# Green Jobs Barometer

Monitoring a fair transition to a green economy

**December 2022**

pwc

# Contents

# Foreword

The world is in a very different place to where it was a year ago, when we launched our Green Jobs Barometer. While covid has abated, Russia's invasion of Ukraine has wreaked havoc on people and markets. We're in a period of energy shortages and rampant inflation. As we head into 2023, the challenges and uncertainties facing businesses and households are substantial and real.

Immediate pressures are an unavoidable focus for governments and businesses. But as the energy crisis has made clear, the need to prioritise and resource a green revolution has never been greater. Climate change threatens every aspect of our lives.

In this context, we've been encouraged by the interest in the Green Jobs Barometer since its launch, spawning working groups throughout England, Scotland and Wales, and further research into reskilling in key sectors.

The question now is whether the UK is making sufficient progress on green jobs to meet Government ambitions and societal expectations. A year on from launch, we now have data for assessing our progress over time.

There is good news–the number of green jobs being advertised in the UK has almost trebled. All regions have seen increases, with Wales and Scotland among the top performers.

We must also sound a note of caution. Green jobs are growing at an exponential rate in London and the South East, with one in five new green roles based in the capital. Growth must be celebrated, but green growth needn't be as polarised. Our analysis shows the need and appetite for green skills across the whole country, in sectors including agriculture, energy and housing. The net zero transition depends on a spread of green jobs, and so does a fair society.

At PwC, we are committed to contributing to work and debate on green jobs and skills, ensuring that the unavoidable transformation of communities and regional economies creates opportunities for all. We hope our research provides a useful guide for policy and business action during this pivotal transition.

**Kevin Ellis, Chair and Senior Partner, PwC**

# Executive summary

The transition to a net zero economy offers the potential of new, well-paying jobs in industries that will come to dominate the UK in the 21st century.

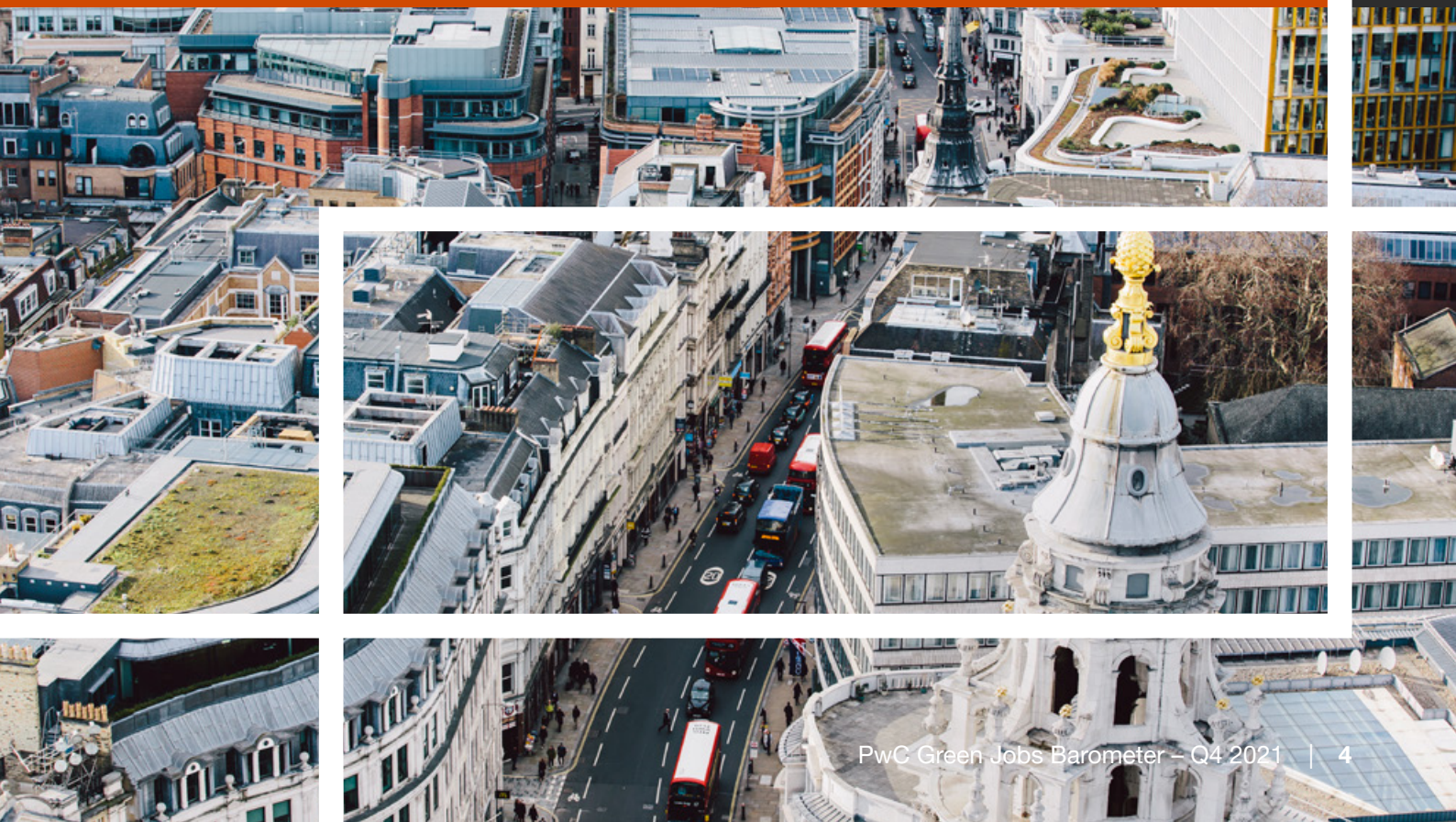
In the face of climate change, the UK–like all major economies–is at the outset of a major economic shift, where every business will be required to make big changes to how they operate.

How this shift impacts communities across the UK depends on our collective response–whether developing new solutions, creating new jobs or providing the investment and training required to fulfil our ambitions.

However, there is a risk that those working in carbon-intensive industries, or living in certain communities, will be left behind by the transition. At PwC, we believe there is a real opportunity to ensure the green transition benefits everyone.

Now in its second year, the Green Jobs Barometer aims to map the pace and spread of the UK's transition to a cleaner economy, across all sectors and regions. This unique tool provides a valuable evidence base, tracking job creation, wider employment benefits, job loss, carbon intensity of employment, and worker perceptions.

Our data shows that green job creation is continuing at an impressive rate. However, a large proportion of these new roles are based in London and the South East. If growth continues on this trajectory, the compounding effect means the green economy will increase London's dominance over other cities and regions. The need to secure a transition that is just and inclusive is greater than ever.



# The Barometer is structured through five Pillars:

## 01
### Green job creation

The relative density of green job advertisement as a total of job advertisements.

## 02
### Wider benefits from green jobs

The multiplier effect of direct new green jobs in creating additional employment, whether indirectly or induced via employment effects.

## 03
### Sunset jobs to disappear

The number of jobs lost by 2030 as a result of a transition to environmental sustainability, in the absence of worker reallocation or upskilling.

## 04
### Carbon intensity of jobs

Carbon dioxide emissions per employer. This provides information about the carbon intensity of different sectors and regions.

## 05
### Green workplaces

Worker sentiment about what the green transition means for their own role and workplace.

The Green Jobs Barometer 2022 reflects updates to Pillars 1, 2, 4 and 5. Pillar 3 is derived from a number of sources that are not updated on an annual basis, however, we have drawn from our research into the energy sector to bring fresh insights on sunset jobs, which we have used throughout this report.

The overall Barometer score is the average of the score of the five pillars. This allows ranking the twelve covered regions in the UK.

| | | | |
|---|---|---|---|
| 1 | Scotland 74 | 7 | North West 39 |
| 2 | London 62 | 8 | West Midlands 38 |
| 3 | Wales 49 | 9 | South West 37 |
| 4 | South East 46 | 10 | East Midlands 33 |
| 5 | East of England 44 | 11 | North East 31 |
| 6 | Yorkshire and The Humber 42 | 12 | Northern Ireland 24 |

## Key findings from 2022

**(1) The UK's green transition accelerates, with the number of green jobs advertised almost trebling in 12 months**

Although the absolute number of green jobs in the UK remains relatively small, there has been a remarkable rate of growth as the transition to net zero gathers pace. In the period July 2021–July 2022, 2.2% of total advertised jobs met our broad definition of green jobs, an almost three-fold increase on last year (in 2021, it was 1.2%). In absolute terms, this reflects a jump from 124,600 to 336,821 unique green job adverts.

In fact, every region of the UK saw the number of green jobs in demand at least double. Scotland has the highest proportion of new green jobs to all jobs, at 3.3% (up from 2.2%), followed by the South West (2.4%) and North West (2.3%). This mirrors last year's rankings and allowed Scotland to retain its position as the leading economic region of the UK in the Green Jobs Barometer.

Green jobs are now growing at around four times the rate of the overall employment market. This is a major signal that economic growth and action to tackle climate change are likely to be closely intertwined in the decades to come.

At a sector level, the energy; water services; and professional, scientific and technical industries have the highest proportion of new green jobs as a percentage of all new jobs in their workforce. In the electricity and gas sector, for example, the percentage of job adverts classified as green grew from 21.1% to 31.6% in the 12-month period.

However, when we consider the volume of green jobs, it's the professional, scientific and technical services sector where we see the largest numbers. More than 110,000 green jobs were advertised in these sectors, far outstripping any other, with construction a distant second with 38,000 adverts. In fact, more than one-third of all green jobs are in the professional, scientific and technical services sector. These sectors are clearly larger, but the growth in green jobs reflects demand in new sub-sectors such as climate tech.

**(2) Green job creation is being driven predominantly in London and the South East. If this trajectory continues, the economic benefits of net zero transition might not be fairly spread**

Although every region of the UK is experiencing green job creation at pace, the rapid increase is disproportionately concentrated in London and the South East. These regions collectively represent approximately one-third (32.7%) of all new green jobs.

Just 7,594 unique green job advertisements were for roles in the North East in 2022, compared to the significant 110,067 located across London and the South East.

The South's dominance is reinforced when you consider the concentration of professional, scientific and technical roles in London and the South East, which, as we've already highlighted, is currently the largest sector for new green jobs. This is creating an ever-growing gap in new green trades jobs, which are more prevalent in other parts of the country, and which are equally vital to the net zero transition.

When the findings from across the Pillars are combined into the overall Barometer Index, it's clear that regional disparities are becoming more pronounced within the green jobs market. For example, the South East has climbed four places, with the North East falling seven.

These disparities could be even more profound given the wider economic benefits of the creation of green jobs. Our analysis shows that every green job supports a further 1.2 jobs. This multiplier effect is most significant in London, where 1.7 jobs are supported by each green job.

Moreover, we are starting to see a correlation, albeit small, between the perceived 'greenness' of jobs and the quality of jobs. This correlation is more pronounced on a regional basis (i.e. the regions that have a higher level of jobs perceived as 'green' also tend to have a greater perceived quality of jobs). The theme of quality will become more prominent in future iterations of the Barometer.

**(3) The biggest barrier to green jobs growth is skills shortages–but the solutions vary by sector, with small and medium-sized businesses (SMEs) needing particular support**

While demand for green jobs is growing, the market is reaching a crunch point where there are not enough skills to meet demand. The challenges and solutions vary significantly–but reskilling will be key.

