

The Energy Transition and Jobs

Can people transition to new green jobs?

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pwc

Introduction and key messages

This paper investigates how the decarbonisation of the UK economy will affect the energy labour market, with a focus on the evolution and transition of sunset jobs¹ into opportunities in renewables and nuclear power.

There is a perception that jobs in the parts of the UK energy sector not linked to renewable, nuclear or low carbon power generation will decline abruptly due to our obligations under international climate law and Net Zero commitments. Such perceptions are influenced by the scars left from the employment losses after the collapse of the mining industry. Whilst this risk is ever present, our analysis provides some positive news. Ambitious targets set to meet net zero by 2050, the subsequent investment into the green economy and the high transferability of skills towards jobs in cleaner energy sub sectors indicate that net employment losses can be avoided.

However, ensuring people can be reskilled into new roles to meet the growing demand represents a challenge, particularly given that one fifth of people currently working in the energy sector are set to retire by 2030², taking their expertise with them.

The stark overriding message from our analysis is that **increases in renewable, nuclear or low carbon energy generation will be constrained by a significant shortage of skilled labour which cannot be addressed from the existing UK energy sector workforce alone despite its high skills transferability.** The implication of this finding is that a successful transition to net zero is dependent upon government and industry action to facilitate widespread reskilling of the current and future workforces.

Our research which includes consultation with key UK energy sector stakeholders across oil & gas, renewables and nuclear power, reveals the following **key findings**:

- 1 There is a growing demand for green skills within the energy labour force:** within the electricity and gas sector, the percentage of green job advertisements grew from 21.1% to 24.6%³, which was the greatest of any sector in the same period.
- 2 Minimal net job losses until after 2030:** In-sector skills demand for additional jobs to be created in offshore wind (41,000 by 2026) and nuclear (40,000 by 2030) means that net job losses in the energy sector are set to be minimal and may not be realised until after 2030.
- 3 The energy sector has a workforce with high skills transferability:** High transferability of skills within the energy sector and the 'greening' of existing roles will make moving between oil & gas and green energy projects highly feasible. As much as 90% of the Oil & Gas workforce would have transferable skills.
- 4 There is a significant skills gap in the UK. It cannot be addressed from the existing energy workforce alone:** Given the scale of demand and the one in five workers in the sector retiring by 2030, the UK faces a significant green skills gap, needing 41,000 people to create a Net Zero Energy Workforce. Without government intervention, there will be an insufficient supply of the skills needed to meet the UK's impending decarbonisation targets.
- 5 The re/upskilling of the workforce needs to accelerate now in order to fill the green skills gap in time to meet net zero by 2050.** Challenges arise in ensuring that workers are sufficiently reskilled into new roles and that the demand for skills are met, particularly given a lack of coherent labour force planning, a lack of engagement with educational institutions and negative perceptions of the energy sector amongst young people.
- 6 Intervention is needed for the transition to net zero to be a 'just transition'.** The majority of early jobs created by the transition to net zero will be highly skilled technical roles, coupled with the fact that women and ethnic minorities are traditionally underrepresented in the energy industry, there is a risk that the transition to net zero may not be a 'just transition'.
- 7 The government and private business are both responsible for achieving net zero.** Each must therefore do more to facilitate the transition, through clearer signalling on the future renewables and nuclear landscape and increased investment into reskilling the current and future energy workforce.

¹ Those jobs that will become redundant following the transition to the green economy

² National Grid (2020) Building the Net Zero Energy Workforce <https://www.nationalgrid.com/stories/journey-to-net-zero/net-zero-energy-workforce>

³ Q3 2020 – Q2 2021 (21.1%) to Q1 2021 – Q4 2021 (24.6%). Source: data from the Green Jobs Barometer, collected by Geek Talent

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1. The UK's race to decarbonise

In a global effort to combat the effects of climate change under the Paris agreement, the UK has set legally binding commitments to decarbonise across the economy. Furthermore, changes to the global energy supply chain brought about by current geopolitical events have sparked efforts to create a resilient energy system.

Decarbonisation of the energy sector represents the first wave in the race to decarbonise, prior to electrification of the transport system and other hard to abate parts of the economy. Whilst good progress has been made in the investment of clean energy, such as power generation, there is still a way to go to meet the impending targets.

The energy sector is undergoing a significant transformation as it grapples with energy security and transitions towards renewable energy, underpinned by ambitions to reach net zero by 2050. The government has committed to reduce emissions by 78% by 2035 compared to 1990 levels, which includes decarbonising the electricity system by 2035⁴.

The UK has positioned itself as a forerunner in setting climate change targets both in terms of speed⁵ and scope⁶. By comparison, the United States has set a target of a 50% reduction in emissions from 2005 levels by 2030 and Germany is set to reach net zero by 2045.

The UK government's Net Zero Strategy provides the foundations for this transition, in which £26 billion of government capital investment has been mobilised as of 2021 to reduce emissions and fuel a green economy. Specific targets have been defined in subsequent plans (Box 1).

The path to the delivery of these commitments is set out in a series of Sector Deals (Box 2). These sectors have set their own objectives and a common denominator is the need to facilitate job transitions, in a fair and inclusive way. For instance, the North Sea Transition Deal brings together both the oil and gas sector and the UK government, in a commitment to work collectively to leverage the existing skills and infrastructure in the oil and gas sector into new renewable and low carbon technologies in offshore wind, carbon storage and hydrogen production, to reduce the barriers to transition and result in minimal net job losses overall.

⁴ BEIS (2021) Press release: UK enshrines new target in law to slash emissions by 78% by 2035. <https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035>

⁵ In 2019, the UK became the first major economy to set legally binding Net Zero emissions targets

⁶ Finland is perceived to be a leader in this regard, aiming to be the first developed country to reach net zero, in 2035, and net negative (absorbing more CO₂ than it emits) by 2040.



Box 1: Targets/Ambitions for the UK Energy sector

Net Zero by **2050**

78% Emissions reduction by 2035 compared to 1990 baseline

50GW

Offshore Wind Capacity by 2030

2025

Closure of remaining coal powered power plants

2035

Decarbonisation of the UK electricity system

24GW

Nuclear Capacity by 2050

25%

Electricity supply from Nuclear by 2050

40%

Women in Nuclear industry by 2030

50%

Reduction in offshore Oil and Gas emissions by 2030

10GW

Low-carbon Hydrogen Capacity by 2050

50/50

Split of 'Blue' and 'Green' Hydrogen



Box 2: Overview of sector deals

The UK Offshore Wind Sector Deal set capacity targets that have since been advanced by the Energy Security Strategy, as well as wider industry goals regarding workforce mobility and gender ratio, including increasing UK-made components for offshore wind fabrication to 60%, reaching a female employment ratio of 33% and a BAME target of 9% and developing an Offshore Energy Passport to facilitate greater job mobility between offshore industries.

1

The Nuclear Sector Deal sets the strategy for renewed investment in nuclear, including a 30% reduction in the cost of new build projects, 20% savings in decommissioning, up to £2 billion in domestic and international contract wins and an aim to reach 40% women in the nuclear industry by 2030. It has a specific focus on investing in the future nuclear workforce including skills strategy, knowledge retention, attracting skills from outside nuclear, and local apprenticeships with a focus on STEM subjects.

2

The North Sea Transition Deal and Net Zero Strategy commits to a 50% reduction in emissions from offshore oil and gas production by 2030, however the recent additional North Sea fossil fuel production as a result of the Energy Security Strategy is already creating challenges for a deal the Committee on Climate Change describes as 'unambitious'⁷.

