

# **Meeting Scotland's workforce needs for a transition to Net Zero – the role of migration and the impact of demographic challenges**

## **Lessons for Scotland**

**Expert Advisory Group on Migration and Population**

## Contents

Executive Summary .....	4
Key findings .....	5
Policy considerations .....	6
1. Introduction .....	9
1.1. The transition to net zero and its workforce challenges .....	9
1.2. The interface with demographic challenges and Scotland’s population strategy .....	12
1.3. A focus on North East Scotland .....	13
1.4. Outline of the report .....	14
2. Understanding and assessing workforce needs.....	17
2.1. The challenge of predicting numbers of ‘green jobs’ .....	17
2.2. Skills shortages and competition for labour .....	20
2.3. Scotland .....	23
2.4. North East Scotland .....	26
3. Growing a domestic workforce – attraction, retention and training.....	31
3.1. Upskilling and transfer of existing workforce .....	31
3.2. Training new entrants.....	35
3.3. Pay and working conditions – how attractive are green jobs?.....	37
3.4. Location, location, location: where are the green jobs? .....	40
4. Recruiting internationally – the role of immigration and global competition for workers.....	44
4.1. Current and proposed immigration policies.....	45
4.1.1. Existing policy and extent of the international green workforce .....	45
4.1.2. New policy proposals from UK Government .....	46

4.1.3. Alternative policy options .....	48
4.2. International competition .....	50
5. How to attract and retain the required workforce in the green economy of North East Scotland .....	55
5.1. Demographic profile and mobility patterns within North East Scotland .....	55
5.2. Barriers and opportunities in attracting and retaining local and incoming workers for the green economy .....	57
5.3. Including mobile populations in a Just Transition at local community level	60
6. Conclusions – key considerations for policy .....	67
References .....	72

## Executive Summary

This report was commissioned in July 2025 to explore the intersection between Scotland's population and migration priorities and its Net Zero targets. The Independent Expert Advisory Group on Migration and Population was asked to consider:

- The impact of the decline in oil and gas on workforce transition to clean energy.
- The role of migration and the immigration system in attracting skilled workers, particularly young migrants, to support Net Zero delivery.
- The barriers to integrating mobile workers, including international migrants and their families, into Scottish communities during the energy transition.

Throughout the report the Scottish Parliamentary Region North East Scotland is used as a focus for more detailed analysis.

The transition to net zero is a strategically significant policy priority for both the UK and Scottish Governments. Scotland has pledged to reach Net Zero by 2045, ahead of the UK's 2050 target. A strong workforce with the necessary skills to support the evolving stages of the energy transition is essential for reaching net zero commitments. Yet Scotland faces skill shortages as well as high inactivity rates and significant numbers of young people who are not in employment, education or training.

Meeting the challenges of demographic change is another key priority for Scottish Government. Achieving population balance, both geographic and demographic, and making it possible for people and communities in Scotland to live well are key principles of the Scottish Government's Population Strategy (2021) and Action Plan to Address Depopulation (2024). Immigration, both international and from other parts of the UK, has a role to play in meeting Scotland's demographic needs. The strategic mitigation role played by migration has helped Scotland, and regions or areas within Scotland, to maintain crucial services, meet skills gaps and sustain local industries. There is potential for this also to be the case with regard to the transition to Net Zero, however, Scotland's devolved powers limit its ability to shape immigration policy.

Together, these twin challenges — delivering Net Zero while managing demographic change — demand joined up policy responses. These responses must also take

account of where the Scottish Government and local authorities have the power to make changes, ensuring that responsibilities are clearly defined and action is targeted at the right level of governance.

### Key findings

Meeting workforce needs for the transition to Net Zero will require efforts to maximise opportunities to:

- Ensure that young people leaving education are equipped with the right skills for the green transition.
- Promote sectoral mobility from 'brown' to 'green' jobs.
- Support the geographical mobility of labour, both internally and internationally.

None of these routes is likely to be sufficient alone, and some will be more able to produce a quick and flexible response than others.

Forecasts (and definitions) of future green jobs vary considerably. UK projections range from 135,000 to 860,000 by 2030 (Climate Change Committee, 2023; UK Government, 2025). Scotland could see between 55,000 and 60,000 clean energy jobs by that date (UK Government, 2025). Other estimates using wider definitions, suggest much greater potential demand, but only a smaller proportion of these are likely to be new roles.

Retraining existing workers offers short term potential, as up to 90% of current energy workers have transferable skills (Offshore Energies UK, 2023). However, significant barriers remain, including:

- geographic mismatch between where fossil fuel jobs are declining and where new green jobs are emerging.
- need for retraining and certification and for clearer frameworks to meet these.
- potential reluctance to undergo retraining or consider relocation for work within the existing workforce.

The education pipeline also requires strengthening. Only 9% of UK vocational learners are trained in engineering or manufacturing compared to an OECD average of 32%, and UK employers invest less than half the EU average on workforce training and have not proportionately increased their spend on training since 2015 (OECD, 2023). Expanding apprenticeships in STEM and energy fields offers

significant potential to build a domestic skills base, particularly if programmes are designed to be accessible to young people and linked directly to emerging clean energy sectors and other low carbon jobs (Skills Development Scotland, 2024). However, perceptions of green jobs as less secure, lower paid or offering fewer career development opportunities than other energy jobs risk discouraging uptake.

UK immigration policy is poorly aligned with Net Zero goals. Immigration is rarely considered as part of the skills strategy for the green transition. A range of proposals for alternative immigration policy approaches have been put forward in the existing literature. These are outlined in the report, and include:

- Lowering skills and/or salary thresholds either through a dedicated Green Skills Visa or through concessions within existing visa routes for roles critical to net zero
- Expanding or adapting the shortage list to include more climate-critical roles
- Establishing umbrella sponsorship bodies to support small and medium-sized enterprises (SMEs).
- Introducing geographically targeted migration routes and visas.

However, Scotland's devolved powers limit its ability to shape immigration policy. Adjacent approaches, less directly linked to immigration policies including bilateral training agreements and targeted recruitment partnerships, remain underexplored and might provide more fertile ground for intergovernmental discussion.

Social and integration challenges must be addressed in developing and supporting a diverse green skills workforce spread across Scotland's rural as well as urban areas. Rural areas face difficulties in attracting and retaining workers due to limited housing, transport, and public services. Integration of international migrants and mobile workers requires attention to family needs, community cohesion, and equitable access to services. Without proactive planning, disparities between urban centres and rural regions could widen, undermining both demographic balance and the just transition.

### Policy considerations

The following key considerations and options for government at multiple levels, as well as other stakeholders, are explored in greater detail in the main report.

1. **Policies and interventions should aim to build a more inclusive, sustainable and diverse workforce.** An inclusive workforce strategy should combine migration with sustained investment in upskilling and reskilling local workers, ensuring decent pay and conditions. Migration must be evidence-based, not a knee-jerk response to shortages, and intergovernmental consultation should underpin decisions.
2. **Bilateral partnerships with other countries could expand the skills base.** While policy powers lie with the UK government. Scotland can play a proactive role in proposing and shaping such agreements.
3. **Greater coherence across immigration, climate, energy, and skills policy is urgently required.** Current inconsistencies undermine workforce planning and investment. Developers and their supply chains need certainty around project pipelines in order to facilitate investment in workforce planning, development and training.
4. **Intergovernmental co-ordination and joint working needs to be strengthened to support effective and strategic regional planning.** A long-term, strategic approach should include climate and energy policymakers, devolved nations, national and regional training providers and agencies, trade unions, industry and community representatives. Moving away from a centralised approach would ensure skills strategies are targeted and beneficial to communities, supporting levelling up across Scotland.
5. **Rural development must be linked to renewable energy strategies as part of a long-term coherent strategy.** Place-based partnerships between communities, local authorities, and developers can channel renewable revenues into housing, transport, training, and services, tackling depopulation and sustaining inclusive growth.
6. **Scotland's leadership in the Just Transition movement provides an opportunity to innovate and build diverse, place-based workforce strategies.** The Just Transition Commission's monitoring framework offers a platform to evaluate success and strengthen Scotland's international reputation.

# 1

## Introduction

## 1. Introduction

This report was commissioned in July 2025 with the overarching aim to better understand the potential interface between the Scottish Government's priorities around population and migration and its targets to deliver a Net Zero economy. The Independent Expert Advisory Group on Migration and Population was asked to consider:

- the impact of the decline in oil and gas on the prospects for a smooth transition to clean energy, in particular with regards to the opportunities for and barriers to transfer of the existing labour force
- the potential role of migration and the immigration system in attracting workers (especially young skilled migrants) to fill roles which support the delivery of a Net Zero economy
- the barriers and challenges to successfully integrating mobile workers including international migrants and their families into Scotland, as part of the energy transition.

In compiling the report the group was asked to use the Scottish Parliamentary Region North East Scotland as a focus for more detailed analysis and to explore comparative case studies and examples which might inform policy and practice in meeting the needs and challenges outlined above.

### 1.1. The transition to net zero and its workforce challenges

The transition to net zero is a strategically significant policy priority for both the UK and Scottish Governments and stretching targets have been set. The UK Government has an agreed target to reach Net Zero by 2050,<sup>1</sup> whilst the Scottish Government remains pledged to reach Net Zero by 2045.<sup>2</sup> Across Europe and many other parts of the globe, countries are undertaking transitions towards net zero economies, creating potential for both collaboration and competition with regard to technological innovation, labour supply and natural resources.

A strong workforce with the necessary skills to support the evolving stages of the energy transition is essential for reaching net zero commitments. Scotland, like other parts of the UK and Europe, faces skill shortages as well as high inactivity rates and

---

<sup>1</sup> [Net Zero Strategy: Build Back Greener - GOV.UK](#)

<sup>2</sup> [Climate change - gov.scot](#)

significant numbers of young people who are not in employment, education or training. These are all constraining factors to Scotland's ambitions for a Just Transition to a green, low-carbon economy. The three main routes to overcoming these constraints and meeting workforce needs are:

- Ensuring that young people leaving education are equipped with the right skills for the green transition.
- Promoting sectoral mobility from 'brown' to 'green' jobs, via re- and upskilling where necessary.
- Supporting the geographical mobility of labour, both internally and internationally as required.

None of these routes is likely to be sufficient alone, and some will be more able to produce a quick and flexible response than others.

The UK's Industrial Strategy recognises that "changes to the skills system will take time to come to fruition", and that in the meantime there will be a domestic shortfall.<sup>3</sup> Investments in training, even where sufficient, will take time to pay off and current training infrastructure is likely to be hard to scale up.<sup>4</sup> Sourcing domestic workers could also be challenging. A significant proportion of the existing energy workforce falls within the mid- to late-career age brackets.<sup>5</sup> The sector is further marked by persistent gender imbalances and a spatial concentration in areas endowed with the relevant natural resources. Green jobs by contrast are often more spatially diffuse, meaning workforce requirements are not necessarily in the same areas as the currently existing workforce.

To deliver on *Mission 2030*,<sup>6</sup> even with increased investment in domestic upskilling, retraining, and apprenticeships, there is a workforce gap. It is widely accepted within

---

<sup>3</sup> [The UK's Modern Industrial Strategy](#)

<sup>4</sup> For example, the Industrial Strategy notes that only 9 per cent of secondary vocational learners are trained in engineering, manufacturing, and construction, versus an OECD average of 32 per cent. UK employers also invest less than half the EU average on workforce training and have not proportionately increased their spend on training since 2015. Even in Germany, where green skills have been integrated into its renowned vocational education system, doubling its green jobs since 2019, the country is still experiencing workforce shortages.

<sup>5</sup> According to the Engineering Construction Industry Training Board (ECITB) 2021 census for the UK oil and gas sector, only 12% of workers are under 30, 54% are aged 30 to 49, and 35% are aged 50 or above (ECITB 2021). Within the wider energy and utilities workforce 17% are expected to retire before 2030 [Energy-Utilities-Workforce-Demand-Estimates-2024-30-Summary-v5\\_Cover-added.pdf](#)

<sup>6</sup> This is the UK's goal for 95 percent of its energy to be from low carbon sources by 2030. See: [Make Britain a Clean Energy Superpower - GOV.UK](#)

the sector that some measure of skilled labour mobility, including both internal and international migration, will be needed in the interim to supplement the domestic workforce.<sup>7</sup> And yet, there has been little detailed discussion of how to ensure that mobile labour is adequately accommodated and integrated into policy and planning in order to achieve just and desirable outcomes for mobile and local workers and host communities (Just Transition Commission, 2025).

There is also a notable lack of coordination between immigration, workforce development, climate and energy policies. The UK Government's 2025 Immigration White Paper, for example, is particularly problematic for the green transition because it makes it more difficult for UK employers to recruit internationally, particularly under the Skilled Worker visa route. The Temporary Shortage List (TSL) is being developed via a 2-stage review process led by the Migration Advisory Committee. Stage 1 identified occupations that warrant further assessment, rather than establishing a final list, and did not confer priority status on the energy sector (Migration Advisory Committee, 2025). Final recommendations on inclusion and any sectoral prioritisation will be determined in Stage 2, which may provide scope for influence.

Many of the specific occupations listed (for example welders, engineers, technicians) are relevant to more than one sector or industry and it is unclear how competing needs for similar job roles across sectors or geographical areas will be managed under this route. Considerable uncertainty persists also over how the provisions of the Temporary Shortage List will be implemented in immigration law - the stated policy intentions are strongly focused on a short-term intervention.<sup>8</sup> This lack of clarity as well as the explicit designation of allowances under this measure as 'temporary' may deter both employers and potential employees from decision making, within what is an urgent time frame (Springford, 2025).

---

<sup>7</sup> [International Workers are Needed for the "Green" Industrial Revolution: Reflections from the All-Energy UK Conference | Center For Global Development](#). Also see written submissions to the ESNZ Inquiry from [RenewableUK](#), the wind association, [The National Grid](#), [ScottishPower](#), [SSE](#), and [Siemens](#).

<sup>8</sup> The Temporary Shortage List is being introduced to replace the Immigration Salary List, which will be phased out by the end of 2026. It is envisaged as a time limited intervention to encourage a domestic pipeline of talent, with inclusion on the list tied to requirements for sectors to introduce training and apprenticeship programmes. Those allowed entry via this route will not be allowed to bring dependents and will be issued with temporary visas only with very restricted options for transfer to longer-term routes.

The lack of joined up thinking between immigration policy and green transition goals presents a particular challenge for Scotland and other parts of the UK because immigration remains a reserved power of the UK Government, and so despite being an important lever that could support a just transition, its potential at present remains limited.

There is then an urgent need for better co-ordination and coherence both across policy areas and between levels of government, including UK government, devolved administrations and local authorities. The challenges faced require a range of policy levers and approaches, none of which can be affected successfully in isolation. Nonetheless, Scotland must meet this challenge. We therefore explore the policy levers, influence and resources that Scottish Government, local authorities and other regional actors can bring to bear in filling labour and skills needs for a just transition in ways which complement wider population concerns wherever possible.

## 1.2. The interface with demographic challenges and Scotland's population strategy

Meeting the challenges of demographic change is a key priority for Scottish Government. It is one which the EAG Migration and Population has written on extensively in previous reports (EAG, 2022; 2025a and 2025b). Achieving population balance, both geographic and demographic, and making it possible for people and communities in Scotland to live well are key principles of the Scottish Government's Population Strategy (2021) and subsequent Action Plan to Address Depopulation (2024). The Ministerial Population Taskforce and Population Programme Board are established to ensure that population concerns cut across policy areas and engage different levels of government and other stakeholders.

Migration, both international and from other parts of the UK, has a role to play in meeting Scotland's demographic needs. Previous reports of the EAG on Migration and Population have made a consistent case that this role should be viewed as one of strategic mitigation (EAG, 2021). Whilst migration certainly does contribute to the size and balance of Scotland's population, slowing demographic ageing and contributing to modest population increases at national level, it is unlikely that population decline at regional or local level can be reversed by means of migration or that patterns of ageing can be permanently changed. Nonetheless, the strategic mitigation role played by migration has helped Scotland, and regions or areas within

Scotland, to maintain crucial services, meet skills gaps and sustain local industries. There is potential for this also to be the case with regard to the transition to Net Zero. If this is to be a Just Transition, however, the needs of mobile workers and families who may accompany them will need to be properly considered and addressed alongside those of other residents.

Consideration should also be given to the possibility of other mobilities resulting from the changing workforce needs of a green economy. If demand for labour in 'brown' energy jobs declines in areas where labour markets have been heavily dependent on oil and gas. This could also result in increased outmigration of working age population. Whilst the more diverse geographical spread of emerging green energy jobs may provide welcome opportunities for other areas, the prospect of future economic and demographic change in areas such as North East Scotland (Robert Gordon University, 2025) create challenges to be met by careful planning and strategic policy co-ordination.

### 1.3. A focus on North East Scotland

North East Scotland is a long-established operational hub of the UK's gas and oil energy infrastructure. Energy production has been an important source of jobs and income, helping North East Scotland to reach levels of economic vibrancy not attained in many other parts of Scotland. The result is also a remarkably high concentration of workers employed within the offshore energy industry – one of the key components in Scotland's planned transition to Net Zero. Whilst approximately 1 in 220 workers (0.5%) UK-wide are employed in offshore energy (this includes offshore wind and oil and gas), this rises to 1 in 30 (3.3%) in Scotland and 1 in 6 (16-17%) in North East Scotland and further still, to 1 in 4 (25%) once induced effects are accounted for (i.e., jobs supported by offshore workers spending) (Robert Gordon University, 2025). The region therefore presents both crucial opportunities and considerable challenges for the management of a successful and just transition to Net Zero, and particularly with regard to labour supply, mobility and the portability of skills between sectors.

