Local green jobs – accelerating a sustainable economic recovery

An Ecuity Consulting report for the Local Government Association (LGA)

ecuity

Contents

Project overview

This report provides analysis of the jobs required for a net zero economy in England, where these will be located in the coming years, and the role that local government could play working with industry to address the sector's skills demands. Based on industry insight from a series of expert interviews and literature review, this report includes an assessment of the number of jobs that will be required by sector. This estimate is further broken-down to regional and local authority level based on industry insight and the current sectoral breakdown in each area.

Accompanying this report is a dataset which includes the results of the employment projections made by low-carbon sub-sector, local authority and across two time-periods (2030 and 2050).

The employment figures included in both the dataset and this report are direct jobs in existing low-carbon and renewable energy industries. We expect new technologies and services to emerge as the UK transitions to a net zero economy, and recognise that this green growth will support a larger number of indirect jobs in the wider economy. This report focuses on England.

Nothing in these documents constitutes a valuation or legal advice. Any party that chooses to rely on this report or dataset does so at its own risk. Details of principal sources are set out within the document and we have satisfied ourselves, so far as possible, that the information presented in the report is consistent with other information which was made available to us by our stakeholders in the course of our work.

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Glossary

AD	Anaerobic Digestion
BRES	British Register and Employment Survey [data]
CCC	Committee on Climate Change
CCS	Carbon Capture and Storage
CHP	Combined Heat and Power
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
FCH JU	Fuel Cells and Hydrogen Joint Undertaking
FES	Future Energy Scenarios
Gigafactory	Battery production factory producing batteries with gigawatt-hours of storage
GW	Gigawatt – unit of power
GWh	Gigawatt-hour – unit of energy
ICE	Internal Combustion Engine [vehicles – e.g. diesel and petrol cars]
LCREE	Low Carbon and Renewable Energy Economy
LGA	Local Government Association
Net zero	UK's target to reach *net* zero greenhouse gas emissions – by 2050
NQF	National Qualification Framework
NVQ	National Vocational Qualifaction
PV	[Solar] photovoltaic panels
R&I	Research and Innovation
SIC code	Standard Industrial Classification of economic acitivites – set by UK Government
ULEV	Ultra Low Emission Vehicle

Introduction

Over 194 nation states have signed the Paris Agreement, a bloc that taken together accounts for 97% of the world's greenhouse gas emissions. Investment in the low-carbon economy has increased in recent years driven by rising concern about climate change from scientists, policymakers, and activists, and a recognition of the economic opportunities that new technologies and services will provide. The booming green economy is recognised as a global megatrend that will develop over the coming years as the world comes together to tackle dangerous climate change.

The pace of change in the UK economy will need to quicken if net zero is to be achieved by 2050. This mid-century target will require close to 28 million homes and the premises of 6 million businesses to change the way they use energy via the installation of energy efficient lighting and measures, microgeneration, and heating systems that produce next to no greenhouse emissions. All of this, including changes to the power system, development of alternative fuels, and low-emission vehicles, needs to be delivered in just under 30 years.

To deliver the substantial change needed in the UK economy by 2050, local government will play a key role in facilitating technology transitions in homes and businesses, informing constituents, supporting local businesses and the upskilling of the local workforce. Whilst the raft of national and local government net zero targets will drive demand for low-carbon goods and services over the coming years, it's crucial that there is a workforce in place to deliver the change needed by 2050.

In collaboration with Ecuity Consulting, the Local Government Association (LGA) has published research which considers the projected net zero jobs and the associated skills demands across England by 2030 and 2050. This project supports the LGA's analysis by utilising industry insight, as well as local economic conditions to estimate the spread of green jobs across England by sector.

This report highlights contributions needed from low-carbon power, low-carbon heat, alternative fuels, energy efficient products, low-carbon services and low emission vehicles. The analysis is based on available data and industry-leading views as to the technologies and industries required for England to meet net zero. Assumptions are presented and discussed in the report for transparency.

In addition to the estimation of regional jobs required to meet net zero, the report has included several case studies which provide tangible examples of the industrial and employment changes that are already taking place at a local level. In addition, this report presents results from key stakeholder feedback to provide insight as to the skills gap that will need to be addressed by each sector.

Section 1 of the report includes an analytical breakdown of the jobs required to meet net zero in 2030 and 2050. Section 2 considers the localised requirements to achieve net zero (broken down by Local Authority). Section 3 of the report contextualises the projections with an assessment of the skills gap in each low-carbon sector and an initial overview of the training needed to bridge the emerging gap - as supported by expert industry insight and views.

For the purpose of this paper and to illustrate our analysis more simply and clearly, the eight National Qualification Framework (NQF) qualification levels have been categorised into three skills groups – people with high, intermediate, and low qualifications. This structure is in line with existing research and analysis into deficiency as follows:

- Low qualifications equates to no qualifications plus qualifications below Level 2.
- Intermediate qualifications equates to Level 2 and Level 3 qualifications.
- High qualifications equates to Level 4 and above qualifications.

1. Jobs required to meet net zero

The UK's low-carbon economy

The green economy is booming. As a key pillar of the UK's Industrial Strategy and highlighted as one of four grand challenges, clean growth has been targeted by national and local governments as an area of economic opportunity. In 2018, the UK Government projected that the low-carbon economy could grow by 11 per cent per year up to 2030, which is substantially higher than the projected growth rate for the economy as a whole (estimated at 1-2% per year)[1], illustrating the potential for green growth as driven by international, national and local climate change targets. While the current Covid-19 (coronavirus) pandemic will lower UK economic growth, as the economy recovers, this could ignite and give rise to a greener global future[2], accelerating and prioritising investment in the UK's low-carbon sector.

Whilst technologies and services will evolve as the country moves towards 2050, the UK Government[3] currently defines the low-carbon and renewable energy economy as consisting of the following industries:

Table 1: low-carbon and renewable energy economy sectors, and key sub-sectors
1. Low-carbon electricity Wind power, solar PV, hydropower, nuclear, CCS
2. Low-carbon heat Renewable heat, heat networks and CHP
3. Alternative fuels Bioenergy and hydrogen production
4. Energy efficient products Insulation, lighting, monitoring and control systems
5. Low-carbon services Low-carbon financial, IT, and advisory services
6. Low-emission vehicles & infrastructure Low-emission vehicles & infrastructure, fuel cells and energy storage systems

This report includes details of new analysis which utilises industry insight from expert interviews and leading reports, with an analysis of regional economic sector strengths to forecast future low-carbon employment across England.

In 2018, businesses active in England's low-carbon and renewable energy economy (LCREE) generated close to £37 billion in turnover and employed 185,000 full-time workers[4]. Around 71% of workers (132,000) are employed in the energy efficiency sector installing insulation materials, lighting and control systems. A further 12% are employed in the low-carbon electricity sector working mostly in the wind, solar and nuclear industries.

[1] OBR (2020) *Economic and fiscal outlook*. Accessed on 6th April 2020. Available from: https://cdn.obr.uk/EFO_March-2020_Accessible.pdf
[2] WEF (2020) *Could COVID-19 give rise to a greener global future*. Accessed on 31st March 2020. Available from: https://www.weforum.org/agenda/2020/03/a-green-reboot-after-the-pandemic/
[3] ONS (2020) *Low Carbon and Renewable Energy Economy (LCREE) Survey QMI*. Accessed on 6th March 2020. Available from: https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/lowcarbonandrenewableenergyeconomylcreesurveyqmi
[4] ONS (2020) *Low carbon and renewable energy economy, UK: 2018.* Accessed on 4th March 2020. Available from: https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/finalestimates/2018.
Turnover and employment for the UK was £47bn and 224,800 respectively.