For the energy sector, skills shortages have largely been mitigated by the high transferability of technical skills between oil and gas and clean energy (research shows that 90% of workers in the sector have transferable skills).[1] However, many of these skilled workers are heading for retirement age, so attracting the next generation is critical. It would be an unfortunate paradox if one of the largest sources of green jobs opportunities–vital for the net zero transition–is shunned by some potential workers for its association with fossil fuels.

Another sector critical to net zero transition is housing. A quarter of the UK's emissions come from its draughty housing stock, which will need to be retrofitted. PwC research shows that the sector will require between 10,000 and 66,000 new tradespeople each year, including heating engineers, glazers and insulation specialists. The problem is that, while this demand will come, it's not there yet. This makes it hard to persuade workers that the retrofit sector is worth entering. It's also preventing the right investment in training–there are few recognised technical education pathways and most training is done on the job as quickly as possible. A step-change in approach, with unprecedented coordination between national and local governments and the private sector, is essential.

SMEs face particular barriers to transitioning to net zero. Given they make up the backbone of the UK's economy–responsible for some 16 million jobs–the UK will not be able to seize the full opportunity of green jobs if more help is not offered to SMEs, especially in the regions outside Scotland, London and the South East. The most pressing hurdles were identified as: access to the right technical expertise to plan the operational changes needed to decarbonise, access to affordable finance, and knowing what skills to hire when the exact path to net zero is uncertain.

While each sector, region and business type has its own set of challenges and requires tailored solutions, these efforts need to be stitched together with overarching policies and plans. Ultimately, a secure and flourishing green jobs market relies on a concerted effort from across all levels of government, along with businesses large and small, and education and training bodies. That is how we will reach net zero in a way that enhances our labour market, expands our skills base and grows our economy.

1. 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

# 1. Overview of the Barometer

First published in November 2021, the Green Jobs Barometer was created to measure and track the jobs impacts of decarbonisation efforts and net zero activity,[2] as well as the adoption of green practices in the workplace. With its coherent empirical framework to monitor impacts across regions, industries and over time, the Barometer is intended as a point of reference in policy debates concerning employment, jobs and net zero activity as well as, more recently, energy security.

Our research confirms that not all sectors, regions or workers stand to gain from the green transition, which is not just a story of job creation, but also one of job loss and the urgent need to reskill or upskill, as the growth of many sectors and trades is mirrored by the decline of others. The Barometer provides insights that go to the heart of the economy's preparedness for the green transition and what that means for jobs and workplaces across the UK.

Interactive and broken down into regions and sectors, the Barometer measures performance via five key Pillars (Figure 1). Each Pillar captures a different aspect of the impact of a transition to a green economy on the UK labour market, and their aggregation into an index allows capturing the overall performance of different UK regions and sectors (more details about the measurements are offered in the original report).[3]

**Figure 1:** the five-Pillar Barometer model

| 01 | 02 | 03 | 04 | 05 |
|---|---|---|---|---|
| **Green job creation** | **Wider benefits from green jobs** | **Sunset jobs to disappear** | **Carbon intensity of jobs** | **Green workplaces** |
| Percentage of job advertisements that are considered green. | Indirect employment impacts via multiplier effects of green investments across supply chains. | Proportion of jobs lost by 2030 as a result of net zero activity. | Carbon dioxide emissions per employee–in different sectors and regions. | Worker sentiment about what the green transition means for their own role and workplace. |
| **Online job ad data** | **Multipliers from I-O tables** | **PwC analysis with ILO data** | **PwC analysis with public data** | **PwC survey** |

2. The UK has legislated to achieve net zero annual carbon emissions by 2050. It is increasingly clear that this requires a suitably skilled workforce and brings with it fundamental shifts in labour demands across the country. The Government's Net Zero Strategy notes that, over the next 30 years, approximately 6.3 million jobs are likely to be affected by the green transition.

3. Green Jobs Barometer 2021: Monitoring the Fair Transition to a Green Economy: https://www.pwc.co.uk/who-we-are/purpose/green-jobs-barometer.pdf

Based on a consistent definition (see 'What is a Green Job?' below), the Barometer offers a reliable and sustained measurement that allows users to monitor the development of green jobs over time and across sectors and regions.

By summarising and aggregating information in a meaningful way, the Barometer enables PwC to provide organisations and policy makers with a solid evidence base to identify trends and challenges, assessing systematically how to adapt to the green transition.[4] In essence, the Barometer has created a link between environmental and employment policy agendas, which had previously remained separate.

## What is a Green Job?

The first contribution of the Barometer was to produce a clear definition of green jobs based on the objectives linked to different jobs. Jobs are considered "green" if their roles involve:

**Producing and providing environmentally friendly products and services.** (E.g. producing solar panels or other forms of renewable energy, also includes environmentally friendly version of traditional products like energy-efficient light bulbs).

**Adapting work processes to become more environmentally friendly or use fewer natural resources.** (E.g. beer brewed in solar-powered breweries, or operations that are managed from wind-powered offices).

**Supporting the green economy indirectly.** (E.g. environmental advisors in business consulting, law and accounting).

*More details about how this definition was reached are offered in the original report[5]

4. The Green Jobs Barometer allows users to undertake a high-level comparison of regions. They are also able to view the raw data across the five Pillars that make up the index. This feature facilitates quick evaluation of strengths (and weaknesses) of specific sectors and regions.

5. https://www.pwc.co.uk/who-we-are/purpose/green-jobs-barometer.pdf

The Barometer will continue growing over time, with regular data updates, but also with additional functionality and pieces of research in order to bring more insight to policy conversations.

This report summarises the findings of the 2022 Barometer update covering data for the period from July 2021 to June 2022. In addition to the data updates, during the last year, we have undertaken a number of activities and ancillary analyses linked to the Barometer:

- The Energy Transition and Jobs report[6]
- The Green skills as an enabler of UK retrofit report[7]
- Expanded the Pillar 5 (Green workplaces) analysis to include indicators of job quality in the questionnaire survey
- Extensive stakeholder engagement across both industry and government[8]
- Hosted an event in the Blue Zone at COP27 on what a 'just energy transition' means for jobs and workers

These follow-up conversations and research have allowed us to identify avenues to continue developing the Barometer, and research related to it, to make it more useful for decision makers. They also give us an indication of the key challenges that specific local economies, industry sectors and employers are facing, and the kind of evidence that they need to act effectively.

Overall, beyond the interesting insights from new data updates and emerging trends, this report gives an overview of how the Green Jobs Barometer agenda is evolving to consolidate as the main tool to monitor the UK's green economy.

**Specifically, we want to explore:**

**Targets:** long-term and defined economy-wide or for specific industry sectors, targets provide a benchmark for how a respective region or sector is performing against its own objectives.

**Granular occupational and careers analysis:** with the goal of identifying how existing jobs are being reconfigured as a result of greening of activities, the relevant reskilling needed, as well as career pathways for those occupations in sunset industries for a just transition.

**Capture job quality:** to give a clearer picture of whether new green jobs are desirable as a career pathway and which segments of the population benefit the most.

**Understanding regional and sectoral drivers:** delivery of net zero is highly complex, achieving desirable outcomes is contingent on cross-sector and regional collaboration.

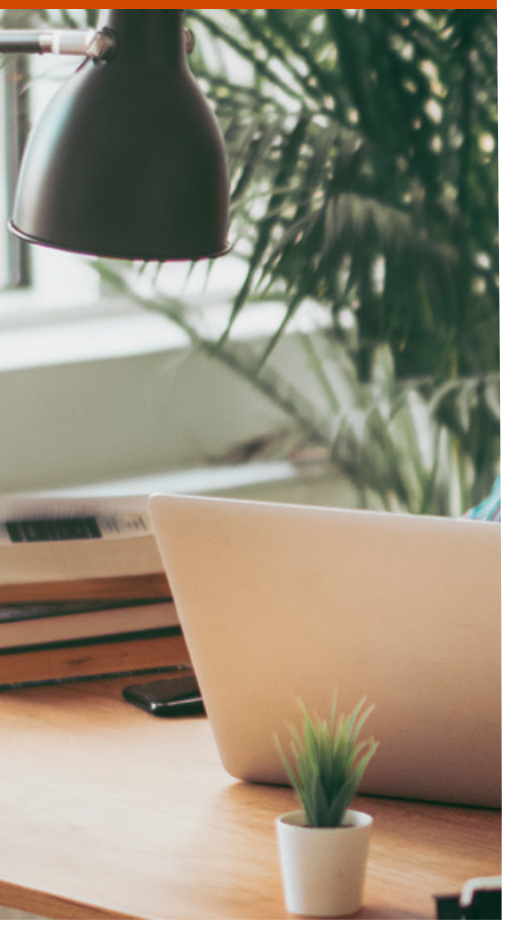
**The Barometer as a platform for conversations:** the Barometer is driving a green jobs agenda by giving agency to some of the businesses most exposed (by virtue of the size or nature of their business) to a transitioning economy.

6. A research article entitled 'The Energy Transition and Jobs: can people transition to new green jobs', exploring the labour force constraints to achieving a decarbonised grid in the context of the UK's energy goals. https://www.pwc.co.uk/who-we-are/purpose/the-energy-transition-and-jobs.pdf

7. PwC (2022) Green skills as an enabler of UK retrofit. https://www.pwc.co.uk/who-we-are/purpose/green-jobs-barometer-retrofit.pdf

8. Section 4 of this update includes our extensive stakeholder engagement and analysis.

# 2. Green jobs in 2022

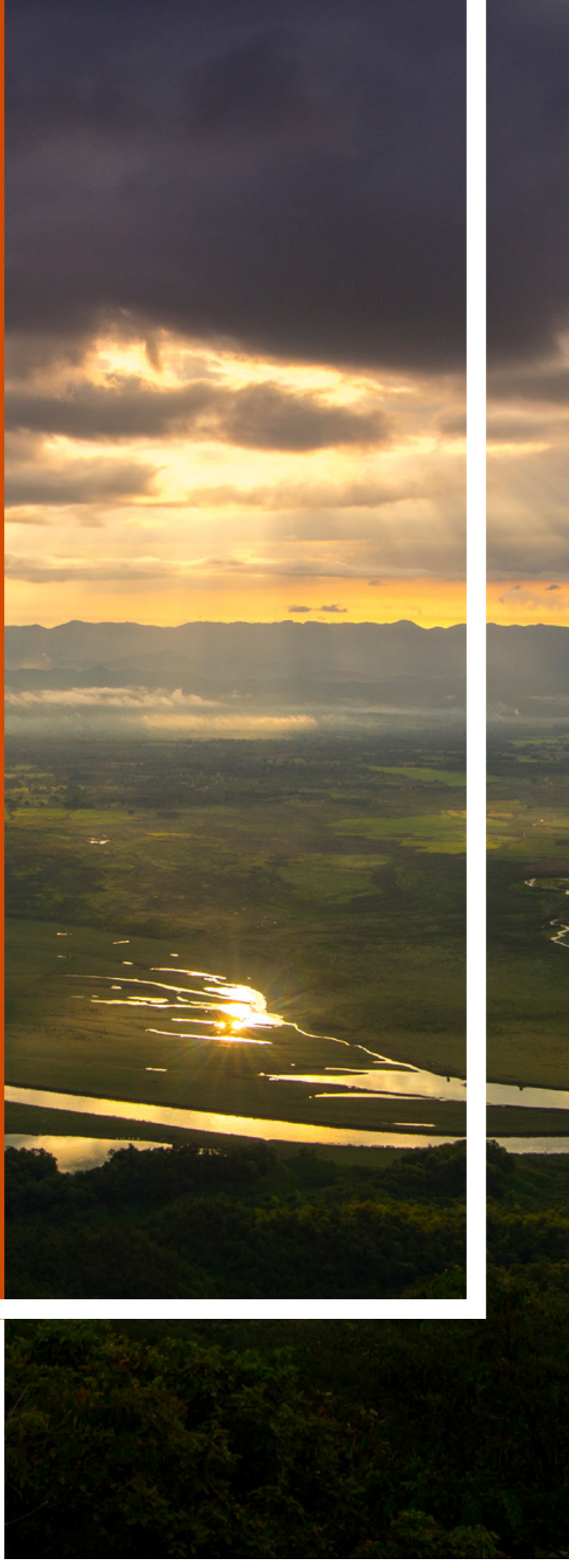


The initial iteration of the Barometer, published in 2021, provided the first systematic view into the relative performance of UK regions and industry sectors in terms of their progress in developing green jobs and work practices.