The region combines large urban centres (Aberdeen and Dundee) with extensive rural areas characterised by many familiar population challenges including slow population growth. There is a trend towards population ageing across the region as

well as sub-regional areas of population decline and more rapid ageing. Experiences of immigration and ethnic diversity also vary greatly. Census data from 2022 reveals that 12.14% of the region's population was foreign born, higher than the Scottish average of 10.24%. However, much of this diversity is concentrated in Aberdeen City, where 21.06% of the population was foreign born, and Dundee, where the proportion was 12.9%. For the remainder of the region excluding these two major cities, the proportion of foreign born residents was 6.76% at the time of the census.<sup>9</sup> In common with other rural regions, parts of North East Scotland face challenges in the provision of housing, transport and public services which can contribute to difficulties in both attraction and retention of population.

A key policy question for the region, and one that resonates broadly at national level, is how to make North East Scotland an attractive place for workers and employers in the green economy, creating opportunities for new entrants to the green workforce, filling skills gaps at pace, and supporting the mobility and career progression of those currently employed in the brown sector.

#### 1.4. Outline of the report

Chapter 2 begins with a discussion of the challenges faced in assessing workforce needs for a transition to Net Zero. We outline existing challenges relating to the definition of and predicted demand for 'green jobs' as well as skills shortages and competition for labour. These are then applied to a more focused consideration of the likely distribution of jobs and their match to existing skills profiles in Scotland generally and North East Scotland specifically. Chapter 3 examines the potential for growing a domestic workforce through retraining and transfer of existing workers as well as by training new entrants. Here we look in some detail at opportunities for and barriers to both routes including those created by comparative pay and working conditions and return to the challenges of spatial mismatch. Chapter 4 considers the prospects for international recruitment, including an analysis of the impacts of current and proposed immigration policies which remain reserved to UK Government. This chapter reviews some commonly proposed alternative policy options exploring the

---

<sup>9</sup> All figures are based on Table UV204 - Country of birth. Geographies - Scottish Parliamentary Region: North East for North East as a whole, and for the remainder of the region excluding the two cities; Local Authority: Dundee City and Aberdeen City for the two cities (<https://www.scotlandscensus.gov.uk/>)

pros, cons and trade-offs which these may involve. We also discuss the issue of international competition for workers and the approaches taken by other countries to getting ahead of this, for example through bilateral partnerships and training agreements. Chapter 5 applies a more social lens to understand the challenges that rural areas in particular may face in accommodating and integrating the diverse needs of a workforce made up of mobile workers as well as retrained workers and new entrants from amongst existing resident populations. This analysis is situated in the context of wider population concerns and issues around attraction and retention including challenges linked to transport and public services. We conclude the report by examining a range of key considerations for policymakers and decision makers at different levels of government emphasising the urgent need for increased coherence both across policy areas and between levels of government.

# 2

## **Understanding and assessing workforce needs**

## 2. Understanding and assessing workforce needs

The first practical challenge in assessing the labour and skills needs for the transition to Net Zero relates to estimating how many jobs will be needed, when, where and with which specific skills. Much in this respect depends on the scale and speed of private and public investments and domestic and international policies with regards to both energy transition and broader net zero activities including carbon capture, nature preservation and new standards and practices in other areas of industry, as well as policy decisions regarding taxes, licensing and other economic considerations.

### 2.1. The challenge of predicting numbers of 'green jobs'

For the reasons outlined above, predictions of future workforce demand in the green economy vary considerably. Predictions for the number of new jobs that could be created across the UK in low-carbon sectors by 2030 have varied between 135,000 and 725,000 (Climate Change Committee, 2023). The most recent UK Government estimates are even more optimistic, claiming that there will be 860,000 clean energy jobs across the UK by 2030, 55,000-60,000 of which could be located in Scotland (Clean Energy Jobs Plan, 2025). Focusing more specifically on the energy transition, the National Grid estimates a need for almost 50,000 jobs in Scotland by 2050 (Scottish Development International, 2021). Analysis by the Energy Transition Institute predicts that Scotland's offshore energy workforce alone could sit at between 45,000 and 100,000 by 2030, compared to its present figure of 75,000, although the estimates of shares of these jobs that are in renewables vary considerably (Robert Gordon University, 2025).

Predictions are further complicated by the lack of a clear consensus amongst researchers or policymakers on how to define green jobs (see Apostel and Barslund, 2024 for an international review). Most UK estimates rely on datasets involving Standard Industrial Classifications that do not contain a separate category for 'renewables' (Skills Development Scotland, 2024). Assessments of current and future green energy labour and skills needs are thus prone to the risk of considerable under or over estimation (Zemanik, 2023). The figures contained in the recent UK Government Clean Energy Jobs Plan, for example, are based on an 'experimental

approach<sup>10</sup> [meaning that] there is inherent uncertainty in estimating the size of the 2030 clean energy workforce' (Clean Energy Jobs Plan, Technical Annex, 2025: 4).

The Office for National Statistics (2021, 2025) and Skills Development Scotland (2024) have been exploring how best to measure green jobs. It has been proposed that the Scottish Government should proactively work with industry to create a standardised jobs taxonomy in order to identify better the future labour and skills needs of the low carbon industry and to help ensure that they are met (Ernst and Young, 2023).

Since 2022, Skills Development Scotland has used an inclusive definition of “green jobs” (Rubio et al, 2022) covering three categories:

1. **Enhanced Skills & Knowledge.** Existing roles where the skills mix is changing to include “green” elements (e.g. electricians upskilling for renewables).
2. **Increased Demand.** Jobs that are already “green” but are seeing **growth in demand** due to the net zero transition (e.g. wind turbine technicians and environmental engineers).
3. **New & Emerging.** Entirely new roles being created to meet climate targets or support the green economy (e.g. carbon capture specialists).

Researchers at Warwick Institute for Employment Research have developed an experimental green occupational definition (greensoc) along similar lines, which they then apply to Labour Force Survey data and information scraped from online job vacancies (Rubio et al 2022). This definition includes both jobs that are labelled ‘purist’ green jobs and those jobs that are recognised as greening i.e. economic activities related to reducing the use of fossil fuels, decreasing pollution and greenhouse gas emissions, increasing the efficiency of energy use, recycling materials, and development and adopting renewable sources of energy. Based on this expansive definition of green jobs, they find that as many as two-fifths of jobs in Scotland already fall under this category (see Figure 1 below). However, only a minority of jobs in Scotland (4.3% or around 100,000 roles) are ‘new and emerging’ green jobs, such as solar system technicians. A much larger share of jobs (25.7%)

---

<sup>10</sup> This approach involves a mix of quantitative analysis and qualitative stakeholder feedback ([UKERC EDC: Publications](#))

are more tenuously green in that the requirements of the transition to Net Zero results in changes to the work and worker requirements of existing occupations, such as architects. A final tenth (9.9%) of jobs in Scotland might be classed as green under this definition in that the transition to Net Zero is stimulating demand in existing occupations, for example, increased demand for electrical power line installers and repairers related to energy efficiency and infrastructure upgrades. These estimates are displayed in Figure 1 below, which helpfully illustrates the three main broader labour market effects of the green transition, in terms of the quantities and general types of green jobs that it might produce.

Figure 1: Green-related jobs in Scotland, based on the novel ‘greensoc’ classification.



Source: Rubio et al, 2022.

Caution is nonetheless needed with these broad estimates. A different analysis using similar categories for green jobs to those listed above, and again quantifying them using the Labour Force Survey, estimates a much lower share of ‘green’ employment (at the UK scale in this case): 17 per cent of jobs in 2019 (5% new and emerging,

7% enhanced skills and 5% increased demand (Valero et al, 2021). Taking a somewhat different approach, a study of green jobs across 30 OECD countries, classified green tasks at occupation level, scoring each occupation by the share of its work tasks that are environmentally relevant (energy efficiency, pollution reduction, waste, and renewables). Jobs are classified as “green” if 10 percent or more of their tasks are green. Using this methodology, the study determined that around 23.7% of jobs in Scotland are green (OECD, 2023).

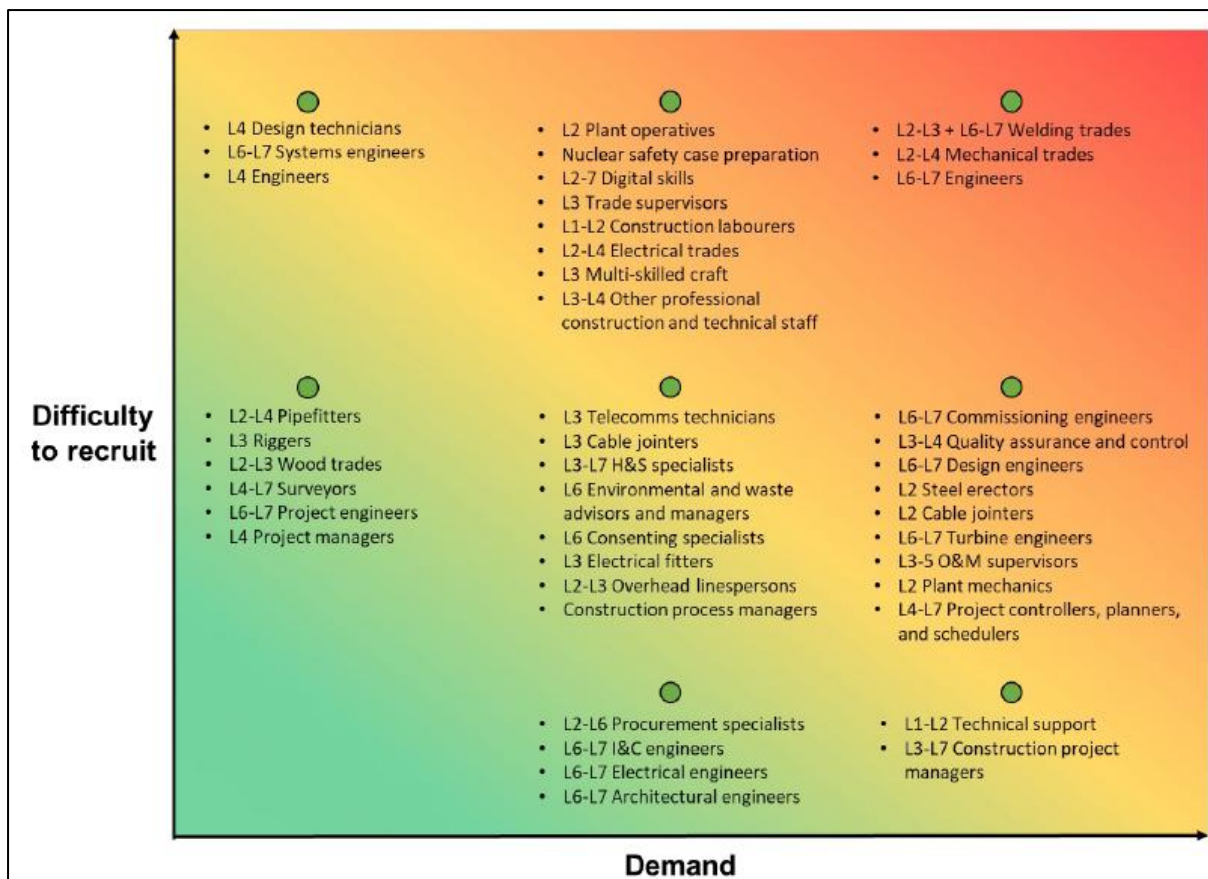
## 2.2. Skills shortages and competition for labour

The other side of this conundrum is understanding the extent of available labour to fill these jobs. The UK (and especially Scotland’s) workforce is ageing, generating labour and skills shortages in general. Acute skills challenges anticipated across clean energy sectors include STEM, digitisation, non-technical skills such as leadership and management, as well as specialist and niche sector-specific skills such as skills for electrification and heat pump installation (UK Government, 2024).

Researchers have aimed to map the likely extent of specific skills gaps by measuring demand against availability (understood as difficulty to recruit). Figure 2 shows a heatmap of critical occupations across power and energy network sectors. This was produced using quantitative data on workforce demand and qualitative data from stakeholders’ views on the difficulty of obtaining workers with the required skills (UK Government, 2024). Areas of greatest demand and highest challenges for recruitment are clustered in the top right hand corner, and include welders, mechanical trades and engineers.

Figure 2: Consolidated view from industry skills bodies of workforce demand and perceived difficulty of obtaining skills across power and network sectors to 2025

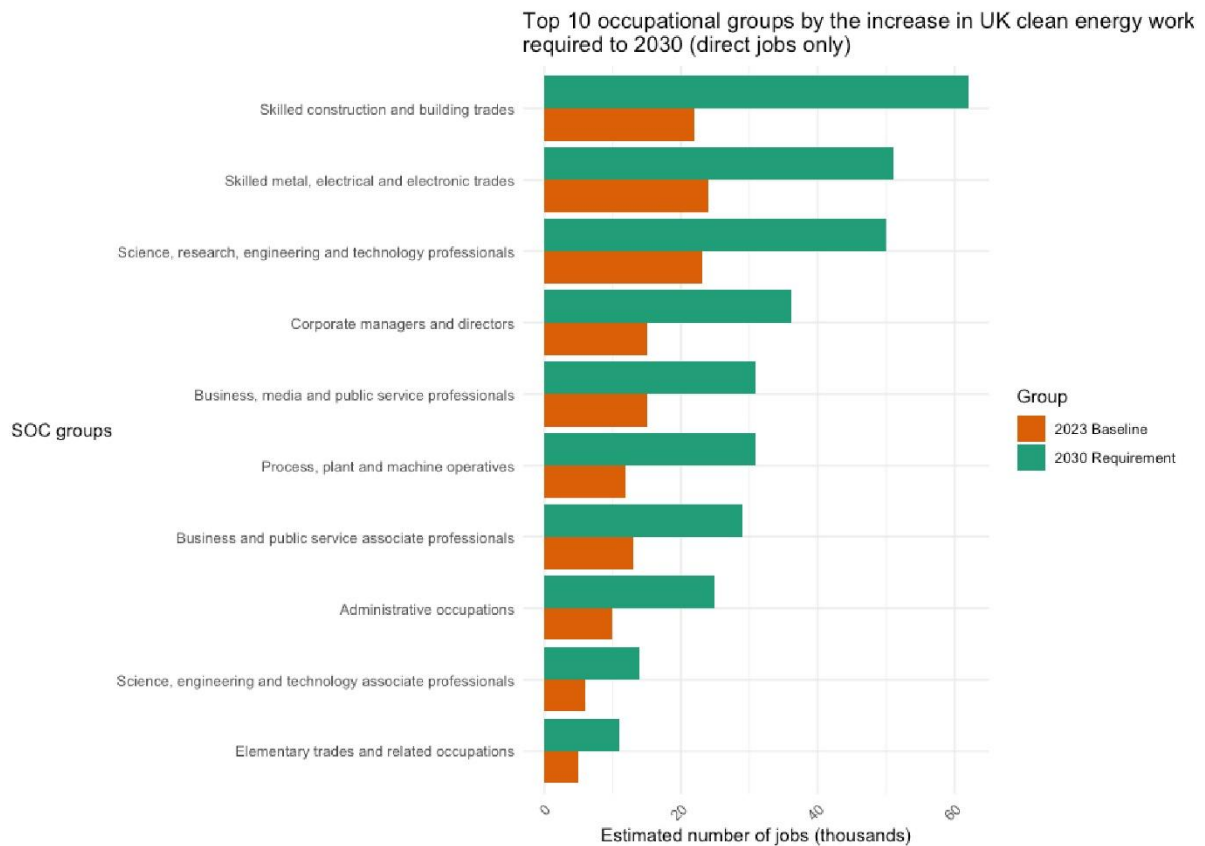
Please note that L refers to skills level, which refers to The Regulated Qualifications Framework (RQF) used across England, Wales, and Northern Ireland.



Source: UK Government, 2024: 21.

In an effort to ensure that Britain has the skilled workforce in core energy and net zero sectors critical to meeting its Clean Energy Mission, the UK Government’s Department for Energy Security and Net Zero (DESNZ) established The Office for Clean Energy Jobs, in March 2025. Recent analysis by DESNZ has identified ten key occupations needed in the clean energy sector by 2030, which consist of a range of technical, professional, and innovative roles. Figure 3 outlines the 2030 workforce projections for the top 10 occupational groups, which it is estimated together will account for 86% of direct clean energy jobs in 2030 (UK Government, 2025: 18).

Figure 3: Top 10 occupational groups by the increase in UK clean energy workforce required to 2030 (direct jobs only)



Source: Department for Energy Security and Net Zero (2025) Experimental DESNZ analysis of ONS Low Carbon and Renewable Energy Economy Estimates, ONS Annual Population survey and DESNZ workforce projections. Data available: <https://assets.publishing.service.gov.uk/media/68f290b91c9076042263f064/clean-energy-jobs-plan-supplementary-data.xlsx> [Accessed 19/11/2025].

Source: UK Government, Clean Energy Jobs Plan, 2025

A more detailed list of 31 expected priority occupations and their associated increases in demand by 2030 is also provided. Plumbers and heating and ventilating installers and repairers top this list, closely followed by carpenters and joiners and electricians and electrical fitters (UK Government 2025: 20).

Many of these occupations are also in demand from other sectors experiencing similar human capital challenges, for example chemical or traditional energy sectors, construction, agriculture, and fisheries. Meanwhile, the UK and Scotland share many of the same challenges and concerns faced by other countries in securing the workforce needed to successfully deliver a green transition. This context creates both internal and international competition for the labour and skills required for the transition to Net Zero. In responding to such challenges, training opportunities (for

education leavers and those in brown jobs) and talent attraction mobility measures require careful targeting and planning.