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⁷ Climate Change Committee (2022) Progress Report to Parliament. <https://www.theccc.org.uk/publication/2022-progress-report-to-parliament/#key-messages>

2. Sunset jobs: will employment really collapse in the Energy sector?

The UK energy sector has a history of constantly evolving to reflect the requirements of society and resources available. Once again, the industry is facing a period of immense change as it moves to scale down its most carbon intensive energy production and catalyse investment in renewables, including investing in nuclear power generation with renewed impetus.

The UK energy sector has already decarbonised by 70% since 1990⁸. Much of the UK's most carbon intensive energy production, and its associated jobs have already been lost. Since the early 1900s, the UK coal industry has rapidly declined from producing 292 million tonnes of coal per year⁹ at its peak to becoming almost non-existent (Box 3).

Box 3: The declining coal industry in the UK

There are currently 3 active coal plants remaining in the UK: Kilroot, Ratcliffe and West Burton A, based in Northern Ireland and Nottinghamshire. The government has stated their intent to phase out coal powered plants by 2025. Kilroot has announced plans to replace the coal fired boilers with gas boilers by 2023 and EDF has committed to closing the West Burton A coal plant by September 2022, though this may be delayed to 2023. Whilst the closure of West Burton will affect circa 170 jobs, EDF's advanced labour force planning around anticipated closures¹⁰ will result in minimal net job losses, as employees will either remain to work on decommissioning, be redistributed to the wider network or delivered through managed redundancies.



⁸ BEIS (2022) 2020 UK Greenhouse Gas Emissions https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1051408/2020-final-greenhouse-gas-emissions-statistical-release.pdf

⁹ BEIS (2021) Historical coal data: coal production, availability and consumption. <https://www.gov.uk/government/statistical-data-sets/historical-coal-data-coal-production-availability-and-consumption>

¹⁰ The Capacity Market, which aims to ensure a reliable supply of electricity, provides timeframes for the anticipated economic life of plants to allow for labour force planning

The oil and gas labour force on the other hand is much more sizeable and will remain a significant employer for some time, with the industry still expected to support 190,000 direct and indirect jobs in 2030¹¹.

A number of factors however, including the cyclical nature of employment in the industry, fuel prices, Brexit and the pandemic¹² have recently contributed to fluctuations and overall decline in employment in oil and gas – these trends have formed part of a wider picture of workforce contraction which has largely linked to the gradual decline in North Sea output. Though recent developments in energy security could give a boost to the sector (see Box 4), the long-term gradual decline will also have ramifications on the oil and gas supply chain. According to Offshore Energies UK (formerly Oil and Gas UK), jobs supported by the oil and gas industry are estimated to decrease by up to 80,000 by 2030¹³.

Robert Gordon University estimates that in the north east of Scotland this decline could reach a workforce reduction of 17,000 by 2030 if insufficient investment is made in the offshore energy sector¹⁴. The knock-on effect of a long-term decline continues to be impactful on the oil and gas industry even in spite of economic conditions which would typically encourage a ramping up of production and investment.

A shift to renewables and low carbon will disproportionately affect oil and gas workers, as the incumbent energy industry transitions into the future renewable and nuclear concentrated energy industry. Nonetheless, whilst there will be a small subset of the workforce whose jobs will cease to exist in the UK due to non-transferability of skills¹⁵, many energy workers will find that the ‘greening’ of their current roles will provide extensive career opportunities in the industry. With the ability to move between oil and gas and adjacent low-carbon and renewable sub-sectors with relative ease and in certain cases within the same company, new entrants to the labour force will have opportunities to enter both directly into renewable, low carbon or traditional oil and gas roles (see Diagram 1 below). As such, the growth of the renewables or low-carbon sectors does not necessarily constitute a direct substitution with oil and gas, but instead demonstrates the ongoing evolution of the energy sector.

¹¹ Oil and Gas UK response to the Environmental Audit Committee Inquiry: Green Jobs. <https://committees.parliament.uk/writtenevidence/21430/html/>

¹² In the UK the COVID pandemic resulted in significant proportions of the workforce being made redundant. Conversations with industry stakeholders suggests there is an ethos of ‘hiring and firing’ staff.

¹³ Oil and Gas UK response to the Environmental Audit Committee Inquiry: Green Jobs. <https://committees.parliament.uk/writtenevidence/21430/html/>

¹⁴ Robert Gordon University (2022) Making the Switch, The future shape of the offshore energy workforce in the North-East of Scotland. <https://www.rgueti.com/wp-content/uploads/2022/05/Making-the-switch-images.pdf>

¹⁵ Taking the RGU (2022) estimate that 10% of the offshore energy workforce studied have ‘low’ skills transferability, it could be further extrapolated that this population contains the subset of workers whose skill profiles are least transferable. Perhaps representing significantly less than the 10% characterised as having ‘low’ transferability, reskilling and retraining those with the least skills transferability could require significant investment in resources which may prove cost ineffective leading to career precarisation or ‘sunsetting’ i.e. job loss.

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Usually an energy crisis would lead to a huge asset push and this is not currently the case. Businesses are not wanting to get too committed to purchasing new drilling capital.

Extract from interview with Stuart Wyness, CFO Stena Drilling

Diagram 1: Illustration of transitional flows of the energy sector workforce

Skills transferability	+ Pure Greening	No net job loss; no retraining required	<p>An employee's role becomes green or moves into an internal green vacancy for a role within the same business, with the same tasks but where the role can be defined as green.</p> <p>Example: Human resource staff at an energy utilities company begins managing headcount for the renewables business unit.</p>	Sunset job risk
	Internal Green Mover	No net job loss; some retraining required	<p>An employees moves into an internal green vacancy within their existing company. The role is not the the same as their existing role but has a high degree of skills transferability.</p>	
	In-Sector Green Mover	No net job loss; retraining required	<p>A worker moves between different employers within the same sector. The move is from a non-green job into a green one. Example: A worker at a power plant scheduled for decommissioning finds employment within an adjacent green sub sector.</p>	
	Sector Hopper	Net job loss for the sector	<p>A movement into another part of economy. The role may be green or not. The retraining requirement will depend on the role as some skills such as a number of digital skills have immediate application across the economy.</p>	
	Sunset Job	Net job loss for the sector and economy	<p>A minority of workers may find means of extending their employment within declining roles but the roles will eventually disappear.</p> <p>Example: Decommissioning of a coal-fired power plant may temporarily extend the operational life of a minority of the workforce and workforce planning may redirect some losses into retirement age redundancies. Net job loss for the sector could become net job loss for the economy without significant reskilling and retraining.</p>	

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Upfront investment in training and development will be key to ensure we have a world class UK energy workforce. Government, industry, unions and the workforce all have a critical role to play to set this up for success.
 Extract from interview with Paul de Leeuw, Director RGU Energy Transition Institute

Box 4: Energy security and the Oil and Gas sector in the UK

To what extent, recent developments in energy security are able to abate a decline in oil and gas roles is unclear, although there is still economic rationale for businesses to exploit these natural resources. For example, the Energy Security Strategy has recently precipitated an increase in North Sea oil and gas production to contribute to displacing the UK’s dependency on Russian gas imports – as an immediate measure to incentivise the sector, the Government announced in May the introduction of an Energy Profits Levy which provides a 90% tax relief for businesses that invest in oil and gas extraction. Increased oil and gas production in the UK will challenge the industry’s capacity for achieving a 50% reduction in emissions by 2030 and delay the transition towards greater renewable power generation.