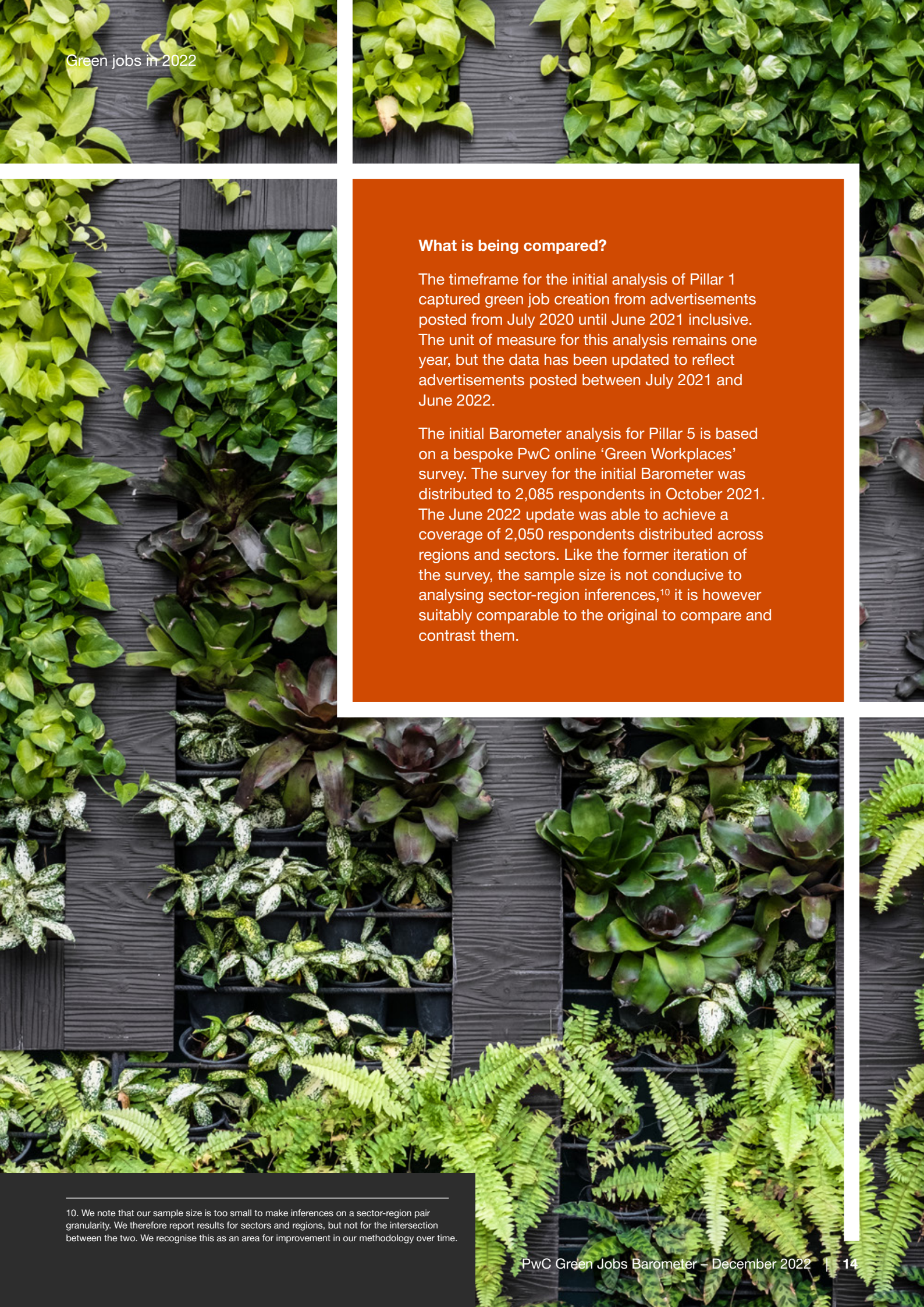
This section focuses on new insights emerging from data updates that took place between July 2021 and June 2022.[9] Pillar 1 in particular (measuring the creation of green jobs) encouragingly attests to a sizable increase in green job creation, providing interesting insights across industries and regions.

Pillar 2, Pillar 4 and Pillar 5 have also been updated: the status of these pillars is described more briefly, because the developments they reflect are less stark and only loosely attributable to wider trends. Comparisons over time are not analysed in detail, although it is expected that, for Pillars 2 and 4, trends will become more apparent over a longer timeframe. The novelty of Pillar 5 in this wave is that it gives us emerging findings about the quality of green jobs–a question that has been raised frequently in conversations with government and industry stakeholders.

Pillar 3 has not been updated–this analysis is derived from a number of sources that are not updated on an annual basis. Instead, insights from our research into the energy sector, about both sunset jobs but also green job creation, are summarised in Section 3.



9. It is not possible to update all pillars of analysis more frequently than annually owing to availability of publicly available data upon which some pillars depend and the frequency with which they are published. While the Barometer constitutes five pillars of analysis, several pillars rely on publicly available data and are therefore beholden to the publication of those respective data sources



**What is being compared?**

The timeframe for the initial analysis of Pillar 1 captured green job creation from advertisements posted from July 2020 until June 2021 inclusive. The unit of measure for this analysis remains one year, but the data has been updated to reflect advertisements posted between July 2021 and June 2022.

The initial Barometer analysis for Pillar 5 is based on a bespoke PwC online 'Green Workplaces' survey. The survey for the initial Barometer was distributed to 2,085 respondents in October 2021. The June 2022 update was able to achieve a coverage of 2,050 respondents distributed across regions and sectors. Like the former iteration of the survey, the sample size is not conducive to analysing sector-region inferences,[10] it is however suitably comparable to the original to compare and contrast them.

10. We note that our sample size is too small to make inferences on a sector-region pair granularity. We therefore report results for sectors and regions, but not for the intersection between the two. We recognise this as an area for improvement in our methodology over time.

## Pillar 1 Green job creation: green roles outpacing market growth by almost 4:1

Pillar 1 of the Barometer focuses on green job creation, demonstrating the percentage of new green jobs as a proportion of total new jobs across different regions and sectors in the UK. Pillar 1 was calculated using Geek Talent[11] data to analyse job vacancies posted across the UK during the 12-month period and identifying green jobs through specific characteristics listed in the description, using the same methodology as the first iteration.[12]

When first published, the Pillar 1 analysis indicated that 1.2% of all advertised jobs in the UK were green jobs, equivalent to 124,600 jobs. This number has since increased to 2.2% for 2022 (**see Table 1**), equivalent to 336,821 job advertisements. The rise in green jobs creates wider benefits for the economy, with each new green job in sectors closely linked to the energy transition set to create a further two to five additional jobs across supply chains, and sectors more closely tied to advisory, advocacy or research, generating an additional 1.8 jobs.[13]

### Regional findings

Green jobs across all regions account for a larger share of the job market than they did last year, with the highest proportional increases occurring in Scotland, London, Wales and the South East (**see Table 1**). This concurs with (increasing) trends seen in the wider economy, with areas such as the North East of Scotland investing heavily in offshore renewables, including carbon capture, usage and storage (CCUS) as well as hydrogen. The Welsh government is also heavily investing in the net zero transition; it has committed to building 20,000 low-carbon homes by 2026, while continuing to develop more offshore wind farms. Further green investment is found in the North Wales Growth Deal, which aims to position the region as a leader in low-carbon energy with a target of up to 980 new green jobs. Additionally, the Welsh government awarded £2 million to educational colleges in 2021 to further the green skills agenda.[14]

The regions with the highest proportion[15] of green jobs remain the same as the first iteration, with Scotland at 3.3%, the South West at 2.4% and the North West at 2.3%, reflecting the continued growth in offshore energy and nuclear power in Scotland and the South West, respectively, and the former's record-breaking renewable electricity generation in 2022.[16]

11. Geek Talent is a provider of skills and salary data and analysis for the UK jobs' market.
12. See details in the Technical Appendices of: https://www.pwc.co.uk/who-we-are/purpose/green-jobs-barometer.pdf
13. Analysis from Pillar 2 of the Green Jobs Barometer 'Wider Benefits of Green Jobs'.
14. https://www.energylivenews.com/2021/07/14/welsh-colleges-awarded-2m-to-provide-training-for-jobs-in-green-economy/
15. In absolute terms, London, owing its population size, dominates green job creation, but is outperformed by other regions in relative terms.
16. https://www.energylivenews.com/2022/10/14/scotland-smashes-renewables-generation-record/

**Table 1: PwC Green Jobs Barometer (Pillar 1: green job creation as a % of total job creation) Q3 2021 to Q2 2022, by region**

| | 2022 | 2021 | Position | Move | Green ads 2022 | % increase in green job ads |
|---|---|---|---|---|---|---|
| Scotland | 3.34% | 1.65% | 1 | = | 24,610 | 170% |
| South West | 2.42% | 1.47% | 2 | = | 32,285 | 112% |
| North West | 2.28% | 1.46% | 3 | = | 31,896 | 101% |
| Wales | 2.24% | 1.14% | 4 | ▲ 4 | 8,100 | 157% |
| South East | 2.22% | 1.13% | 5 | ▲ 5 | 54,498 | 149% |
| East Midlands | 2.17% | 1.18% | 6 | ▲ 1 | 20,432 | 134% |
| London | 2.07% | 0.95% | 7 | ▲ 5 | 55,569 | 224% |
| North East | 2.05% | 1.26% | 8 | ▼ 4 | 7,594 | 126% |
| West Midlands | 2.03% | 1.13% | 9 | = | 24,044 | 135% |
| East of England | 1.96% | 1.02% | 10 | ▲ 1 | 25,998 | 152% |
| Northern Ireland | 1.95% | 1.24% | 11 | ▼ 6 | 2,185 | 115% |
| Yorkshire and The Humber | 1.94% | 1.21% | 12 | ▼ 6 | 17,219 | 103% |
| **Total in the UK** | **2.22%** | **1.20%** | **-** | **-** | **336,821*** | |

*This total includes more than 30,000 green ads which were location agnostic, and can be located anywhere in the UK.