### 2.3. Scotland

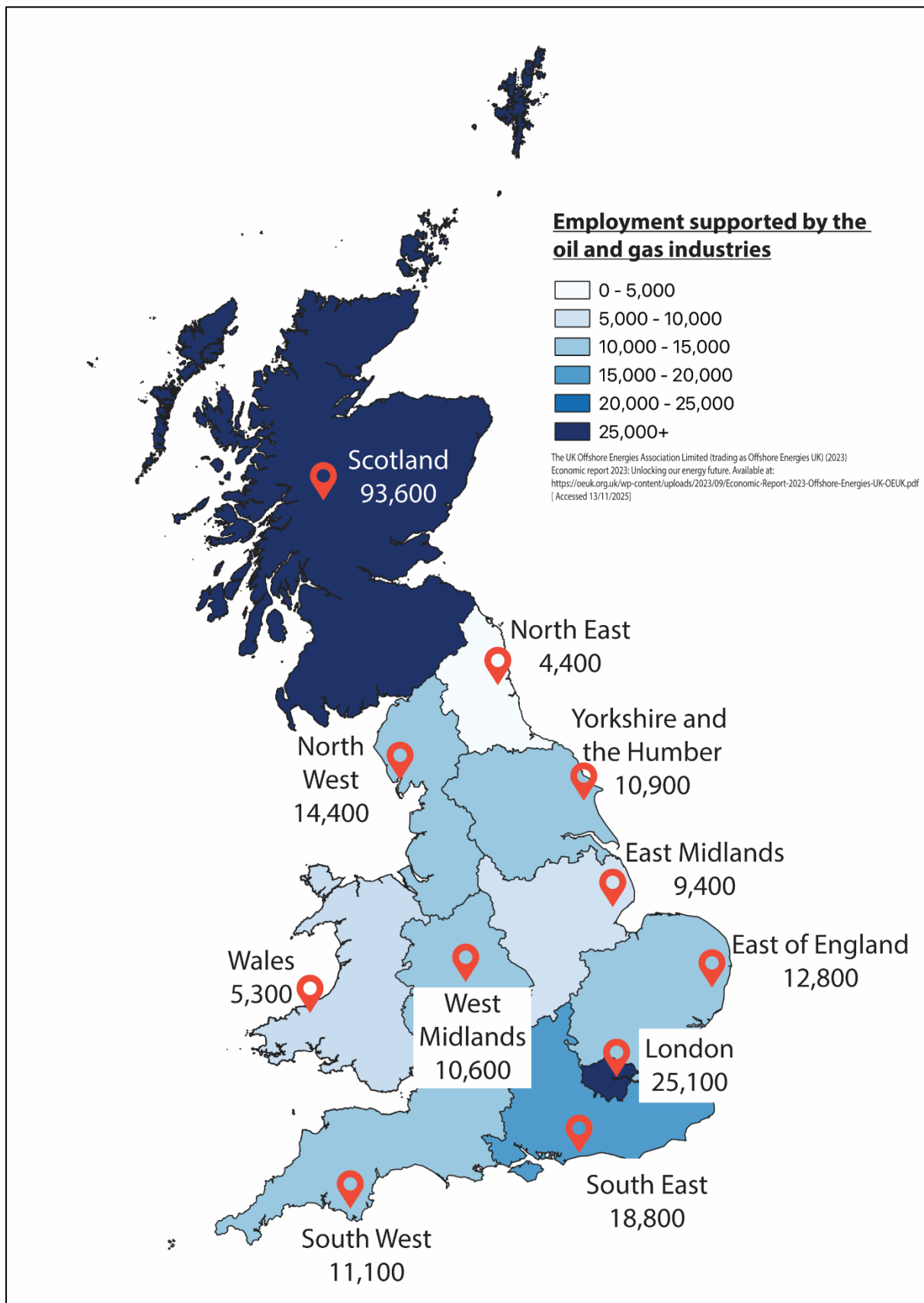
Scotland is perhaps best placed of all UK nations and regions to benefit from the transition to a green economy (Oxford Economics, 2021), and has potential to show international leadership in this area (SDS, 2021). Scotland has both a large volume of low-carbon energy capacity already in place and a strong supply of skilled workers who could enable the transition to clean energy production (Zemanik, 2023). The energy sector accounts for around 4 per cent of Scotland's total economic output, however the economic contribution of the sector has decreased over the past decade. The energy sector workforce grew by only 0.4 per cent over the decade 2014-2024, whilst Scotland's overall workforce grew by 3.8 per cent during the same period. Whilst caution is required with projections, over the period 2027-34, the energy sector workforce is forecast to fall by 4.2 per cent (3,700 jobs) (SDS, 2024). Such decline is connected to structural changes within Scotland's oil and gas sector, which means that Scotland, and North East Scotland in particular, has much at stake in the green transition.

When considering the three routes to filling labour and skills needs for the transition to Net Zero (training new recruits; re-training and upskilling existing energy workers; promoting and supporting geographical labour mobility) the transfer of existing energy workers into the green sector appears at first glance to offer significant potential, especially in the short-term. Making changes to educational structures can take considerable time, whilst the outcomes in real terms of both training programmes and international recruitment can be hard to predict or control. It should be noted that Scotland's (and the wider-UK's) already well-established but declining conventional energy sector already contains many of the skills needed for the green transition. It is estimated that as many as 90 per cent of the UK's existing energy workforce already possess skills with medium to high transferability to the green sector (Offshore Energies UK, 2023). Of course this does not mean that these workers would immediately be able to step into green jobs with no additional training. In a successful transition, approximately three in five people in the current offshore energy workforce could support the renewables industry by 2030 (Energy Transition Institute, 2023), however, substantial challenges remain.

The demographic profile of Scotland's existing brown jobs workforce is ageing, male dominated and geographically concentrated. At the same time, the green sector will need a more diverse and spatially diffuse workforce to meet its skills needs. The need to undergo re-certification and acquire domain-specific knowledge may present a significant barrier, especially to an ageing workforce, potentially reluctant to undergo retraining or to move to the locations where new green job opportunities become available. Both young people leaving education and geographically mobile workers will be needed to supplement the sectoral mobility of existing energy workers from brown to green jobs.

Another significant concern relates to how the location, quantity and quality of green jobs will compare to the brown jobs where most energy workers currently work. Scotland's low-carbon energy sector already has an established economic footprint. In 2019, this sector supported over 19,000 direct and indirect jobs and contributed £2.9 billion to Scotland's economy - 0.8% of total employment and 1.6% of GDP respectively (Ernst and Young, 2023). Scotland had the highest regional proportion (16%) of UK clean energy adverts over the period 2021-24. However, green employment is relatively evenly distributed across the UK and is certainly not concentrated in Scotland (See Valero et al, 2021, page 3 for map of green employment shares across the UK's regions). This is in stark contrast to the much more geographically concentrated spatial patterning of brown jobs (See Fig 4, showing that 43% of the UK's oil and gas jobs are located in Scotland). This aspect of the green transition might be seen in a positive light in that it will generate employment opportunities across the country, reducing pressure on particular localities in terms of housing and other public provisions. However, it may present net losses of economic activity and jobs for those areas that have for many decades thrived as centres of non-renewable energy production, including North East Scotland.

Figure 4: UK-wide employment supported by oil and gas production, 2022



Source: OffShore Energies UK, 2023.

Furthermore, there are likely to be time lags and imprecise geographical alignment between the decline of brown jobs and the growth of green jobs to replace them. In offshore wind for example, 80% of UK projects in construction or installation between 2025 and 2030 are forecast to be outside of Scotland. ScotWind, INTOG and other key Scottish-based projects are scheduled to come online only in the early 2030s (Robert Gordon University, 2025: 21-22). There is understandable concern amongst oil and gas workers about a 'cliff edge' scenario whereby a rapid decline in brown jobs does not happen in sync with a growth in the quantity and quality, or location, of green jobs that are needed to replace them. The evidence base remains limited in this respect, but it is plausible to assume that such factors may result in a loss of skilled workers from the ageing but highly qualified oil and gas sector, either through early retirement, transfer out of the energy sector or into either brown or green jobs overseas or elsewhere within the UK (See also section 3.1. below).

A final issue is the perceived 'quality' and security of jobs, which are linked to the nature of the work required as well as to pay and working conditions (See section 3.3 below). Some of the most promising estimates of the volume of jobs to be created by the transition to Net Zero include temporary roles in the construction of green infrastructure, with fewer permanent roles involved in its subsequent operation (Just Transition Commission, 2025). This poses significant challenges not only with regard to the retraining and transfer of an existing energy workforce. It also indicates a critical need for long-sighted planning and consideration of lifelong career prospects for younger people recruited to new training or apprenticeship programmes.

#### 2.4. North East Scotland

Key concerns facing North East Scotland are (a) whether the energy transition will engender a sufficient quantity and quality of green jobs to replace declining brown jobs and (b) how many of the green jobs will actually be located in the region. Whilst the North East is host to only about a tenth of jobs in Scotland, its role in oil and gas extraction has for many decades made it the operational hub of Scotland's (and the UK's) energy sector, reaping considerable financial dividends in the process. However, in recent years the region has been vulnerable to the decline of oil and gas extraction in the North Sea.

Mean household incomes and employment rates in North East Scotland remain above the national UK average, but there has been a weakening of the region's labour market since the mid-2010s. The biggest falls in average earnings have been in Aberdeen and Aberdeenshire and employment rates there have also declined relative to the rest of the UK when comparing statistics for 2013-15 to those for 2020-22 (Phillips et al, 2023).

Almost a third of the UK's offshore energy workforce is employed in North East Scotland (Robert Gordon University, 2022) and close to 1 in 6 workers in this region are engaged directly or indirectly in offshore energy, rising to nearly 1 in 4 when including induced jobs (Robert Gordon University, 2025). However, only 11 per cent of green job vacancies in Scotland between February 2019 and January 2022 were in this region (Rubio et al, 2022). In contrast, 44 per cent were in South West Scotland.<sup>11</sup> This represents a considerable challenge specifically for North East Scotland but also for the viability of Scotland's green energy transition, as it infers a considerable spatial mismatch between the location of new employment opportunities and the workers with the skills needed to take advantage of them.

Alongside this spatial challenge comes the question of timing, as analysts have noted that a decline in brown jobs prior to sufficient replacement roles becoming available in adjacent energy sectors could pose the risk of increased economic inactivity (whether through early retirement or unemployment) in the region and potentially a further loss of working age population as people seek employment elsewhere (Robert Gordon University, 2022).

### **Demographic Challenges**

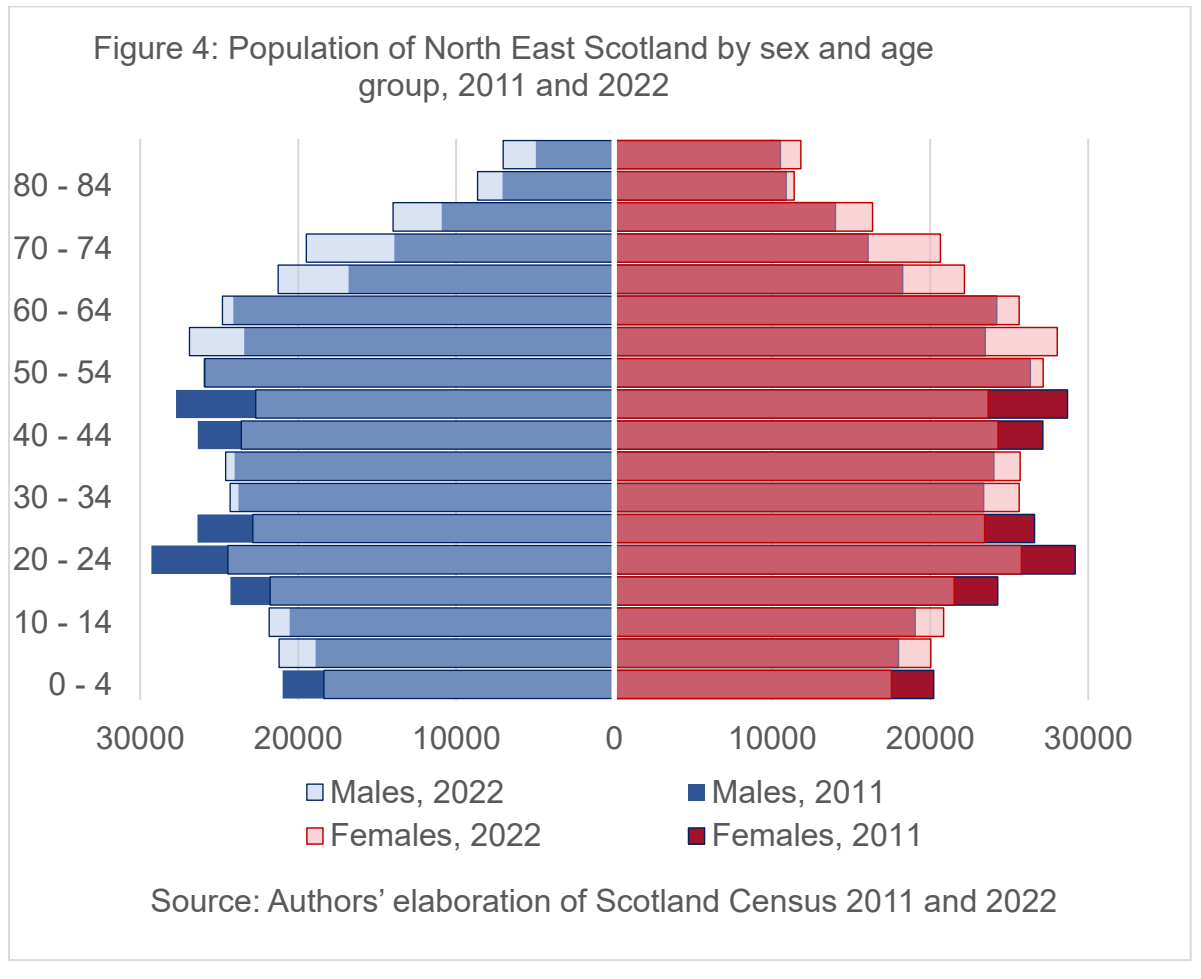
The broader demographic challenges facing North East Scotland are well documented (Improvement Service, 2025) with outmigration and declines in working age population. Between 2011 and 2022 the population of North East Scotland grew by only 1.5%, much slower than the national average of 2.7%. The population has also been ageing, which will continue to put pressure on the working-age population and dependency ratios in the region. Aberdeen City and Aberdeenshire have both seen a fall in their working age populations by 3.9% and

---

<sup>11</sup> This analysis of regions in Scotland is based on the 2020 Nomenclature of Units for Territorial Statistics (NUTS), which have subsequently changed

4.1% respectively over the same period. These declining numbers compare with rises in Midlothian (12.9%), Edinburgh city (8.3%) and Glasgow (8.3%) (Improvement Service, 2025).

Population projections (NRS, 2025), accounting for the combined effect of plausible future migration, fertility and mortality trends, predict a further decline in the working age population of North East Scotland between 2022 and 2047.



The level and timing of new investments will be key to a successful transition for North East Scotland. Getting these wrong will have consequences for the region both economically and demographically. This is of course true for other areas also and balancing regional, economic and demographic needs is one of the many challenges facing Scottish Government plans for a Just Transition to a Net Zero economy. Careful planning and clear communication of the scale, timing and geography of investment in the green transition are urgently required in order to

maximise the chances of there being a sufficiently large and skilled workforce available to deliver it.

Workforce planning must also take careful consideration of the pressures and competition for skills outlined earlier in this chapter. Training opportunities (for education leavers and those in brown jobs) as well as talent attraction mobility measures will require careful targeting to address those needs where either demand or challenges of recruitment, or both, are particularly high.

# 3

## **Growing a domestic workforce – attraction, retention and training**

### 3. Growing a domestic workforce – attraction, retention and training.

Of the three main routes to meeting workforce needs, the first two focus on growing a domestic workforce either by upskilling and transferring workers from existing 'brown' energy jobs or by developing an attractive offer for new entrants with appropriate entry routes through education and training pathways and apprenticeships.

#### 3.1. Upskilling and transfer of existing workforce

As noted at the start of this report, the UK's oil and gas sector, which is in relative decline has been identified as a key potential source of skilled labour for the green energy transition (Offshore Energies UK 2023; UK Government 2025). The Energy Transition Institute at Robert Gordon University projects that, under a successful transition, 62 per cent of the offshore energy workforce could be supporting the renewables industry by 2030, compared with 22 per cent in 2023. With a slower transition only just over half of energy jobs will be in renewables with the rest in traditional oil and gas (Robert Gordon University, 2023).

Similarly, a PwC (2022) report suggests that approximately 270,000 existing oil and gas workers across the UK could potentially transition into green energy roles. However, the sector's age profile, around 20 per cent of this workforce is expected to retire by 2030, reduces the pool of transferable workers to approximately 216,000. This falls well short of the estimated 400,000 workers required to build the UK's net zero energy workforce across sectors such as nuclear, hydrogen, and renewables by 2050, including around 48,000 roles in Scotland alone.<sup>12</sup> The PwC report concludes that the growth of renewable energy generation will be constrained by this substantial shortage of skilled labour and that considerable attention needs to be paid to making green roles more attractive to students as well as boosting the provision of entry level apprenticeships.

Both sets of claims broadly align in emphasising the high degree of transferability of skills, reflecting significant overlap, particularly with respect to foundational competencies within the existing energy workforce. Many roles in the oil and gas

---

<sup>12</sup> These figures cited by PwC are derived from estimates originally presented in a **National Grid (2020)** report.

sector (such as mechanical, electrical, piping, instrumentation, project engineering, subsea, offshore operations, health and safety, welding, and inspection) share core engineering, safety, systems, and project management skills that are also highly relevant to low-carbon and clean energy industries.

