blue mirror insights

GATSBY

Green Skills Survey
Report on Results

Blue Mirror Insights
October 2021

Contents

Foreword

From Fraser Harper of Blue Mirror Insights.

Since the results of our green skills survey were correlated and the draft of this report was prepared in early October 2021, HM Government has released its much-anticipated 'Net Zero Strategy: Build Back Greener'. In the section called 'Green Jobs, Skills and Industries'[1] we find these key commitments:

- *Reform the skills system so that training providers, employers and learners are incentivised and equipped to play their part in delivering the transition to net zero – including by legislating for skills required for jobs that support action on climate change and other environmental goals to be considered in the development of new local skills improvement plans.*
- *Deliver a Lifetime Skills Guarantee and grow key post-16 training programmes (such as apprenticeships, Skills Bootcamps and T levels) in line with the needs of employers in the green economy, helping individuals get the training they need for a job in the green economy, either at the start of their careers or when retraining or upskilling once already in the workforce.*
- *Introduce a sustainability and climate change strategy for education and children's services which will include a focus on equipping children and young people with the knowledge and skills they need to contribute to the green economy.*

Inevitably, much is being made in the media and elsewhere about the lack of – and urgent need for – detail on how the UK's Net Zero strategy will be executed. While the Green Jobs Taskforce, launched by the Department of Business, Energy and Industrial Strategy and the Department of Education in November 2020, describes the need 'beyond STEM' for cross-cutting skills in digital and data, project management, communication, change management and leadership[2], many of the 'whiches, wheres, whys, whens, whos and hows' remain vague. So much so, in fact, that the most recent report from the House of Commons Environmental Audit Committee[3] (@CommonsEAC) begins with:

> *'The Government is aiming for 2 million green jobs by 2030; the level of Government ambition and the work carried out by the Green Jobs Taskforce provides a good foundation for delivering this green workforce. What is needed now is a detailed plan for how these ambitions will be delivered.'*

On behalf of Blue Mirror Insights, I would like to thank The Gatsby Foundation for its support in running this Green Skills Survey. Our key objective was to gauge the appetite among the type of people who have valuable knowledge of the type we believe is needed, for creating a network that can contribute to the understanding of the detail being called for above. Having, we believe, gained a degree of affirmation that such an appetite does exist, we are therefore pushing the boat out into the sea of net zero and proposing an initiative we are calling 'The Green Edge'. Initially in the form of a newsletter on the

[1] Section 4iii, p. 229.
[2] Green Jobs Taskforce Report to Government, Industry and the Skills Sector, July 2021.
[3] House of Commons Environmental Audit Committee, Green Jobs, Third Report of Session 2021–22, HC 75, 25 October 2021.

Substack platform, we envisage The Green Edge to become an artefact-focused resource containing postings and discussions about the detailed skills required for net zero. We will invite contributions from actors in the field of net zero skills discovery, beginning with the cohort of respondents to our survey and some of the valuable comments they made in their responses. The posts may range from problem statements to descriptions of – or, at least, pointers to – solutions, but we will moderate to keep focused on the details of skills required, their application, their development and their relevance.

To ensure The Green Edge does not merely exist as a talking-shop, we propose it as having as its end users *those involved in technical and vocational education development who need feedback from the leading edges of net zero skills discovery.* For example, one university programme known to us that is researching sustainable aviation fuel (SAF)[4] has identified the need for skills related to new additive manufacturing techniques for SAF nozzles. Are these new green skills? We would argue that they are[5]. To quote again from the aforementioned @CommonsEAC report:

> *'The green skills pipeline will determine both the number and types of UK green jobs which can be produced. We need to ensure we are training our current and future workforce now for the careers and demands of the future economy, and make climate and environmental literacy a priority across all education and training. Environmental sustainability should be embedded across all National Curriculum and A Level courses, and a module on sustainability included in every apprenticeship and T Level course.'*

At the same time as we are publishing this report, we are preparing The Green Edge for launch. Please find its introduction on https://greenedge.substack.com/. We look forward to the opportunity to talk further with you about its content and development, with the aim of contributing real value to the net zero skills discussion from the outset.

Fraser Harper
Director, Blue Mirror Insights
28 October 2021

[4] The HMG net zero strategy states the UK will *'[a]im to become a world-leader in zero emission flight [and] our ambition is to enable delivery of 10% SAF by 2030'.* Current national usage of SAF is at most around 2-3% .
[5] …although many policy makers do seem confused about what are and are not green skills, with some even conflating 'green skills' with 'green jobs'.

Purpose of the survey

The recent (July 2021) Green Jobs Task Force (GJTF) report to Government, Industry and the Skills Sector makes key recommendations for developing the green skills needed to meet the UK Government's Net Zero targets. The report also proposes milestones to be to be achieved before July 2022, which include:

- Publication by Government of its detailed Net Zero Strategy (by November 2021), setting out how government levers will be used to deliver job quality in the green economy;
- Publication by the Skills and Productivity Board (SPB) of its first net zero skills report;
- Co-creation by schools, local government and employers of modular programmes to teach climate change and the knowledge and skills (in science, technology, engineering, and mathematics (STEM) and other key subjects) required for green jobs;
- An expanded Government review of green apprenticeships to cover all training pathways and set out how it will ensure these align with the net zero transition;
- Reviews and reports by employers and industry on existing routes to retraining and upskilling in each sector.