The supply of green skills will primarily come from the oil and gas sector, made feasible due to the high transferability of skills. The transferability of skills, defined through the RGU transferability index, is evaluated through the assessment of similarity of work activities, similarity of the skills undertaken in comparison to the adjacent energy sector and for job availability. It estimates that 90% of those working in oil and gas have medium to high transferability of skills. The majority of jobs types have high transferability, with the exception of offshore facilities management, drilling, wells, subsurface and catering jobs, although these only make up 6% of the existing workforce. Paul de Leeuw of the Robert Gordon University Energy Transition Institute told us that even as in this example where the role is characterised as having low transferability of skills, job loss was not necessarily inevitable.

The high transferability of skills (see table 1 for examples) within oil and gas and adjacent sub-sectors as well as flexibility of workers will mean that for some employers within the industry the retraining requirements will be minimal, facilitating the migration of skills into low carbon and renewables organically through standard workforce deployment.

Table 1: Examples of skills that are highly transferable between offshore oil & gas and offshore renewable and low carbon.

Offshore structures skills	Health, safety, environment and quality	Electrical engineering and high voltage
Management	Digital/IT skills	Human resources
Finance	Business development	Supply chain management



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With oil and gas activities declining in the UK, we are going to need a more flexible and agile energy workforce, enabling people to seamlessly move between adjacent energy sectors and to support opportunities anywhere in the world.

Extract from interview with Paul de Leeuw, Director RGU Energy Transition Institute

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Stena would not specifically look to amend skills to work on wind farm vessels. Stena has a standard training regime and our workforce are incredibly adaptable to new technology where there is a big push from digitisation to reduce the requirement of manpower offshore.

Extract from interview with Stuart Wyness, CFO Stena Drilling

A similar transferability of skills is observable in the nuclear industry workforce. The UK currently has the lowest operable nuclear power capacity since 1982, at 6.8 GW¹⁶. As part of the UK's renewed interest in nuclear power generation within the British energy mix, the Nuclear Sector Deal supports the transfer of skills between adjacent sectors to nuclear, particularly from the coal, oil and gas industries, where workers are trained to operate in similar safety critical energy production environments.

The evidence heavily suggests that a transition to net zero will not cause a collapse of employment in the energy sector. This has been confirmed by interviews with several experts in the sector: those looking to enter the industry will acquire skills that will allow them to benefit from the extensive opportunities that both renewables, low carbon and nuclear power will offer for decades to come. A transition to net zero will still require workers from the oil and gas industry, due to the high transferability of skills. Existing workers and new entrants should be able to transition fluidly between the sectors, as long as the appropriate policy decisions are made by the government to facilitate this change.

Box 5: Implications for the Green Jobs Barometer

The first iteration of the Green Jobs Barometer indicated that the majority of sunset jobs to disappear as a result of decarbonisation were distributed across both the professional, scientific & technical sector and the electricity & gas sector in London, Scotland and North West of England. Whilst on a sectoral basis, the declining roles are anticipated to be distributed in carbon intensive sectors, as highlighted by the Barometer, the scale of these declines remains a challenge to quantify with much subject matter expertise reflecting the feeling that these losses may not constitute a significant proportion of their respective labour forces, may not materialise by the 2030 time horizon and may more likely be better characterised as 'transformative' roles – i.e. jobs that have evolved as a result of the transition to Net Zero. Examples of quantification efforts have confirmed the relatively modest sunsetting of carbon-intensive roles, including job losses in the coal industry. As there are only three remaining coal plants in the UK, one of which is planned to transition to gas boilers, job losses in this sector are set to be minimal. The closure of the West Burton A coal plant will affect c.170 jobs with many of these being redirected into other parts of EDF's business (for example, transferred into nuclear plants), channelled into decommissioning or being 'managed' to support moves within the sector. In the oil & gas sector, primarily based in the North East of Scotland, Robert Gordon University estimates¹⁷ that a maximum of 17,000 jobs could be lost if insufficient investment is made into the net zero economy, however, the growth of offshore wind, hydrogen and carbon capture in the region underpinned by government and private investment could in fact see a rise in net jobs of 20%.

Pillar 3 of the Green Jobs Barometers provides us with a snapshot in time of the economic dynamics with regards to sunset job losses. Within key parts of the energy sector such as oil and gas there is a presumption of long term decline, which will ultimately result in job losses. The Barometer shows that global megatrends occurring concurrently to decarbonisation are creating peaks and troughs in long term employment trends and the decline of traditional oil and gas will not be linear.

¹⁶ World Nuclear Organisation (2022) Nuclear Power in the United Kingdom. <https://world-nuclear.org/information-library/country-profiles/countries-t-z/united-kingdom.aspx>

¹⁷ Robert Gordon University (2022) Making the Switch, The future shape of the offshore energy workforce in the North-East of Scotland. <https://www.rgu.ac.uk/wp-content/uploads/2022/05/Making-the-switch-images.pdf>

3. Green jobs: the demand for a Net Zero energy workforce

The UK faces a continuous rise in the demand for energy, with decarbonisation plans adding an additional hurdle to the scaling up of capacity, highlighting the need for a sizeable workforce to manage the transition. By 2050, the National Grid estimates that 400,000 roles will need to be filled to build the Net Zero Energy Workforce required to meet increased demand for renewable energy production and our net zero targets. 260,000 of these will be additional roles (equivalent to approximately 35% of the UK's current energy workforce) and the remaining 140,000 will replace those who have left¹⁸. These jobs will need to be filled across all regions of the UK, particularly in the North and South West where significant investments are being made into offshore wind and nuclear power.

¹⁸ National Grid (2020) Building the Net Zero Energy Workforce. <https://www.nationalgrid.com/stories/journey-to-net-zero/net-zero-energy-workforce>



The UK energy market is increasingly creating more green jobs. When first published, PwC's Green Jobs Barometer indicated that 1.2% of all advertised jobs in the UK were green jobs; this number has since increased to 1.6% for 2021 (see table 2). Within the electricity and gas sector, the percentage of green jobs advertisements grew from 21% to 25% in the same period (see table 3), further highlighting the growing demand for green skills within the energy industry.

The need for a sizeable energy workforce is underpinned by the opportunities presented by the green economy. There are a number of technological pathways to nuclear power and also to low carbon, including offshore wind, solar power, carbon capture usage and storage (CCUS) and hydrogen. This report focuses on the opportunities linked specifically to offshore wind and nuclear power, whilst acknowledging that the other technologies will continue to have a role in the UK's future renewable energy mix.