Scotland has not only shown the strongest regional performance in respect to green job creation over both iterations of the Barometer; its growth in green jobs advertised outperforms all other regions proportionally (1.6 percentage point increase on last year). The demand for green jobs in Scotland is being driven by the energy sector in the North East; a thriving energy hub, the region boasts the largest pool of energy-related skills in the UK, skills which are highly transferable to roles in the emerging renewables subsector.[17] Research from Robert Gordon University[18] suggests that if sufficient investment is made in the region to deliver 18GW of offshore wind, it would lead to a 20% increase in North East Scotland's offshore energy workforce to 54,000 people by 2030.

London is the second strongest performer by growth in the proportion of green jobs, with the South East close behind. Given the large volume of jobs in London and the South East, the rate of growth is having a disproportionate impact on the green jobs market. One in five new green jobs are based in the capital.

17. 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.rgueti.com/wp-content/uploads/2022/05/Making-the-switch-images.pdf

18. 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

**Sector findings**

The water supply and electricity and gas sectors remain to be those with the highest proportion of green jobs at 34.5% and 31.6% respectively. Within the electricity and gas sector, the percentage of green jobs advertisements grew from 21% to 31.6% in the same period (**see Table 2**), further highlighting the growing demand for green skills within the energy industry. The water supply sector surpassed the electricity and gas sector which may, in part, be associated with the recent high levels of public and governmental scrutiny over the environmental stewardship of water companies at processing wastewater.[19] [20] This may have been a driver of greater investment on the part of those companies in addressing these failings through an increase in employment of environmentally qualified staff but this is speculative.

A significant increase (6.2%) was similarly observed in the 'agriculture, forestry and fishing'[21] sector, reflecting the prominence of the net zero agenda within the sector but, similarly reflecting the drive for 'nature friendly' farming enshrined within the Environment Act 2021. This sector has seen a large investment in clean technology, with thousands of new climate-technology startups fueling net zero solutions.[22] Additionally, the professional, scientific and technical activities sector had the largest absolute increase in green jobs, with 34% of all green job adverts in this sector, up 2.2%.

The construction and manufacturing sectors saw a 2.0% and 1.5% growth in green jobs respectively, but growth of green jobs is widely expected to accelerate in the coming years given their role in pursuing net zero objectives – with the challenge for both sectors is that they will need significant investment in upskilling and training in order to prepare the UK workforce for those jobs (between 10,000 to 66,000 new tradespeople will be needed each year to retrofit the UK's 30 million homes requiring such upgrades). The Barometer will continue having a key role in tracking how the demand for certain jobs and skills is growing over time.

The only sector to show a sharp decrease in the percentage of green jobs is the mining and quarrying sector, which faced global closures during the pandemic and has since seen a reopening of roles in the latter part of 2021.[23]

19. https://news.sky.com/story/eleven-water-companies-fined-and-forced-to-give-money-off-customers-bills-12711127

20. However, part of this shift was also in part due to Northern Ireland's water supply sector, which consisted of only one job and therefore had a green jobs rate of 100%.

21. Job creation in the agricultural sector is not as well reflected in vacancy data on job advertisement aggregator sites with businesses often preferring to use local or industry-specific agents and informal routes. As such, these data are more sensitive to absolute changes in the numbers observed.

22. PwC (2022) Overcoming inertia in climate tech investing.

23. It is also worth noting however that the small sample size of mining jobs in the first iteration of the barometer was not sufficiently large to confidently infer whether the findings were representative of the sector.

**Table 2: PwC Green Jobs Barometer (Pillar 1: Green Job Creation) Q3 2021-Q2 2022, by Sector***

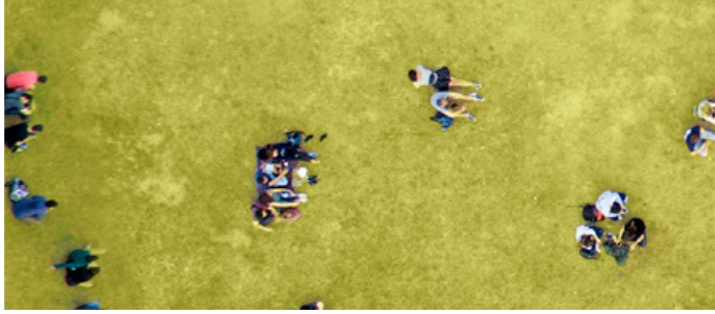
| Sector | Percentage of green jobs | Growth in green jobs[24] (%) |
|---|---|---|
| Electricity, gas, steam and air conditioning supply | 29.52% | 7.52% |
| Water supply; sewerage, waste management and remediation activities | 23.50% | 3.61% |
| Mining and quarrying | 7.74% | -20.52% |
| Public administration and defence; compulsory social security | 5.94% | 3.28% |
| Professional, scientific and technical activities | 5.66% | 1.93% |
| Agriculture, forestry and fishing | 4.17% | 1.69% |
| Other service activities | 3.44% | 0.45% |
| Manufacturing | 3.37% | 1.17% |
| Construction | 3.31% | 1.66% |
| Transportation and storage | 2.28% | 0.91% |
| Information and communication | 1.93% | 1.71% |
| Financial and insurance activities | 1.66% | 1.20% |
| Administrative and support service activities | 1.64% | 0.63% |
| Wholesale and retail trade; repair of motor vehicles and motorcycles | 1.27% | 0.88% |
| Arts, entertainment and recreation | 1.26% | 0.39% |
| Accommodation and food service activities | 1.23% | 0.70% |
| Education | 0.33% | 0.28% |
| Human health and social work activities | 0.29% | 0.23% |

*This table has been updated since first publication.

24. By comparison to Q3 2020-Q2 2021

**Table 3: Green job advertisements as a proportion of total in UK sectors and regions, by green segments, Q3 2020-Q2 2021 vs Q3 2021-Q2 2022**

| Green advertisements / All advertisements | Sectors more closely aligned to the energy transition | Sectors more closely tied to producing and adapting green products or services | Sectors more closely tied to advisory, advocacy or research | All sectors' |
|---|---|---|---|---|
| North East | 25.1% | 2.2% | 1.9% | 2.0% |
| North West | 33.4% | 2.4% | 2.1% | 2.3% |
| Yorkshire | 21.9% | 2.2% | 1.7% | 1.9% |
| East Midlands | 22.7% | 2.2% | 2.1% | 2.2% |
| West Midlands | 22.7% | 2.3% | 1.8% | 2.0% |
| East of England | 24.5% | 2.0% | 1.8% | 2.0% |
| London | 33.7% | 2.3% | 1.9% | 2.1% |
| South East | 23.5% | 2.3% | 2.0% | 2.2% |
| South West | 22.1% | 2.5% | 2.3% | 2.4% |
| Wales | 27.5% | 3.0% | 1.8% | 2.2% |
| Scotland | 29.5% | 2.8% | 3.2% | 3.3% |
| Northern Ireland | 24.6% | 2.6% | 1.7% | 2.0% |
| UK | 26.4% | 2.3% | 2.0% | 2.2% |

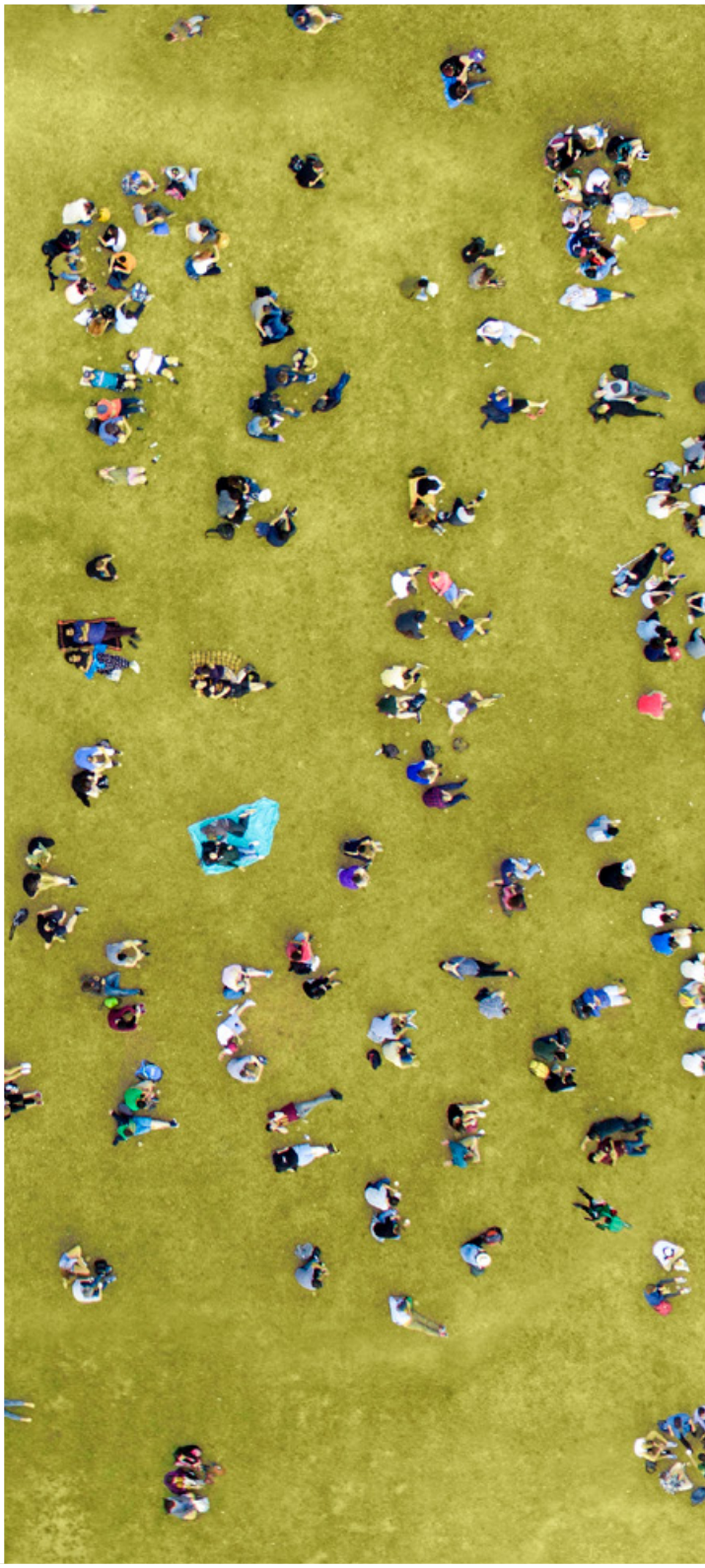


**Case study: Green Skills as an enabler of UK retrofit**

This November, we published an additional deep dive research paper into the decarbonisation challenges to the UK's housing retrofit workforce.[25] Our report 'Green Skills as an Enabler of UK Retrofit' identifies labour force challenges to achieving the UK's net zero targets. We quantify the number of workers needed to deliver domestic heat efficiency improvements under a number of scenarios and identify a pervasive cycle of factors inhibiting tradespeople from upskilling to deliver on some key areas of government policy such as the rollout of heat pumps as low-carbon alternatives to domestic heat and propose some actions which could break this cycle and accelerate the development of a skilled retrofit workforce.

In the retrofit sector, our analysis shows that more than 65,000 new tradespeople could be needed each year as retrofit take-up accelerates–with heating engineers, glazers and insulation specialists the most in demand. In addition to these specific trades, many more green jobs will be required both in the retrofit sector–retrofit coordinators, receptionists, marketing–and in its wider manufacturing and distribution supply chains.