In its own words, the report 'represents a call to arms for government, industry and the education sector across all stages of the green jobs life cycle: to invest in delivering net zero and our environmental goals; to build pathways into green careers for people from all backgrounds; and to ensure that workers and communities dependent on the high carbon economy are supported with the transition'.

We were therefore keen to test the appetite for the creation of an informal, mutually supportive, information-sharing network, with the broad aim of exploring the skills that will be needed in the future workforce to enable business and industry to meet its net zero requirements and take advantage of the opportunities that net zero presents.

Scope of the survey

With this survey, we looked to gather some initial information on organisations who are currently active in work that involves an understanding of green skills and who might need them. This understanding may come from studies of the skills themselves; or through the development of new green technology that will require specific skills to build, operate or maintain; or through the development of retrofitting technology; or through any number of other sources.

The survey was built using Google Forms and was carried out over a short period of three weeks in September 2021. The collected data is now being jointly curated by Blue Mirror Insights and Gatsby and we asked for consent from participants to share with relevant UK Government bodies in pursuit of their green technical education and skills programmes.

Summary of Results

Survey participation

We made email invitations to just over 700 individuals for the survey. We identified these individuals from a desk-based review of institutions, literature and web resources that we assessed to be either involved, or potentially involved, in green-based research (see Appendix 1).

We received 52 responses to our invitation, spread across the organisational categories and job groups shown in Figs. 1 and 2.

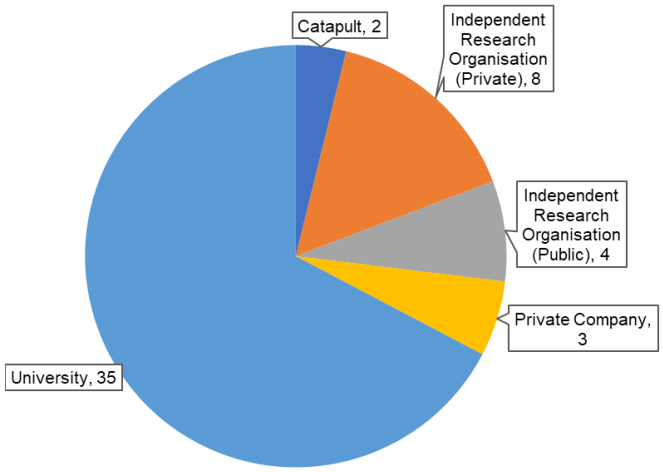

Fig. 1: Organisation types of survey respondents

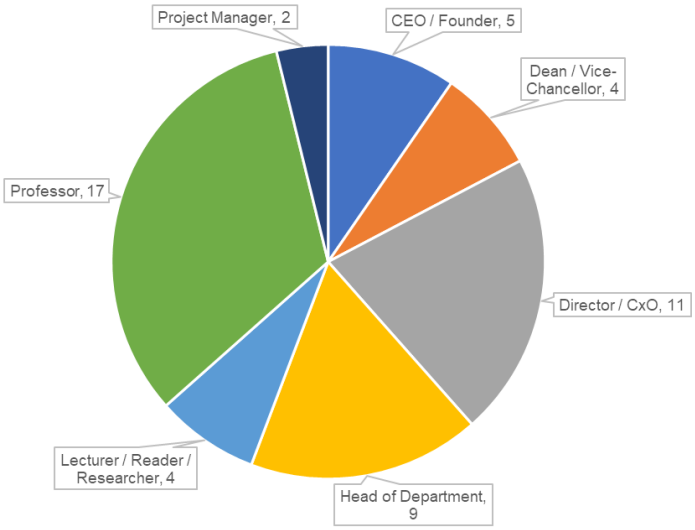

Fig. 2: Job groups of survey respondents

Data consent

All respondents confirmed data consent to the question: *The data you have given will be jointly curated by Blue Mirror Insights and The Gatsby Charitable Foundation and will only be shared, with your consent, with relevant UK Government bodies in pursuit of their green technical education and skills programmes. May we share the answers you have given as described?*

Organisational focus

The recent (July 2021) Green Jobs Task Force (GJTF) report to Government, Industry and the Skills Sector described the following sectors as being crucial to meeting net zero:

- Power – including renewables (such as wind, solar and hydropower), nuclear power, grid infrastructure, energy storage and smart systems technology;
- Business and industry – including hydrogen production and industrial use, carbon capture, utilisation & storage (CCUS) and industrial decarbonisation;
- Homes and buildings – including retrofit, building new energy-efficient homes, heat pumps, smart devices and controls, heat networks and hydrogen boilers;
- Transport – including low or zero emission vehicles, aviation and maritime, rail, public transport and walking or cycling;
- Natural resources – including nature restoration, tree planting and decarbonising agriculture, waste management and recycling;
- Enabling decarbonisation – including science and innovation for climate change, green finance, circular economy and energy networks;
- Climate adaptation – including flood defences, retrofitting of buildings to be resilient to extreme weather/climate events, nature-based solutions to reduce climate impacts and civil and mechanical engineering for infrastructure adaptation.