Table 2: PwC Green Jobs Barometer (Pillar 1: Green Job Creation) Q1-Q4 2021, by region

Region	Percentage of Green Jobs
Scotland	2.3%
North West	1.8%
South West	1.8%
Wales	1.6%
North East	1.5%
Northern Ireland	1.5%
South East	1.5%
Yorkshire and The Humber	1.5%
East Midlands	1.4%
West Midlands	1.4%
London	1.4%
East of England	1.3%
United Kingdom	1.6%

↑ 3.5%

Increase in green jobs created
(Barometer Update: Pillar 1)

Q3 2020-Q2 2021 vs Q1 2021-Q4 2021

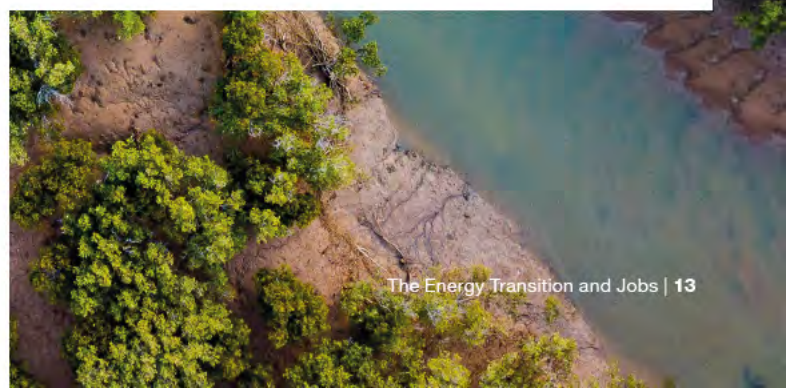


Table 3: PwC Green Jobs Barometer (Pillar 1: Green Job Creation) Q1-Q4 2021, by Sector

Sector	Percentage of green jobs
Electricity, gas, steam and air-conditioning supply	24.6%
Water supply; sewerage and waste management	20.2%
Mining and quarrying	5.9%
Public administration and defence; compulsory social security	5.0%
Professional, scientific and technical activities	4.4%
Agriculture, forestry and fishing	3.2%
Other service activities	2.8%
Manufacturing	2.5%
Construction	2.1%
Transportation and storage	1.7%
Administrative and support service activities	1.2%
Accommodation and food service activities	0.9%
Arts, entertainment and recreation	0.9%
Financial and insurance activities	0.9%
Information and communication	0.9%
Wholesale and retail trade; repair of motor vehicles	0.8%
Education	0.2%
Human health and social work activities	0.2%

Offshore wind

The offshore wind industry is forecasted to provide a significant number of green jobs to the UK labour market. As a result, it is estimated that 40,700 direct and 29,148 indirect jobs will be supported by the industry by 2026, facilitated by £60 billion in private investment¹⁹. These jobs will primarily be based in the North East of England due to projects such as the Moray East and Dogger Bank offshore wind farms (see Dogger Bank case study below) providing opportunities in non-Southern regions to aid in closing the North-South economic gap.

The North East of Scotland is a thriving energy hub, hosting the largest pool of energy-related skills in the UK²⁰. Reaching Global Energy Hub status – defined as becoming the global leader for a net zero transition, offshore energy innovation and green skills- would lead to a 20% increase in North East Scotland's offshore energy workforce to 54,000 people by 2030, however, slow net zero progress resulting in the regional decline scenario would see a loss of 17,000 workers between 2021 and 2030. Investments of £17 billion into renewables will be needed – the majority from private businesses – in order for North East Scotland to reach Global Energy Hub status, creating a regional offshore wind capacity of 18GW. Consequently, the composition of the future workforce is expected to change significantly. With the most recent findings of the Green Jobs Barometer indicating a 3.5% rise in green job creation in the electricity and gas sector.

¹⁹ Offshore wind industry council (2021) Press release: More than 69,000 jobs and £60 billion private investment in UK offshore wind by 2026. <https://www.renewableuk.com/news/557871/More-than-69000-jobs-and-60-billion-private-investment-in-UK-offshore-wind-by-2026.html>

²⁰ Research from Robert Gordon University maps future employment to four different scenarios: regional decline, incremental progress, UK Energy hub and Global Energy hub- directly linked to the level of investment into the region. Robert Gordon University (2022) Making the Switch, The future shape of the offshore energy workforce in the North-East of Scotland. <https://www.rgu.ac.uk/wp-content/uploads/2022/05/Making-the-switch-images.pdf>

Case study: Dogger Bank

The Dogger Bank Wind Farm is a series of offshore wind farms currently in construction between 130 km and 190 km off the North East coast of England in the North Sea. Built in three 1.2 GW phases, Dogger Bank A,B and C will have a collective capacity of 3.6 GW. The project is owned by SSE renewables (40%), Equinor (40%) and Eni Plenitude (20%) and is due to be completed in 2026, with an operational life of 35 years²¹. Set to be the world's largest offshore wind farm, Dogger Bank is expected to support 3000 jobs predominantly in the construction phase but including 200 operational roles²². Jobs supported include those both in manufacturing, installation, commissioning and servicing. The majority of servicing jobs will be based out of Port of Tyne in the North East, highlighting the skilled jobs being created due to renewables in non Southern-centric parts of the UK.

Dogger Bank Map

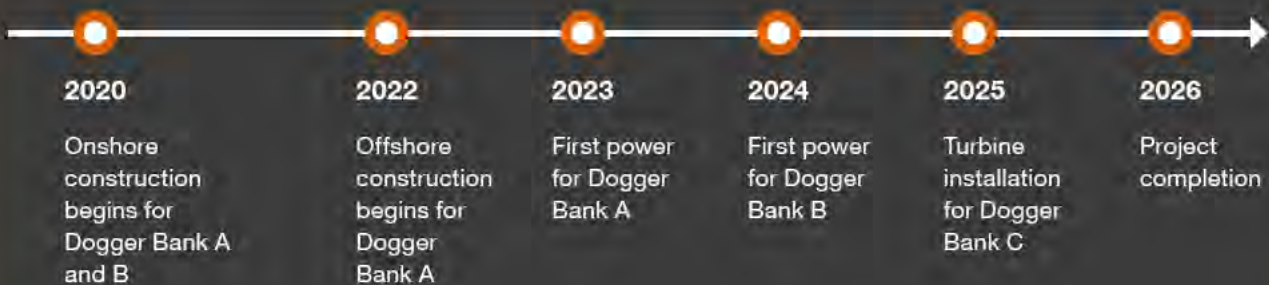


Dogger Bank Offshore Wind Farm

Capacity	3 x 1.2 GW phases
Total investment	£9 billion
Ownership	SSE Renewables (40%), Equinor (40%), Eni Plenitude (20%)

Source: offshorewind.biz 2020
<https://www.offshorewind.biz/2020/02/27/largest-offshore-wind-project-pays-homage-to-historic-construction-site/>

Timeline



Jobs supported: Operational roles: 200
 Total jobs supported: 3,000

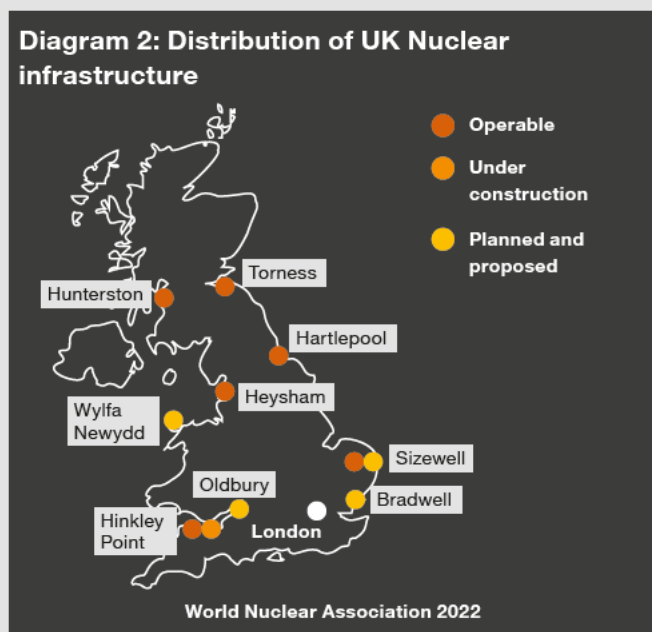
²¹ SSE Renewables. Building the world's largest offshore wind farm. <https://www.sserenewables.com/offshore-wind/projects/dogger-bank/>