However, not all the necessary skills are currently available, indicating that additional training will be required. Greenspon and Raimi (2024) examine how well the skills of existing fossil fuel workers in the United States align with those demanded by growing or emerging energy sectors, particularly within the same local labour markets. They find notable skills gaps: fossil fuel workers tend to possess strong technical and mechanical abilities, while many green jobs require more interpersonal, managerial, and analytical skills and these gaps limit direct transferability.

Similarly, in the UK, Valero (2024) employs panel data from the ONS five-quarter longitudinal Labour Force Survey to differentiate between “green jobs” (those involving core green tasks) and “brown jobs,” which are concentrated in emissions-intensive sectors. Their definition is in line with the approach outlined in Chapter 2 where a job is classified as green if it exhibits one of three characteristics (Rubio et al. 2022). The study finds that green jobs are more likely to involve non-routine, analytical, or interpersonal tasks, whereas brown jobs tend to be more routine, manual, and physically oriented. Green jobs are also more prevalent among workers aged 35 to 54 and those with higher education, particularly university graduates, while brown jobs are more common among individuals with lower or vocational qualifications. Transitions into green jobs typically occur among graduates of prime working age who move between roles with similar task profiles rather than across major skill divides, reflecting the more analytical and non-routine nature of green work. Sato et al. (2023) reach similar conclusions across both the US and the UK, finding that low-carbon jobs generally demand higher levels of technical, managerial, social, IT and cognitive skills compared with other comparable generic occupations.

Greenspon and Raimi (2024) argue that in the U.S., even when fossil fuel skills overlap with those required for green jobs, these opportunities are often located in different regions. Workers in oil-producing areas may not live near expanding renewable energy hubs, making relocation a significant barrier. Hanson (2023)

explores how the energy transition could disrupt local labour markets, particularly in regions heavily dependent on carbon-intensive industries. Hanson maps the spatial distribution of fossil-fuel-intensive employment across U.S. commuting zones to identify areas most at risk. The study is motivated by concerns that the transition may lead to localised job losses and deepen regional inequality, echoing the persistent effects of past structural shocks such as the decline of manufacturing. Hanson estimates that around 1.7 million U.S. workers are employed in fossil-fuel-intensive industries most likely to be affected. These jobs tend to offer relatively high wages for non-college educated workers, meaning their loss could have a substantial negative impact on earnings. Moreover, Hanson highlights that such workers often have limited mobility, constrained by financial, personal, and social factors that make it difficult to relocate to areas with growing green job opportunities. Hanson's core messages about concentrated exposure, weak worker mobility, and the need for place-sensitive policies map well to the UK, Scotland and North East Scotland. That said, there are notable differences also. General worker mobility in the US has historically been higher than in the UK albeit with recent declines in the US (Azzopardi et al. 2020). Meanwhile, the smaller spatial distances in the UK may mean that mobility takes the form of longer commutes rather than more general mobility.

Transitions can also be constrained by differences in certification, regulatory standards, work practices, and technical specialisation, for example, between oil and gas drilling, wind turbine maintenance, and electrolysis plant operations. Strict licensing and training requirements further slow the expansion of labour supply. Offshore Energies UK (2023) reports that more than 170 organisations are involved in administering skills recognition and training. Creating more flexible systems, such as "skills passports" and bespoke training programmes, could help accelerate workforce transitions.

Recently launched schemes in Scotland and the UK include the new energy skills passport, launched in January 2025, and the Aberdeen Oil and Gas Transition Training Fund announced in July 2025 and administered by Skills Development Scotland (UK Government 2025: 37). Both initiatives are too new to have been evaluated and neither has so far reached more than relatively modest numbers of

workers. Nonetheless both have potential to encourage a transition of fossil fuel workers into green energy jobs. Further afield, across Europe, several regional energy strategies already highlight initiatives of this kind, aiming to map and align existing workers' competencies with emerging green job pathways on the assumption of significant overlap in foundational skills.

### **RES-SKILL project**

The ERASMUS+ funded RES-SKILL project (2020-23) sought to help coal workers transition into high-demand jobs in the renewable energy sector.

The project was a collaborative effort involving VET providers, industry representatives, social partners, and regional development agencies from Germany, Greece, Austria, Romania, Bulgaria, and Poland. Together, these countries employ 81 per cent of the EU's coal workforce.

The project identified complementarities and mismatches between coal workers and renewable energy sector occupations; developed transition profiles, self-assessment tools, and skills portfolios; created resources for the establishment of Joint Competence Centres; and disseminated outputs through awareness raising activities.

One of the primary outcomes of RES-SKILL was the development of learning materials tailored to coal workers' career reorientation. RES-SKILL also formulated strategic and operational plans for the establishment of Joint Competence Centres, laying the groundwork for these hubs to become operational. These centres are expected to play a crucial role in the transition, offering a structured environment for career reorientation and practical training, as well as fostering collaboration between vocational education providers, industry stakeholders, and other partners, such as sector skills bodies and associations, trade unions, and NGOs.

Demographic factors such as age, willingness to move spatially and availability of housing, workers health and physical condition, are all additional hurdles that need to be carefully considered before assuming a straightforward transfer of workers from brown to green jobs. It is possible for example that older workers may leave the labour market even if they possess relevant skills, others may choose to move abroad as part of a brown-to-brown job transition rather than retraining into green

jobs.<sup>13</sup> This points again to the need to co-ordinate and combine a number of strategies to meet labour needs complementing re-training for existing energy workers with initiatives to attract younger entrants from outside the traditional energy sector.

### 3.2. Training new entrants

While UK regions may be constrained on immigration policy, there is much more potential flexibility on green skills investment, coordination and provision. Experience to date suggests that the region is the most ‘local’ scale at which activity targeting green skills can be strategically coordinated to both reduce the risk of skills and labour gaps and maximise the benefits to host communities. Across EU countries to date, most initiatives targeting green skills have taken place at the regional and local level.

#### **Examples of local and regional responses to green skills provision**

Denmark’s local Vocational Education Centre South (EUC Syd) provides green skills provision at a regional level across all its 75 study programmes and a specialist centre for construction workers that focuses on new energy-saving techniques. The centre combines traditional classroom training with learning in its test facility where participants can use real energy-saving tools and materials.

In the UK, Liverpool City Region Local Enterprise Partnership developed a strategy focused on skills for the low-carbon economy. As part of this, the partnership coordinated skills training in higher education colleges with the demands of local companies manufacturing products used by offshore wind. It has also played a central role in filling a skill gap reported by Scottish Power, which faced an imminent shortage of labour, caused by an ageing workforce and lack of new apprentices. To tackle this, the partnership created a strategy to help upskill the existing workforce and train new engineers.

The Liverpool City Region is actively pursuing a zero-carbon future by 2040. It has a strong low-carbon economy focused on offshore wind and holds a leading position as a Centre for Offshore Renewable Engineering (CORE), being the location of one

---

<sup>13</sup> See for example Mehta, A. (2024) [How a skills gap threatens to blow UK’s energy transition off course | Reuters](#)

of the world's largest concentrations of offshore wind farms in Liverpool Bay. COREs are partnerships between Central and Local Government and Local Enterprise Partnerships (LEPs) that ensure businesses looking to invest in manufacturing for the renewables industry receive the most comprehensive support possible.

(Cedefop, 2018. Skills for green jobs in Denmark: an update and Skills for green jobs in the UK: an update).

Green apprenticeships may be one pathway to increasing interest and skills for green jobs amongst younger people and one which is being considered at various levels. In Scotland, there are currently three main types of apprenticeships:

- **Foundation Apprenticeships**, which provide school pupils with early workplace experience;
- **Modern Apprenticeships**, which offer paid, practical training to help young people begin or progress in their careers;
- **Graduate Apprenticeships**, which enable participants to gain degree-level qualifications while working.

These apprenticeship pathways are tailored to different stages of education and career development and thus can play an important role in equipping the workforce with the skills needed for emerging green jobs. Skills Development Scotland (SDS) administers a number of modern and graduate apprenticeship opportunities in the green and clean energy sector and reported in 2023 that 30% of Modern Apprenticeship starts and 38% of Graduate Apprenticeship starts were in sectors “of importance to the transition to net zero” (Skills Development Scotland 2023). While the current SDS (Rubio et. al., 2022) analysis focuses on defining what constitutes a green job and assessing present and future green job and skills needs (see Chapter 2), further review is required to understand the role of modern and graduate apprenticeships in meeting these needs. Nevertheless, the Energy Transition Skills Hub in Aberdeenshire - which opened in summer 2025 and aims to support 1,000 students and mid-career professionals into energy-transition-focused jobs within its first five years - could be viewed as a strong example of emerging ‘green apprenticeship’ pathways in Scotland.

### 3.3. Pay and working conditions – how attractive are green jobs?

Both transferability across sectors and recruitment of new entrants to training programmes, apprenticeships or directly into green jobs will also be dependent upon labour market conditions including relative pay and working conditions. Arguments for why there may be a green wage premium include the need for more advanced or specialised skills or education, greater complexity or specialised tasks, a scarcity of qualified workers in emerging green industries sectors pushing up wages and employers boosting wages to attract skilled talent. The evidence on the size and direction of green wage gaps however is more mixed.

A small literature indicates a *wage premium* or higher wages for green jobs. Kuai et al. (2025) look at Japan using a worker level survey from 2021 and find that green workers receive a wage premium of about 7.3 per cent compared to non-green workers. They also find that a 10 per cent increase in a job's green intensity is associated with around a 0.8 per cent increase in wages. The premium is heterogeneous with more highly skilled and younger workers benefiting the most. Valero et al. (2021) use microdata (labour force surveys in the UK and EU) mapped to O\*NET task classifications of "green jobs" to classify jobs as directly green, new and emerging green, enhanced skills green, or green increased demand. Green jobs (around 17 per cent of jobs) are generally associated with a wage premium, especially for lower and middle skilled occupational roles. With the addition of controls for occupation, which account for wage differentials between jobs regardless of how 'green' or not they are, the premium falls to about 7 per cent (from 24 per cent without occupational controls).<sup>14</sup> A broader review by Cerimelo et al. (2024) estimates wage differentials between green and non-green jobs in nine major Latin American countries and finds a wage premium of around 18 to 22 per cent for the period 2012-2019 where this gap has remained relatively stable over time.

Other evidence suggests that any green wage premium is unevenly distributed across green jobs, and that some may in fact incur a wage penalty or lower wages when compared to non-green jobs. A recent report by the Adecco Group indicates a

---

<sup>14</sup> A study by Jackman and Moore (2021) examine the wage premium in a small developing economy, namely Barbados. Over the period 2004 to 2014 they find that individuals in green industries earn about 7% more than those in non-green industries.

small overall wage penalty with more complex green roles offering a wage premium of up to 22 per cent (e.g. sustainability consultants) whilst green jobs with less complexity pay less than comparable non-green roles. In other words, there is no universal guarantee of a green wage premium; in routine, lower-skilled roles, green jobs may pay less.

Sato et al. (2023), adopting an occupational approach, also document substantial variation in the size of the green wage premium. Using UK job posting data, they find that during the early 2010s, green (or low-carbon) jobs in engineering, skilled trades, and machine operative roles commanded positive wage premiums ranging from 6 to 20 per cent. Wage premiums are also found to persist in some middle- and low-skilled occupations, such as construction, building, and process, plant, and machine operative roles. However, within more narrowly defined occupational categories, premiums have either declined or largely disappeared in recent years, likely reflecting an increased supply of green workers. This more recent absence of lasting positive wage premiums, even in occupations requiring higher skill levels, is likely to pose a challenge for attracting workers into certain low-carbon jobs.

Other potential barriers, particularly for recruitment of new, younger workers are a result of information asymmetries which limit awareness of opportunities or create perceptions of certain types of manual green jobs (e.g. insulation, roofing) as temporary and more generally unattractive. Crowhurst and Taylor (2023) report on a nationally representative poll and five focus groups involving 16- to 25-year-olds across the UK. They find low awareness of what green jobs are as well as low appetite to take up a range of roles. Less than 25 per cent found specific roles attractive (especially manual jobs such as installers and roofers) and only 7 per cent expressed interest in being a “heat pump engineer.” In addition, there were concerns around job insecurity and low pay with a quarter of young respondents seeing low pay as a key disadvantage of many green jobs.

There is limited published analysis of pay differentials between brown and green energy sectors at the regional level, including in North East Scotland. The recent *Workforce Insight 2025* report by Offshore Energies UK (OEUK) indicates that salaries in the UK oil and gas sector are, on average, 15–30 per cent higher than

those for equivalent roles in offshore wind, nuclear, hydrogen, and carbon capture and storage. The report further finds that this pay premium is most pronounced in technical and craft occupations, although it is narrowing as renewable energy sectors mature. While the analysis is not disaggregated at the Scotland or Aberdeen level, it is reasonable to expect the oil and gas wage premium to be particularly significant in regions with economies strongly linked to offshore energy, such as Aberdeen and the wider North East.<sup>15</sup> Oil and gas roles (especially technical, offshore, and higher-risk positions) have traditionally commanded relatively high wages, whereas many green energy roles do not share these characteristics and therefore tend to offer lower pay premiums. Complementary evidence is provided by Skills Development Scotland's Regional Skills Assessments, which compare advertised salaries for green and non-green jobs across Scotland. This reveals that the median advertised salary for green jobs in Aberdeen City and Shire was £37,600 in the first six months of 2024 (see Table 1 below). This was higher than the median advertised salary for all jobs in the region which was £32,400 (a 16 per cent gap). expected, the gap is smaller than in other regions, reflecting Aberdeen's strong dependence on the oil and gas sector, which elevates median earnings. However, this measure does not provide information on what workers are actually paid, nor is comparable data for jobs in the brown sector presented.

---

<sup>15</sup> Some local commentators have warned that workers may face pay cuts when moving from oil and gas roles to green jobs, which could discourage career transitions. Merson, A. (2023). Job 'pay cut' warning in switch from oil and gas to renewables [Press and Journal](#)

Table 1: Median advertised salaries

Region	Green	All	Gap (%)
Aberdeen City and Shire	37,600	32,400	16
Edinburgh and South East	37,100	30,000	23.7
Glasgow City	37,600	31,000	21.3
Inverness and Highland (City Deal)	35,000	28,200	24.1

Source: Skills Development Scotland, Regional Skills Assessments, Oct 2024.

### 3.4. Location, location, location: where are the green jobs?

We have noted already the importance of considering potential spatial mismatches in the distribution of green jobs and available skills and labour. Sato et al. (2023) document the spatial pattern of green jobs across the UK (and the USA). They show that whereas high-carbon manual jobs tend to cluster tightly around fossil fuel extraction centres, low-carbon vacancies are more widely spread across regions. This applies to both high-skill (e.g., engineering) and low-skill (e.g., buildings and transportation) occupations. Sato et al. (2023) estimate a locational Gini coefficient of 0.46 for low-skilled high-carbon jobs, compared with 0.22 for their low-carbon counterparts indicating that the latter are more spread out.<sup>16</sup> They further show that this spatial concentration also characterises high-skill high-carbon roles: around 20 per cent of all high-carbon job advertisements in the UK are in Aberdeen, and roughly half are concentrated in just three travel-to-work areas, namely Aberdeen, Glasgow, and London.

PwC's 2024 Green Jobs Barometer also provides information on the distribution of green job vacancies in the UK in 2024. Scotland leads for the proportion of green adverts (5.6%) and has the highest share amongst regions. This compares to a UK average of 3.3% green adverts, whilst London has the largest in absolute number of

---

<sup>16</sup> The locational Gini coefficient measures how unevenly an industry, activity, or group of workers is distributed across spatial areas.

green adverts (58, 585 adverts). The PwC report does not disaggregate to the sub regional level.

Skills Development Scotland does provide more spatially disaggregated vacancies data, using its published framework for classifying jobs as green/non-green (see Chapter 2). Online job postings are labelled green or non-green and then further broken down as Enhanced Skills and Knowledge, Increased Demand or New and Emerging. Table 2 below provides some information on the demand for green jobs comparing Aberdeen City and Shire with selected regions.

Table 2: Regional Distribution of Green Job Postings

Region/Area	Total Job Postings (Jan -June 2024)	Green Job Postings	Green Share (%)	Share of Scotland's Green Adverts (%)
Aberdeen City and Shire	25,100	12,700	50.5	12
Glasgow City Region	84,500	38,000	44.9	36.1
Edinburgh and South East Region	74,000	30,700	41.4	29.2
Inverness and Highlands (City Region Deal)	12,800	4,600	36.1	4.4

Source: Skills Development Scotland, Various Regional Skills Assessments, 2024

In general, the data indicates that green job vacancies are more geographically spread. This was a higher proportion of green job postings than the Scottish average (42.3%) and considerably higher than the Inverness and Highlands region (36.1%). The number of green job postings in the region accounted for 12.0% of all green job postings in Scotland.

The geographic mismatch between where workers are needed and where they are available may undermine progress toward carbon-reduction targets, weaken local and regional economic performance, and exacerbate existing demographic pressures. A recent UKERC study, *Jobs, Skills and Regional Implications of the Low Carbon Residential Heat Transition in the UK(2025)*, which examines the rollout of heat pumps, highlights some of these challenges. It finds persistent worker and skills shortages, noting that in some regions, a lack of qualified labour may slow deployment, increase costs, or divert workers from other sectors of the economy. This is consistent with our previous discussion on green skills passports and transition training funds, which would need to be fully evaluated and then scaled up to enable more effective movement of workers into green roles.