Consequently, we were keen to get an indication of, firstly, the spread of focus on these sectors and, secondly, to what extent our respondents where specifically considering the skills required by these sectors. The numbers are shown in Fig. 3.

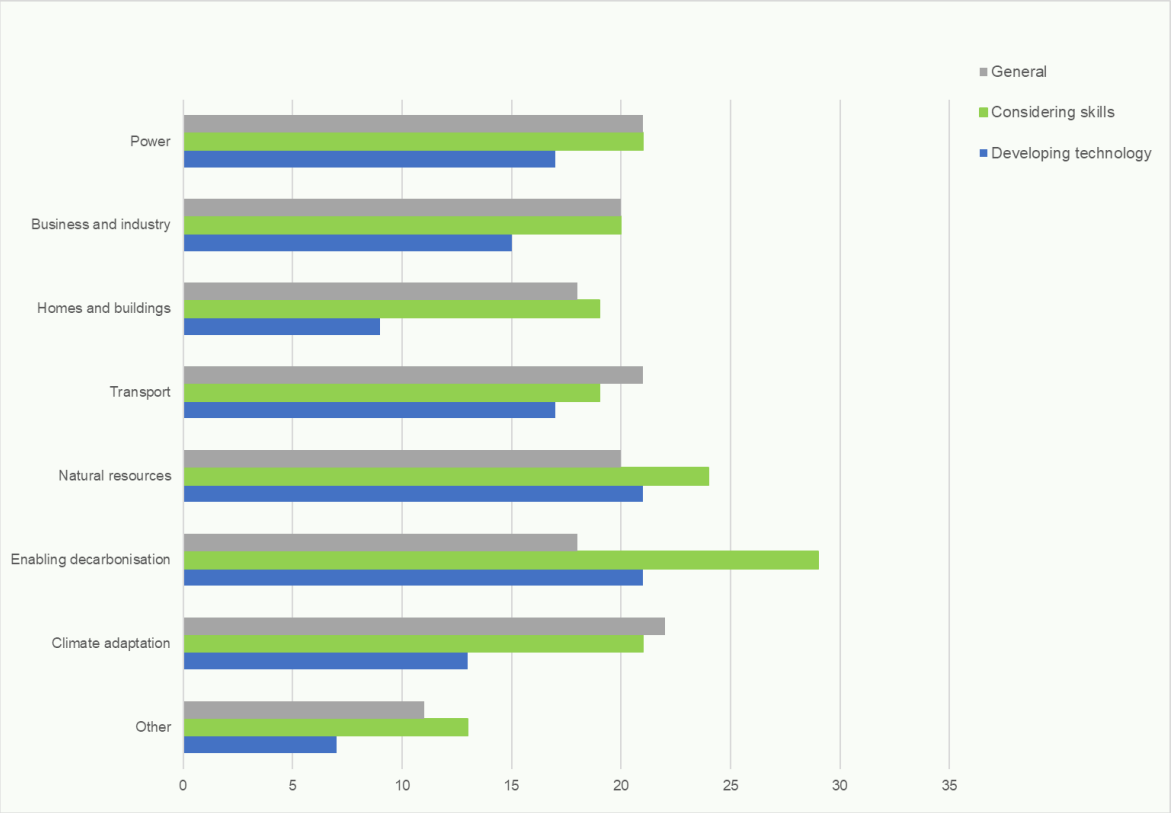

Fig. 3: Organisational focus

As we expected, we saw a reasonable level of activity in all the sectors, with most respondents in each sector saying they were also considering the skills implications. Unsurprisingly, power, transport, natural resources and enablers for decarbonisation showed relatively high levels of focus on technology development. However, the sectors that include some of the shorter-term priorities like retrofitting (i.e. homes / buildings and climate adaptation) showed a relative predominance of skills development over technology development, which may reflect that in these sectors the priorities are more associated with upskilling for existing technology than in developing new technology.

Among the organisational focus areas listed as 'other' we note the following of particular interest:

- Climate related insurance and investment skills and products;
- Green/Blue - governance, regulation and ecosystem development; corporate environmental sustainability;
- Sustainable food production and agriculture;
- Green skills from a systems perspective; using a systems based approach to address complex problems such as logistics;
- Sustainable approaches to R&D, particularly in areas which are energy- and/or waste-intensive;
- Decision tools to support technology appraisal;
- Sustainable low carbon manufacturing;
- Hydrogen - use and production;

- Waste management; metal / material recovery;
- Interplay between green and digital.