Pillar 2 multipliers show that for each green job, the wider employment effects originated in this sector could result in between 1.7 and 5.3 additional jobs.[26] However, since demand for labour in this sector has been limited until now, and has slowed markedly in the past decade as retrofit activity has decreased, people have not yet acquired the relevant skills.



25. https://www.pwc.co.uk/who-we-are/purpose/green-jobs-barometer-retrofit.pdf

26. The multiplier effect is based on the assumption that these jobs will be entirely based in construction or electricity, gas and air conditioning.

**Case study two: London leads in climate tech**

When it comes to climate tech innovation, the UK is punching above its weight. Globally, investment dollars into climate tech start-ups has fallen 30% year on year according to PwC's State of Climate Tech 2022 report. However, in the UK, climate tech investment has actually grown by 40%, with London second only to San Francisco in attracting funding. Climate tech is defined as technologies that are focused on reducing greenhouse gas emissions or addressing the impacts of global warming. The technologies can be broadly classified into three main groups, those that directly mitigate or remove emissions; those that help us adapt to the impacts of climate change; and those that enhance our understanding of the climate.

What does climate tech investment mean for jobs? By their nature, start-ups tend to be small (sub 50 employees), but they have the potential to grow quickly. The UK has nine climate tech unicorns – valued at more than $1bn each. A further 16 climate tech start-ups are on their way to becoming unicorns, currently valued between $250m and $1bn. Unicorns can have thousands of employees.

A large cluster of climate tech start-ups can make a difference to local job markets. London dominates the UK's climate tech scene, attracting 809 deals over the last five years. The next most active city–Cambridge–had 77.

### Green skills for a greener Britain

The rising demand for green jobs has led to a subsequent increase in the demand for green skills. While changes seen in this second iteration are not likely to represent long-term trends just yet, our aim is to capture trends over time and to continue refining measurements to improve accuracy.

An analysis of the required skills outlined in the advertisements used in the Pillar 1 analysis gives us an indication of what green skills[27] employers are currently looking for. The green skills in highest demand were largely sector agnostic ('sustainability', 'environmental' 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 the continued significance of low-carbon energy generation in driving the green economy.

**Table 4: Most demanded green skills from employers across all sectors, PwC analysis of job vacancy data, Q3 2021-Q2 2022**

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

27. 'Skills' are inclusive of both technical skills, soft skills, and wider knowledge domains.

The construction sector will see significant increases in green employment linked to the build phase of green infrastructure. Nuclear power generation construction, for instance, 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 lifetime.[28] 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, while green skills linked to nuclear infrastructure construction feature frequently in construction job advertisements; a 'site engineer' at Hinkley Point C for instance, our analysis of vacancy data identifies that demand from general green infrastructure, particularly from solar renewables (**see Table 5**) is driving the majority of construction demand.

**Table 5: Most demanded green skills from employers in the construction sector, PwC analysis of job vacancy data, Q3 2021-Q2 2022**

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

Of the skills, the electricity and gas sector have deviated the most since last year, 'infrastructure' and 'renewable energy' again rank in the top ten, whilst 'nuclear' falls in prominence. New skills 'wind' and 'offshore wind' rank 7 and 10 respectively, highlighting the proliferation of wind technology in the renewable energy sector. The electricity and gas sector needs additional skills linked to energy management and energy efficiency, (**see Table 6**) showing that job demand is being driven as much by efforts to balance the grid as other trends.

**Table 6: Most demanded green skills from employers in the electricity, gas & steam sector, PwC analysis of job vacancy data, Q3 2021-Q2 2022**

| Skills (electricity & gas sector) | Rank |
|---|---|
| Carbon | 1 |
| Sustainability | 2 |
| Environmental | 3 |
| Renewable Energy | 4 |
| Infrastructure | 5 |
| Energy Industry | 6 |
| Wind | 7 |
| Energy Efficiency | 8 |
| Energy Management | 9 |
| Offshore Wind | 10 |

Our own research into the energy sector highlights that significant skills gaps cannot be addressed from the existing workforce, so considerable investment in reskilling will be needed.[29] More details about skills gaps in the energy sector are presented in Section 3.

28. 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

29. https://www.pwc.co.uk/who-we-are/purpose/the-energy-transition-and-jobs.pdf

## Pillar 2 Wider benefits of green jobs: each job produces 1.3 additional roles

This Pillar seeks to identify where direct green jobs are creating additional employment across other sectors and regions. This helps show the full benefits of green jobs, and means policy decisions can be based upon wider economic impacts rather than narrow green employment creation. These wider impacts are based on employment multipliers (**see box below**).

### Employment multipliers of Green Jobs

Pillar 2 is based on sectoral employment multipliers: a sector-specific parameter that tells us how many additional jobs are created in the economy (e.g. across supply chains relevant to that industry) for each green job created in that sector.[30] The total employment impact in a given region (i.e. the 'regional multiplier') is the product of the sector-specific parameter and the size of green job creation in each sector.

Multipliers remain relatively constant over time. The sectoral multiplier parameter, which is based on wider economic analysis of input-output tables in the UK, is updated once every three years and therefore the parameter remains fixed for some years.[31] The wider employment effect in a given region (the regional multiplier) can still change based on the size and where the demand for green jobs is being created–and how such green job creation from Pillar 1 is distributed across sectors. For a given region, larger demand for green jobs in sectors with lower employment multipliers can actually lead to a lower regional (aggregated) multiplier.[32]

This year, the aggregated multipliers for regions and for the UK overall, have decreased–even if, on average, the number of green jobs has increased.[33] This is not necessarily bad news. Multipliers tend to be higher in technical roles, which usually have extensive supply chains. That's why green jobs in the energy sector have such a significant impact on employment–each new job generating a further five additional jobs in the wider economy. Last year we had predicted that as green activities broaden out, overall multipliers might decrease. This has proved to be the case.

But since the demand for green jobs has actually increased (from 124,600 to 336,821 green ads), the total wide employment impact, in absolute numbers, has also increased. Furthermore, this could also be interpreted as a positive outcome if it reflects a diversification of the location of green jobs, both regionally and sectorally.

The phenomenon above can be illustrated with an example. Scotland's green jobs multiplier decreased by 0.4 points, the largest decrease. Our Input-Output model shows that Scotland has an average job multiplier for all sectors of 2.6, and green job ads increased by 1.6 percentage points. Notably, in 2021 14% of Scotland's green jobs were in the electricity, gas, steam and air conditioning sector, which has a high regional multiplier of 8.6. This year's data shows that around 9% of Scottish green jobs are found in the electricity sector. Moreover, the standard deviation of Scottish green jobs has decreased this year, while the number of green jobs has dramatically increased from 9,130 to 24,610. This signals a positive trend in green job creation, as well as a more even distribution of secondary benefits throughout the region–a trend we can see for other regions, as well as most sectors.

In order to be able to better take this into account and conduct a time-comparison analysis, we would have to look at the number of green jobs, not only the percentage of green jobs. This time series can be used to monitor the impact of actual green job creation. We will provide this analysis in further editions of the analysis, once more data is available.

30. In economic terms, the multiplier parameter gives us the 'marginal' employment impact of each green job.

31. This is a reasonable assumption. As green activities move from highly technical and design roles (which can be expected to have larger multipliers, particularly well-paid jobs with extensive local supply chains) into broader roles, there is indeed a possibility that multipliers might decrease, but this impact is likely to be minimal over the short term.

32. In other words, the multiplier will decrease if regions or sectors with low job creation see an increase in the proportion of green jobs, while those with high job creation see a decrease in green jobs.

33. This refers to the absolute number of green jobs reported in Pillar 1 for the time period covered in this update (from Q3 2021 to Q2 2022).

## Pillar 4 Carbon Intensity of Employment: emissions down 12%

Pillar 4 compares carbon dioxide ($CO_2$) in different UK regions and sectors to employment in the same UK regions and sectors. In this year's Barometer, we calculated there were eight tonnes of $CO_2$ emissions per employee, down 12% from last year's 9.1 tonnes.

Inventories of greenhouse gas emissions are critical to monitor progress against domestic and international targets such as the Kyoto Protocol. $CO_2$ is the main greenhouse gas, accounting for 79% of greenhouse gas emissions in the UK in 2020.[34] It is therefore important to track $CO_2$ trends in their own right. Emissions also matter for jobs. Emissions per employee give us an indication of how environmentally-friendly jobs are, independently of whether such jobs are considered green jobs or not, and also give an indirect indication of jobs that could lose out in the future as the green transition accelerates.[35] Indeed, as we show in the remainder of this section of the report, and consistent with Pillar 3, jobs in decline tend to be concentrated in the most carbon intensive sectors. As sectors and regions decarbonise, and as the UK moves towards net zero, we expect to see carbon intensity of employment reduce.

There is considerable variation across sectors in this Pillar, which is the primary driver of our analysis.

**Table 7: Carbon intensity of employment, Q3 2020-Q2 2021 vs Q3 2021-Q2 2022, by sector**

| Sector | Tonnes of $CO_2$ Emitted per Job |
|---|---|
| Electricity, gas, steam and air-conditioning supply | 597.5 |
| Mining and quarrying | 339.3 |
| Transportation and storage | 43.1 |
| Manufacturing | 31.9 |
| Agriculture, forestry and fishing | 26.1 |
| Water supply; sewerage and waste management | 20.0 |
| Construction | 6.1 |
| Public administration and defence; compulsory social security | 2.8 |
| Wholesale and retail trade; repair of motor vehicles | 2.6 |
| Real estate activities | 1.5 |
| Accommodation and food service activities | 1.4 |
| Other service activities | 1.1 |
| Human health and social work activities | 1.0 |
| Administrative and support service activities | 1.0 |
| Arts, entertainment and recreation | 0.9 |
| Activities of households | 0.8 |
| Education | 0.8 |
| Professional, scientific and technical activities | 0.5 |
| Financial and insurance activities | 0.2 |

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

35. It is important to add a caveat that while looking at emissions on a per employee basis also enables us to make allowance for the different sizes of UK regions and sectors, it is important to be aware that circumstances vary greatly across different UK regions and sectors, and in some cases are driven by many factors other than the working population.

Since the Barometer's first iteration, carbon intensity across the electricity, gas, steam, and air-conditioning and mining and quarrying sectors has increased the most, with increases of 28.5 tonnes and 27.3 tonnes emitted per job, respectively. These two sectors were heavily carbon intensive during the covid pandemic, demonstrated by this increase in carbon emissions per employee. Alternatively, other sectors saw decreases in their emissions intensity due to the reduction of business and economic activity across the UK. These reductions might appear significant, however, they will likely return to their baselines in the post-covid economic recovery.

The mining sector has the highest level of $CO_2$ emissions per employee, despite the steady decline in coal mining over the past three decades, due to its smaller workforce.

The UK regional average across all sectors remained at nine tonnes of $CO_2$ emitted per job, which is consistent with findings in other Pillars and the demands from the current energy crisis occurring in the UK. Northern Ireland, Wales and the North East remain the regions with the highest $CO_2$ emissions per employee, due to their proportionally smaller workforces. In London, where professional services roles are more prevalent, emissions were just 4.7 tonnes per employee.

## Pillar 5 Green Workplaces: workers' expectations increasing

Taken alone, the other Pillars of the Green Jobs Barometer are limited in how much they can tell us about how existing jobs will change–whether through the activities conducted as part of a role, the sustainability of workplaces or the education and training provided by employers. Pillar 5 seeks to fill these gaps, harnessing employee sentiment to give an extra layer of insight.