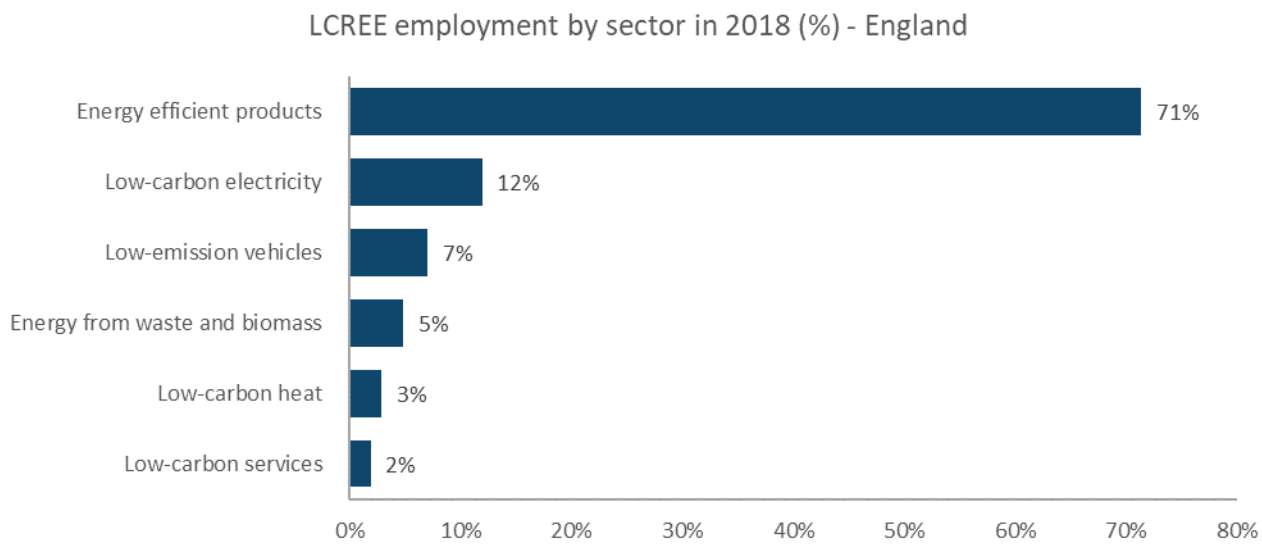


Figure 1 - current employment by LCREE sector (source: ONS)

The national picture

The Local Government Association commissioned Ecuity Consulting to estimate the total number of low-carbon jobs that will be supported by England's net zero transition by 2030 and 2050. The number of direct jobs estimated cover the value chain from manufacturing, construction and installation, to operation and maintenance (see appendix for the methodology on how these jobs were estimated). These are total jobs that we estimate will be needed to deliver the goods and services needed in a net zero economy.

This research found that there could be as many as 694,000 direct jobs employed in the low-carbon and renewable energy economy by 2030 in England, rising to over 1.18 million by 2050[5].

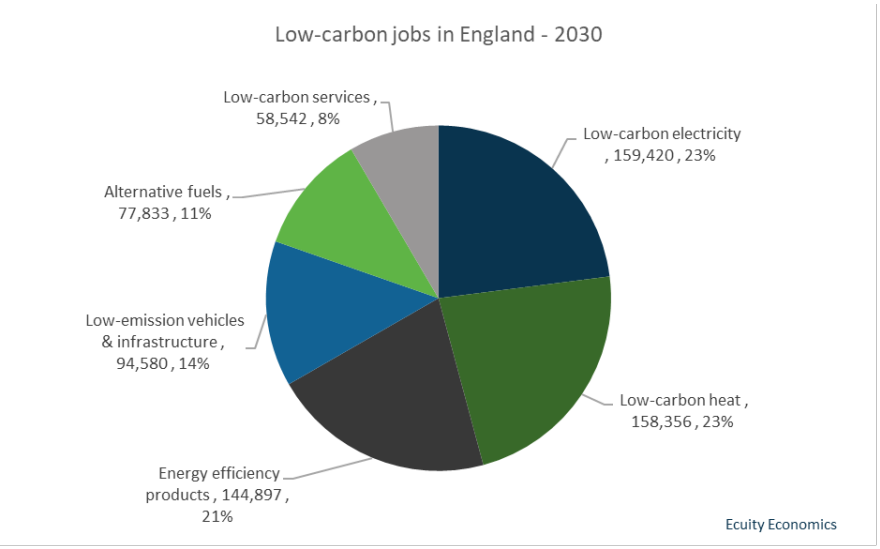


Figure 2 – split of LCREE (direct) jobs in England by 2030 (source: Ecuity estimate)

[5] For the UK, the number of low-carbon jobs estimated in 2030 and 2050 is ~804,000 and 1.38 million respectively.

Nearly half (46%) of the total low-carbon jobs by 2030 will be in clean electricity generation and providing low-carbon heat for homes and businesses. These jobs will range from manufacturing wind turbines, deploying solar PV, constructing nuclear reactors, installing heat pumps and maintaining energy-system infrastructure.

Over one-fifth (21%) of jobs by 2030 will be involved in installing energy efficiency products ranging from insulation, lighting and control systems.

Around 19% of jobs in 2030 will be involved in providing low-carbon services (financial, legal and IT) and producing alternative fuels such as bioenergy and hydrogen.

A further 14% of jobs will be directly involved in manufacturing low-emission vehicles and the associated infrastructure. These jobs will range from manufacturing electric vehicles (and hydrogen vehicles), manufacturing EV batteries from the proliferation of gigafactories in England and sustaining low-carbon mobility by installing electric vehicle charge-points and hydrogen refuelling stations.

Between 2030 and 2050, the low-carbon workforce in England could increase by a further 488,569 taking the total level of jobs to over 1.18 million by 2050. These jobs will be directly supporting the UK's commitment in achieving net zero. Over this period, employment will be created mainly in low-carbon electricity generation, alternative fuels production, low emission vehicles and infrastructure and low-carbon services.