Understanding of green skills

Almost all respondents answered 'Yes' to the question: *Do you think your organisation is building an understanding of green skills in any of the categories or types described above?* See Fig. 4.

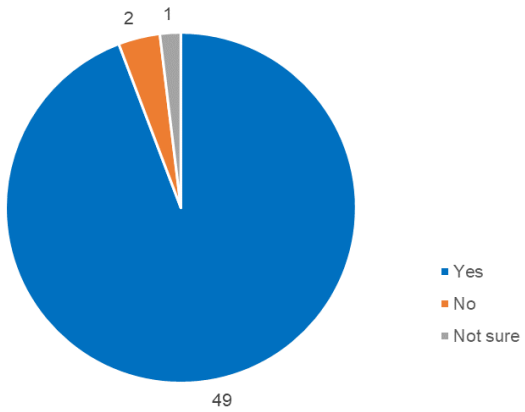

Fig. 4: Understanding of green skills

Green skills focus

For those respondents (i.e. almost all) who are building their understanding of green skills, we wanted to get an indication of which types of skills were being considered. For this, we used two indices of green skills. The first was the general green skills index recognised by the United Nations Industrial Development Organization (UNIDO), which identifies four groups of work tasks that are especially important for green occupations[6]:

- Engineering and technical skills: hard skills encompassing competences involved with the design, construction and assessment of technology usually mastered by engineers and technicians. This know-how is needed for eco-buildings, renewable energy design and energy-saving research and development (R&D) projects.
- Science skills: competences stemming from bodies of knowledge broad in scope and essential to innovation activities, for example physics and biology. These skills are especially in high demand in each stage of value chains and in the utility sector, which provides basic amenities such as water, sewage services and electricity.
- Operation management skills: know-how related to change in organizational structure required to support green activities and an integrated view of the firm through life-cycle management, lean

[6] See https://www.unido.org/stories/what-are-green-skills

production and cooperation with external actors, including customers. Such skills are important, for example, for sales engineers, climate change analysts, sustainability specialists, chief sustainability officers and transportation planners.

- **Monitoring skills:** technical and legal aspects of business activities that are fundamentally different way from the remit of engineering or of science. They refer to skills required to assess the observance of technical criteria and legal standards. Examples are environmental compliance inspectors, nuclear monitoring technicians, emergency management directors and legal assistants.

Secondly, research by the European Centre for the Development of Vocational Training has also found that the transition to a net zero economy requires three broad categories of new green skills, these being:

- New green skills in existing occupations;
- Skills for new green occupations, and;
- 'Greening' of existing tasks in existing occupations.

We therefore asked for an indication of which of these skill categories (new green skills; skills for new occupations; 'greening; of existing tasks in existing occupations) were being considered within the skill groups (engineering and technical; science; operation management; monitoring). The numbers are shown in Fig. 5.

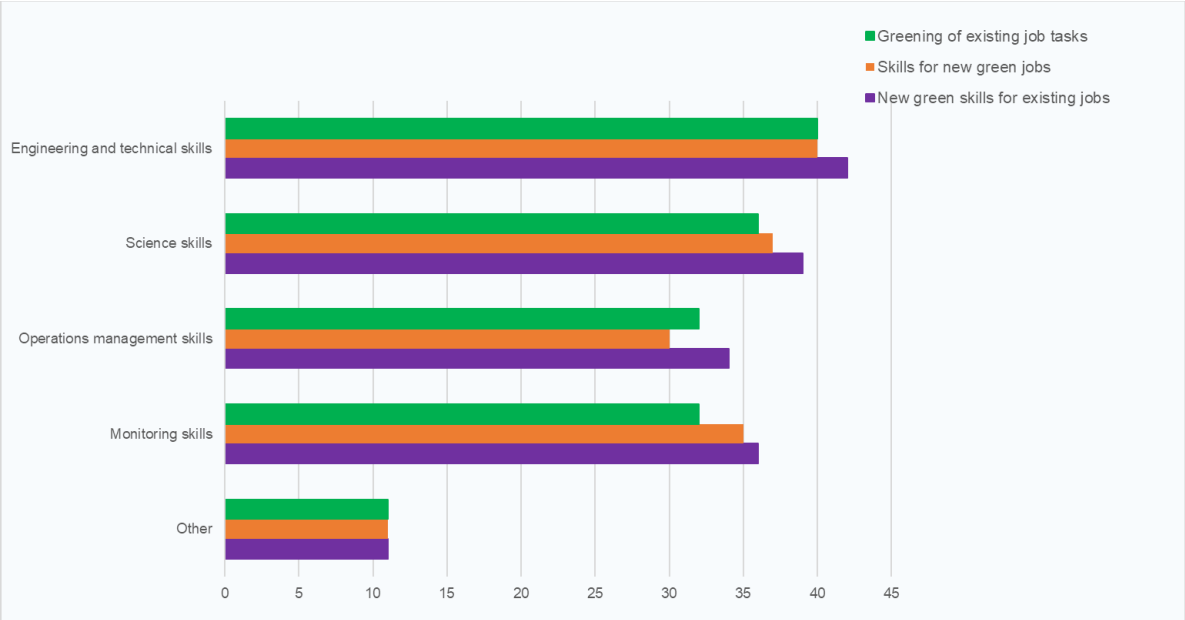

Fig. 5: Green skills focus

In the responses, consideration of **skill groups** was fairly evenly distributed, with a small bias towards engineering, technical and science skills over operation management and monitoring skills[7]. The