²² Dogger Bank Wind Farm (2021) Press release: Hundreds more green UK jobs created by delivery of Dogger Bank Wind Farm. <https://doggerbank.com/press-releases/hundreds-more-green-uk-jobs-created-by-delivery-of-dogger-bank-wind-farm/>

Nuclear

The UK nuclear industry has faced decades of declining investments, as the share of renewable low carbon electricity supply from other sources has rapidly increased. A lack of investment in nuclear and the retirement of numerous plants has meant that power generation from nuclear, and by extension, the size of its operational workforce is set by 2024 to be the lowest since the 1970s. The last nuclear power plant to be commissioned was Sizewell B in 1995, with the construction of Hinkley Point C providing the first new supply of nuclear power in almost 30 years.

The nuclear industry will provide a key source of green energy to the UK during its transition to net zero, with an aim of creating 24GW of nuclear capacity by 2050, compared to the current capacity of 7GW. The UK is one of the few countries that has a nuclear power industry with plants in all stages of the life cycle. There are currently 34 decommissioned reactors, 11 operable reactors and 2 under construction by EDF in Hinkley Point, Somerset⁹. The construction of Hinkley Point C is expected to create 25,000 jobs during construction and 900 jobs throughout its 60 year operational lifetime¹⁰ – a similar level of employment as can be expected if proposals to develop Sizewell C are pursued.



There is an appetite in the UK for large infrastructure projects and the need for more nuclear power generation. The Nuclear Energy (Financing) Act 2022 received Royal Assent on March 31 2022 signalling the introduction into law of a provision for the implementation of a regulated asset base (RAB) model which could help unlock investment in nuclear energy infrastructure projects. The model, which has been successfully utilised to finance other large infrastructure projects, is seen as a more attractive investment model than the existing mechanism which supports new low-carbon electricity generation – the Contracts for Difference (CfD) model²³. The risk profile in nuclear is significantly greater than renewables, with the initial investment in construction perhaps being the largest obstacle to financing nuclear new builds. The RAB model provides for a sharing of costs and risks between consumers and the developer²⁴. These recent changes to the financing landscape are designed to catalyse investment in new build nuclear and drive demand for construction workers and subsequently, operational staff.

Prior to the enactment of the Financing Act 2022, in 2019 the Nuclear Skills Strategy Group published a scenario-based workforce assessment²⁵ to approximate the employment demand of the nuclear sub-sector given varying investment pathways. Their conservative scenario which forecasts a 9 Gwe (business as usual style scenario) (see table 3) leads to a steady decrease in overall employment demand with a peak in 2027 of 83,600. Despite the forecasted decrease, around 40,000 job opportunities will be required by 2030 to address the combination of replacement and expansion demand the sector is expected to undergo^{26,27}. The second scenario of 18 GWe which includes an additional three reactors by 2030, would create 60,000 job opportunities in the same period.

²³ Under the CfD model, developers of renewable energy projects pay the high upfront costs of construction

²⁴ Via an economic regulatory regime defined in the economic licence which the GenCo adheres to. The regulator re-assesses the allowed costs and financing return on a periodic basis

²⁵ Nuclear Skills Strategy Group (2019) Nuclear Workforce Assessment 2019. <https://www.nssguk.com/media/2018/nuclear-workforce-assessment-2019-full-report-final.pdf>

²⁶ In fact, the decommissioning of nuclear plants creates long term jobs for those in current operational roles as it takes decades to complete the decommissioning process

²⁷ At least half of these need to be women to reach the Nuclear Sector Deal target of 40% by 2030

“

Hinkley Point B closure will end generation there in August this year but it then moves into an exciting new phase of defueling which will bring its own opportunities.

Extract from interview with Andrew Cockroft, Community Relations at EDF

Table 3: 9 GWe Scenario: Nuclear Workforce Assessment, Nuclear Skills Strategy Group 2019

Scenario: 9 GWe (2030)						
Site	Status	Location	First Power Generation	Reactor type	Generating Capacity (GWe)	Developer
Hinkley Point C	Under construction	Somerset	2026 Q4	EPR	3.26	EDF
Sizewell C	Under development	Suffolk	2032 Q3	EPR	3.26	EDF
Bradwell B	Proposed	Essex	2032 Q3	UKHPR 1000	2.36	CGN/EDF

The mid to near term implications of nuclear job creation in the energy sector is that the demand for labour will be disproportionately impacted in the construction sector supply chain, as the majority of jobs currently needed for the scaling up of nuclear capacity are in construction as opposed to operations following on from decades of declining investment in British nuclear power. The most recent iteration of the Barometer indicated 2% of jobs in the construction sector were green²⁸, rising from 1.5% in the first iteration. This number is expected to continue to rise as the UK invests more in nuclear power, with the construction of Hinkley Point C alone utilising an estimated 22,000 workers.

Nuclear plants as a whole can be thought of as national infrastructure projects, with many of the skills particularly in construction and basic operations transferable from the wider industry, with the addition of specialised training to better tailor skills to work in a nuclear plant. This means that the availability of labour for nuclear power is in competition with other infrastructure projects such as the High Speed Two (HS2) high speed railway, which commands a similar skill set of specialist roles, from design engineers to project managers. Competition for labour also comes from abroad, as whilst ambitious nuclear targets in the UK provide job opportunities on home ground, investment into nuclear energy in other countries such as the United Arab Emirates provides enticing job opportunities for British nuclear workers in other countries.

Nuclear innovation

The development of small modular reactors (SMR's) has been posited as having significant potential for assisting the UK in its decarbonisation goals whilst providing a boost to the economy. SMRs, which have a power capacity of around one third of traditional nuclear reactors and can be transported as a unit for installation, could see a revival in green jobs within the supply chain and specifically in manufacturing, bringing opportunities to areas such as the West Midlands.

British engineering firm Rolls Royce has already begun plans for its small modular reactor business after receiving a £210 million government grant. The government has asked the Office for Nuclear Regulation (ONR) to begin a Generic Design Assessment (GDA)²⁹ for Rolls-Royce SMR Ltd's 470 megawatt SMR plans. The approval process

typically takes 4-5 years for large scale reactor (i.e. > 1 gigawatt) design but Rolls-Royce hopes to complete the regulatory process in 2024, with an aim to begin generation in 2029, potentially creating long term high skilled jobs along with affordable low carbon electricity before the end of the decade³⁰.

The most recent Green Jobs Barometer findings highlighted that the West Midlands was one of the poorest performing regions in terms of green job creation, at 1.4% compared to an average of 1.6%. The development of small modular reactor technology could see a revival in green jobs within the supply chain and specifically in manufacturing that would provide opportunities to regions such as the West Midlands.