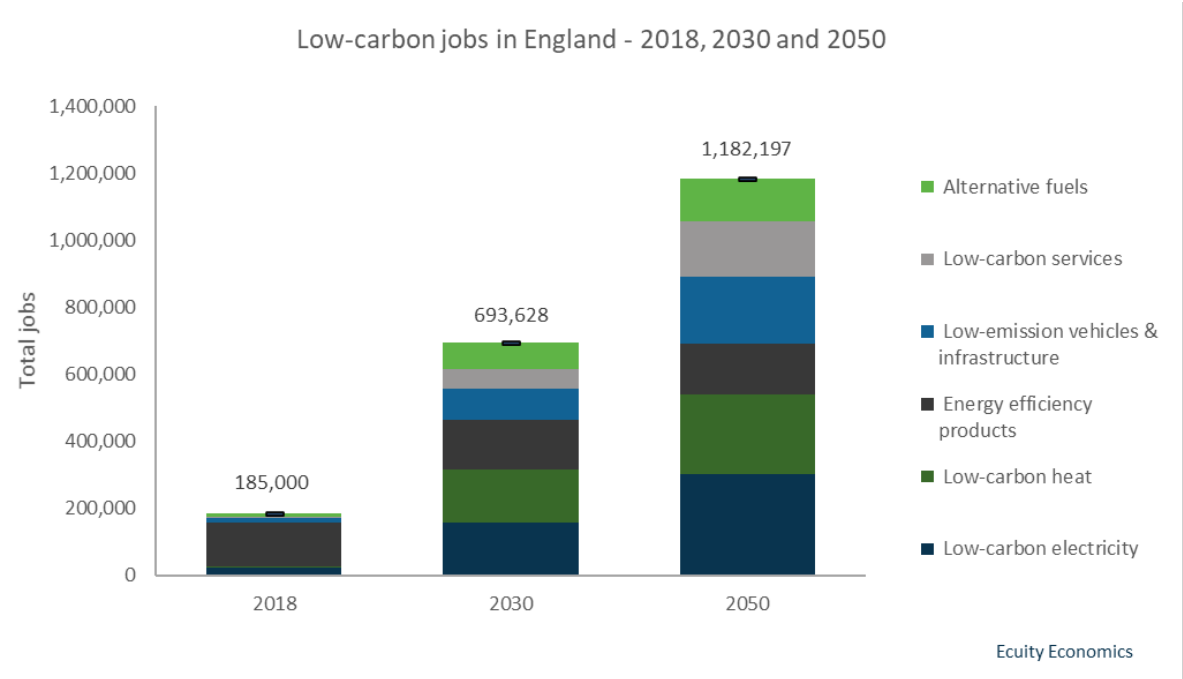


Figure 3 – low-carbon jobs in 2018, 2030 and 2050 (sources: ONS and Ecuity estimate)

By 2050, we anticipate at least 1.18 million jobs directly employed in sectors supporting England's net zero commitment. These are total jobs, and will be engaged in different activties ranging from manufacturing/production, construction and installation of low-carbon plant, to operating and maintaining services, infrastructure and technologies.

The table below illustrates the job breakdown for each sector by function – manufacturing/production, construction/installation and operation and maintenance. For the low-carbon electricity sector, the job breakdown is fairly evenly split across function. It is interesting to note that while the job breakdown is fairly evenly split, there can be larger differences at a sub-sector level. For example, solar PV requires considerably more labour than offshore and onshore wind technologies. For the low-carbon heat sector, over 50% of the jobs are estimated to be involved in installing low-carbon heating technologies such as heat pumps. In the low emission vehciles and infrastructure sector, there will be more jobs manufacturing and producing low-emission vehicles and associated parts and components (batteries and modules). Additional jobs will be needed to install refuelling stations and chargepoints across the country.

	Manufacturing / Production	Construction / Installation	Operation & Maintenance
1. Low-carbon electricity			
2. Low-carbon heat			
3. Alternative fuels			
4. Energy efficient products			
5. Low-carbon services	-	-	
6. Low-emission vehicles & infrastructure			

Key:

0-20% labour intensity, 21%-49% labour intensity, >50% labour intensity.

Table 2- Job breakdown by function (sources: Ecuity research and calculation)

By 2050, it is estimated that most jobs will be engaged in constructing or installing low-carbon technologies. This amounts to an estimated 491,000 workers or 42% of the total low-carbon jobs by 2050. Jobs supporting operations and maintenance are estimated to account for 35% (~410,000) of total jobs by 2050. Around one-quarter (~281,000) of jobs will be engaged in manufacturing and producing low-carbon technologies[6].

[6] For the UK - jobs in 2050 engaged in construction are estimated at 601,000 (44%); operation and maintenance ~478,000 (35%) and manufacturing ~298,000 (22%).

2. Localised breakdown of net zero job requirements

Local government's political response to the climate crisis

Many local authorities across England have declared a climate emergency. While there is no single definition, many local authorities are committing to becoming carbon-neutral in advance of 2050. As of February 2020, over 230 councils in England have declared climate emergencies[7]. Local decalarations of a climate emergency can be a key driver of change.

Figures 4 and 5 below show a selection of the commitments made by local authorities in respect of net zero. Whilst definitions vary by local authority, it is clear that local authorities are driving the agenda at a local level, with some ambitous targets beginning to influence local economic growth plans, and skills-programmes.

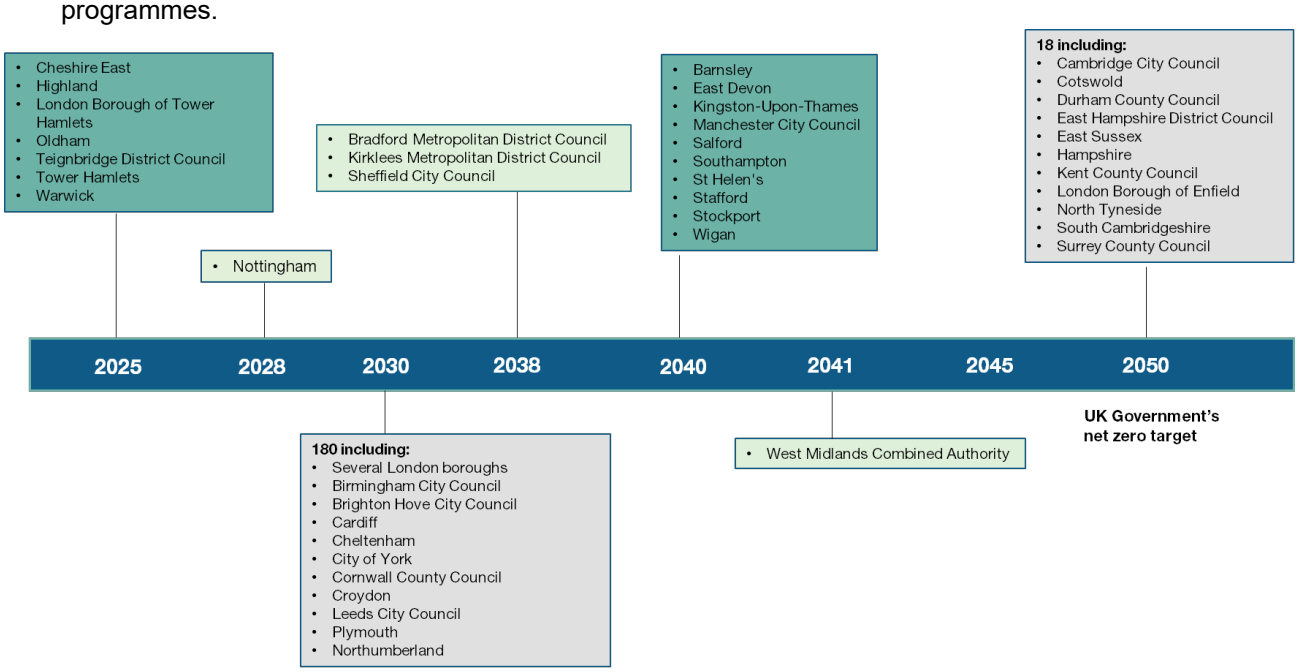


Figure 4 – select English local authorities' carbon neutrality commitments (as at February 2020, source: Climate Emergency)