Pillar 5 measures how environmentally friendly employees perceive the activities conducted as part of their job to be currently, and whether they expect this assessment to change over the next 1-2 years. These activities span across eight environmental outcomes–reducing waste, reducing carbon, reducing pollution, protecting biodiversity, improving resource efficiency, reducing water use, increasing reuse and recycling and reducing energy consumption.

The 'water supply, sewerage and waste management' sector as well as the 'arts, entertainment and recreation'[36] sector share the highest perceptions on the environmental friendliness of their workplaces, while those in the 'human health and social work' sector had the lowest.[37]

This second iteration does not show an overall upwards trend in employee sentiment; this might owe to the fact that the first iteration was conducted around the same time as COP26 of the UNFCCC in Glasgow–anecdotal evidence suggests this event made green workplace initiatives of greater importance around this time. There is also the possibility that, as workplaces introduce green practices, workers' perceptions reflect a temporary 'premium' of green sentiment that diminishes marginally as higher expectations on what it means to be 'green' become established.

An overall upward trend is expected to develop slowly. As the survey is conducted over a longer timeframe, we will acquire greater insights into the changing perceptions of workplace greenness.

36. The 'arts, entertainment and recreation' sector contains workers engaged in botanical and zoological gardens, the preservation of historical sites and nature reserves activities which could possibly explain why perceptions of environmental friendliness are high. Similarly, the sector contains people involved in sports events, where a number of high-profile initiatives are driving decarbonisation–in September 2021, for example, Tottenham Hotspurs partnered with Sky Sports to host the world's first net-zero carbon football game at an elite level.

37. Insufficient respondents from 'mining and quarrying' mean this sector's perceptions are not captured in the survey responses.

### Capturing job quality

This publication updates the green workplaces survey to introduce the theme of quality to the analysis, which is a key feature that has been requested by several stakeholders.

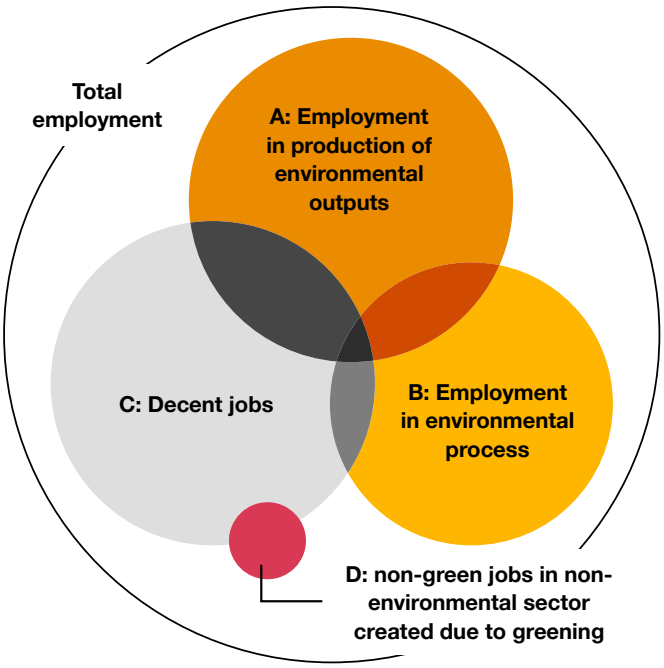
Definitionally, a number of organisations (**see Figure 2 below**) only consider a job to be a 'green job' if the work undertaken in that role is 'decent' and work has been done by the International Labour Organisation (ILO) to evaluate indicators of 'decent' work.[38] While we intend to develop a full list of survey questions to gauge the breadth of indicators of job quality in future publications of the Barometer, our initial ambition was to capture a limited number of themed questions (**see 'Quality Questions' below**) associated with job quality and explore the relevance of their findings, for example, whether there is a correlation between greener workplaces and higher salaries–i.e. a 'green premium'.

**Quality Questions**

1. The extent to which the respondents' job uses the best of their skills and abilities
2. The extent to which the respondents are satisfied with the hours they work
3. The extent to which the respondents find their job fulfilling
4. The respondents' working hours relative to a 48-hour week (regular exceedances of which indicate a negative quality indicator)
5. The extent to which the respondents have access to an employment contract they find desirable
6. Respondents' salary before tax and deductions

38. ILO (2022) Decent Work Indicators. https://www.ilo.org/integration/themes/mdw/WCMS_189392/lang--en/index.htm

**Figure 2: Schematic relationships between total employment, green jobs and decent work**




Source: UNEP, ILO, IOE, ITUC: Green jobs: Towards decent work in a sustainable, low-carbon world (Nairobi, UNEP, 2008).

We have gathered the following early insights from quality questions:

- There is a small correlation between the perceived 'greenness' of jobs and quality of jobs. This correlation is more pronounced on a regional basis (i.e. the regions that have a higher level of jobs perceived as 'green' also tend to have a greater perceived quality of jobs).
- In regard to one component of the quality index, job 'greenness' is positively correlated with salaries. This holds true for both the regional basis and the sectoral basis. This correlation is more pronounced for regions, but it is largely driven by the extremes, such as London, where there is a significant cluster of green jobs and high-paying jobs.
- The 'electricity, gas, steam and air conditioning supply' sector is second in the perceived job 'greenness' ranking, and people working in this sector are happier with their salaries and the use of their skills and abilities. Overall, they have an above-average perceived quality of jobs, although satisfaction with hours worked and job fulfilment could be improved.
- The construction sector, which is critical to the development of renewable and low-carbon infrastructure, ranks fourth in the perceived job 'greenness', but people working in this sector perceive the quality of jobs to be below average across all the quality of jobs indicators, except for salaries.

Moving forward, the introduction of job quality analysis will help determine the key indicators of high-quality green jobs. Understanding what makes a job desirable and green will be instrumental in the proliferation of green jobs and driving growth across all sectors and regions. Capturing the most crucial elements of job quality and embedding them into new green jobs could help with some of the bottlenecks in sectors such as manufacturing and construction, which need to bolster their workforce with upskilling opportunities. Ensuring that these jobs are desirable and green will also help assess the fairness of the transition (**see below on the theme of a just transition**).

**Green jobs are vital at ensuring a 'just' transition, not just a transition**

Forecasting the number of jobs lost is not the only measure that can identify the adverse potential of a decarbonising economy. Measuring the quality of green jobs is also essential for understanding the impact of the transition–the transition would not be equitable or desirable if, for instance, carbon-intensive jobs of high quality were to be replaced by low-quality jobs just because they have a smaller carbon footprint. As represented in **Figure 2**, the need for green jobs to also be decent has become definitional.

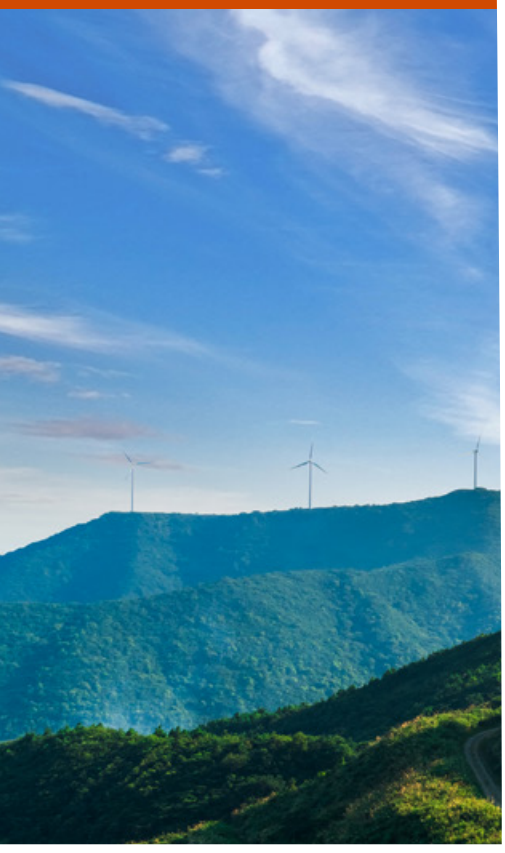
Affirming whether green workplaces are also providing decent work is the aim of Pillar 5, but ensuring that green jobs are decent will be the main determinant of whether the transition to a low-carbon economy is also a 'just' transition. Defined by the ILO[39] as "a process towards an environmentally sustainable economy, which needs to be well managed and contribute to the goals of decent work for all, social inclusion and the eradication of poverty", the just transition seeks to ensure the energy transition as a vehicle for achieving a fairer society.

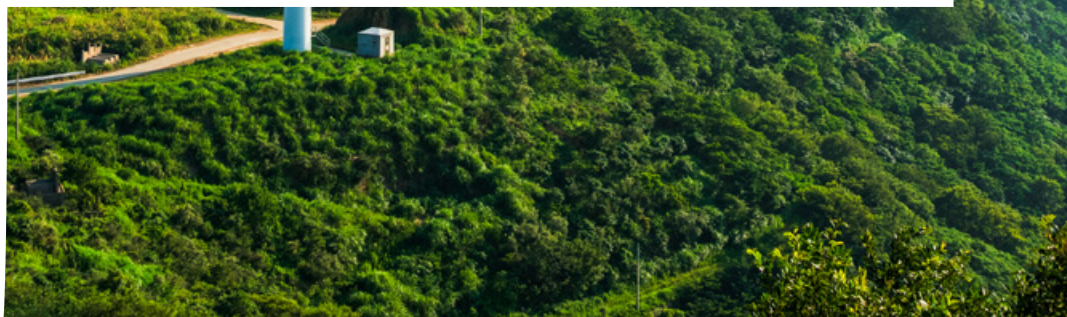
To explore how our work on the Green Jobs Barometer can help support a just transition, PwC hosted an event in the Blue Zone at COP27 in Sharm El Sheikh on what a 'just energy transition' means for jobs and workers. Through a series of insights from several stakeholder conversations, we shed light on how businesses, policy makers and NGOs are preparing for the energy transition, what challenges they face at different stages of their decarbonisation journeys and what practical and actionable steps to help businesses in both developed and emerging markets advance a just transition agenda according to their respective capabilities.

Acknowledging decent work as one component of the wider just transition narrative, there will be an ongoing need to empirically validate whether green jobs are providing quality work. The introduction of the quality indicators into the Barometer is therefore an important start that can serve as the basis for a wider and more inclusive measure of the UK's net zero progress.

39. ILO (2015) Guidelines for a just transition. https://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/documents/publication/wcms_432859.pdf

# 3. Spotlight on the energy sector





A key result of the first edition of the Barometer was that the net employment impact on sunset jobs is expected to be moderate this decade. That was captured in Pillar 3[40] and the results were surprising to some readers, given the perception that jobs in sectors like oil and gas could abruptly decline as the UK decarbonises–with comparisons being made with the coal miner jobs lost in the 1980s, which was abrupt and created significant social challenges.

Our modelling at the level of the economy suggested otherwise; therefore, to better understand why that was the case, we embarked on deep dive research of the energy sector, whose related industries are the ones being affected the most by net zero goals and decarbonisation (particularly jobs in oil and gas).

Though the aggregated data of Pillar 3 (for regions and sectors) is not updated this year, the granular insights from the energy sector tell us that job losses can certainly be contained and that many green jobs are emerging–and workforces can reskill for them.[41] Other sectoral deep dives can offer similar granular insights, as further explained below.