[7] We expected more of a bias away from operations management and monitoring skills but – in our opinion thankfully – this does not seem to be the case.

distinction between the **skill categories** was less evident and may be an unclear index, reflecting perhaps the tendency across the green spectrum to conflate 'green skills' with 'green tasks' and 'green jobs'. One respondent commented:

I think you may have a bit of a false distinction between "new green skills for existing jobs" and "greening of existing job tasks" – they're both basically changes in the task content of existing jobs

We accept the point made.

Among the green skill areas listed as 'other' we note the following of particular interest:

- Climate/green finance, insurance and economics;
- Agricultural production and landscape management;
- Systems thinking;
- Critical social science;
- Green business strategy;
- Green design.

Occupational groups

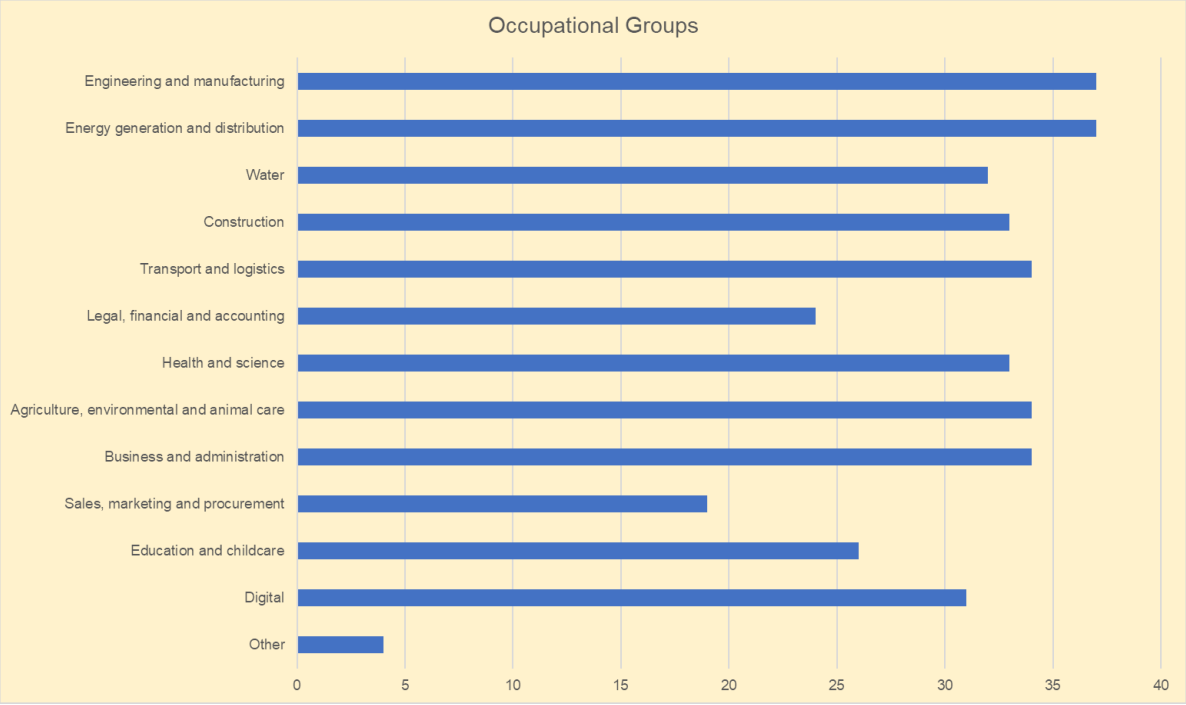

Fig. 6: Occupational groups

We included this question to get a feel for the skills coverage for (typically) technician-level occupations in line with the occupational maps maintained by The Institute for Apprenticeships & Technical Education

(IfATE)[8]. We adapted the IfATE occupational map categories slightly to produce groups suited to this survey.

The responses are shown in Fig. 6.

Consideration of occupational groups was as expected, with a slight bias towards engineering and manufacturing, and energy generation and distribution. We consider that no occupational group seemed particularly under-represented relative to their importance to net zero.

Among the occupational groups listed as 'other' we note the following of particular interest:

- Waste management
- Operations and maintenance;
- Defence and security;
- Sustainable architecture and design.

Geographical focus

The geographical focus of the respondents is shown in Fig. 7. As we expected, most respondents have a United Kingdom focus, with some regionality. A significant proportion also work internationally/globally.