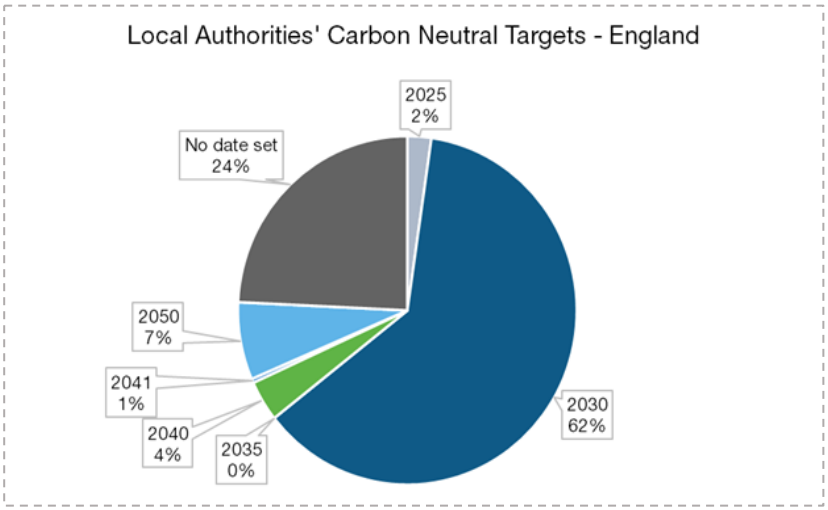


Figure 5 - Share of English local authorities targeting a particular year to go carbon-neutral (as at February 2020, source: Climate Emergency)

[7] Climate Emergency (2020) *List of councils who have declared a climate emergency*. Accessed 06/04/20. Available from: climateemergency.uk

Box 1 – Kent County Council Case Study

County characteristics impacting clean growth outlook:

Kent County Council has announced a climate emergency and committed to net zero by 2050. Kent's Energy and Low Emissions Strategy is a subsector of the Kent Environment strategy which defines an evidence-based approach to deliver clean growth, including actions to eliminate poor air quality, reduce fuel poverty and deliver an affordable, clean and secure energy supply through an integrated approach.

There have been key achievements in Kent made to-date that have supported the transition towards a cleaner society, including increasing the installed capacity of solar-power, wind-power, energy-from-waste and Combined Heat and Power (CHP) by over 7 times between 2012 and 2017. Further, a decision to extend the wind farm off the coast of Thanet is expected imminently and would increase Kent's renewable energy capacity by 340MW making it one of the largest producers of renewable electricity of any English county. There are plans to produce renewable hydrogen within the county which would make use of excess renewable electricity and offer a clean fuel to decarbonise transport and heat. Furthermore, through the delivery of the Low Carbon Across the South East (LoCASE) Programme consumer-focussed activities such as the installation of electric vehicle chargers to support the uptake of ultra-low emission vehicles and the scaling-up of the county's domestic and commercial retrofit installations have reduced energy demand and the carbon intensity of Kent's energy system – these activities will continue to be scaled up over the coming years and will require additional support for the low carbon supply chain to ensure the appropriate knowledge and skills are available.

The planned extension of Thanet Windfarm at Pegwell Bay will see Kent increase its contribution to the UK's low carbon power supply by up to 340MW. The planned extension will require up to 34 new turbines, up to 4 28km long offshore cables and 4 onshore circuits with a grid connection at the Richborough Port and Ricborough Energy Park substations. This activity will require a number of high-skilled and low-skilled jobs to deliver on the project.

Picture source: *Vattenfall*

Existing resources/opportunities:

Work within the county is being undertaken to ensure that the workforce has the relevant skills to participate in key low-carbon activities within the region, Taskmasters (UK) Ltd received funding from Kent County Council. This funding allowed the SME to diversify from traditional training for the construction sector and to support the delivery of skills required to work within the offshore wind sector. Further support is to be received by The Electrical Academy in Maidstone and Ashford to support the move to a larger facility to enable the development of key transferrable skills that can support a career in the low carbon sector. Much of the specific support today for skills and retraining for individuals is covered by the South East Local Enterprise Partnership within the Skills Strategy 2018 - 2023, this resource will be key to facilitate a smooth transition for the region's workforce.

Future outlook:

Kent County Council plays an increasingly important role in providing strategic direction, key information, and greater-certainty to the stakeholders that will need to play their part in delivering low-carbon growth and investment. This includes providing local training academies with insight into new demands for novel skills and the evolving skills gap in important sectors such as offshore wind.

Much work has been undertaken to define the low-carbon pathway that Kent will take, and as part of this work there has been evaluation as to how Kent can deliver new projects. For renewable-power plant developers, there is a recognition that further resource will be required to ensure work ready engineers are available that have both the technical skills, and sub-sector specific skills that will enable them to deliver this work.

Other key areas such as the development of new build homes using modern methods of construction will require evaluation and support in future. The council recognises its ongoing role as a leader in the energy transition; it will be required to coordinate different stakeholder groups including those within industry, Further Education institutions and individual workers to come together and resource the supply chain and address emerging challenges and opportunities within the energy sector.

Regional green economy employment

As England transitions to a net zero economy, demand for green jobs will rapidly increase. These jobs will require a diverse range of skills and expertise to support the production and deployment of clean technologies. Some of these jobs could involve installing heat pumps, manufacturing wind turbines, engineers with renewable energy skills and installers of EV chargepoints.

There is a strong split between manufacturing and services in the England, with services concentrated in London and the wider South East, and manufacturing in the North of England and the Midlands.

These regional specialisms should align with the split of jobs by region estimated for 2030 and 2050. For example, the north of England has strong expertise around generation, storage and low-carbon technologies and processes, especially in nuclear and (offshore) wind[8]. The Midlands is well-known for having a dynamic workforce engaged in the manufacturing and production of vehicles. Around half of automotive companies produce vehicle components in the West Midlands[9].

Some sectors, however, do not display strong regional traits. For example, energy efficiency products are likely to be installed across all households and this will happen across the whole country. This is the same for the installation of low-carbon heating technologies such as heat pumps that are likely to be deployed in households across England. Some low-carbon heating technologies such as hydrogen boilers could initially see deployment in the north of England initially[10] in proximity to industrial clusters and local hydrogen-hubs. By 2035 South Yorkshire and East/West Midlands, and East London could have hydrogen production and distribution facilities deployed[11].

The Office for National Statistics' Business Register and Employment Survey (BRES) publishes employee and employment estimates by geography and industry. BRES employment statistics are widely used, particularly by local government planning departments who use it to forecast trends in employment in their specific areas. Ecuity used this survey, alongside SIC mapping of sectors and sub-sectors, to robustly map where the 1.18 million jobs by 2050 will be located regionally. (More information on this can be found in the methodology section).

This estimation relies on the well-established observation in economic geography that clusters of industry develop in locations that have pre-existing resources that support a competitive advantage[12]. We assume that parts of the country that already specialise in a particular industrial classification, will continue to have a competitive edge and interest in similar economic activities in a net zero economy. So, areas that are already involved in the current automotive industry are likely to have a strong involvement in the future. Whilst the dynamics of place and work will change, our approach utilises existing data to develop a robust projection based on what we know today.

This projection is then adjusted based on expert advice received during a 4-week period of interviews and stakeholder engagement, to better calibrate the projections.