²⁸ As seen in the green job creation table above

²⁹ A GDA is the formal process for approving a new nuclear reactor. This is the first time a small scale reactor has been assessed by the regulator

³⁰ It is unclear however how the government will support the continued development of SMR's and future nuclear innovations – clear oversight of the proposed funding mechanism is yet to be communicated

Case study: EDF Taking the skills challenge in house

Companies such as EDF have begun to take the skills challenge in house through securing a pipeline of talent and workforce planning. To address their future skills demand, EDF have recently unveiled a Welding Centre of Excellence at Bridgwater and Taunton College. This represents one of many training centres opened in preparation for the next phase of construction on Hinkley Point C, along with the Electrical Centre of Excellence in Cannington, a Construction Skills and Innovation Centre and a soon to be opened Mechanical Centre of Excellence³¹. EDF have similarly invested time and resources into workforce planning to manage the transition of staff as parts of their nuclear fleet move into a decommissioning stage.

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As more of EDF’s plants move towards ending generation, things are changing for our staff. Most of our highly trained, highly skilled employees want to remain with us and help us defuel the stations, a process which we expect to take around four years for most of the plants, but we also know some won’t want to do this. We know a proportion will want to continue working on generating plants around the country and so we do what we can to link our highly skilled staff with opportunities elsewhere. We also know some members of our teams are keen to explore new careers – and it’s important to remember years of working on a nuclear station equips anyone with a suite of highly transferable and in demand skills.

Extract from interview with Andrew Cockroft,
Community Relations at EDF

Part of the ability of large energy companies like EDF to invest in such centres has to do with securing a strong pipeline of activity and planned future work, in addition to having the size and resources to invest in their own skills set. Businesses also have the option to go to market to acquire these skills, though they run the risk of facing competition for new hires under the current labour shortages and skills supply constraints.

³¹ BEDF (2022) Press release: New training centres ready for next phase of construction at Hinkley Point C
<https://www.edfenergy.com/media-centre/news-releases/new-training-centres-ready-next-phase-construction-hinkley-point-c>



Implications for Green skills

Skills demand, which is part of our analysis used to complement the update of ‘Pillar 1: Green job creation’ of the PwC Green Jobs Barometer, serves to indicate what skills – and particularly what ‘green’ skills – employers are currently looking for.

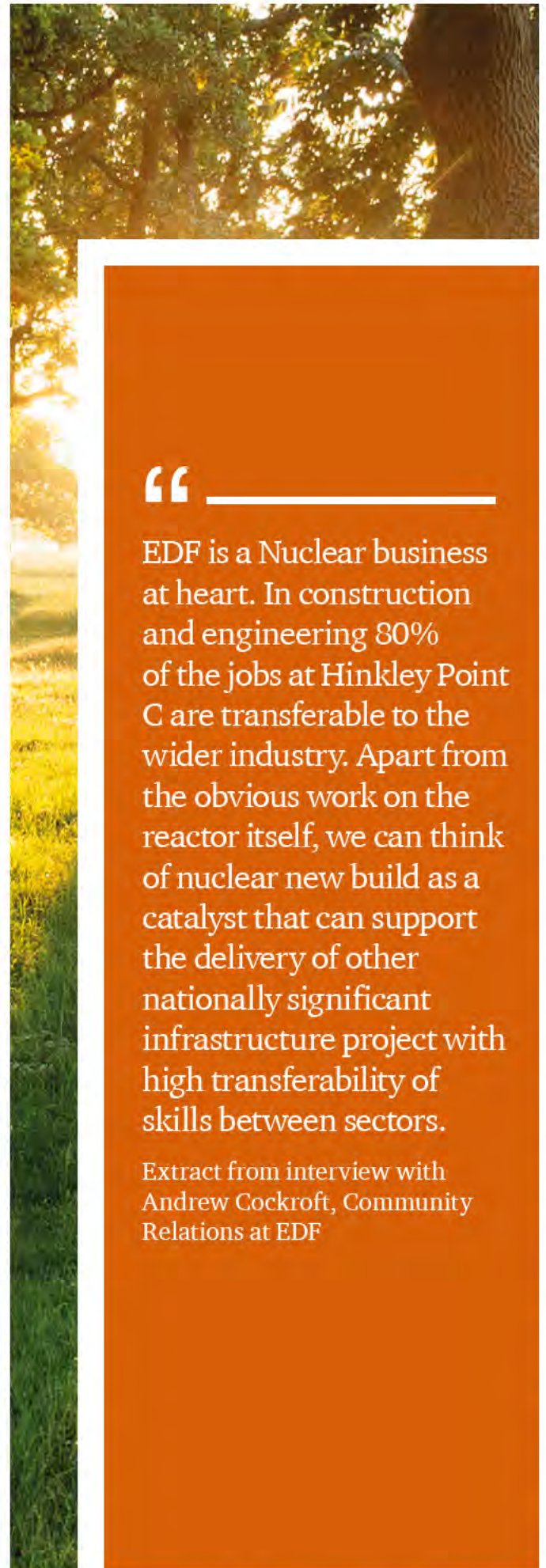
The highest demanded green skills featured within advertisements of green jobs across all sectors in Q3-Q4 of 2021 were largely sector agnostic (‘Recycling’, ‘Sustainability’ and ‘Carbon’ ranking first, second and third respectively) reflecting the high demand for green skills across the economy (see table 4). However, ‘Renewable Energy’, ‘Infrastructure’ and ‘Nuclear’ all rank in the top ten skills highlighting how significant renewable energy generation is in driving the green economy overall.

Table 4: Most demanded green skills from employers across all sectors, PwC analysis of job vacancy data, Q3-Q4 2021

Skills (all sectors)	Rank
Recycling	1
Sustainability	2
Carbon	3
Environmental	4
Renewable Energy	5
Infrastructure	6
Nuclear	7
Climate Change	8
Energy Management	9
Environmental management	10

The construction sector will see the greatest increase in green employment linked to the build phase of green infrastructure. Nuclear construction will significantly boost green jobs in the sector. The construction of Hinkley Point C is expected to create 25,000 employment opportunities during construction, in a broad range of occupations and careers, and it will also provide around 900 jobs throughout its 60-year operational lifetime³². Nuclear-specific skills, which we consider to be ‘green’ skills, are less prevalent in nuclear construction than the generic construction skills (non-green skills) associated with general infrastructure projects. Accordingly, whilst green skills linked to nuclear feature frequently in construction job advertisements, our analysis of vacancy data identifies that demand from wind and solar renewables (see table 5) is driving demand.

³² BEIS (2018) Hinkley Point C Wider Benefits Realisation Plan. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/725960/HPC_Benefits_Realisation_Plan.pdf



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EDF is a Nuclear business at heart. In construction and engineering 80% of the jobs at Hinkley Point C are transferable to the wider industry. Apart from the obvious work on the reactor itself, we can think of nuclear new build as a catalyst that can support the delivery of other nationally significant infrastructure project with high transferability of skills between sectors.