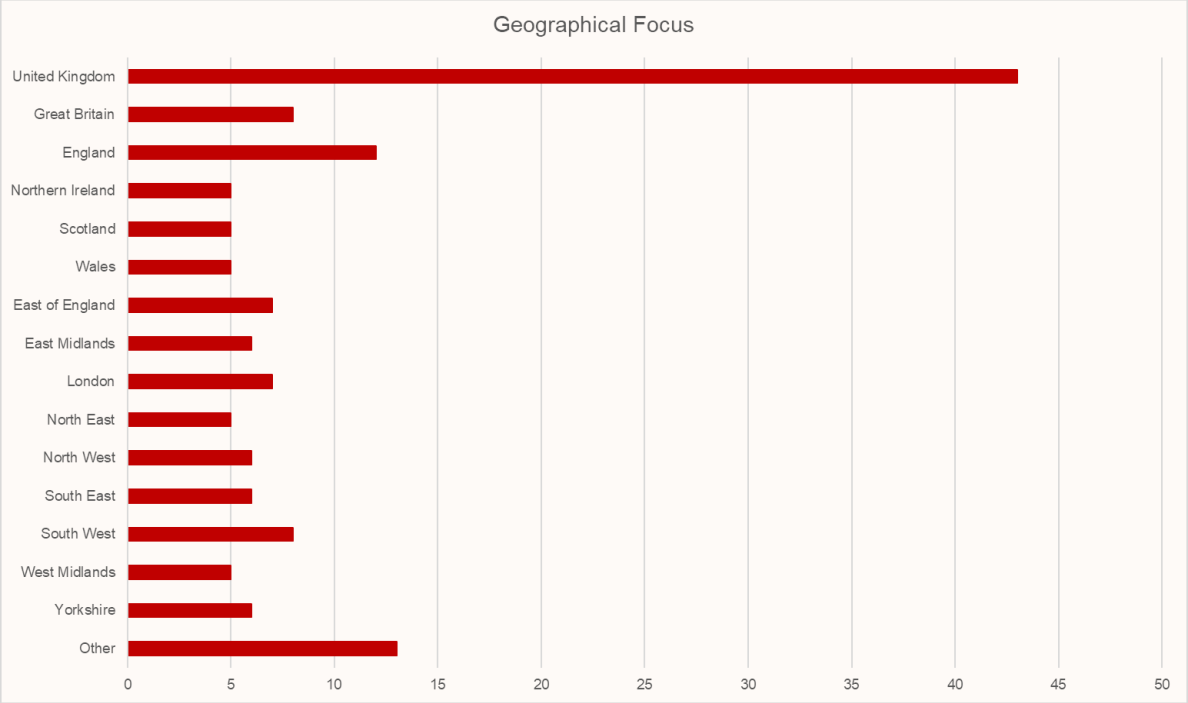

Fig. 7: Geographical focus

[8] See https://www.instituteforapprenticeships.org/occupational-maps/

Network engagement

43 out of 52 respondents answered 'Yes' to our question: *Do you (or your organisation) have an interest in joining a network to explore future green skills and employment issues?* See Fig. 8.

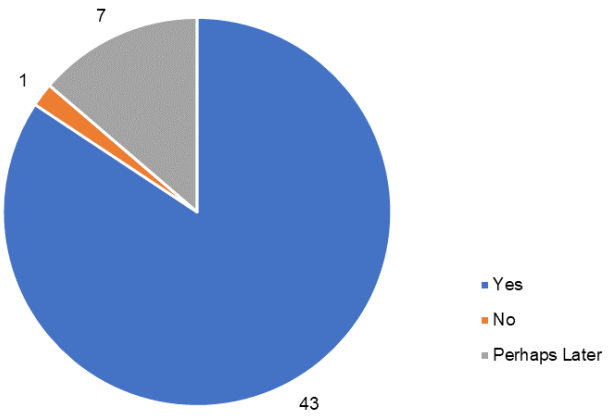

Fig. 8: Interest in network engagement

Gaps in current green skills education and development

In the final part of the survey, we asked respondents for an optional free-form answer to the following question:

We are interested your view as to the areas requiring the greatest attention and further skills education and development over the next 5 years. What are the top areas?

In many ways this was the key part of the survey, as we were looking for common themes that may be useable going forward with a green skills network.

Over two-thirds of the respondents gave some form of response to this question. In addition to a direct response to the question itself, a significant number of respondents described a general need for green education as well as a better foresighting process for the anticipation of green skills. We therefore cover each theme separately below. Note that direct quotes from the responses are given *in italics.*

The general need for green education

A significant number of respondents replied to the question with general comments about an across-the-board need for green education, in some cases linked to social awareness and behavioural change. Early education in climate heating, adaptation and mitigation was mentioned, together with transforming the UK's vocational education and training (VET) system to embed climate and energy literacy in all occupations.