Results

The path to net zero will be a major strategic opportunity for every region in England. Hundreds of thousands of jobs will be created across English regions by 2050 to support this transition. Significant employment opportunities could be created in the north of England where an estimated 422,500 jobs

[8] IPRR (2017) *Net-zero North: Delivering the decarbonisation mission in the North of England.* Accessed on 26th March 2020. Available from: https://www.ippr.org/files/2017-12/net-zero-north-report-1712.pdf
[9] Automotive Council *Mapping UK Automotive.* Accessed on 26th March 2020. Available from: https://www.automotivecouncil.co.uk/mapping-uk-automotive/
[10] NGN (2017) *Leeds City Gate: H21 Report.* Accessed on 26th March 2020. Available from: https://www.northerngasnetworks.co.uk/wp-content/uploads/2017/04/H21-Report-Interactive-PDF-July-2016.compressed.pdf
[11] Element Energy (for Equinor) (2019) Hy-Impact Series Study 1: Hydrogen for economic growth. Accessed on 26th March 2020. Available from: http://www.element-energy.co.uk/wordpress/wp-content/uploads/2019/11/Element-Energy-Hy-Impact-Series-Study-1-Hydrogen-for-Economic-Growth.pdf
[12] Porter, M. (1990) *The Competitive Advantage of Nations.* Available from: http://www.economie.ens.fr/IMG/pdf/porter_1990_-_the_competitive_advantage_of_nations.pdf

will be supported by low-carbon industries. In the North West, new jobs could be created to increase England's wind capacity and nuclear operations. In the North East, and Yorkshire and the Humber, employment opportunities are expected to be created to construct, install and maintain Carbon Capture & Storage (CCS) plants to decarbonise energy production and carbon intensive industries (such as cement manufacturing and large oil refineries). Furthermore, employment opportunities will also be created from the installation of bioenergy facilities and the production of hydrogen to support industrial (and wider) decarbonisation.

Across the Midlands, there could be an estimated 194,000 jobs working in low-carbon sectors. Most of these jobs would be focused on manufacturing low emission vehicles, battery packs and modules in gigafactories situated near existing production sites. Jobs are also likely to be created to install low-carbon heating technologies, energy efficiency products and solar installations (particularly in the East Midlands).

In London and the south of England, an estimated 447,000 jobs could be supported to deliver the transition to net zero. Many of these jobs will be in the financial, IT or legal sector supporting low-carbon activity. This is due to the strong service sector in the London and south England regions. Other jobs are likely to be created to deliver low-carbon electricity generation in solar deployment (South West and South East) and nuclear operations and maintenance in the South West.

In the East of England, around 119,000 jobs could be engaged in low-emission vehicle and component manufacturing, and low-carbon financial and IT services. This is broadly in line with the region having a strong financial services sector and being active in automotive manufacturing.

Table 3- Number (and % share) of low-carbon jobs in 2050 split by region (sources: Ecuity calculations)

Region	Number of low-carbon jobs in 2050	% share of low-carbon jobs
North East	84,205	7.1%
North West	170,601	14.4%
Yorkshire and the Humber	167,697	14.2%
East Midlands	96,842	8.2%
West Midlands	97,015	8.2%
East of England	119,294	10.1%
London	143,764	12.2%
South East	163,014	13.8%
South West	139,765	11.8%
Total England	**1,182,197**	**100%**

The map below shows the number of low-carbon jobs in 2050 split across ceremonial counties in England[13].

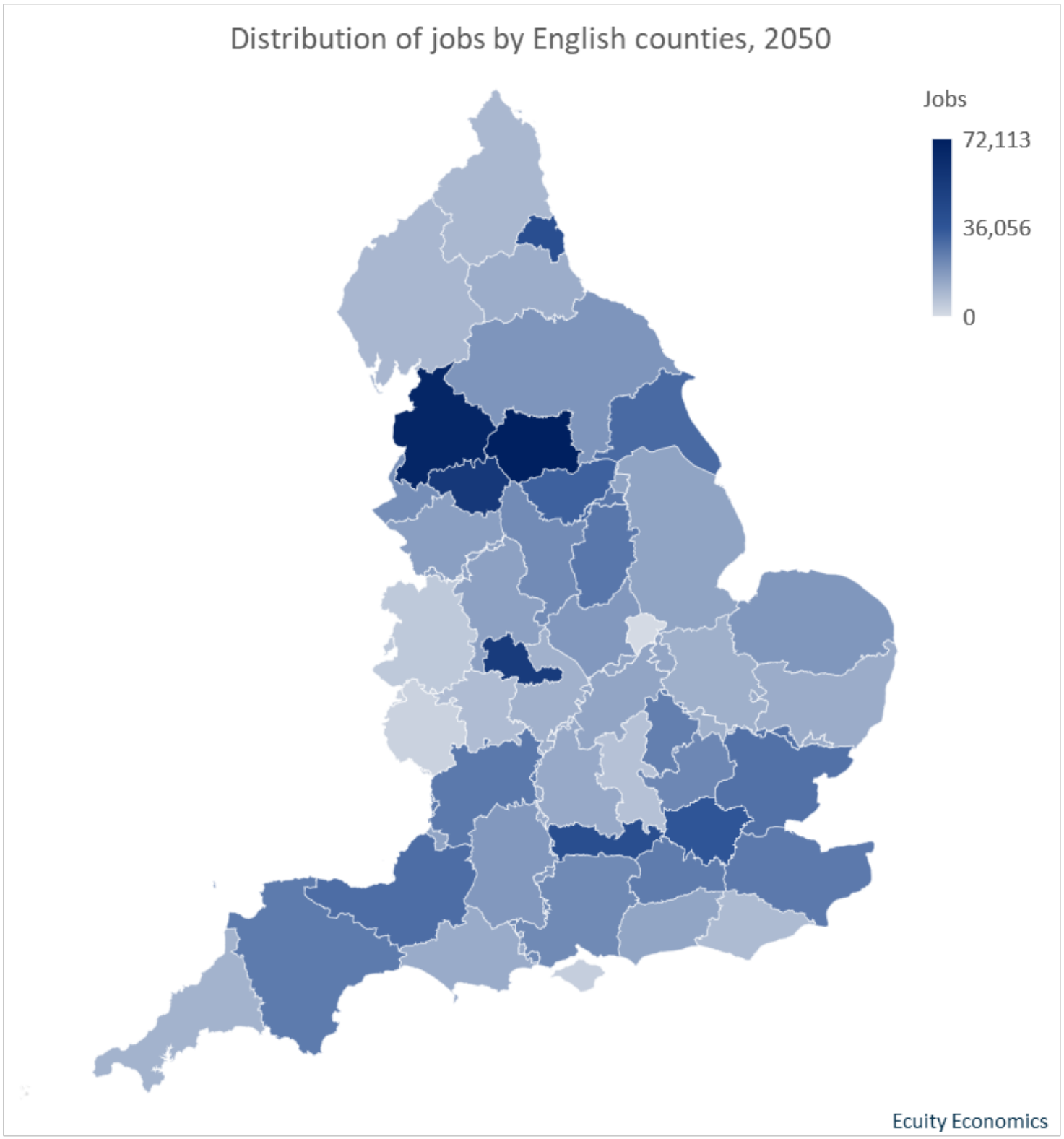


Figure 6 - Split of low-carbon jobs in 2050 by English county (source: Ecuity calculations)

[13] Ceremonial counties, as referred to in ONS, are metropolitan and non-metropolitan counties (created by the Local Government Act 1972) as well as Greater London.

3. Assessment of emerging skills gap

Low-carbon growth is rapidly evolving as wider government intervention accelerates the take up of low-carbon products and services. As part of this project, interviews have been undertaken with experts from individual sub-sectors to provide critical perspectives on the future requirements for green jobs, skills and training. Their perspectives are summarised in the Tables below.

Additional interviews were undertaken with local authorities to understand existing or future work to address the skills needs of the low carbon sector. This intelligence is included in Boxes 1, 2 and 3.

Table 4, which is below, provides an overview of perspectives from three key elements of the supply chain: research and innovation, manufacturing, and sales, installation and services. These comments serve as a valuable snapshot of expert opinion and aspirations. Policy commitments such as the accelerated phase out of ICE vehicles and a number of measures included in the 2020 Budget have been cited by interviewees as impacting their current perspectives, and as new policy mechanisms are introduced to support the transition to net zero, expectations will naturally evolve.