Extract from interview with Andrew Cockroft, Community Relations at EDF

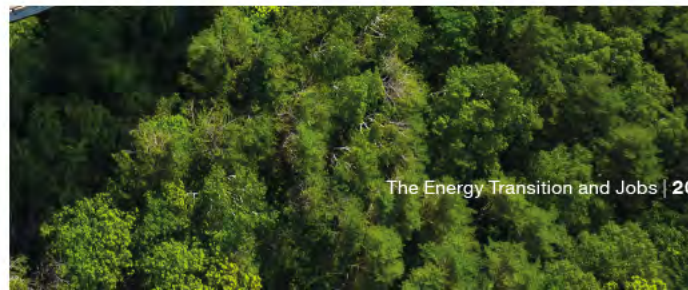
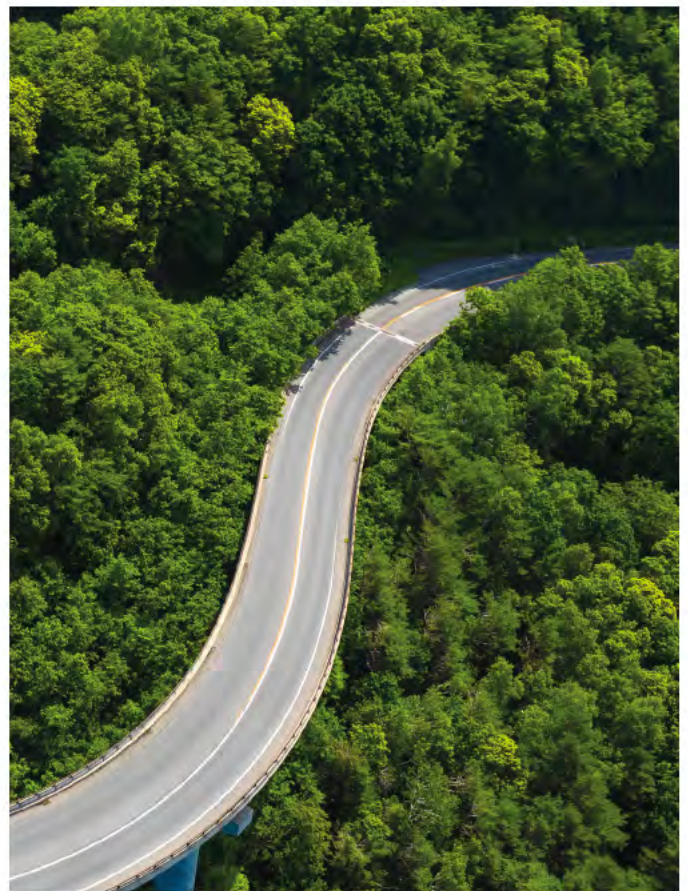
Table 5: Most demanded green skills from employers in the construction sector, PwC analysis of job vacancy data, Q3-Q4 2021

Skills (construction sector)	Rank
Environmental	1
Sustainability	2
Carbon	3
Environmental Management	4
Infrastructure	5
Recycling	6
Renewable Energy	7
Water Supply	8
Environmental Policy	9
Nuclear	10

Table 6: Most demanded green skills from employers in the electricity, gas & steam sector, PwC analysis of job vacancy data, Q3-Q4 2021

Skills (electricity & gas sector)	Rank
Carbon	1
Sustainability	2
Smart Metering	3
Renewable Energy	4
Energy Efficiency	5
Infrastructure	6
Environmental	7
Energy Industry	8
Energy Management	9
Energy Markets	10

Of the skills the electricity & gas sector are most demanding in the period, 'infrastructure' and 'renewable energy' again rank in the top ten, whilst 'nuclear' falls in prominence. The electricity & gas sector are needing additional skills linked to energy management and efficiency (see table 6) showing that job demand is being driven as much by efforts to balance the grid as other trends.



4. The challenge: meeting the demand for skills

The UK currently faces a large green skills gap which has deteriorated during the pandemic (as a number of long-term sick and older 50+ workers have left the workforce). Despite the relevant stock of skills from within the existing energy industry, there are barriers to future supply. The supply of skills will primarily come from the oil and gas industry, however, whilst 400,000 jobs are needed to build the Net Zero Energy Workforce to deliver on decarbonisation targets, only an estimated 270,000 people currently work in the oil and gas industry. Furthermore, a large proportion of these workers are set to retire as the UK faces economy-wide baby boomer retirement, with one fifth of energy workers expected to have exited the workforce by 2030. The remaining workforce will need to be transitioned into the adjacent renewables and nuclear sector, though despite high transferability of skills, additional upskilling to tailor these skills to green roles will still be required.

Quantifying the size of the labour and skills shortage requires further analysis, but from simple extrapolation it is evident that with 117,000 of the 400,000-strong demand articulated by the National Grid study³³ being required to join the sector by 2030, immediate progress needs to be made. In 2020 employment in the energy industries rose by only 2.3% on the previous year to 181,000³⁴ representing an additional 4,000 jobs. The 5 year sector employment increase of 3.8% provides for only a modestly more sanguine expectation that the sector will reach the workers required by 2030. Extrapolating the current growth rate of the industry, by 2030 the UK could already be many tens of thousands off the pace to reach a net zero energy workforce by 2050.

The growth in demand for electricity will require many new energy sector workers³⁵ with the relevant green skills, therefore attracting the younger generation is imperative to filling the green skills gap. A pertinent issue in the energy sector is the attractiveness of the industry and particularly how school leavers and graduates perceive it. As a historically high-emitting sector with a pattern of cyclical employment, the oil and gas industry faces issues attracting new joiners to the workforce with graduates from relevant backgrounds increasingly considering competing industries such as renewables. This trend is increasingly facilitated by the prominence of digital skills across all industry sectors.

³³ National Grid estimate that an additional 152,000 will join in the decade that follows and a final 131,000 joining before 2050

³⁴ BEIS (2021) UK Energy In Brief 2021.

³⁵ The UK's total energy consumption will fall as energy efficiency improvements are rolled out. Electricity creation will increase as the UK places a greater emphasis on energy security. Renewable energy generation is more labour intensive than traditional carbon-intensive methods. Source: National Grid (2021) Future Energy Scenarios. <https://www.nationalgrideso.com/electricity-transmission/document/202851/download>

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The energy industry is evolving and our role in renewables and emerging energies is expanding at pace, which offers great opportunities for young people to be part of our energy transition journey.

Extract from interview with Steve Wisely, Senior VP at Subsea 7

Are green jobs higher quality?

This article has previously indicated that high skills transferability makes the transition highly feasible, but in reality there are a number of other relevant factors which determine whether feasibility translates into measurable change. As an example, whether a transition is desirable may be as significant a determinant in evaluating any future skills supply. The creation of green jobs therefore prompts additional considerations surrounding job quality and more explicitly whether these new green roles provide better job satisfaction, skills utilisation, stability and higher salaries for workers. The most recent findings of the Green Jobs Barometer included an analysis of survey results from respondents in the UK energy sector. Initial findings indicate that there is a positive correlation between an

employees' perceived 'greenness' of their job and their salary³⁶ at both a regional and sectoral level, suggesting that green jobs on average pay higher. By contrast, perceived greenness is negatively correlated with satisfaction of the number of hours worked i.e. there is a perception amongst people with 'green' jobs that their job quality is impacted by long hours³⁷. Those working in the electricity and gas sector have high perceptions of the greenness of their work and overall have an above average perception of the quality of their jobs. These are initial findings³⁸ that suggests that green jobs are on average of higher quality, therefore an increase in green jobs in the electricity and gas sector may provide jobs that are high quality to workers across the UK.

A just transition

Amidst the green energy revolution, there are increasing calls for the green transition to become a 'just transition'³⁸. Opportunities for upskilling need to be accessible to different segments of the population, of different ages, socioeconomic background and gender. This is not only fair but it also broadens the talent pool and thus benefits the sector – and the wider economy.