> *Engag[e] early in the education pipeline - making kids of 10 - 15 years of age aware of green jobs / career paths so they are applying to uni and studying accordingly*

One respondent emphasised that green transition is not just about developing 'green skills' but also about knowledge and behaviours. In particular, changing behaviours brings in the social science aspects of education.

Education in the 'business' side of the green economy – green finance, insurance and investment, for example – was mentioned several times, together with education in new business models, regulation and policies:

> *Far more Business Schools need to form programmes within climate finance and management. Most have no programme at all on climate change.*

Unsurprisingly, the need for more STEM skills was mentioned several times:

> *A key issue in today's labour market is that advances in technology are creating demand for more high-skilled workers, with an emphasis on increased STEM skills, while there is also a shortage in supply of workers with the right skills. As many activities related to decarbonisation are expected to require the same skills that are already required by other trends (such as technological change), the shift to high-skilled jobs will be magnified by other global trends besides just decarbonisation.*
>
> *Evidence suggests that STEM skills will become ever-more important, but that in transitioning between sectors (i.e. between traditional sectors to green sectors), a topping up of STEM skills may be all that is required to effectively carry out new roles.*

A significant number of respondents mentioned the need for green skills education through VET and within the workforce, in subjects such as zero energy construction. Climate change and work, just transition, climate literacy, and the role of trade unions and workers in addressing climate change were all mentioned, as was retraining, work experience and job brokerage support for people currently out of work.

> *[W]e need to do more than just Sector Based Work Academies and Apprenticeships - Bootcamps could be a good model to build on).*

Reskilling programmes for professionals was mentioned several times, including transferrable skills from outdated jobs to green jobs, interdisciplinary skills, communication skills and design/systems thinking.

> *[S]o many professionals are disengaged in their current jobs and want roles with more purpose. There is a huge opportunity to match these people with green jobs. What might a really bold professional reskilling programme look like where professionals can retrain while in their current roles?*
>
> *Energy efficiency improvements/ retrofitting of buildings and the decarbonisation of heating in buildings will be a huge challenge in the UK, and currently it is extremely difficult for homeowners to find a qualified contractor with the right skills to carry out improvements to their home. Better training and education programmes, and support for existing contractors need to be in place.*

Lastly in this section, several respondents mentioned the need to 'train the trainers'. Continuous professional development (CPD) and upskilling of educators is needed in multiple sectors, including those educating apprentices or using teaching to new technical qualifications such as T Levels across a host of different subject specialisms. The need for curriculum reform, top-down indicators for the education and training sector to embed green skills in its curricula, and incentives for industry/education sector collaboration were all mentioned.

The need for foresighting

One respondent commented – correctly, in our opinion – that there is…

> *…a process issue around identification of new and emerging green skills and their incorporation into existing and emerging occupations.*

In some opinions, foresighting for use by skills providers in forecasting the green skills requirements in a 5-10 year time horizon should be done by encouraging creative mixing of different industries in identifying green skills and should be used to…

> *…create[e] a clear pipeline from skills development through to employment including a feedback loop.*
>
> *Could be training credits/ incentives, or penalties... but needs to link to developing skills within firms to mainstream this (not just rely on consultancies).*

Areas requiring the greatest attention and further skills education and development over the next 5 years.

Direct responses to the question are given below, without further comment. For convenience, we have arranged the comments (in some cases, loosely) by the green sectors identified in the GJTF report.

[R]etrofit/construction, renewable energy, monitoring, transport, green finance, tourism - most sectors will require greening in near-mid term.

Power – including renewables (such as wind, solar and hydropower), nuclear power, grid infrastructure, energy storage and smart systems technology;

- Advanced electrification, alternative fuels and fuel systems;
- Sector coupling (power-heat-transport);
- Energy storage
- Plastics

Business and industry – including hydrogen production and industrial use, carbon capture, utilisation & storage (CCUS) and industrial decarbonisation;

- Low carbon engineering;
- Electro-mechanical engineering skills;
- Process design and optimisation (particularly for energy intensive process industries);

- Electrochemistry and electrochemical engineering;
- Hydrogen space skills;
- Decarbonising energy conversion.

Homes and buildings – including retrofit, building new energy-efficient homes, heat pumps, smart devices and controls, heat networks and hydrogen boilers;

- Buildings efficiency, conversion, and retrofitting (mentioned several times as being where the highest volume of jobs demand will be);
- Hydrogen and heat pumps;

Energy efficiency improvements/ retrofitting of buildings and the decarbonisation of heating in buildings will be a huge challenge in the UK, and currently it is extremely difficult for homeowners to find a qualified contractor with the right skills to carry out improvements to their home.