Table 4- Industry perspectives on status of the supply chain

	Sub sector	Research and Innovation	Manufacturing	Sales, installation and services
Low-carbon electricity	Solar	Significant progress has been made to reduce the cost of solar and research is ongoing – including by UK-based researchers – to increase efficiencies further.	UK primarily imports pre-fabricated PV cells; this is not core focus of the UK supply chain.	Provision of services are (and will be) demand led, and are broadly considered achievable within the sector today.
	Nuclear	Opportunity for UK nuclear to capitalise on additional supply chain activities; funding and resource are required to enable R&I to mature here which will require high-skilled jobs.	There is ambition to increase domestic activity; today much of prefabrication is conducted abroad and this signals a gap in UK competences.	Emerging skills gap expected to meet demand of existing and new nuclear commissioning, also in competition with nuclear submarine fleet and other large infrastructure projects.
Low-carbon heat	Heat pumps	Relatively mature technology means this is not core focus of UK companies today.	Expected increase in domestic manufacturing when industry reaches critical mass.	Likely to be a shortage in near-term (5 years) of people with low qualifications for design, specification and installation..
Alternative fuels	Anaerobic digestion	Relatively mature technology driven by policy/regulation; R&I not considered core activity of UK industry.	Plant construction is one of largest burdens on supply chain for high-skilled workers.	Plant commissioning and grid connection is one of largest burdens on supply chain for high-skilled workers.

Energy efficient products	Hydrogen fuel cells	R&I is critical for sub-sector to maintain competitive edge versus. international competition. The challenge for organisations is to maintain highly skilled workers in UK.	Near term there is scope to capitalise on downscaling of UK automotive sector. However, long term demand for jobs may curtail due to automation.	Low-skilled jobs may be undertaken in other countries close to large demand centres. Key activities related to sales and installation may naturally follow.
	Smart controls	R&I will preserve jobs within the sub-sector in the coming years, although these jobs will switch from electrical engineering to software-based.	Relatively mature and stable sub-sector within the UK, evolving consumer expectations should sustain jobs.	Additional services to support service to aid integration into homes/businesses may be required in longer term.
Low-carbon services	Consultancies and financial services	R&I is an ongoing aspect of service sector business models to exploit opportunities in the transition and emerging demand for novel technologies. Ongoing demand for highly-skilled jobs.	N/A	Services are demand led and are critically impacted by sector wide activities. Ongoing demand for highly-skilled jobs.
Low emission vehicles & infrastructure	Electric vehicles	An emerging technology sub-sector where scope to innovate remains.	Job preservation, switching from ICE to electric motors.	Job preservation of existing automotive services will be required in the future, further as this sub-sector grows there could be growth and corresponding need for skills in activities ranging from infrastructure installation, servicing and other high-skilled jobs.

Table 5, below, summarises the key perspectives outlined in Table 4 to highlight the skill level gap that has been identified as the main challenge for industry to manage in each individual sub-sector. This is considered purely as indicative information given that investment and innovation within industry (i.e. automation, retraining) can change the longer-term outlook and implication for skills. Furthermore, industry and local authority stakeholder interviews demonstrated that understanding the true demands on skills and jobs is an ongoing and iterative process particularly as national initiatives are introduced.

In Table 5, the column on the right hand-side indicates the time horizon within which emerging skills gaps are expected to emerge with respect to the NVQ level equivalent outlined in the comments column. **Those sub-sectors that are considered to have key near-term (2020 – 2025) skills gaps are coloured red, those that are considered to have a skills gap emerging in the longer-term (2025 – 2035) are coloured yellow.**

Table 5 - Comments on key area of skill level for individual sub-sector (corresponding to relevant NVQ Level)

Table 5: Comments on key area of skill level gap for individual sub-sector (corresponding to relevant NVQ Level)			
Sub-sector		**Comment on skill gap areas**	**Time horizon**
Low-carbon electricity	Solar	Supply chain considered relatively secure, however an uptick in demand would require technicians to be trained at **NVQ level 3** equivalent to develop a larger installer base to deliver grid connected solar for utility scale/decentralised generation.	
Low-carbon electricity	Nuclear	Entire supply chain in need of upskilling to meet emerging demand; **NVQ level 1 – 3** for construction; **NVQ level 4+** for design and planning.	
Low-carbon heat	Heat pumps	Key skills gap area to meet increasing demand is in the design, specification and installation of heat pumps; **NVQ level 2 – 3.**	
Alternative fuels	Anaerobic digestion	To meet forecasted demand, higher skill levels would be required **NVQ 4+** to design and connect AD plants to the grid and ensure biomethane is of sufficient quality for DNOs**.**	
Alternative fuels	Hydrogen fuel cells	Highly skilled jobs (**NVQ level 4+)** for R&I required in future; a good stock of technicians expected to be available from existing automotive sector to meet manufacturing demand (i.e. NVQ 1 – 3).	
Energy efficient products	Smart controls	Highly skilled **NVQ level 4+** in software engineering is considered as a key skill to enable future innovations within the sub-sector**;** good stock of manufacturing technicians expected to be available (NVQ 1 – 3) for manufacturing demands.	
Low-carbon services	Consultancies and financial services	Highly skilled **NVQ level 4+** demand is ongoing and required to ensure service sector organisations can exploit emerging opportunities.	
Low emission vehicles and infrastructure	Electric vehicles	Sector is expected to preserve jobs across all NVQ levels as existing, large automotive capacity in UK switches to ULEV technology. Ongoing R&I activities demands highly skilled researchers **NVQ Level 4+.**	

Key	Sub-sectors that are considered to have key near-term (2020 – 2025) skills gaps	
	Sub-sectors considered to have a skills gap emerging in the longer-term (2025 – 2035)	

For the purpose of this paper and to illustrate our analysis more simply and clearly, the eight National Qualification Framework (NQF) qualification levels have been categorised into three groups – people with high, intermediate, and low qualifications. This structure is in line with existing research and analysis into deficiency as follows:

- Low qualifications equates to no qualifications plus qualifications below Level 2.
- Intermediate qualifications equates to Level 2 and Level 3 qualifications.
- High qualifications equates to Level 4 and above qualifications.

Box 2 – Portsmouth City Council Case Study

City characteristics impacting clean growth outlook:

Portsmouth City Council has declared a climate emergency, with an ambitious net zero target set for 2030. Portsmouth's economic development and regeneration strategy recognises the significant opportunity that clean growth offers the region, with a particular focus on the region's marine and maritime sector, which offers a unique opportunity for the city's existing workers, corporations and education institutions to play an important role in shaping the city's low-carbon future.

There are specific activities underway in Portsmouth today to scale-up its low-carbon agenda with the Victoria of Wight hybrid electric ferry that runs to the Isle of Wight, and Brittany Ferries are now making trips to France running on LNG from Portsmouth International Port which is owned by the Council and aims to be the first carbon neutral port in the UK by 2030. These activities can deliver immediate emissions reductions for the city. Further initiatives are under development to ensure the city transitions in a timely and coordinated manner including participation with the Plastic Revolution (a new plastic eating enzyme research programme) and massive expansion of Portsmouth's integrated Park and Ride facility to support the move to a possible Class B Clean Air Zone, and through concerted efforts to scale up key adjacent sectors such as in advanced manufacturing and autonomous mobility. Portsmouth also has proposals to develop an innovation quarter (or quarters) focussing on clean growth and clean energy which would see key activities happening in the heart of the city centre. The City's Tipner West, a car-less and kerb-less new community currently under development, puts sustainable design in the centre of its design as indicative of the ambition within Portsmouth. The community will integrate a low-carbon business zone that will have a focus on deep water marine and the University of Portsmouth's research and development.