# 4

## **Recruiting internationally – the role of immigration and global competition for workers**

#### 4. Recruiting internationally – the role of immigration and global competition for workers

The challenges of growing a sufficiently large and appropriately skilled domestic workforce at pace are such that, if the UK Government is serious about meeting existing net zero targets, it must reconcile its immigration control objectives with the need for flexible and targeted labour migration. And yet, migration is rarely considered as part of the skills strategy for the green transition. Although numerous reports have been published on green jobs, few, if any address the role of migrant labour.

The UK's 2021 Green Jobs Taskforce Report, for instance, makes no mention of immigration whatsoever. The Clean Energy Jobs Plan states "Our priority is to grow the domestic skill base to meet the demand for clean energy workers. However, there may be exceptional cases where skilled workers from abroad may be required to fill critical workforce gaps" (UK Government, 2025: 28). There is some recognition that domestic supply may not be sufficient, when it is stated that the Plan will assist the Migration Advisory Committee (with support from the Labour Market Evidence Group) in informing the temporary shortage list. However, no consideration is given to a specific green jobs visa or a dedicated immigration route just for green occupations.

Many occupations critical to the green transition, particularly in construction and related trades, are already facing acute shortages across both high-skilled roles (such as engineers) and mid-skilled roles (such as installers and technicians). Further restrictions on immigration pathways could exacerbate existing gaps and shortages, driving up costs, delaying projects, and ultimately undermining public confidence in the transition itself.<sup>17</sup>

---

<sup>17</sup> In its October 2023 submission to the UK House of Commons Energy Security and Net Zero Committee, the Center for Global Development warned that immediate labour shortages pose a risk to achieving net zero targets, making a strong case for targeted labour migration. The submission identified six occupations currently experiencing shortages, with two (welding and roofing) particularly dependent on international recruitment. Despite a marked increase in welding apprenticeships, 58 per cent of new entrants into the occupation still came through international visas, highlighting the persistence of domestic supply constraints.

A strategic mitigation approach could see international migration play an important role in the short and medium term, helping to meet urgent skills needs while the education and training system adapts. In other words, international migration could play a role as a bridging mechanism complementing and providing space for expanded UK training capacity. The challenge is to avoid “locking in” a reliance on migration. Targeting specific shortages that cannot be filled domestically may be the best approach so that migrant workers are seen as complementing local workers.

A more coordinated approach across policy areas, including immigration, climate and industrial strategies must also take account of wider global contexts. The global interdependencies of the climate emergency, the urgency of international targets and the challenges of international agreements and collaboration all contribute to fierce competition for skills and labour. This competition may also directly affect the domestic supply of labour if displaced UK energy workers are able to find better paid work abroad. Strategies and approaches that are mutually beneficial in developing skills and enhancing the capacity of both sending and receiving countries to meet their targets for reduced carbon emissions are likely to be required.

#### 4.1. Current and proposed immigration policies

This section examines current and proposed UK immigration policies, assessing their potential impact on the supply and demand for labour and skills in green jobs. The UK Government’s May 2025 Immigration White Paper is a key focus, but it is important to acknowledge other policies influencing labour demand in the energy sector, such as North Sea licensing and taxation regimes. While these are undoubtedly important, they are beyond the scope of this analysis.

##### 4.1.1. Existing policy and extent of the international green workforce

According to a policy brief by the Centre for European Reform (CER; 2025) between 2011 and 2019, foreign-born workers made a significant contribution to green employment in the UK. In particular, they accounted for about one third of net new employment in green sectors (including energy and construction). Post-pandemic and Brexit, foreign-born workers contributed an even higher share of growth in green jobs, particularly in construction, energy, and skilled trades (e.g. electricians, double-

glazing installers), partially offsetting declines in UK-born employment. Arguably then, previous migration policies, including free movement and limited visas for non-Europeans up to 2021 and the relatively liberal regime for all foreign workers between 2021 and 2024 delivered significant labour to fill green jobs.

That said the data on the extent to which labour demand is being met by international migrants in the green sector are not entirely clear, especially at sub national levels. The CER report notes a growing labour demand for green jobs (measured by the number of job adverts), especially in energy, construction and skilled trades. The report does not however model regional or sectoral variation, meaning we are not able to disaggregate down to the level of Scotland and North East Scotland.

The ONS's "Experimental estimates of green jobs, UK" gives total numbers of green jobs (about 690,900 FTEs in 2023) but does not break down the share held by immigrants (ONS, 2025). Thus, while we know the scale of green/low-carbon jobs, ONS data currently do not appear to have disaggregation by migrant status nor by region although with regard to the latter there is acknowledgment that further work is needed to establish regional estimates. The earlier Climate Change Committee report from May 2023 titled "A Net Zero Workforce" maps where net-zero will create and transform jobs across regions and sectors and does acknowledge that the spatial concentration of carbon intensive jobs (around Scotland the NES) will potentially be quite disruptive at a local level and so require targeted transition intervention (Climate Change Committee, 2023).

In order to develop clearer analysis of the current role played by international migrant labour and to understand more fully the future needs at national and regional levels and across a range of sectors, better data are required. Ideally, we would have information on key jobs in the green sector broken down at regional level, how many are currently occupied by migrant labour and the gaps that exist.

#### 4.1.2. [New policy proposals from UK Government](#)

In May 2025, the UK government published a White Paper, "Restoring Control Over the Immigration System." This significant overhaul of UK immigration policy aims to reduce net migration from 906,000 in 2023, tighten visa eligibility, and better align

immigration with the country's labour market and broader integration goals. For our purposes, the key elements of the new immigration White Paper include:

1. Raising the minimum qualification level for skilled worker visas from A-level to RQF 6 (degree level) and above.
2. A 32 per cent rise in the Immigration Skills Charge (ISC) boosting employer's costs and potentially discouraging firms from recruiting internationally.<sup>18</sup>
3. Scrapping the existing "immigration salary list", which allows workers doing specific types of job to be brought in with lower pay and replacing it with a "temporary shortage list". To avoid this becoming a longer run measure, the relevant industry will be expected to set out plans to train and recruit more UK workers.
4. Maintaining the salary threshold of £38,700 but with a subsequent rise for new applications to £41,700 from July 2025.
5. Increasing the standard residency requirement to apply for Indefinite Leave to Remain under the Points-Based System (e.g. for work visas) from 5 years to 10 years.

These immigration reforms are relatively new and so the available evidence of impacts is necessarily limited. However, a 2025 report by the Centre for European Reform (CER, 2025) suggests that by tightening visa rules the new White Paper could undermine the UK's net zero and housing objectives. Drawing on ONS LFS data, it estimates that more than half (260,000 of 465,000) of foreign-born workers currently employed in green occupations would not have met the new eligibility criteria, including the salary threshold of £38,700.<sup>19</sup> The challenge is particularly acute in construction, skilled trades, and environmental clean-up occupations. Many of these roles currently offer salaries below the proposed threshold or do not require degree-level qualifications. As a result, labour shortages are likely to emerge in

---

<sup>18</sup> The rises in ISC are from £364 to £480 per year for small sponsors, and from £1,000 to £1,320 for large sponsors. There is also a proposed extension of the settlement period from 5 to 10 years which doubles the total ISC paid over the period.

<sup>19</sup> The CER defines green jobs using a broad task-based approach rather than an occupational measure (see Chapter 2) in which workers spend at least one-third of their time on environmentally focused tasks.

sectors that are critical to achieving both the government's housebuilding targets and its net zero and retrofit ambitions.

Flexibility is then inevitably required. Indeed, between 2017 and 2023, government exemptions allowed certain foreign workers on offshore wind vessels operating within UK territorial waters (12 nautical miles) to bypass standard visa requirements. These concessions were justified as temporary measures to address labour shortages, given that existing immigration rules (such as sponsorship and visa processing) were considered too rigid for the mobile, project-based nature of offshore work (Friends of the Earth, 2023). With the expiry of these concessions, some industry stakeholders now warn that existing visa routes remain overly inflexible for short-term, rotational offshore roles, potentially leading to renewed labour shortages and project delays. One possible solution mooted is the introduction of a sector specific immigration route where this could take the form of an "offshore wind visa" (Gravelle, 2023).

#### 4.1.3. Alternative policy options

A number of studies and reports, as well as governmental submissions have proposed alternative policy options to bring immigration control in line with green workforce needs. These are laid out below with some discussion of the potential pros, cons and trade-offs of each.

##### 1. **Lowering skills and/or salary thresholds either through a dedicated Green Skills Visa or through concessions within existing visa routes for roles critical to net zero (CER 2025; Hooper and Huang 2024; Kumar et al 2023).**

Whilst a Green skills visa would provide a dedicated route for international recruitment of workers contributing directly to net zero goals (e.g. retrofit, renewable energy) it runs counter to stated goals of the UK government both to reduce net migration and to simplify the immigration system by reversing a previous proliferation of 'dedicated routes'. Lowering skills and salary thresholds, whether within a dedicated visa or as a concession within existing routes also brings risks of increased worker exploitation and in work poverty as encountered under the social care visa route. A variation entailing potentially less risk could be a green degree visa, allowing international students with appropriate skills to stay

in Scotland after graduation, perhaps over a longer time frame than under the current graduate visa. This would, however require a clear definition of ‘green graduate skills’.

**2. Expanding or adapting the shortage list to include more climate-critical roles (Hooper and Huang 2024; CER 2025; Kumar et al 2023).**

This approach is in line with the stated wish of UK Government to manage skills gaps through a temporary shortage list. Inclusion of industries, sectors or job roles might be linked to enhanced domestic training (Kumar et al 2023) and indeed this is the intention currently set out in the proposal for the new Temporary Shortage List, although the exact mechanisms by which this is to be achieved remain untested.

The use of shortage occupations lists especially where these involve reduced salary thresholds or strict limits on potential to transfer to other visa and/or settlement routes again bring risks of increased exploitation and potential underemployment, where workers become “trapped” in low-paid jobs with limited mobility, and skills are underutilised. This mirrors issues observed in the social care sector, where poor working conditions and limited career progression are common (Manning, 2025). In the UK’s offshore wind industry, trade unions have previously raised concerns that immigration concessions were used to undercut pay, with some jobs reportedly advertised below the national minimum wage (Friends of the Earth, 2023). Allowing occupational mobility to shortage list visa holders may be a route to mitigate some of these risks and one that might also encourage employers to create better conditions to retain staff (CER 2025).

**3. Establishing umbrella sponsorship bodies to support small and medium-sized enterprises (SMEs).**

Some areas of industry with an important contribution to make to the transition to Net Zero involve a considerable proportion of small and medium sized employers, for example construction and retrofitting companies (Kumer et al. 2023). These SMEs often struggle with the administrative and financial burdens of the current immigration system and could be assisted to overcome this by umbrella bodies assuming visa sponsorship and compliance responsibilities on behalf of multiple firms. The recently established Scotland’s Migration Service has a clear remit to support Scottish employers to navigate the immigration system and may be a basis for development of such an initiative.

#### 4. Geographically targeted migration routes and visas.

Drawing on the model of a rural visa route, the Scottish Government has responded to the UK Immigration White Paper (Scottish Government, 2025), explicitly flagging the importance of migration levers for green skills planning and arguing for routes tailored to Scotland's demographic and sectoral needs.<sup>20</sup> Underlying this is the belief that rising opportunities in the green sector may be constrained due to broader demographic changes, a declining working age population and an already tight labour market.

##### 4.2. International competition

Intensifying global competition for green skills adds a further dimension to the challenges of securing the required workforce. The UK is competing with other high-income nations seeking to attract and retain green skilled workers. As well as reducing the pool of mobile labour willing to relocate to the UK, global competition may also directly affect the domestic supply of labour - if displaced UK energy workers are able to find better paid work abroad they may choose to leave.

Hooper and Huang's (2024) cross-country report for the Migration Policy Institute, highlights global shortages of green-sector workers and notes that many countries are competing for a limited pool of talent. While acknowledging that available data are patchy, they find that immigrants already make up a substantial share of the green energy workforce in many countries, around 8 per cent of renewable energy workers in Spain (2022) and approximately 26 per cent in Australia (2021).

Huckstep and Dempster (2024) examine the imbalance between the supply of and demand for green skills across ten countries, five in the Global North, including the UK, and five in the Global South, with a particular focus on solar photovoltaics and heat pumps. They find evidence of excess labour demand and argue that labour migration can play a complementary role to domestic training and reskilling efforts, especially given the age-related constraints in many national workforces. More

---

<sup>20</sup> The response cites research focusing on the Highlands and Islands and green energy projects and estimates a peak temporary increase of 16,250 workers by 2027, with a long-term increase of 12,750 workers by 2040 (Highlands and Islands Enterprise 2025). The existing regional construction workforce, it is suggested, will not be able to meet this demand and so without nuanced immigration policy carbon reduction targets will be missed.

broadly, they contend that UK immigration policy lacks coherence, as green subsidies and investment incentives are not aligned with visa policy. The system, they suggest, is overly complex, bureaucratic, and costly and these issues are compounded by the fact that many firms in green transition related sectors lack experience in international recruitment.

Beyond offering higher wages, many countries are adopting innovative approaches to training and recruitment as a way of securing labour in this competitive context. Huckstep and Dempster recommend a coordinated approach that integrates migration, training, and industrial policy to prevent siloed decision-making. Mechanisms such as umbrella sponsorship arrangements or global skills partnerships with partner countries could support this approach (Huckstep and Dempster, 2024).

Partnerships between sending and receiving countries to build an international pipeline of skilled workers could potentially be a way of mitigating and managing international competition more effectively. Such partnerships could fill immediate skill shortages while investments in building a domestic pool of workers yield results. Bilateral agreements and skills partnerships would be one way to do this, offering both training support and an international recruitment pathway. Training and migration partnerships also offer the opportunity to mitigate the challenges related to the recognition of qualifications while equitably ensuring that the country of origin doesn't experience 'brain drain.'

Germany, for example, has developed new Global Skill Partnerships with Ecuador, Nigeria, Vietnam, and Jordan in engineering; and with Ghana and Senegal in construction.<sup>21</sup> In addition, Australia is training Pacific Island workers in a range of vocational skills, including solar panel installation.<sup>22</sup> The MOVE\_GREEN project between the Spanish region of Andalusia and the Moroccan national employment agency Anapec aims to bring up to forty young Moroccan graduates to Spain for four months of training and internships in green transition-relevant occupations before

---

<sup>21</sup> <https://www.migrationpartnershipfacility.eu/mpf-projects/52-skills-partnerships-between-senegal-ghana-and-germany/preview>

<sup>22</sup> The training complements the Pacific Australia Labour Mobility (PALM) scheme that trains Pacific Island workers in vocational skills to address labour shortages in the country and provide them with technical skills for the workplace and to take home.

facilitating their return to employment by Moroccan firms.<sup>23</sup> None of these training and migration partnerships have yet been formally evaluated for impact and are presented only as examples.

Such partnerships are not substitutes for domestic skills investment. Experience from the health and social care sector in the UK shows that over reliance on international recruitment to fix immediate shortages has come at the detriment of more sustainable workforce development. That said, the potential of training and migration partnerships has been highlighted by several stakeholders, including the Norwegian energy multinational Equinor and by the Institution of Mechanical Engineers.<sup>24</sup> January 2025 parliamentary committee evidence from SSE (UK Parliament, 2025) suggests that, prior to the UK's tightening of immigration criteria, SSE were planning to recruit craft workers from overseas training academies.<sup>25</sup>

Finally, it is worth noting that many of these cited developments happened organically, and in response to regional or sectoral skills needs, but have rarely come about from an explicit linking of green transition strategies and immigration policy. Even in the case of Germany (below), the origins of this partnership were not explicitly linked to migration, even though it is in its current form.<sup>26</sup>

---

<sup>23</sup> Migration Partnership Facility (MPF), (2024), "(E)Co-development for innovation and employment in green and circular economy between Andalusia and Morocco (MOVE\_GREEN)".

<sup>24</sup> Equinor (2025), Written Evidence Submitted by Equinor UK Ltd: [committees.parliament.uk/writtenevidence/136164/pdf/](https://committees.parliament.uk/writtenevidence/136164/pdf/) (last accessed November 2025); Institution of Mechanical Engineers (2025), Written Evidence Submitted by the Institution of Mechanical Engineers: [committees.parliament.uk/writtenevidence/134165/pdf/](https://committees.parliament.uk/writtenevidence/134165/pdf/) (last accessed November 2025).

<sup>25</sup> There is also some precedence for this in the UK. Immigration has been a major contributor to the stock of skills and labour in the construction sector for decades, with Polish and Romanian builders dominating the installation of external wall insulation prior to Brexit. In the 1990s, UK Power Networks partnered with City and Guild and Apex Training to train workers in Harare, Zimbabwe, to British standards. Workers then moved to the UK through the then Skills Visa, often staying several decades and contributing to grid development as electricians.

<sup>26</sup> The programme was initially launched by the Indian Government to train solar technicians to support India's growing solar energy sector. It only later cooperated with Germany to leverage training models and secure employment opportunities abroad for its graduates.

### **Green skilled migration between India and Germany**

In 2023, an agreement was made between the German solar association and India's Skill Council for Green Jobs for 2,000 Indian skilled solar panel installers to move to Germany. At the time, India had a surplus of installers who had been trained under the long-running programme 'Suryamitra,' whilst Germany must recruit 100,000 solar PV workers by 2030. This programme had been supported by Germany's international development agency since 2015 which meant that German actors already had an in-depth knowledge of India's training infrastructure and could ensure that a migration agreement was equitable.