Historically, very few energy industry roles have been held by women or ethnic minority groups. Government and businesses alike should ensure that this legacy is not carried forward during the transition to net zero. The PwC Women in Work Index¹⁶ revealed that a transition to net zero could stand to leave women behind without appropriate intervention, where women already feel less prepared and aware of the opportunities in green jobs compared to their male counterparts. There is a higher than average gender pay gap within the UK energy sector, analysis by Energy Monitor reveals that 92% of companies pay their male employees more than females, with 80% of the top paying jobs in the industry occupied by men³⁹.

A transition to net zero stands to most benefit workers that are highly skilled and educated due to the technical nature of new green roles, research conducted by the London School of Economics indicates that graduates are more likely to enter green job roles compared to those ending education at a GCSE equivalent level, with 16% of graduates currently in a green role compared to 11% at GCSE level⁴⁰. There is therefore a risk that the transition leaves behind lower skilled workers, contributing to socio-economic inequities in the labour force. To rectify these disparities, there are opportunities to up-skill new and existing workers through both in-house upskilling initiatives within large energy corporations and through targeted training initiatives funded by, for example, the Department of Education.

There is also a practical basis for diversifying the workforce in the energy sector. As the sector matures, it will require a broader and more diverse skill set than at present – a more diverse workforce can help achieve this.

³⁶ The data are reflective of some skewing at a regional level owing to clusters of green jobs and high paying jobs in London

³⁷ Interestingly, there was no correlation between actual number of hours worked and perceived greenness of jobs at a sectoral level

³⁸ There is intention to further explore the theme of quality in relation to green jobs. This is consistent with our definition of 'green job' as outlined in the original publication of the Barometer

³⁹ A 'just transition' refers to a transition to net zero that ensures the benefits are equally and equitably distributed to all groups within the economy

⁴⁰ Energy monitor (2022) How big is the gender pay gap in the energy industry in Britain and who are the worst offenders? <https://www.energymonitor.ai/policy/just-transition/exclusive-how-big-is-the-gender-pay-gap-in-the-energy-industry-in-britain-and-who-are-the-worst-offenders#:~:text=Across%20the%20sector%2C%20men's%20median,the%20national%20average%20of%2011.6%25>

⁴¹ The Resolution Foundation (2022) Net zero jobs: The impact of the transition to net zero on the UK labour market

5. Energy Policy Leadership

The UK government has reaffirmed its commitment to low carbon energy, and to balancing energy security and a stable and affordable transition via a mix of energy sources, through the Energy Security Strategy. The Strategy should help to provide businesses with a forward view on how much to invest in order to prepare for future skills demand.

Whilst the intent to transition indicates a minimal loss of sunset jobs overall, this is dependent on net zero investment, which needs to be underpinned by government policy.

Demand signals will need to be sufficient and far enough in advance in order to drive labour force planning and investment decisions. There also needs to be investment across the value chain to support the transition - oil and gas through to renewables.

Balancing shorter term goals of energy security with long-term goals of decarbonisation is a key priority for the UK. Examples from other countries can provide

useful lessons about how to support the oil and gas industry in a way that contributes to both decarbonisation and energy security. Norway is an example of a country that has championed this through subsidies. Norwegian shipping company Solstad Offshore received an 87 million krone (c. £7.2 million) grant from state owned Innovation Norway to reduce its fleet emissions, allowing the integration of battery hybrid vessels into their fleet⁴². Investment into the decarbonisation of vessels does not only create green jobs and skills for operations of the vessel, there is a multiplier effect that stems down into creation of skills for the fueling of that vessel and further down the supply chain.

Underpinning the actions to secure a low carbon power supply and deliver stable and affordable energy is a need for concurrent actions to reskill the workforce and develop the capabilities required to deliver those actions; a reskilling which extends into businesses; into the Net Zero supply chain; into education.

⁴² Operators in oil and gas/renewables that require vessels operate them in the absence of infrastructure to refuel with biofuels and in the absence of support to invest in hybrid fuel vessels. Supporting and incentivising greener technologies across the offshore energy supply chain is vital to decarbonising the sector and would catalyse efforts to decarbonise from within the industry. Source: Offshore engineer (2021) Solstad Offshore Gets Grant to Cut Offshore Vessel Emissions. <https://www.oedigital.com/news/493041-solstad-offshore-gets-grant-to-cut-offshore-vessel-emissions>



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We recognise the importance of continuing our focus on sustainable and efficient operations to reduce the carbon footprint of our own activities. In 2021, we committed to target Net Zero by 2050, with a 50% reduction in emissions by 2035. We continuously assess our operations to evaluate the very latest options for cleaner lower-carbon fuels and more efficient fuel use.

Extract from interview with Steve Wisely, Senior VP at Subsea 7



Supporting green skilling

The UK's need for reskilling their labour force requires much greater investment than just incentivising large private businesses in the energy sector. Incentivising big business shows the government's indirect role in reskilling and retraining, but it also has a direct role to play in ensuring there is an adequate green skills supply through reskilling programmes and the education of the younger generation to entice and prepare them for the green energy workforce.

To address any potential skills or labour shortages, government and industry must work more closely with education providers to make the energy sector attractive to students and specifically to address declines in the entry-level apprenticeships⁴³ which support the sector; work with the existing workforce to upskill for net zero jobs and work with people from other parts of the economy to develop their skills and support their transfer into the energy workforce.

The government need to fully utilise existing policy tools, e.g. the Baker Clause⁴⁴, to increase the visibility of technical green career paths for the younger generation and reverse the declining uptake of entry-level apprenticeships. There has been commitment from UCAS who aim to bolster digital green career guidance for young people by pledging to reform its service to provide an equal abundance of information on

technical apprenticeships as it does for university degrees⁴⁵. In addition, green upskilling should be facilitated through national bodies such as the Department of Education, the Department for Work and Pensions and through the National Curriculum. There are positive indicators of this, for example the Department of Education funded Skills Bootcamp Programme which partners with employers and local colleges to offer free courses to develop green and other technical skills.

The government and businesses can work together to create the conditions for a fair playing field that go beyond the gender and BAME representation targets outlined in the Sector Deals- for instance, government conducted gender budgeting⁴⁶ and gender and ethnic pay gap reporting by firms to increase transparency and promote fair business practises during the transition. More broadly, policy intervention can facilitate the conditions for the industry and education providers to develop relevant training that is equally accessible by all socio-economic groups.

The findings of this article indicate that action needs to be taken at both government and industry level to support the labour market in the transition to net zero. If not acted upon, the UK is at risk of falling behind its roadmap to reach net zero, leading to wider ramifications on the effects of climate change.

⁴³ The number of starts at entry-level apprenticeships in England (NVQ Level 2 equivalent) in 2019/20 had fallen to 31% of all apprenticeship starts, down from 65% in 2013/14. At the same time starts in higher level apprenticeships, often taken up by older people, have skyrocketed. Source: House of Commons (2021) Apprenticeship Statistics. <https://researchbriefings.files.parliament.uk/documents/SN06113/SN06113.pdf>

⁴⁴ The Baker Clause is an amendment to the 2017 Technical and Further Education Act stating that schools must allow colleges and training providers to inform all students from Years 8-13 on the technical qualifications and apprenticeship schemes that are available to them

⁴⁵ UCAS (2021) Press release: UCAS research shows students struggle to access information on apprenticeships <https://www.ucas.com/article/ucas-research-shows-students-struggle-access-information-apprenticeships>

⁴⁶ For further explanation of gender budgeting see the PwC 2022 Women in Work index. <https://www.pwc.co.uk/services/economics/insights/women-in-work-index.html>

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