Portsmouth's Tipner west will be a home to a new community focused explicitly around sustainability and low-carbon living, including a designated space for low-carbon businesses.
Picture source: *Portsmouth City Council*

Existing resources/opportunities:

Portsmouth's ambitious net zero commitment means that work is already underway to support the transition. Given the area's established maritime and marine sector much of the existing activity will directly support job growth and low-carbon skills within this sub-sector. The Council funded membership organisation Shaping Portsmouth is one such initiative that sets out its vision as being "..to grow the number of Jobs and increase the overall educational attainment of the population… by bringing business education and the community together". Portsmouth City Council is also part of the Department for Education's Opportunities for Apprenticeships project that is soon to complete year one, and Portsmouth Council has the aspiration to be a lead council on further activities to develop this work further.

The Marine Enterprise Zone (MEZ) is an employer led group by the Navy is also looking at skills and development with support from the Southampton and Portsmouth Councils. The Portsmouth Advanced Manufacturing and Engineering Cluster (PAMEAC) is a broader cross-sector collaboration within the region that aims to ensure growth continues and works to deliver on STEM skills and innovation – sharing capability and capacity is considered its priority within this work. The PAMEAC will collaborate with schools to support careers within the sector, and ensure that the Apprenticeship Levy is effectively distributed across the sector to build productivity in line with the clean growth agenda. There is ongoing work to continue strengthening links with Further Education colleges and the workforce which includes formal plans and working with the Apprenticeship Levy including working with Solent's Apprenticeship Hub. The Local Authority is considered a key facilitatory of much of this work.

Future outlook:

The ongoing development of skills and training resources in Portsmouth must be done in line with key resources such as the National Skills Fund and National Retraining Scheme, and with 2 of Portsmouth's feeder colleges are also leading on pilots for the phase in of T Levels, the area is well poised to benefit from this transition.

Research to date from the Skills Survey also demonstrates that whilst the region is well developed and the majority of organisations feeling that their workforce do meet their current business needs, some specific areas including engineering, management/leadership and IT/computer skills. Given that the achieving net zero is both a binding commitment and a key opportunity to build prosperity for the region, further analysis of the skill needs of businesses is critical to ensuring a smooth transition. The work done to date in close collaboration with the city's strong marine and maritime sector demonstrates the city is shaping up well to participate in the low-carbon transition by leveraging its existing strengths, expertise and resources – integrating this approach to all of its energy related activities will be the next step.

The following Tables (6 – 13) outline a more detailed summary of perspectives from industry stakeholders as to the current state-of-play for several sub-sectors. In considering the broader outlook of the sub-sectors, additional detail can be drawn out to inform local authorities on the trajectory that businesses are moving in and the implications that this may have on skills and jobs. Specific comments on regional demand and skills more generally are also included. The perspectives of stakeholders have been split in to four categories, as follows:

- **High level outlook:** includes comments on the existing conditions of the sector, and key perspectives that should be considered moving forwards
- **Regional demand on jobs:** includes comments on sub-sector specific demand on jobs from the regional perspective.
- **Skills:** includes direct comments on perspectives raised around skill specific challenges and opportunities
- **Key considerations for local authorities:** includes comments on the sub-sectors on the role that Local Authorities can play to aid the transition to net zero.

Table 6 – Solar Photovoltaics

High level outlook	Solar PV industry matured rapidly due to the 'solar boom' in the global market place, and in the UK due to the Feed in Tariff and Contracts for Difference, the removal of the Feed in Tariff in 2019 has however led the industry to plateau somewhat. Over next few years the growth of industry may well remain stable, however specific policy intervention could see increasing demand for the solar supply chain. A key market opportunity for the sector is noted in the installation of rooftop solar where deployment has lagged behind other European nations countries. However, support is not yet in place to i) grow demand or ii) grow the supply chain in England.
Regional demand on jobs	The low cost of PV cells means that there is potential to deploy solar across England and the whole of the UK to decarbonise power in the grid, for businesses or households. This low cost means that even northern areas with low levels of solar irradiation can still benefit from PV independent of geographical differences in solar irradiation levels. Thus, the regional opportunity for this sector is not based in specific localities. PV installers and the wider services required within the sub-sector are relatively evenly distributed and are able to travel for work due to relative quick install times and limited need for ongoing maintenance of the technology.
Skills	For the time being professional services (legal, financial and so forth) are considered relatively secure in England and achievable in the long-term, there could be some uncertainty here if demand was to rapidly ramp again – these services are primarily required for utility scale solar. Solar technician skill requirements will also be demand led; Level 3 Electrical Installations qualification are required to install grid connected solar, however there is relatively robust installer base due to previous boom in the sector. If there was an increased demand in rooftop solar, this would be a skill area that could require strengthening.
Key considerations for local authorities	There has been engagement with local authorities from this sub-sector, primarily where they have commissioned their own solar projects; engaging with the supply chain to achieve these installations strengthens the relationship with the sub-sector.

Table 7 - Nuclear

High level outlook	There will be a net increase in demand for jobs from new projects and decommissioning on top of maintaining existing fleet. The construction of proposed plants (Hinckley Point C, Sizewell and others) and the major transformation programme for nuclear submarines are noted as two critical drivers for increasing this demand. It is also noted that this increase in demand for engineering expertise and technical skills will be in competition with demand from other large infrastructure projects in adjacent sectors. There is also scope to increase competence in wider supply chain activities including pre-fabrication of components to build the UK's domestic nuclear industry to benefit projects here and to exploit the international export opportunity, however given there is limited UK activity on this front to-date this is not considered to be an immediate factor that will create a skills gap.
Regional demand on jobs	Nuclear employment is, and will continue to be, highly localised around key projects for example in Clyde, Sellafield, Hinckley Point. Workers with low qualifications involved at the construction phase of projects typically travel for work for the set period of time they are required for. Those higher skilled individuals that are involved in the planning phase may be able to work remotely or intermittently visit the site depending on project specific requirements.
Skills	Increasing standards within the nuclear industry may change skill requirements in the near-term, for example enforcement of French standards (RCC-M) could increase need for high-skilled welders and other supply chain workers and will require businesses to invest in these skills. Across the entire sector there is need to upskill and reskill individuals to work on nuclear from other sectors, this includes construction workers that have non-nuclear specific skills, as well as civil contractors and mechanical engineers.
Key considerations for local authorities	A coordinated approach to upskilling the entire supply chain will be beneficial to allow UK-based operations to meet demand sufficiently. Ensuring industry, universities, colleges and local authorities collaborate on this can ensure this transition is smooth and prosperous for all stakeholders involved in the UK. It is further recognised that there is an opportunity for local authorities in 'nuclear regions' to ensure provisions are in place for the nuclear industry, as training and reskilling individuals to work on projects can increase prosperity to these areas by ensuring the local workforce can participate in a key area of local economic activity and remain in the area for the long-term.