**Key findings from the energy sector**

According to OGUK,[42] there are 26,900 UK offshore oil and gas direct jobs, supporting a further 91,500 indirect jobs (e.g. metal work, geologists etc) and 77,500 induced jobs (spending by high-earning offshore workers when they get back home). Over time, many of these jobs will likely decline, however, this will not necessarily translate to net job losses due to high transferability of skills to green industries.[43]

Fears of imminent job losses have been prevalent in policy conversations. Yet direct stakeholders in the sector think that fears are exaggerated (see 'The declining coal industry in the UK' below), at least for this decade. The UKOG thinks half of these jobs can be transferred into new areas such as carbon capture and storage and hydrogen. Our PwC paper 'Energy Transition and Jobs'[44] actually shows that the proportion of people with transferable skills who can move to other sectors is actually larger. And, in fact, the challenge could be more about finding enough workers for greener energy sectors and upskilling for the rising demand of green skills in current roles, as opposed to a challenge of job losses.

**The declining coal industry in the UK**

There are currently three active coal plants remaining in the UK: Kilroot, Ratcliffe and West Burton A, based in Northern Ireland, Nottinghamshire and Lincolnshire, respectively. 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 had committed to closing the West Burton A coal plant by September this year–the station no longer has any Capacity Market contracts to fulfil and it will move into its full decommissioning phase in April 2023. While the closure of West Burton will affect circa 170 jobs, EDF's advanced labour force planning around anticipated closures[45] will result in minimal net job losses, as employees will either remain to work on decommissioning, be redistributed to the wider network or be affected through managed redundancies.

40. The Barometer (via Pillar 3) does not attempt to quantify the absolute number of potential jobs to be lost through modelling but instead attempts to elucidate the relative distribution of the sunset job impact across sectors and regions.

41. Here we summarise key messages emerging from the PwC article titled 'The Energy Transition and Jobs: can people transition to new green jobs?' (published August 2022).

42. https://oguk.org.uk/wp-content/uploads/woocommerce_uploads/2021/08/OGUK_Workforce-Employment-Insight-2021-z07os0.pdf

43. That said, we will still need oil production for ethene, plastics, etc., which means that the sector will not completely decline in the coming decades.

44. 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

45. 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.

Unlike the decline of the coal miner jobs of the 1980s which left many unemployed without opportunities to transfer to neighbouring sectors, the situation in energy employment is different in multiple ways. To start with, the green transition will be quite slow, which helps people to adjust (in contrast to the pit closures, which were compressed over a relatively short period). Moreover, many of the job losses will be in higher-paid, technical roles. Some, like specialist rig operators, will need retraining, but these skilled people are more likely to find new jobs compared to miners who were generally less skilled.

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

- **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%[46], which was the greatest of any sector in the same period.
- **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 might not be realised until after 2030.
- **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 and gas and green energy projects highly feasible. As much as 90% of the oil and gas workforce would have transferable skills.
- **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 400,000 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.
- **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 is met, particularly given a lack of coherent labour force planning, a lack of engagement with educational institutions and negative perceptions of the energy sector among young people.
- **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; this coupled with the fact that women and ethnic minorities are traditionally underrepresented in the energy industry, means there is a risk that the transition to net zero might not be a 'just transition'.
- **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.

While the analysis suggests that the overall number of jobs that are at risk of being lost is low, this figure will grow without adequate investment and implementation in the proper time frame–for example ensuring workers are retained and retrained in good time for clean energy projects.

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

**Further sectoral deep dives**

As discussed in Section 2, deep dive research for retrofitting[47] also tells us that skills gaps and labour shortages can be large and slow down net zero and emissions objectives, while impairing potential economic and employment gains. Action is needed to address UK-wide skills gaps observed in several sectors and such deep dives help inform policy-making with key information about the jobs and skills more in demand, how large the employment numbers are expected to be, and about barriers–and opportunities–for reskilling workforces.

We started with the energy sector and retrofitting (**see the box below for the rationale**), but other deep-dive sectoral articles will be coming in future research to supplement the aggregated data and analysis provided by the Barometer. They provide real-life examples that help gauge the actual impact of decarbonisation on jobs in specific industries (those declining and those expanding).

**Energy and retrofit: two sides of the same coin**

Deep dives into the areas of energy transition and retrofit were chosen for this first update of the Barometer, given their strategic relevance to the green transition–each sub-sector can be seen as representing one half of the same coin, i.e. the decarbonisation of energy will be achieved by creating a net zero emissions grid and the demand pressure for energy creation can be met through energy efficient retrofitting. Achieving decarbonisation of the grid as well as retrofitting the built environment also share a common denominator: both sectors face labour shortages and skills gaps that could constrain progress towards the UK's net zero goals.

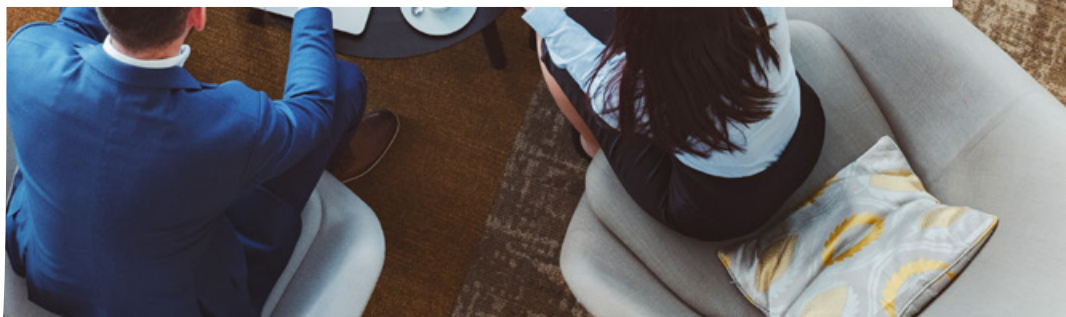
What the Barometer has highlighted is that decarbonisation will continue to impact different sectors asymmetrically–given the expected impacts on employment and also the challenges they face with existing (and future) skills gaps. It is important that we therefore continue to look at the UK's decarbonisation pathway at this level of detail, especially for sectors that will be pivotal to decarbonising, be it because of their carbon intensity or because of their strategic significance to the UK economy. Future deep-dives for instance, could look at the UK's financial services sector or explore how the agricultural sector is responding to changes in the policy landscape around biodiversity and net zero.

Sectoral deep dives bring more granular quantitative data on jobs and skills where possible, but they also bring a better qualitative understanding of trends observed within specific sub-sectors and organisations–also reflecting the voices of businesses at the cold front of the transition, those whose labour forces are changing as a result of decarbonisation.

The availability of sectoral deep dives will help identify at a more granular level how specific occupations in such industries will be affected and what their career pathways are, which are key questions identified through extensive stakeholder engagement.

47. See PwC (2022) 'Green Skills as Enabler of UK Retrofit' available here: https://www.pwc.co.uk/who-we-are/purpose/green-jobs-barometer-retrofit.pdf

# 4. Conversations across the UK: many voices, consistent themes



The launch of the Green Jobs Barometer last year sparked a national conversation about how the transition to net zero could impact different regions, sectors and communities in different ways. While the Barometer provides a helpful overview for each region, we were keen to understand the challenges and opportunities in much greater detail.

We therefore chose to assemble a series of working groups across the UK that brought together more than 100 businesses, investors, policy makers, skills providers and local leaders to explore their experiences, concerns and hopes for the transition to net zero. These ongoing discussions, which have so far been convened across Scotland, Wales, Yorkshire & the Humber, the East Midlands, West Midlands and London, have been, in part, focused on local challenges, but a number of themes emerged that cut across the whole of the UK. The insights gained from these conversations are shaping our focus and future development of the Barometer. Below are some of the key commonalities that emerged from the working groups.

## The opportunity and cost of transition

The importance for the UK to reduce its emissions to net zero was universally appreciated by the working group participants, with the businesses highlighting that a wide range of their own stakeholders, from investors to employees, were looking to them to play their part. There was also an appreciation that the transition poses a significant opportunity if the UK can successfully take a lead.

But there was also a recognition that the transition will be complex. Most of the businesses had committed to net zero emissions, but only a smaller group had so far developed a detailed plan for how to achieve this. Particularly for manufacturing and industrial companies, there was acknowledgement that achieving net zero would require significant capital investment, often beyond the limits of the businesses' own cashflow or affordable finance. There was special concern for the steel sector in Wales, which involves processes that are especially expensive to decarbonise, at a time of fierce international competition. While there was acknowledgement that the UK's problems are not unique, it was suggested that the key differentiator for the UK will be whether we have 'the will to win'.

Access to finance was raised consistently as a pressing challenge. From investments to improve the energy performance of housing to moving away from fossil fuels in manufacturing processes, there were a wide range of examples where businesses and organisations faced high upfront costs to reduce emissions without an easy route to pay for them. And for some businesses, there was an added challenge of investing in decarbonisation at the same time as meeting their shareholders' expectation of financial returns.

Greater sharing of knowledge between businesses, and across sectors, was also highlighted as a potential opportunity to accelerate companies' transitions to net zero. Participants suggested the creation of local platforms to operate as a form of knowledge exchange and support hub, to aid businesses in their decision making as they progressed towards their carbon reduction targets.

> "There is a massive opportunity in the transition to net zero. We need to work out what the goods and services of value are in a net zero world–and think about how we shift our offering."
>
> **Local business group, Wales**

## A particular challenge for smaller businesses

In every region, concern was expressed about how to get SMEs on the path to net zero. From local economic partnerships to larger companies speaking about their suppliers, there were stories of how smaller companies faced particular barriers to understanding and reducing their emissions. A common sentiment was that net zero is perceived as a luxury that only big companies can afford, especially at a time when smaller companies are grappling with inflation and a challenging economy.

It was acknowledged that while there are a variety of online portals that offer advice to SMEs, it was felt that this might be insufficient, with local businesses needing at least some form of tailored advice that isn't currently available at the scale needed.

While some organisations have green procurement policies in place, they warned they would still need to consider non-compliant suppliers if they were at the right price point due to financial constraints. However, some bigger businesses felt that the UK SMEs in their supply chain were not moving fast enough in their transition to net zero, which is motivating them to consider the possibility of using in-house options going forward.

One of the barriers identified as holding back SMEs' transition to net zero is limited availability of the knowledge and skills to do so. Participants felt that the public sector could assist in this endeavour by supplying organisations with the necessary resources. However, concerns were raised that Government funding for the green agenda to date has not been consistent.

Positively, participants highlighted examples of collaboration between other organisations and SMEs to help them overcome these challenges, with universities and skills providers in particular saying they were open to working together with SMEs. But at the same time, there was a view that the competitive business environment meant there would be less collaboration between industry players, which could make action to reduce emissions harder to achieve.

> "It's very difficult for us to go first, to take the risks, and choose higher costs, when our customers won't pay for it. We need demand– the government should reward producers of lower carbon steel. If we are going to invest, we need government intervention."
>
> **Local steel manufacturer, Wales**

## Bridging the green skills gap

There was excitement from participants about the new skills and jobs, especially for young people, that would be created in the transition in areas such as construction and retrofitting. One challenge raised was a mismatch between the skills that employers say they need, and the courses currently being offered by skills providers. Several attendees suggested that closer collaboration between government, businesses and education providers would be necessary to equip workers for the transition, and that action was urgently needed.