Since then, Germany has stepped up its efforts to attract Indian workers to green jobs in its 2024 strategy, 'Focus on India,' which makes it easier for Indian professionals to move and work in Germany. The 30 new measures include a simplified visa process, faster recognition of qualifications, and integration support.

It is interesting to note that while India has sought to capitalise on its youth bulge, creating a network of institutions to provide young people with green skills to international standards, and signing migration partnerships with over thirty countries, the UK Prime Minister has explicitly ruled out any visa liberalisation as part of the free trade deal between the UK and India.

# 5

## **How to attract and retain the required workforce in the green economy of North East Scotland**

## 5. How to attract and retain the required workforce in the green economy of North East Scotland

We turn now to consider the more social aspects of workforce attraction and retention. These are necessarily shaped by considerations of place. Given the predominantly rural nature of large parts of North East Scotland – with a majority of its land being rural and a higher proportion of the population residing in rural areas compared to Scotland as a whole – we consider the particular challenges of attraction and retention in rural areas.<sup>27</sup> The recently published ‘Regional Transformational Opportunities in the Highlands and Islands’ research report notes significant investment opportunities, including in many rural areas of North East Scotland. The report finds potential for large scale investment and significant job creation, both in temporary construction work and in longer term operational posts but also challenges relating to available workforce and skills as well as infrastructure to attract and retain new workers (Highlands and Islands Enterprise, 2025).

### 5.1. Demographic profile and mobility patterns within North East Scotland

The problem of depopulation in rural Scotland has been highlighted in earlier EAG reports (2021, 2022, and 2025). Many rural communities face demographic challenges as their populations shrink in size but also age due in significant part to the outmigration of younger residents.<sup>28</sup> Overall, the population of North East Scotland has aged between 2011 and 2022, with the share of those aged 65 and over increasing from 16.4% to 20.3% - in line with trends observed for Scotland as a whole (from 16.8% to 20%). Between 2011 and 2022, the size of the population of North East Scotland increased for all ages above 55, while it decreased at ages 0 to 4, 15 to 30, and 40 to 50.

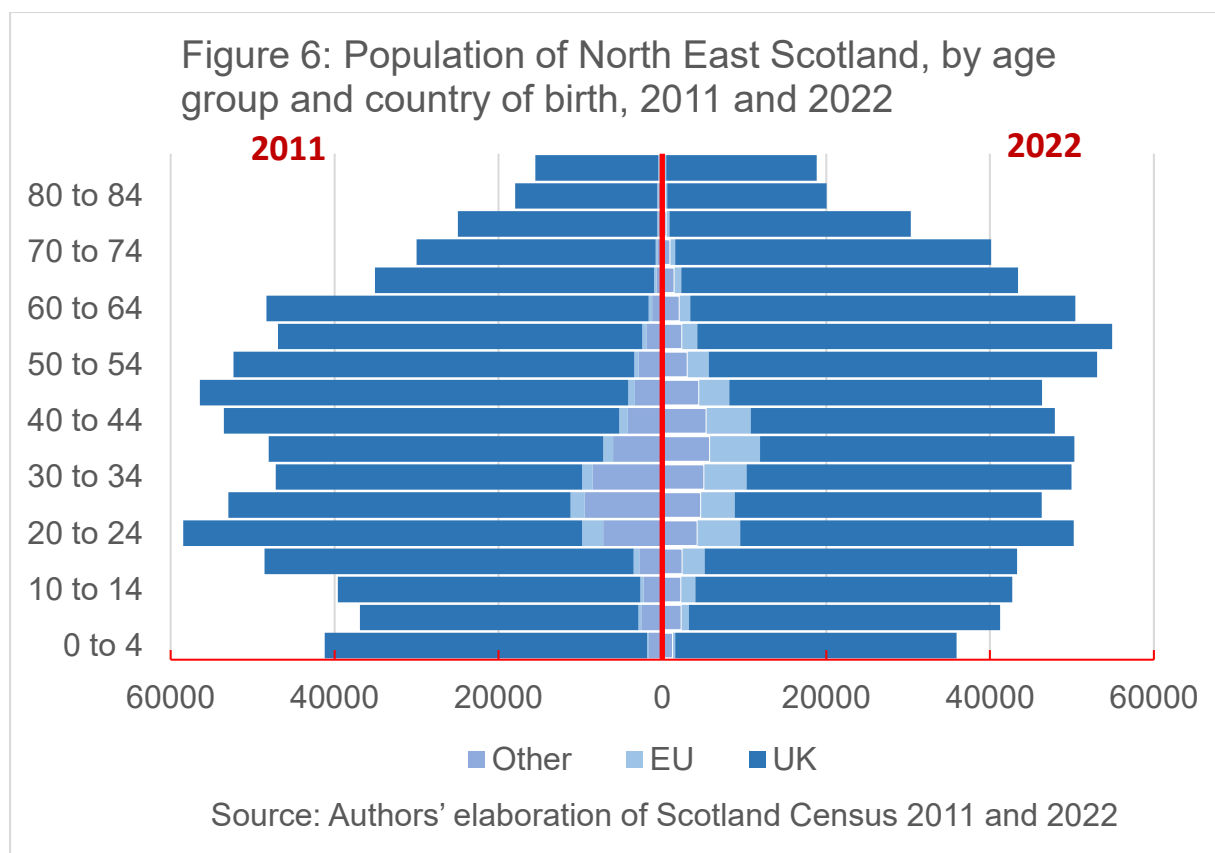
As well as population change linked to fertility, mortality and internal mobility, rural places in Scotland, including North East Scotland, are also sites of international migration. Fig 6 compares the Population of North East Scotland in 2011 (left side of

---

<sup>27</sup> While we refer to rural region, this is also to acknowledge that rural places are heterogeneous, multiple, dynamic and constructed and any discussion around ‘rural’ or ‘rurality’ must be contextualized and appropriately defined (see Vuin and Atterton, 2023, for further discussion around ‘rurality’),

<sup>28</sup> While there has been a long-standing focus on rural youth outmigration, existing research also provides evidence on diverse forms of mobility among this group, including staying, returning following graduation or to start family (EAG 2025).

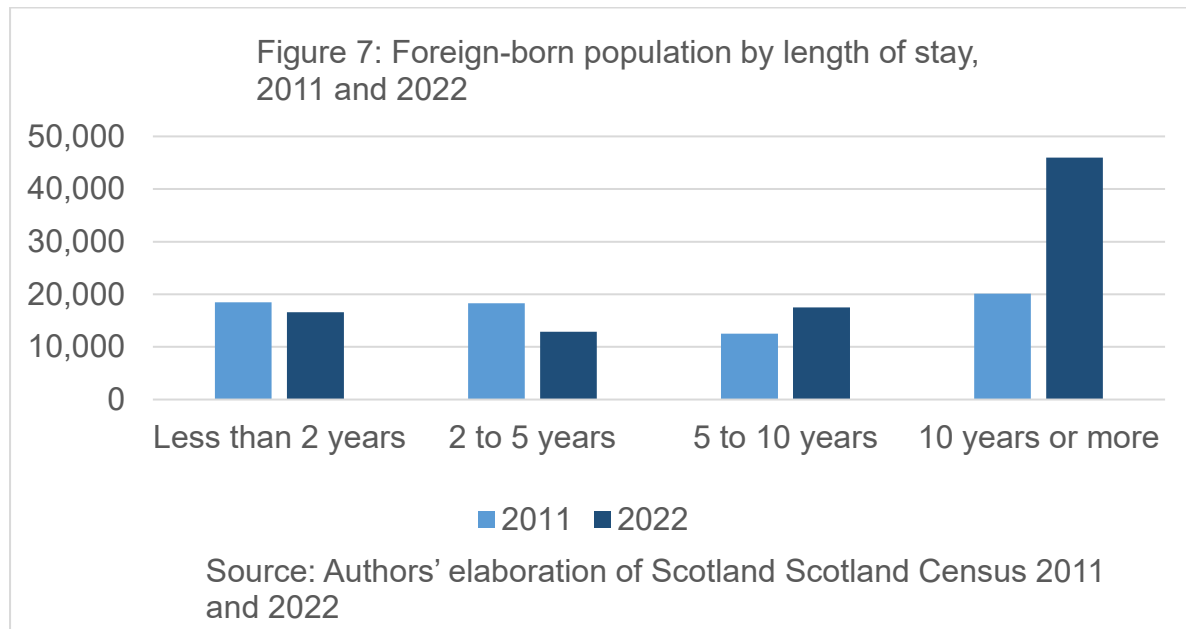
the graph), to that in 2022 (right side of the graph) by age-group and country of birth (UK, EU, Other), to illustrate the contribution made by foreign born residents to overall patterns of population change and ageing.



In both census years, the foreign-born population contributed positively to the size of the working age population. There are, however, two main differences between the two census years. In 2011, the foreign-born population was predominantly from non-EU countries and had a younger profile, with the largest contribution in the age group 20 to 34. In 2022, the non-EU population had reduced in size, while the EU-born population had grown. Moreover, the largest numbers of foreign-born residents were aged 30 to 44, partly reflecting the longer-term settlement of migrants already present in 2011. It is clear that the foreign-born population has contributed not only to the moderate population increase observed in the region between the two censuses, but also to slowing down demographic ageing and particularly by increasing the size of the working age population.

As well as coming from a variety of different countries and regions of the world, international migration is also characterised by a variety of temporalities, including short-term and seasonal labour migration (Jentsch et al., 2007), and longer-term

settlement (Flynn and Kay, 2017). Figure 7 illustrates the larger presence of more established migrants in North East Scotland in 2022 compared to 2011. The size of the foreign-born population who has been resident in the UK for more than 10 years doubled between the two censuses, while the numbers of newer arrivals (less than 2 years) remained more or less the same.



These complex mobilities raise important questions about how best to attract and retain local and incoming population (internal and international) and under what conditions (short-term vs long-term). Further, the issue of retention also raises questions about the attractiveness of place and whether both incoming and local workers are able to live in rural places because they want to live there (Pinilla and Sáez, 2021). These have been discussed at length in a variety of studies and previous reports of the EAG (2021, 2022, 2025) but not with a specific focus on the intersection between demographic concerns and the workforce needs of a transition to Net Zero.

### 5.2. Barriers and opportunities in attracting and retaining local and incoming workers for the green economy

Outmigration of young people impacts on rural populations both in terms of demographic balance and in relation to the availability of skills and labour, included those needed for the transition to a green economy. Patterns of outmigration amongst rural 17 to 21 year olds, whether temporary or longer term, are strongly

linked with entering higher education and as such can be a positive part of young people's transition into adulthood (Alexander, 2025). The question arises however as to whether opportunities for training and entry into 'green skills' based careers could provide jobs in rural places for both those who prefer not to leave, and those who leave for study but wish to return. In their review of rural education in the Glenkens, Dumfries and Galloway, Fisher and Morrison highlight the importance of "a significant rebalancing of schooling that does not just focus on learning to leave" (2024: 13) and call for the development of place-based education in rural places to provide young people not only with skills but also opportunities and choices to pursue their lives and careers locally. Pathways for young people into local jobs and enterprise created through training opportunities, including local apprenticeships or dedicated training initiatives can offer meaningful incentives for local young residents to stay.

Across Scotland, a range of apprenticeship programmes provide both local and incoming young people with valuable work experience and training opportunities (see also Section 3.2). The Rural Skills apprenticeship programme already demonstrates how these can be developed both as local, community-lead initiatives and adapted to focus on particular workforce needs dovetailing with regional demographic concerns. Co-ordinating the development and focus of such educational pathways and apprenticeships to meet a growing demand for green skills in sectors contributing to the transition to Net Zero would have a double benefit.

### **Rural skills apprenticeships – a model for a green skills apprenticeship**

'Galloway Rural Skills' was delivered by the Galloway Glens Landscape Partnership and funded by the National Lottery Heritage Fund Scotland between 2018-2023. This programme offered internships in 'green' jobs and work experience placements supporting conservation, restoration, and sustainable management in ecology, forestry and fisheries. The programme created 15 full-time, six-month paid roles over four years, hosted by a variety of local employers with 50% funding support. As a result, 9 of the 15 interns have continued to work within the sector in which they undertook their placement. <sup>29</sup>

---

<sup>29</sup> For more insight into this initiative see <https://www.youtube.com/watch?v=8flcjahexdU>

Housing has been identified as a key challenge in meeting the skills and workforce needs that are vital to attracting transformational investment in rural areas of Scotland.

With a need for more workers, the region will need more housing to accommodate the workers and where relevant, their families. However, housing availability in the Highlands and Islands is already challenging and ... private sector housing development tends to be concentrated in more urban or accessible rural parts of the region, due to factors such as higher construction costs, scarcity of appropriate land, and lack or required infrastructure.

(Highlands and Islands Enterprise, 2025: 14).

Partnership work between Green Jobs employers and developers, potentially coordinated by local authorities and considered as part of the social impact assessments of tenders, could offer avenues to support the refurbishment of existing housing stock or appropriate newly built homes to provide homes for key workers and meet the recruitment needs of employers.

### **Current initiatives addressing shortage of housing stock in rural places in Scotland**

The [Smart Clachan](#) model is an innovative model of housing development in rural Scotland. It refers to the traditional “clachan” (a small settlement or hamlet) but with modern, sustainable, community-led features aimed at offering affordable housing to the local population by providing affordable homes, often for rent, shared equity ownership, or plots for self-builders but also shared community spaces. The examples in Scotland include [Comrie Croft](#) and [Uist](#).

Other initiatives include the [Pamela Young Trust](#) in Glenkens that focus on bringing empty homes back to use to local population, with particular focus on supporting young people and families accessing suitable housing.

Transport is also noted as a critical infrastructure concern and a vital ‘enabler’ to allow transformational investment (Highlands and Islands Enterprise, 2025).

Transport within rural regions, including North East Scotland, is mainly dominated by privately owned cars, with limited provision of bus or rail services. Limited public

transport opportunities pose significant challenges for commuting, further exacerbating the spatial challenges of matching jobs to workers discussed in section 3.4. While transport links are crucial, the low population density in rural regions presents challenges to the provision of commercially sustainable public transport services. Improving transport infrastructure in rural areas requires substantial financial subsidies, and may need a co-ordinated approach between public and private funds. Current initiatives to develop on-demand transport in North East Scotland, including [A2B Dial a-Bus Service](#) and [M.Connect](#) Bus Service in Morray can be a good starting point in development of public transport infrastructure supporting greater mobility within the region.

As noted earlier in our report, the transition to a low carbon economy offers opportunities to diversify the workforce. Programmes aiming to attract and retain the required workforce for the green economy should also consider the need for improved gender balance and diversity within that workforce and this requires consideration of the need for services supporting family life, in particular available and accessible childcare and education services. Current evidence on childcare provision in rural areas in Scotland (Scottish Government, 2021) highlights the lack of flexibility and availability of childcare, limiting parents' ability to take up or continue employment.

**Initiatives to improve access to care services in rural Scotland:**

The [Single Care Model in Highlands](#) is new model of delivering care services that is designed to address particular challenges in relation to recruitment and retention of staff to offer care services across the ages. Such model can serve as an example of good practice in addressing particular challenges in delivering care provision in rural and island communities to support working parents and carers within these regions.

**5.3. Including mobile populations in a Just Transition at local community level**

Returning to the start of our discussion it seems likely that the workforce required for the transition to Net Zero will need a combination of both longer- and shorter-term labour mobility, whether international or from elsewhere in Scotland or the UK, as well as newly trained and retrained workers from within the existing resident population. Deliberate interventions will be needed to support newcomers to orient themselves, make connections, and avoid social or workplace isolation and

segregation and to maximise the benefits of increasing diversity to local communities.

The need to attract and actively recruit international migrants is often justified by labour shortages. With industries where the problem is of skills gaps rather than more generalised labour shortages, international migrant workers can be perceived as a necessary short-term measure (de Lima and Wright, 2009). Yet, immigration policies focused on control and reduction of net migration may fail properly to consider the mix of drivers that shape migration choices, and which in a situation of competition for labour make different countries and regions more or less attractive to potential mobile workers.

Existing evidence on labour migration to rural Scotland shows that drivers for immigration among labour migrants are not purely economic, but also depend on individual circumstances, and may include other factors like the desire to learn a language, study or improve the quality of life of individual family members (de Lima and Wright, 2009; Flynn and Kay, 2017). In addition, decisions regarding length of stay are frequently open-ended and dynamic (Pietka-Nykaza and McGhee, 2016). Understanding the varied motivations for and forms of mobility patterns (e.g. return, staying, outmigration) along with their fluid and open-ended character (e.g. long-term, short-term, seasonal) are important to ensure that appropriate interventions are developed to support all forms of mobility within an area or region.

Research on labour migration also shows that migration systems involve a diverse group of key actors. This includes labour market intermediaries, such as temporary staffing agencies, contractors, and recruitment agents (Findlay et al. 2012), as well as employers' practices and preferences (McCollum and Findlay 2015). Taken together these actors play a significant part in shaping, enabling, or constraining migration (Cranston et al. 2017). As noted in section 4.1.3 there is a need for policy interventions which recognise the specific contexts and constraints within which green skilled migration may take place and how these impact on the diverse actors involved.

A joined-up approach to shaping the mobility of the workforce required for a transition to Net Zero should include this diverse set of actors as active participants. They have a crucial role to play not only for the development of recruitment

strategies but also for advancing and implementing social inclusion policies and initiatives. The latter will need to be suited to a diverse mobile labour force, arriving from a variety of places of origin (including elsewhere in Scotland/UK) and with varied intentions and entitlements regarding length and conditions of stay.

