willmott Dixon
Dustin Benton	Green Alliance
Sue Ferns	Prospect
Yvonne Kelly	Barking and Dagenham College
Professor Stephen Machin	London School of Economics
Anna Markova/Mika Minio	Trades Union Congress
Nick Molho	Aldersgate Group
Mary Thorogood	Net Zero Technology Centre

B: Progress against the Climate Emergency Skills Action Plan (CESAP) In Scotland

Below we set out selected progress to date against the CESAP's five implementation priorities.

Inspiring and empowering young people	Supporting transition and upskilling training	Securing the talent pipeline for Net Zero jobs	Helping employers & individuals capitalise on Net Zero opportunities	Driving change in the skills system through robust evidence
Fuel Change Apprenticeship Challenge	Green Jobs Workforce Academy	Green Skills Foundation Apprenticeship Pilots	Green Jobs Skills Hub Scoping via Zero Waste Scotland	Aligning green skills provision via Regional economic Partnerships
Green Labour Market Intelligence for Careers Advisers	National Energy Skills Accelerator	Embedding of green skills in Engineering, Digital manufacturing MAS	Net Zero toolkit for Farmers	CESAP Pathfinder Research
Green Careers: My world of work	National Transition Training Fund: Transitioning at PACE		National Transition Training Fund: Net Zero road map for manufacturing	Establishment of network of sectoral skills groups in sectors critical to

Net Zero Scottish Apprenticeship Awards	Flexible Workforce Development Fund	Sustainability embedded in work-based learning quality standards		transition to Net Zero
Climate Literacy in Schools Programme				

C: Summary of funded programmes related to Net Zero

In 2021, the Local Government Association published a summary of existing funded initiatives that support skills in the UK.¹²⁷ We developed a mapping based on this summary and on government announcements following 2021, to show the extent to which a **selection** of existing funded initiatives include explicit Net Zero components.¹²⁸¹²⁹ The table below summarises this mapping and is intended to give an illustration of the range of funded programmes, but is not exhaustive of all programmes.

Name of Initiative	Qualification Levels Delivered	Net Zero Components	One year funding average	Geographic coverage
Help to grow	N/A	None	£60,000,000	UK
Restart	1-3	None	£400,000,000	England and Wales
Job Entry Targeted Support (JETS)	N/A	Limited	£158,700,000	GB
Skills support for the workforce	1-2	Limited	£36,300,000	England
Lifetime Skills Guarantee	2-3	Limited	£95,000,000	England
Sector-based work academy programme (SWAPs)	Short courses	As required	£13,200,000	England and Scotland
Shared Prosperity Fund	As required	As required	£867,000,000	UK
Careers & Enterprise Company	N/A	As required	£21,300,000	England
Skills/Digital Bootcamps ^{††}	2-3	Yes	£36,300,000	England
Adult education budget ^{‡‡}	2-3	Yes	£703,500,000	England
Advanced Learner loans and Bursaries	3-6	Yes	£273,000,000	UK

^{††} Funding for the Lifetime Skills Guarantee may overlap with funding for Bootcamps; figures in this table should not be summed.

^{‡‡} This is a sum of funding for 'adult education budget allocated' and 'adult education budget procured'.

D: Selected policies, plans and initiatives relating to Net Zero education and skills

We summarised at a high-level some key overarching published plans relating to Net Zero education and skills across the four nations of the UK. We note the lead organisation in brackets. This is not exhaustive.

	UK	England	Scotland	Wales	Northern Ireland
Overarching skills plan	Net Zero and Nature Workforce Action plan <i>Due in 2024</i>	N/A	Climate Emergency Skills Action Plan 2020-25 <i>Due to be updated end 2023</i>	Net Zero Skills Action Plan for Wales	No plan
Sub-national	N/A	LSIPs that include consideration Net Zero	Regional Tertiary Pathfinders (SFC) Energy Strategy & Just Transition Plan (Scottish Government)	Green Personal Learning Accounts (FE colleges)	Net Zero NI Skills Programme (South West College)
Education-specific	'Green College Commitment' (AoC) Climate Education Bill (Whittome)	Sustainability and climate change strategy (DfE) National Climate Education Action Plan (University of Reading)	Vision 2030+ & 'Learning for Sustainability' entitlement (Scottish Government) Net Zero & Sustainability Framework for Action (SFC)	New Curriculum for Wales (Welsh Government)	N/A
Skills-specific	Green Apprenticeships Advisory Panel (IfATE) Green Jobs Delivery Group (DESNZ)	Skills Bootcamps, where focussed on Net Zero skills	Energy Skills Partnership Green Jobs Workforce Academy (SDS) National Energy Skills Accelerator (NESA)	Stronger, fairer, greener Wales (Welsh Government)	Skills for a x10 economy (Department for Economy)

Endnotes

- ¹ UK Climate Change Committee (2023) A Net Zero Workforce, Analytical Brief.
- ² UK Government (2019) The Climate Change Act 2008 (2050 Target Amendment) Order 2019 <https://www.legislation.gov.uk/ukdsi/2019/9780111187654>
- ³ UK Government (2020) The Ten Point Plan for a Green Industrial Revolution <https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution/title>
- ⁴ UK Climate Change Committee (2020) Economic Impact of the Sixth Carbon Budget <https://www.theccc.org.uk/wp-content/uploads/2020/12/Cambridge-Econometrics-Economic-Impact-of-the-Sixth-Carbon-Budget.pdf>
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