Participants agreed that helping to inform young people about the different opportunities that exist in the vast range of green jobs, and changing attitudes, is critical. But there was acknowledgement that the growing demand for these roles in the short term poses a significant challenge.

Participants also identified enthusiasm for the growth in green jobs facilitated by the energy sector's transition to renewables. Despite fears that this transition would lead to current workers being supplanted, there was a lot of optimism that there was a high transferability of skills.

However, concerns were raised by participants about the scale of the energy transition and whether the UK would be able to keep up with the skills demand.

Participants highlighted, however, that attracting new talent posed a significant challenge for the energy sector, saying that it would need to work hard to explain how they were part of the transition, and how young people could build careers with them that would contribute to tackling climate change.

It was felt that diversified energy companies, those with both renewable and fossil fuel parts to their business, would find it easier to attract young people to work for them than companies which remain purely oil and gas would, even if those companies do have a role in the transition.

## Working groups will keep working

These working groups across the UK have proven an invaluable source of insight, have helped to shape our understanding and have already directed our further research into specific challenges. We will continue to host similar groups to support future iterations of the Green Jobs Barometer, and inform our discussions with businesses, skills providers, as well as national and regional leaders as we seek to support a fair and successful transition to net zero.

"My pupils care passionately about climate change and want to work for organisations they know are making a difference"

**Local education leader, Scotland**

"We're currently in the process of transitioning a coal power station into part of our renewable energy infrastructure and will be reskilling the existing employees and apprentices there into new, long-term green jobs"

**Energy company, Yorkshire & the Humber**

# 5. What next?

Stakeholder conversations also helped us identify areas where the Barometer can be expanded – particularly to address the questions and challenges they are sharing with us.[48] In addition to data updates to monitor progress and identify trends across the five Pillars over time by sector and region, three key areas for further study and engagement are put forward below.

## Green jobs quality

Measuring job quality, as advocated by several stakeholders we have interviewed,[49] gives a clearer picture of whether new green job creation really translates into better standards of living and prosperity and, crucially, whether a 'viable' job transition (say from offshore oil and gas into offshore renewable) is a 'desirable' one.

Career pathway analysis for the net zero transition often, for example, focuses on determining those job transitions that are considered viable from the point of view of skills (it is easier to transition to jobs that do not require radically different sets of skills) or feasible in the context of market, regulatory or geographical barriers that limit job mobility but little analysis pays attention to identifying 'desirable job' transitions. The International Labour Organization promotes the definition of green jobs as those that promote decent work.[50]

In general, the rise of green jobs is expected to create 'decent work' that is higher quality, better paid and at lower risk of automation.[51] This expectation is fueled by perceptions that jobs in growing sectors, like in renewable energy, use technology more intensively and often require new skills.

Improving the Barometer's measurement of job quality and monitoring its evolving relationship to green jobs is one of the key next steps in driving the green jobs agenda and the Barometer. Though measurements will be refined in further iterations, results from a new survey run by PwC already give us more insight into the quality of jobs (**section 2**)–and into whether the above perception is true.

Establishing a 'green premium' narrative around salary or satisfaction can help encourage and rationalise institutional decision making around the benefits of a greening economy. Conversely to identifying a 'green premium', its absence, or the presence of a 'green handicap' may endorse a more negative narrative around a greening economy.

Job quality and access to decent work is a central tenet to ensuring the transition to a low-carbon economy is a 'just transition'–i.e. ensuring that the transition that prioritises net zero and decarbonisation efforts also delivers well being for all people and communities providing fair access to sustainable livelihoods, including support for upskilling and retraining to obtain those livelihoods. Future research on green jobs will look at how to facilitate just transitions by creating career pathways towards new green jobs and supporting the 'greening' of existing roles, an endeavour that requires having clear taxonomies of the skills related to green jobs and from other emerging green occupations and industries, and linking sunset jobs through common skills to identify viable transition pathways.

48. Following consultation with the Department of Business, Energy & Industrial Strategy (BEIS), the Department for Work and Pensions (DWP), Office for National Statistics (ONS), London First, as well as many others from regional roundtable events in Scotland, the West Midlands and London, we captured a number of themes that repeatedly identified as having the potential to enhance the usability and value of the Barometer analysis.

49. Following the publication of the Green Jobs Barometer (GJB), a number of stakeholders including the UK Department of Work and Pensions (DWP) highlighted that, in its perspective, the value of the analysis could be enhanced through the inclusion of indicators of job quality.

50. For instance, many current recycling jobs recover raw materials and thus help to alleviate pressure on natural resources. However, the jobs involve a working practice that is often dirty and dangerous, causing significant damage to human health.

51. Valero A, Li J, Muller S, Riom C, Nguyen-Tien V and 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. https://cep.lse.ac.uk/pubs/download/special/cepsp39.pdf

## Monitoring targets

One feature that is expected from the Barometer, as it continues monitoring data over time, is that it measures progress against targets.

In time, the Barometer should be used to measure progress against targets–long-term and defined economy-wide or for specific industry sectors–so it can provide a benchmark for how a respective region or sector is performing against its own objectives. Though lack of data may limit how far we can add targets to specific industries in a systematic way,[52] using targets outlined in various sector deals has been included as a feature within the publication of the Barometer 'deep dives'.

The sector deals provide helpful reference material for sectoral analysis linked decarbonisation but often are wider in scope to include ambitions around workforce gender balance and ethnic minority representation (**see 'Overview of sector deals' below**). We will continue to incorporate government targets in the qualitative elements of the Barometer in order to contextualise observed progress across pillars and explore whether any areas of the Barometer analysis would be more impactful by capturing the UK's performance with reference to stated targets and goals.

52. Targets vary significantly across regions and sectors. A hard-to-abate sector such as construction will not achieve decarbonisation on the same time horizon as those which are less carbon-intensive. This not only presents an issue of comparing like-for-like, but as some hard-to-abate sectors are geographically clustered in certain regions, this could have an impact on regional performance against targets, particularly as there will likely be asymmetries between regional target setting and the decarbonising potential of that region's respective industrial make up.

## 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.

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 £2bn 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.

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'.[53]

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

## Granular analysis of jobs and career pathways

The Barometer offers a high-level view of green job performance across regions in the UK and by comparing sectors. Some of the questions it has prompted from stakeholders would benefit from more granular data,[54] for instance from insights about the diversity of the workforce taking on green jobs to how jobs and occupations in specific industries are affected by decarbonisation[55] and details about specific skills and training needed to transition to new jobs.

Though the impact of decarbonisation on employment of 'sunset' sectors and occupations is not expected to be immediate (our research on the energy sector as summarised in Section 3 and further studies in the UK and EU shows clear net positive employment impacts),[56] the evidence shows that many workers will need to prepare for new jobs or to prepare to do more green tasks as part of their current work (**see box opposite**).

### UK economy-wide estimate of 'time spent on green tasks'[57]

In March 2022 the Office for National Statistics (ONS) published 'Research into green jobs: time spent doing green tasks, UK, 1997 to 2019'.

The analysis provides new experimental estimates of the time spent doing green tasks, over time, by UK countries and by industry. It uses a novel method, based on task-level data from the O*NET database in the US. In essence, it captures the 'greening' of the whole UK economy which includes the greenness of roles that are not defined as 'green'. This opens up the possibility of tracking which occupations are becoming increasingly green (they may increasingly contain a higher proportion of green jobs or are increasing in green tasks undertaken to the point where they may be primarily green in nature). It also makes it possible to identify which occupations are not adapting in light of decarbonisation or are even becoming less green as time goes on.

The analysis also provides fresh insight into 'thresholding' of green job definitions. If, for example, a job is only considered green if a majority of tasks undertaken within the occupation are green, then analysis from this research may suggest that >50% is too high a threshold. For example, of the tasks undertaken by 'Conservation Professionals (SOC: 2414)', only 57% are considered green.

As a nascent study, the application of these numbers to wider estimates of green jobs remains untested.

54. A recurring theme arising out of such engagements is that greater insights and granularity were needed to understand how the net zero transition would affect regions and sectors.

55. Much of the analysis around workforce requirements linked to decarbonisation focuses on the industry-level impacts. Data and analysis can become more granular within sectors, mainly by analysing occupations that are affected by the green transition.

56. An area where the Barometer can expand over time is in identifying jobs completely destroyed in relation to those that can be reallocated. Research by the ILO finds that over 71% of workers whose jobs are affected by the green transition have the potential to be reallocated to new jobs with the right training and upskilling.

57. ONS (2022) Time Spent on Green Tasks (Online) Available at: https://www.ons.gov.uk/economy/environmentalaccounts/datasets/timespentongreentasks

The more granular occupational lens, which further complements the regional and sectoral lenses, is a key ingredient to further understand job transitions amid the greening of the economy, and to identify career pathways for people moving from declining jobs to growing jobs (for instance, those being created in clean energy generation). A clear understanding of career pathways is also key to motivating young people to pursue green jobs in sectors like energy, that are often subject to misconceptions, and thus to skills shortages.[58]

Granular measurements of green tasks and activities are also important to understand the demand for skills and address prevailing skills gaps. In future releases of the Barometer, the 'green skills density'[59] of different occupations will be elaborated upon through greater analysis of job vacancy and CV data.[60] Clear taxonomies of green skills and measurement of the green density of occupations (based on how much they use green skills as part of their work) will help plan initiatives in education and training.

Linking existing (or new) occupational classifications to green jobs will allow us to better understand who will be positively and negatively impacted by these transitions. Identifying these exposed sub-populations, supported by more granular data on gender education and income groups, is particularly important to policy makers who are tasked with ensuring the green transition is a just transition.[61]

58. Our research shows that within power, employers are struggling to fulfil existing demand for skills related to a number of occupations: e.g. technical engineering roles (including commissioning, instrumentation and control, power systems, etc), quantity surveyors, project managers, piping and cable specialists as well as various roles, such as data scientists, which were increasingly in need of digital competencies. In addition, attracting and retaining young people, particularly those with STEM qualifications, was repeatedly cited as a challenge to workforce planners within the industry.

59. In the initial version of the Barometer, the green job creation analysis of Pillar 1 involves a binary classification of green versus non-green jobs. In future updates, there will be different shades of green, based on the activities and skills associated with specific types of jobs and occupations.

60. Green jobs are evolving, as is our understanding of what jobs meet the definition of 'green'. Our evolved understanding will be reflected in our future analysis with some jobs being gained and others being lost.

61. Insights from stakeholder engagements suggest that the people that are able to retrain/take up green jobs are currently mostly in higher-educated professions, which highlights the importance of addressing questions of social mobility and green jobs.

# Supporting decisions and policy

The Green Jobs Barometer is increasingly focusing on the ‘so what’, using the data to answer pressing questions of policy makers, institutions and businesses. The ultimate goal is to support evidence-based action in widening the benefits of the green transition.

The transition to a green economy requires complex transformation efforts across all parts of the economic system, such as strategic workforce planning, sector and place based policies or re-imagining lifelong-learning systems. This means that the Barometer is not the end, but the beginning of a sustained effort to create the right evidence for policies conducive to a more prosperous and sustainable future.

In providing a snapshot of progress, the Barometer serves as a tool for decision makers on where effort and investment needs to be targeted. For this reason, it is important not to shy away from areas of concern. But the Green Jobs Barometer 2022 also shows there is plenty of reason for optimism–with the rate of green jobs growth demonstrating the human-power that is helping the UK become greener.

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