As well as facing the same negative spiral effects of limited service accessibility in rural areas as the resident population (including housing, transport and education, and childcare), incoming populations, both internal and international, often face additional barriers that contribute to their social and economic exclusion. In rural areas with relatively few international migrants, dedicated services for these groups, are limited (Flynn and Kay, 2017) and wider public services may have little experience of supporting migrant service users (Jentsch et al., 2007; Kay and Price 2024).

Newer arrivals, especially those coming for more temporary periods of stay, may also have limited place-based social connections and thus limited access to the support systems provided through social and community networks (Pietka-Nykaza et al. 2025). This can be compounded if workforces are not well integrated and workers are clustered with specific migrant groups predominating in certain jobs or sectors. This was seen previously, where EU migration to rural Scotland often resulted in a high concentration of EU migrant workers in low-skilled and lower-paid rural employment (Jentsch et al., 2007).

Access to social networks and community relations plays an important role in enhancing quality of life in rural areas and building bridges and bonds between different parts of the population whether long-term resident, newly arrived, temporary or intending to remain. Efforts to retain and attract population to support a Just Transition, including the workforce needed for the green economy, must therefore also prioritise the strengthening and maintenance of social and community ties among diverse rural residents.

Such efforts should also ensure that rural communities are actively consulted and supported in building and maintaining relationships across different groups. The experience following the 2004 EU enlargement, when many rural communities across the UK faced challenges due to the rapid pace of change, manifesting in pressure on public services and increased community tensions, illustrates the need

for meaningful local engagement to design targeted and effective support measures. In Scotland, the Just Transition principles underline the importance of broad and inclusive engagement to foster and sustain social consensus. The Just Transition Commission has accordingly been tasked with ensuring meaningful engagement with those most directly affected by the transition.

## **Bringing rural communities together: the role of social infrastructure in rural places**

Rural areas are often characterised by a limited number of public spaces, meaning that residents frequently share and use the same places. Recent community studies in rural Scotland highlight the important role these key rural spaces play in fostering and maintaining community relationships, including:

- **Rural primary schools** for example, have been found to facilitate routine and regular contact between diverse school users (e.g. carers, pupils, and staff members of different backgrounds) over an extended period, thereby contributing to both developing and strengthening community relations Pietka-Nykaza and Baillot (2022).
- Dedicated and **locally-run community spaces** such as **community/village halls** are also important shared spaces of frequent use by diverse rural residents and often a central location for local services like health outreach programmes, clubs, and support groups, but also general social gatherings and celebrations (see [SRA](#), 2025). Joining dedicated community spaces, as indicated in the study of the Moray Firth area (Pietka-Nykaza and Baillot, 2022), can be a key strategy for the incoming population to “meet people” and get involved in community life. Activities offered in community/village halls can allow all rural residents to gather around particular interests, such as art classes, woodworking, and outdoor activities, while also responding to their immediate needs, including childcare, social isolation, or leisure.
- Local green places like **parks**, including **play parks** that are routinely used by pupils and their parents for play dates, picnics, and other social gatherings
- Local **high street shops** and **businesses** that provide important goods and services, but also are recognised as symbolic, local signature places that contribute to the identity of rural places (Pietka-Nykaza and Baillot, 2022).

Community-based and creative approaches to language learning can also act as social spaces bringing together newer and longer established groups. Initiatives in North East Scotland such as [Home-Home-Дом-Дом](#), the [Huntly Diversity and Language Group](#), [the Deveron Project](#), and the national [New Scots Refugee Integration Strategy](#), offer valuable models for expanding access to English classes and linking language learning to other forms of social integration.

Experiences of exclusion from public spaces can result from lack of access to information on what is going on locally as well as from perceptions of the community place or activity as being “not for us” (Pietka-Nykaza and Baillot, 2022). Evidence on EU migrant’s experience in rural Scotland illustrates that lack of engagement in social activities with local communities is also linked to factors such as long or irregular working hours (de Lima and Wright, 2009). These experiences of spatial exclusion relate not only to immigration statutes or ethnicity, but also to other intersecting factors, such as gender and age, meaning that not only the incoming population but also local young residents may feel left out (Shucksmith and Brown, 2016). Addressing such barriers, requires planning, investment and active outreach community strategies to ensure that diverse groups are aware of and feel ‘welcome’ in dedicated local places.

Increased co-ordination and coherence is required as well as long-term coherent strategies for linking relevant stakeholders in renewable energy and other parts of the low carbon economy to those concerned with rural development, including the communities themselves. The current lack of joined up thinking presents a particular challenge for Scotland, not least because immigration remains a reserved power of the UK Government, and so despite being an important lever that could support a just transition, as discussed in Chapter 4, its potential at present remains limited. Nonetheless, Scottish authorities have considerable power to shape community development and support new approaches to diversity and social cohesion and these need to be part of the conversation about meeting workforce needs for a transition to Net Zero.

# 6

## **Conclusions – Key considerations for policy**

## 6. Conclusions – key considerations for policy

The transition to Net Zero is an urgent and complex priority for Scotland. It presents a considerable workforce challenge that is further complicated by connections between environmental, social, economic and demographic factors. In what follows we present key considerations and options for government at multiple levels as well as other stakeholders. This is neither exhaustive nor at a level of detailed policy choices. Rather it sets out some parameters and principles to guide those choices in future.

- 1. Policies and interventions should aim to build a more inclusive, sustainable and diverse workforce.** This means that labour migration should sit alongside sustained investments in upskilling and reskilling local workforces. While immigration and related skills interventions can play important roles in the energy transition, investments in upskilling and reskilling local workforces, including people displaced from obsolete roles, will be critical, as will efforts to promote decent pay and working conditions to better attract and retain local workers. The UK Government has taken a number of steps already to demonstrate their commitment to supporting the energy transition in Scotland,<sup>30</sup> and in October 2025, the announcement to create 400,000 jobs through a UK green energy plan was particularly welcome in its focus on training those coming from fossil fuel jobs, school leavers, the unemployed, veterans and ex-offenders.<sup>31</sup> Within such an inclusive approach international labour migration should be treated not as a knee-jerk response to shortages, as it often has been in other sectors, but instead part of a considered and evidence-based assessment of sectoral needs, skills gaps, and of the capacity to meet those through sustainable workforce development. Intergovernmental consultation should remain an important part of this process. Arguably, the Scottish Government may wish to focus efforts and resource on how to upskill, reskill, or ‘activate’ local workforces given that immigration remains

---

<sup>30</sup> For example, setting up *Great British Energy* in Aberdeen, a publicly owned company which will drive the clean energy transition; establishing the skills passports, in collaboration with the Scottish Government, to help people get into the clean energy workforce by showing their relevant skills; and committing to the *Acorn* carbon capture and storage project in Aberdeenshire.

<sup>31</sup> [Clean energy jobs boom to bring thousands of new jobs - GOV.UK](#)

a reserved power of the UK Parliament, and thus a limited policy lever for devolved nations.

2. **Bilateral partnerships with other countries offer important potential to increase the international skills base and fill the domestic shortfall in labour.** Power to establish such partnerships also lies with the UK government, however Scottish government may wish to make proposals and use existing relationships to encourage further exploration of such possibilities. The UK Industrial Strategy recognises that “changes to the skills system will take time to come to fruition,” and that in the meantime there will be a domestic shortfall.<sup>32</sup> Investments in training, and retraining even where sufficient, will take time to pay off and sourcing domestic workers could be challenging. Given this, the UK Government should consider bilateral partnerships in line with other countries that are already doing so or seeking to do so. Global competition for skilled workers is rising. Historically, the UK has recruited from countries like India, Pakistan and Philippines for roles relevant to the green transition (engineers, roofers, electricians etc), so the foundations of potential partnerships are there.
3. **Greater coherence across policy areas including immigration policy, climate and energy policy, workforce development, and skills investment is urgently required.** The clean energy industries are identified by the government as being one of the eight growth-driving sectors of the industrial strategy,<sup>33</sup> and yet the 2025 Immigration White paper proposed a number of measures (including an increase in the salary threshold) which would make it harder to recruit migrant labour into occupations relevant to the green transition, such as roofers and welders. Shortly after the publication of the White paper, the Industrial Strategy acknowledged that changes to the skills system are likely to take time and so shortage occupations key to the ‘IS-8’ set of sectors, prioritised by the strategy (such as welders), are to be temporarily exempted from the planned increase to the pay threshold of the Skilled Worker visa. The Government then rowed back on aspects of the White Paper and, in July, announced a new temporary shortage list that included many roles relevant to green skills (which the MAC are to review in Spring 2026). They have also announced the Clean Energy Jobs Plan.<sup>34</sup> This

---

<sup>32</sup> [The UK's Modern Industrial Strategy](#)

<sup>33</sup> [Invest 2035: the UK's modern industrial strategy - GOV.UK](#)

<sup>34</sup> [Clean energy jobs boom to bring thousands of new jobs - GOV.UK](#)

kind of incoherence and instability does not bode well for workforce planning or future investments in this area by training organisations and employers.

Uncertainty around energy policy and in the skills system exacerbates workforce planning issues because developers and their supply chains need certainty around project pipelines in order to facilitate investment in workforce planning, development and training.

**4. There is also a need to strengthen intergovernmental co-ordination and joint working at all levels to support effective and strategic regional planning.**

A long-term, strategic approach should include climate and energy policymakers, devolved nations, national and regional training providers and agencies, trade unions, industry and community representatives.

It is at the level of regions and local authorities that skills, labour, and sectoral needs will vary, and where skills and workforce interventions will have most impact. Hence, it makes sense to move away from a centralised and often disjointed approach (energy governance and immigration remains at the national level, while impacts are felt more locally), to cooperating more on joint initiatives with regions and devolved nations. This will ensure that labour and skills interventions are targeted and beneficial to the local communities in which they are situated, potentially levelling up parts of the country that have historically seen low levels of investment in skills and training.

For Scotland, work is already underway in the form of regional transition plans and the expansion of shared ownership of renewable energy developments. The recent announcement from both the Scottish and UK Governments to contribute up to £18 million (up to £9 million each) to the expansion and extension of the Oil and Gas Transition Training Fund is an example of how national policy can support such developments.<sup>35</sup> The collaboration between the two governments on Skills Passports is another.

**5. There is a need for longer term, coherent strategies for linking renewable energy and rural development.**

Although rural areas in Scotland are rich in natural assets, they continue to face persistent challenges such as depopulation, the outmigration of young people,

---

<sup>35</sup> [Pilot to support oil and gas workers in the North East - gov.scot](https://www.gov.scot/news/2022/05/2022-05-10-uk-scotland-agree-oil-and-gas-transition-training-fund/)

limited housing, and declining service provision. These pressures undermine opportunities for inclusive and sustainable growth. Addressing them requires an integrated, holistic, and place-based approach that recognises local natural assets, identifies skills and infrastructure gaps, and prioritises partnership working to tackle the demographic and economic issues facing rural regions. This can be achieved through formal place-based partnerships between communities, local authorities, and renewable energy developers, supported by policies that channel renewable energy revenues into long-term local development. Such an approach can provide stable funding for rural regeneration, supporting training, employment, housing, and transport needs, while strengthening local support and overall project coherence.

In areas which have also seen a historic lack of investment in skills training, cooperation from across different regions may help to access the necessary technical skills and the numbers of people required for the development of green jobs in that area. This may, in turn, necessitate a degree of internal labour mobility within or between regions, which in itself is not unproblematic given that not all green jobs, and the areas in which they are situated, will be attractive enough to warrant such mobility. The infrastructure of these areas, such as transport, housing, and public services, may also not have the capacity to cope with in-migration.

To help alleviate regional disparities, governments could direct investment to those geographical areas which are most adversely affected by skills gaps; whilst also providing subsidies to support the migration of jobs into those areas. This would create opportunities for all regions to participate in the energy transition, and some of this work is already being addressed through the Regional Transition Plans. However, there remain questions around how to best support rural economic development in this regard, and how to embed renewable energy projects within these contexts. As the Just Transition Commission has pointed out, what counts as ‘success’ in this regard will vary between different areas, depending on needs, demography, industry and local labour markets.<sup>36</sup>

## **6. While Scotland has limited scope on immigration, its position as an international leader of the Just Transition Movement puts it in a strong**

---

<sup>36</sup> [Measuring and Evaluating Success in the Scottish Just Transition – Just Transition Commission](#)

**position to proactively tackle labour market exclusion and build a diverse workforce.** The transition to cleaner energy across EU countries has been largely characterised by ad hoc plans and strategies, mostly by organisations in sectors strongly affected by the transition to cleaner energy.<sup>37</sup> These have mostly happened organically and in response to regional or sectoral skills needs, mostly because of weak connections between policy areas such as energy, environment, skills and immigration – a problem which is not unique to the UK. While Scotland has not been immune to the effects of this, its commitment and approach to a Just Transition has been far more intentional in many respects. As well as the £500 million Just Transition Fund, the Just Transition Commission has gone beyond academic research and principles to develop a practical, people-and-placed-based approach to a Just Transition, including evaluation and monitoring.<sup>38</sup>

Very little of this concrete work has been carried out anywhere else in the world with regard to Just Transition, and so it presents an opportunity for Scotland to test, innovate, and build on promising practise where it can.<sup>39</sup> The Just Transition Commission has already started to publish case studies of projects and initiatives across Scotland which are making a positive contribution across a range of transition challenges, including to what community benefit looks like in different areas of Scotland.<sup>40</sup> This work will be important in providing a fine-grain, localised picture of what labour market exclusion looks like from area to area, and flowing from that, what tailored responses can be implemented to build more inclusive, diverse, and sustainable workforces.

---

<sup>37</sup> [Skills for green jobs: 2018 update](#)

<sup>38</sup> [Measuring and Evaluating Success in the Scottish Just Transition – Just Transition Commission](#)

<sup>39</sup> [Ibid.](#)

<sup>40</sup> [Case Studies Map – Just Transition Commission](#)

# References

## References

- Alexander, R. (2025) Higher Education, Place, and Career Development Learning from Rural and Island Students, London: Routledge
- Apostel, A. and Barslund, M. (2024). "Measuring and Characterising Green Jobs : A Literature Review." *Energy Research and Social Science*, vol. 111.
- Azzopardi, D., Fareed, F., Hermansen, M., Lenain, P., & Sutherland, D. (2020). The decline in labour mobility in the United States: Insights from new administrative data (OECD Economics Department Working Paper No. 1644). Paris: OECD Publishing. <https://doi.org/10.1787/9af7f956-en>
- Cedefop (2018), Skills for green jobs in Denmark: an update. Read in full here: [denmark\\_green\\_jobs\\_2018.pdf](#) (last accessed November 2025).
- Callejo-González, J. and Ruiz-Herrero, J. (2024) Factors influencing the decision of young adults to remain in their rural environment: Social origin, education and gender, *Journal of Rural Studies*, 106.
- Cranston, S., Schapendonk, J., and Spaan, E. (2017). New directions in exploring the migration industries: introduction to special issue. *Journal of Ethnic and Migration Studies*, 44(4), 543–557
- Cerimelo, M., de la Vega, P., Porto, N., & Vazquez, F. (2024). Beyond traditional wage premium: An analysis of wage greenium in Latin America (CEDLAS Working Paper No. 325). Centro de Estudios Distributivos, Laborales y Sociales (CEDLAS), Universidad Nacional de La Plata. Available at: <https://www.cedlas.econo.unlp.edu.ar/wp/en/no-325/>
- Cedefop (2018), Skills for green jobs in the United Kingdom: an update. [Skills for green jobs: an update](#) (last accessed November 2025).
- Climate Change Committee. (2023). A Net Zero workforce. May 2023 report. Available at: <https://www.theccc.org.uk/wp-content/uploads/2023/05/CCC-A-Net-Zero-Workforce-Web.pdf>

Crowhurst, M. and Taylor, A. (2023). Generation Green Jobs? Exploring young people's readiness for the Net Zero skills revolution. Public First; The Prince's Trust.

Curits, M. and Marinescu, I. (2023). Green Energy Jobs in the United States: What Are They, and Where Are They? Environmental and Energy Policy and the Economy 4. pp 202-237.

De Lima, P., and Wright, S. (2009). Welcoming Migrants? Migrant labour in rural Scotland. Social Policy and Society, 8 (03), 391- 404.

<https://doi.org/10.1017/S1474746409004941>

Department for Energy Security and Net Zero. (2025), Press Release: Clean energy jobs boom to bring thousands of new jobs. [Clean energy jobs boom to bring thousands of new jobs](#) (last accessed November 2025).

Engineering Construction Industry Training Board. (2021). Workforce Census 2021: Oil & Gas

Energy and Utility Skills. (2024), Workforce Demand Estimates – 2024 – 2030. The Energy and Utilities Sector. Available at: [Energy-Utilities-Workforce-Demand-Estimates-2024-30-Summary-v5\\_Cover-added.pdf](#) (last accessed November 2025).

Equinor UK Ltd. (2025), Written Evidence Submitted to the Energy Security and Net Zero Enquiry into workforce planning to deliver clean, secure energy: [Written evidence submitted by Equinor UK Ltd](#) (last accessed November 2025).

Ernst and Young. (2023). Just Transition Review of the Energy Sector. Chapter 3 – Just Transition Scenarios Analysis. Available at: <https://www.energy-system-and-just-transition-independent-analysis.co.uk/chapter3.pdf>

Expert Advisory Group on Migration and Population. (2025). [Rural Scotland - trajectories of young people and young adults](#).

Expert Advisory Group on Migration and Population. (2022). [Place-based policy approaches to population challenges: lessons for Scotland](#).

Expert Advisory Group on Migration and Population. (2021). [Designing a pilot remote and rural migration scheme: analysis and policy options](#).