Transport – including low or zero emission vehicles, aviation and maritime, rail, public transport and walking or cycling;

The automotive transformation to net zero requires a completely new supply chain for batteries, emachines, power electronics and fuel cells. All of the materials that go in this and the energy and infrastructure streams to go with this. Most of this is totally new and require the transition of existing skills and new skills on a enormous scale

Natural resources – including nature restoration, tree planting and decarbonising agriculture, waste management and recycling;

- Primary food production
- Zero carbon food production

Enabling decarbonisation – including science and innovation for climate change, green finance, circular economy and energy networks;

- Circular economy;
- Evaluating sustainability;
- Green economics and finance;
- Natural capital in practice;
- The technology-green finance interface;
- Delivering green infrastructure partnerships - citizen engagement, activists and politicians;
- Being able to design and manage complex multi disciplinary projects;
- Communication and presentation of technical data and observations; statistical analysis of complex system data eg. demographic, geographic, trends;
- Uptake of existing technology and practices;
- Applying systems thinking as a complementary approach to science based approaches to tackling complex problems (techno-social-enviro systems);
- Behavioural change;

- Sustainability by design;

Climate adaptation – including flood defences, retrofitting of buildings to be resilient to extreme weather/climate events, nature-based solutions to reduce climate impacts and civil and mechanical engineering for infrastructure adaptation.

- Retrofitting (see also Homes and buildings).

Concluding Remarks

We thank our respondents for their time and interest in participating in this Green Skills Survey. We believe the responses indicate that much good work, involving both technology development and consideration of green skills, is being carried out in UK universities and elsewhere.

However, we believe that one of the key challenges will be to build an active flow of up-to-date information from the 'green coal-face' back into the education and training system. As some of our respondents observed, much of the net zero effort will involve behavioural change and an understanding across the present and future workforce of what is required. This should start early and be part of each person's continuous educational and professional development. To make this happen, educators need to be upskilled, to know what to teach and what the educational outcomes should be.

This initial survey shows the willingness of those organisations engaged in making net zero a reality to share their knowledge and insights. One positive action which we support is the creation of a Green Skills Network, which can actively share and promote the latest developments in green technologies and skills. Targeted at the education system as its key beneficiary and user, we envisage this could take the form of a newsletter-style blog, with regular (e.g. weekly) contributions from the type of 'skills thinkers' we found in the responses to our survey. We believe contributions from people with the credibility of the respondents to this initial survey, together with others that we would hope to find along the way, would build a valuable green education development resource, to help educators acquire green skills insights at speed and to contribute real value to the UK's net zero agenda.

Appendix 1: Target respondents

<table>
<tr><td colspan="8">Routes taken to derive the initial target list of organisations which could contribute to the understanding and definition of emerging and future green skills in the UK</td></tr>
<tr><td colspan="2">Universities
(164 in total)</td><td colspan="4">Research and Innovation Organisations
(c200)</td><td>Knowledge Transfer Network
(16)</td><td>Research Programme Projects e.g. UK R&I funded</td></tr>
<tr><td>Universities
Departments and Groups</td><td>Research Centres and Institutes</td><td>Public Sector Research Establishments
Sponsored directly by government departments or the Research Councils</td><td>Public Research Organisations
Infrastructural bodies including major standards-setting organisations e.g. NPL, BGS</td><td>Independent Research and Technology Organisations
Mainly private non-profit and are usually members of AIRTO</td><td>Catapults and related organisations
Seek to link business, advanced research and engineering around innovation processes
e.g. Carbon Trust</td><td></td><td>Usually located in one of the organisations identified to the left of this chart.</td></tr>
<tr><td colspan="8">Search all websites for their listings of centres, institutes and research groups and networks, and identify those which are actively tackling green/low carbon research topics and might have an insight into emerging and future green skills. Representative bodies were also contacted and asked for their advice as regards the most appropriate centres and individuals to contact. Likewise, senior university officials were also contacted to validate the lists of centres and institutes generated.</td></tr>
<tr><td colspan="8">Review research capability directories and project listings produced over the last 5 years These directories are sector, technology, or programme focus and often identify both core research centres contacts and their industrial partners e.g. Innovate UK (January 2020) Energy Catalyst. Directory of Projects; the UK Low Carbon Capabilities Report, UK Smart Cities Directory, Smart Energy and Storage Directory (2nd edition); Eunomia's report, Identifying UK Academic Capabilities in Plastics Research. Final Report for KTN (March 2020); Faraday's Annual Report 2019-2020, Powering Britain's Battery Revolution; UK R&I Driving the Electric Revolution 2020 Annual Report (April 2021); H2FC Supergen/The Hydrogen and Fuel Cell Research Hub, UK Hydrogen and Fuel Cell Research Capability Document; UK R&I UK Transport Vision 2050: Investing in the future of mobility (August 2021); UK Research on the Social Science of Climate Change. A Synthesis of ESRC and Related Investments (2019); Research and Innovation Organisations in the UK: Innovation Functions and Policy Issues (BIS Research Paper No 226); UK Transport Vision 2050: Investing in the future of mobility (2021); Getting to net zero: Bridging the innovation gap between places and companies (2021)</td></tr>
<tr><td colspan="8">Initial target list of 720 generated from the above sources</td></tr>
<tr><td colspan="8">Additions to the target list recommended by respondents to the initial survey</td></tr>
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