Findlay, A. King, R., Smith, F.M., Geddes A. and Skeldon, R. (2012) World class? An investigation of globalisation, difference and international student mobility, Transactions of the Institute of British Geographers, 37 (1), 118-131

Fisher, T. and Morrison, T. (2024) A review of rural education in Glenkens, Available at:

[https://www.glenkenstrust.org.uk/files/ugd/a7a70d\\_2ee30634904f417b859165ef9ae3b5bc.pdf](https://www.glenkenstrust.org.uk/files/ugd/a7a70d_2ee30634904f417b859165ef9ae3b5bc.pdf)

Flynn, M. and Kay, R. (2017) Migrants' experiences of material and emotional security in rural Scotland: Implications for longer-term settlement, Journal of Rural Studies, 52, Pages 56-65

Friends of the Earth Scotland. (2023). Establish universal rights and a wage floor across the UKCS [Demand Briefing Paper]. Retrieved from <https://foe.scot/wp-content/uploads/2023/03/Demand-Briefing-6-Our-Power-FINAL.pdf>

Gravelle, M. (2023, Nov 14). Offshore wind workers 'deterred by UK's visa requirements'. Pinsent Masons / Out-Law. Retrieved from [Offshore wind workers 'deterred by UK's visa requirements](#)

Greenspon, J. and Raimi, D. (2024). Matching geographies and job skills in the energy transition. Extractive Industries and Society, 17, 101397.

Hanson, G. H. (2023). Local labour market impacts of the energy transition: Prospects and policies (NBER Working Paper No. 30871). National Bureau of Economic Research. Available at: <https://doi.org/10.3386/w30871>

Highlands and Islands Enterprise (2025) 'Regional Transformational Opportunities in the Highlands and Islands, Executive Summary. Available at:

<https://www.hie.co.uk/media/dxnkmq0/regional-transformational-opportunities-in-the-highlands-and-islands-executive-summary-may-2025.pdf>

Huckstep, S and Dempster, H. (2024). Meeting Skill Needs for the Global Green Transition: A Role for Labour Migration? CGD Policy Paper 318. Washington, DC: Center for Global Development. Available at: <https://www.cgdev.org/publication/meeting-skill-needs-global-green-transition-role-labour-migration>

Hooper, K, and Huang, L. 2024. The Role of Immigrant Workers in the Green Transition. Migration Policy Institute.

Improvement Service. (2024). 'Navigating demographic change. How local government is responding to Scotland's changing population'. Available at: [https://www.improvementservice.org.uk/\\_data/assets/pdf\\_file/0017/54143/Navigating-Demographic-Change.pdf](https://www.improvementservice.org.uk/_data/assets/pdf_file/0017/54143/Navigating-Demographic-Change.pdf)

Improvement Service. (2025). Navigating Population Changes. Improvement Service.

Institution of Mechanical Engineers (2025), Written Evidence Submitted to the Energy Security and Net Zero Enquiry into workforce planning to deliver clean, secure energy: [Written evidence submitted by the Institution of Mechanical Engineers \(WFP0082\)](#) (last accessed November 2025).

Jackman M, Moore W (2021), "Does it pay to be green? An exploratory analysis of wage differentials between green and non-green industries". Journal of Economics and Development, Vol. 23 No. 3 pp. 284–29.

Jentsch, B., De Lima, P., Macdonald, B. (2007) Migrant Workers in Rural Scotland: "Going to the Middle of Nowhere" International Journal on Multicultural Societies, 9 (1) 35-53.

Just Transition Commission (2024), Measuring and Evaluating Success in the Scottish Just Transition. Available at: <https://www.justtransition.scot/wp-content/uploads/2025/03/Measuring-and-evaluating-success-in-the-Scottish-Just-Transition-March-2025.pdf> (last accessed November 2025).

Just Transition Commission. (2025). A Just Transition for Aberdeen and the North East. Available at: <https://www.justtransition.scot/wp-content/uploads/2025/05/A-Just-Transition-for-Aberdeen-and-the-North-East-web.pdf>

Kay, R and Price L (2024) Open the Door Migrants Facing Financial Disadvantage and their Needs for Support, Migration Policy Scotland, Available at: <https://migrationpolicyscotland.org.uk/wp-content/uploads/2024/10/Open-the-Door-Findings-Report-CORRECTED.pdf>

Kuai, W., Elliott, R. J. R., Okubo, T., & Ozgen, C. (2025). Estimating the green wage premium (IZA Discussion Paper No. 17878). Institute of Labor Economics (IZA). [EconStor: Estimating the Green Wage Premium](#)

Kumar, Claire, Sam Alvis, and Arpana Giritharan. (2023). Decarbonising the UK's Building Stock: Can Immigration Policy Help Solve Workforce Challenges? London: ODI. <https://odi.org/en/publications/decarbonising-the-uks-building-stock-can-immigration-policy-help-solve-workforce-challenges/>.

Manning, A. (2025) Why the social care visa had to go. LSE blog available at: <https://blogs.lse.ac.uk/politicsandpolicy/why-the-social-care-visa-had-to-go/>

McCollum, D., and Findlay, A. (2015). 'Flexible' workers for 'flexible' jobs? The labour market function of A8 migrant labour in the UK. *Work, Employment and Society*, 29(3), 427-443.

Mehta, A. (2024). How a skills gap threatens to blow UK's energy transition off course. Available at: <https://www.reuters.com/sustainability/how-skills-gap-threatens-blow-uks-energy-transition-off-course-2024-10-31/>

Merson, A. Jobs 'pay cut' warning in switch from oil and gas to renewables. *The Press and Journal*. Available at: [https://www.pressandjournal.co.uk/fp/politics/scottish-politics/6259296/pay-cuts-oil-and-gas-renewables/?utm\\_source=chatgpt.com](https://www.pressandjournal.co.uk/fp/politics/scottish-politics/6259296/pay-cuts-oil-and-gas-renewables/?utm_source=chatgpt.com)

Migration Advisory Committee (2025) Temporary Shortage List: Stage 1 Report. Available at: <https://www.gov.uk/government/publications/temporary-shortage-list-stage-1-report>

Migration Partnership Facility (MPF). (2024). (E)Co-development for innovation and employment in green and circular economy between Andalusia and Morocco (MOVE\_GREEN):

[Co-development for innovation and employment in green and circular economy between Andalusia and Morocco \(MOVE\\_GREEN\)](#) (last accessed November 2025).

National Grid. (2020). Press Release: Hundreds of thousands of people needed to power UK's net zero energy commitment. Available at: <https://www.nationalgrid.com/responsibility-and-sustainability/net-zero-energy-workforce/media-information>

National Grid (2020) Building the Net Zero Energy Workforce. London: National Grid. Available at: <https://www.nationalgrid.com/document/126256/download>

National Grid (2025), Written Evidence Submitted to the Energy Security and Net Zero Enquiry into workforce planning to deliver clean, secure energy: [Written evidence submitted by the National Grid](#) (last accessed November 2025).

National Records of Scotland (2025) Subnational Population Projections: 2022-based. Edinburgh: National Records of Scotland.

Offshore Energies UK. (2023). Economic Report 2023. Offshore Energies UK.

Office for National Statistics. (2021). The challenges of defining a "green job".

Available at:

<https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/thechallengesofdefiningagreenjob>.

Office for National Statistics. (2025). Developing estimates of green jobs in the UK.

Available at:

<https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/experimentalestimatesofgreenjobsuk/july2025>

Organisation for Economic Co-operation and Development. (2023). Education at a glance 2023: OECD indicators. OECD Publishing. Available at:

<https://www.oecd.org/education/education%E2%80%91at%E2%80%91a%E2%80%91glance%E2%80%9119991487.htm>

Oxford Economics. (2021) UK green growth index. Oxford: Oxford Economics.

Pinilla, V. and Sáez L. A. (2021). What Do Public Policies Teach us About Rural Depopulation: The Case Study of Spain, *European Countryside*, Sciendo, 13(2), pages 330-351.

Pietka-Nykaza (2024) Social Relations Among Diverse Rural Residents in the Scottish Highlands, *Social Inclusion*, 12, [Social Relations Among Diverse Rural Residents in the Scottish Highlands](#)

Pietka-Nykaza E., Fisher, T. and Morrison, T (2025), Theme 2: Communities and Depopulation, report commissioned by Dumfries and Galloway Council

Pietka-Nykaza, E. and Baillot, H (2022) "This is my place now" A summary report of the Rural Living Project. Available at:

[https://www.rurallivingscotland.com/uploads/1/4/1/6/141638142/rural\\_living\\_project\\_40pp\\_230622\\_proofv3.pdf](https://www.rurallivingscotland.com/uploads/1/4/1/6/141638142/rural_living_project_40pp_230622_proofv3.pdf)

Pietka-Nykaza, E., and McGhee, D. (2016). EU post-accession Polish migrants trajectories and their settlement practices in Scotland. *Journal of Ethnic and Migration Studies*, 43(9), 1417–1433.

Phillips, D. Waters, T. and Wernham, T. (2023). 'Employment, earnings and incomes in Scotland'. London: Institute for Fiscal Studies. Available at:

<https://ifs.org.uk/publications/employment-earnings-and-incomes-scotland>

PwC. (2022). The Energy Transition and Jobs: Can people transition to new green jobs? London: PwC. Available at: [https://www.pwc.co.uk/who-we-are/our-](https://www.pwc.co.uk/who-we-are/our-purpose/building-trust-in-the-climate-transition/supporting-a-fair-transition/the-energy-transition-and-jobs.html)

[purpose/building-trust-in-the-climate-transition/supporting-a-fair-transition/the-energy-transition-and-jobs.html](https://www.pwc.co.uk/who-we-are/our-purpose/building-trust-in-the-climate-transition/supporting-a-fair-transition/the-energy-transition-and-jobs.html)

PwC. Green Jobs Barometer. Available at:

<https://www.pwc.co.uk/services/sustainability-climate-change/insights/green-jobs-barometer.html>

Robert Gordon University. (2022). 'Making the switch: The future shape of the offshore energy workforce in the North-East of Scotland'. Available at:

<https://www.rgu.ac.uk/wp-content/uploads/2022/06/Making-the-switch-images.pdf>

Robert Gordon University. (2023). 'Powering up the Workforce' review. Available at:

<https://www.rgu.ac.uk/wp-content/uploads/2023/09/powering-up-the-workforce.pdf>

Robert Gordon University (2025) 'STRIKING THE BALANCE Building a sustainable UK offshore energy workforce' Available at: [https://www.rgu.ac.uk/wp-](https://www.rgu.ac.uk/wp-content/uploads/2025/06/RGU_ETI_Report_2025.pdf)

[content/uploads/2025/06/RGU\\_ETI\\_Report\\_2025.pdf](https://www.rgu.ac.uk/wp-content/uploads/2025/06/RGU_ETI_Report_2025.pdf)

Rubio, J. Warhurst, C. and Anderson, P. (2022). *Green Jobs in Scotland : An Inclusive Approach to Definition and Analysis*. Skills Development Scotland, Glasgow. Available at:

[https://www.skillsdevelopmentscotland.co.uk/media/q2lhq1v5/green-jobs-in-scotland-report\\_final-4.pdf](https://www.skillsdevelopmentscotland.co.uk/media/q2lhq1v5/green-jobs-in-scotland-report_final-4.pdf)

Sato, M., Cass, L., Saussay, A., Vona, F., Mercer, L., and O’Kane, L. (2023). *Skills and wage gaps in the low-carbon transition: comparing job vacancy data from the US and UK*. London: Grantham Research Institute on Climate Change and the Environment and the Centre for Climate Change Economics and Policy.

Scottish Government. (2025). UK Immigration White Paper 2025: Scottish Government proposals. Retrieved from <https://www.gov.scot/publications/uk-immigration-white-paper-2025-scottish-government-proposals/>

Scottish Government. (2024). Supporting and enabling sustainable communities: an action plan to address depopulation. Retrieved from: <https://www.gov.scot/publications/supporting-enabling-sustainable-communities-action-plan-address-depopulation/>

Scottish Development International. (2021). How Scotland will deliver renewable energy skills for a sustainable future. Available at: <https://www.sdi.co.uk/news/how-scotland-will-deliver-renewable-energy-skills-for-a-sustainable-future>

Scottish Government. (2021). The challenges of rural childcare provision, innovative models and the needs of agricultural families, Social Research Series. Retrieved from: <https://www.gov.scot/publications/challenges-rural-childcare-provision-innovative-models-needs-agricultural-families/>

Scottish Government (2021). A Scotland for the future: opportunities and challenges of Scotland's changing population. Retrieved from: <https://www.gov.scot/publications/scotland-future-opportunities-challenges-scotlands-changing-population/>

Scottish Power (2025), Written Evidence Submitted to the Energy Security and Net Zero Enquiry into workforce planning to deliver clean, secure energy: [Written evidence submitted by Scottish Power](#) (last accessed November 2025).

Shucksmith, M. and Brown L. (2016) ed. International Handbook of rural studies, Routledge.

Skills Development Scotland. (2021). Climate Emergency Skills Action Plan 2020-2025. Available at: <https://www.skillsdevelopmentscotland.co.uk/media/w0ulewun/climate-emergency-skills-action-plan-2020-2025.pdf#:~:text=The%20CESAP%20sets%20out%20a,by%20the%20end%20of%202023.>

Skills Development Scotland (2023). £90 Billion of Investment in Green Industries Signals Need for Net Zero Skills. Available at:

<https://www.skillsdevelopmentscotland.co.uk/news-events/2023/november/90-billion-of-investment-in-green-industries-signals-need-for-net-zero-skills>

Skills Development Scotland. (2024). Sectoral Skills Assessment. Energy. October 2024. Available at:

<https://www.skillsdevelopmentscotland.co.uk/media/yijj12it/sectoral-skills-assessment-energy.pdf>

Springford, J. (2025) Reconciling UK migration policy with migration policy with the energy transition the energy transition, Centre for European Reform.

Available at: <https://www.cer.eu/publications/archive/policy-brief/2025/reconciling-uk-migration-policy-energy-transition>

UK Government. (2024). 'Clean Power 2030 Action Plan: A new era of clean electricity'. Available at:

<https://assets.publishing.service.gov.uk/media/675b3171348e10a16975a422/clean-power-2030-clean-energy-skills-assessment-annex.pdf>

UK Government (2025). Clean Energy Jobs Plan. Available at:

<https://www.gov.uk/government/publications/clean-energy-jobs-plan/clean-energy-jobs-plan-html>

UK Government (2025), The UK's Modern Industrial Strategy. Available

at: [https://assets.publishing.service.gov.uk/media/68595e56db8e139f95652dc6/industrial\\_strategy\\_policy\\_paper.pdf](https://assets.publishing.service.gov.uk/media/68595e56db8e139f95652dc6/industrial_strategy_policy_paper.pdf) (last accessed November 2025).

UK Energy Research Centre (UKERC). (2025). Jobs, skills and regional implications of the low carbon residential heat transition in the UK. Available at:

[https://ukerc.ac.uk/publications/jobs-skills-and-regional-implications-of-the-low-carbon-residential-heat-transition-in-the-uk/?utm\\_source=chatgpt.com](https://ukerc.ac.uk/publications/jobs-skills-and-regional-implications-of-the-low-carbon-residential-heat-transition-in-the-uk/?utm_source=chatgpt.com)

UK Parliament (2025), Written evidence submitted by SSE plc (WFP0089). Available at: <https://committees.parliament.uk/writtenevidence/134198/pdf/>

Valero A, Li J, Muller S, Riom C, Nguyen-Tien V, & Draca M. (2021). Are 'green' jobs good jobs? How lessons from the experience to-date can inform labour market transitions of the future. London: Grantham Research Institute on Climate Change and the Environment and Centre for Economic Performance, London School of Economics and Political Science.

Valero A. (2024) Net Zero and the Labour Market: Evidence from the UK. LSE Public Policy Review. 3(2): 9, pp. 1–11. DOI: <https://doi.org/10.31389/lseprr.97>

Vuin,A. and Atterton, J. (2023) Rural Housing (Policy Spotlight),  
<https://doi.org/10.6084/m9.figshare.24057414>

Wu, H, Liu, J., Hu, X, He, G. , Zhou,J, Wang, X, Liu, Y, Ma, J and Tao S,  
Fewer than 15% of coal power plant workers in China can easily shift to green jobs  
by 2060, One Earth, Volume 7, Issue 11, 2024, Pages 1994-2007,  
ISSN 2590-3322, Read full: <https://doi.org/10.1016/j.oneear.2024.10.006>.

Zemanik, M. (2023). Putting people professionals on the road to net zero. Chartered  
Institute of Personnel and Development. Available at:  
[https://www.cipd.org/globalassets/media/knowledge/knowledge-hub/reports/putting-people-professionals-road-net-zero\\_tcm18-114454.pdf](https://www.cipd.org/globalassets/media/knowledge/knowledge-hub/reports/putting-people-professionals-road-net-zero_tcm18-114454.pdf)



Scottish Government  
Riaghaltas na h-Alba

© Crown copyright 2026



This publication is licensed under the terms of the Open Government Licence v3.0 except where otherwise stated. To view this licence, visit [nationalarchives.gov.uk/doc/open-government-licence/version/3](https://nationalarchives.gov.uk/doc/open-government-licence/version/3) or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or email: [psi@nationalarchives.gsi.gov.uk](mailto:psi@nationalarchives.gsi.gov.uk).

Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

This publication is available at [www.gov.scot](http://www.gov.scot)

Any enquiries regarding this publication should be sent to us at  
The Scottish Government  
St Andrew's House  
Edinburgh  
EH1 3DG

ISBN: 978-1-80643-698-9 (web only)

Published by The Scottish Government, January 2026

Produced for The Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA  
PPDAS1674166 (01/26)

W W W . g o v . s c o t