Table 8 – energy efficient products: heating controls

High level outlook	Demand for energy efficient technologies and products will remain towards 2050, although the key aspects of digital technologies will likely change to become increasingly 'smart'. Whilst key infrastructure, services and capacity of manufacturers will therefore likely remain constant and manageable, there is likely to be a shift away from traditional electrical engineering skills to digital skills. The most recent policy intervention via Building Regulations Part L and the Domestic Heating Compliance Guide, known as "Boiler Plus" set the bar for heating controls in 2018, and future policy shift including the Future Homes Standard and prospective 'smart' requirements could catalyse further growth. There is also some dependence on installer network of heating systems to effectively translate information on emerging heating control technology to the customer (see heat pumps for detail on the skill demands here).

Regional demand on jobs	Highly localised in the area of manufacturers' core operations; this includes manufacturing, sales, communications/marketing and research. Again, this sub-sector is dependent on the existing heat installer supply chain to install the technology within homes/businesses.
Skills	Engineering, hardware, firmware and software engineers are a staple of the industry today, however a concerted shift to increasing software engineering competence is expected as technology changes to be a core port of the 'smart' energy system. Today, employment in key supply chain operations including in R&D, manufacturing and services is largely satisfied by the regional workforce in the operations' key localities. However, increasingly requiring highly-skilled software engineering expertise has anecdotally required a change in a recruitment tactic to broaden recruitment to wider regions. The workforce primarily includes experienced professional and graduates. Much of the company's training comes from investing in the existing workforce, apprenticeships, as well as in undergraduates with a year in industry.
Key considerations for local authorities	This sub-sector is well-placed to develop its own competences by investing in the younger workforce to ensure they have the skills and context to contribute to technical work. However, Local Authorities would be well-placed to recognise the types of skills that organisations within their regions are requiring and ensuring that local education is geared towards this – doing so will ensure that those who live in the region can participate in a key low-carbon activity.

Table 9 – alternative fuels: anaerobic digestion (AD)

Table 9 – alternative fuels – anaerobic digestion	
High level outlook	Similar to the solar market there was a real boom in the 2010s due to the Feed in Tariff and the Renewable Heat Incentive, however growth has plateaued more recently as these policies have expired or are expiring. Positive inclusions for this sub-sector in the 2020 budget (i.e. the biomethane levy) indicate there could be further growth, however this is a recent announcement and the response from the AD industry is still to be seen.
Regional demand on jobs	Regional demands for this sub-sector varies from being close to municipal centres where there are large volumes of waste feedstock to rural (off-grid areas) where farm waste can be used as a feedstock. Ultimately, plants are relatively evenly spread across the country, with larger ones close to municipal waste centres. Those installations close to municipal centres will require grid-connection; those in rural locations may feed directly in to Combined Heat and Power (CHP) generators, demonstrating some variance in specific activities related to the sub-sector.
Skills	There is a diverse set of skills required throughout the supply chain for AD, this includes farmers who have detailed knowledge in the management of land and feedstocks, to specialist grid-connection engineers and operators who ensure grid connections are safe, and that the biomethane fed in to the grid is of suitable quality and calorific value as per the grid operators requirements. As demand increases, this wide-range of skills must be managed.
Key considerations for local authorities	Local authorities have a key role in ensuring that there is sufficient internal education and understanding of AD technology and its low-carbon credentials to support this industry. Indeed, the management and enforcement of Compulsory Food Waste recycling will require local authority action – ensuring this policy is functioning will ensure that municipal waste feedstocks can be sourced by AD operators for mutually beneficial circular economy outcomes.

Table 10 – hydrogen fuel cells

Table 10 – hydrogen fuel cells	
High level outlook	A highly innovative sector that is continually pushing boundaries of research and innovation with the aim of exploiting economies of scale and remaining ahead of international competition in a burgeoning marketplace. Hydrogen demand is broadly expected to increase (globally) towards 2050 and fuel cell manufacturers are critically aware of this – there are challenges associated with continuing to innovate, retain highly skilled workers and to remain ahead of international competition.
Regional demand on jobs	Job demand is highly localised in areas where primary operations are, this includes manufacturing, research, design, sales and marketing. In future it is possible that manufacturing could be moved abroad to meet major demand markets internationally, whilst key research and innovation jobs would likely remain in the UK. This sub-sector could feasibly capitalise on existing expertise from automotive manufacturing workers in localities where current automotive operations are downsizing.
Skills	Again, for low-skilled jobs, there is an expectation that downsizing of existing UK automotive operations can be exploited by the hydrogen fuel cell sub-sector in areas where key operations take place. The primary skill demand is however expected to be for highly skilled workers including engineers and scientists that can support innovation and research activities. However, given the significance of this market segment and the evolving competition from other large economies that are pursuing hydrogen opportunities, there is a need for UK higher education institutions to deliver key skills such as engineering, physics and other core STEM subjects within the workforce. It is recognised that automation in this sub-sector could reduce the demand for low-skills workers in the long-term.
Key considerations for local authorities	Local Authorities can play a critical role in identifying emerging technologies and championing them to increase local demands, awareness and understanding of technology. This can have knock on benefits including preparing the young workforce for employment in the sub-sector through awareness raising/education and in developing local markets – some local authorities are cited as having already done this to the benefit of manufacturers and progress towards decarbonisation.

Table 11 – low carbon heat: heat pumps

High level outlook	The design, specification and installation of heat pumps is key for this sub-sector. In the UK there were 2,000 heat pump installers at peak capacity, today there is closer to 800, this is in contrast to the existing 133,000 gas safe registered heating engineers. With the onset of the Future Homes Standard from 2025 there needs to be a step change in the resource committed to ensuring there are enough installers on the ground to deliver electrification of heat requirements. Towards 2050, much of the heat sector will be electrified and demand will be significant and ongoing for installation and maintenance services.
Regional demand on jobs	Rural areas and new builds will see the deployment of heat pumps, but this is not region specific, and all UK homes could theoretically see them installed. Those who install heat pump technologies are decentralised and dispersed and are essentially contained within the existing heat installer supply chain; there are many micro, small and medium enterprises across the country.

Skills	The challenge is currently one of training and upskilling of the existing supply chain which is currently able to meet conventional heating demand requirements. In the future there may be more of a question around how to ensure there are more heating engineers trained and ready to enter the supply chain, but given the 133,000 of existing Gas Safe engineers, the challenge today remains around upskilling to support the transition to low carbon technologies.
Key considerations for local authorities	Indication in the 2020 Budget that there is money for skills/training is positive, although this is non-specific – collaboration with local authorities on the allocation of skills budgets would be productive. Furthermore, individual local authorities could be innovative where there is decentralised community demand for low-carbon technologies, or where there is a large rural population (e.g. in Lincolnshire, Cambridgeshire) to ensure that early provisions for skills are utilised. A broader challenge is that there needs to be a clear training route to get certified for installers, as today it is far from clear.

Table 12 – professional services: financial services and consultancy

High level outlook	A diverse sector that commands a range of skills and expertise from environmental impact assessments, to finance and technical consultancy. The personnel employed are typically highly-skilled with graduate or post graduate level qualifications – these skills requirements are broadly expected to remain similar towards 2050. The sub-sector will be demand led and will flux based on the ongoing activities including large-scale infrastructure projects and the up-scaling of emerging technologies such as hydrogen. This means that there will competition within the sector as many of the technical transferable skills are pulled in multiple directions.
Regional demand on jobs	Much of the work can be undertaken remotely from offices (in urban hubs), although some critical skills are required onsite, particularly activities needed to conduct environmental impact assessments or location specific activities.
Skills	Skill and training requirements are broadly influenced by wider sustainability agenda and infrastructure projects – specific subsectors that have greater demand will see the service sector build their competence through training and resource allocation. Whilst resource is finite and will be in competition with the wider energy sector demands, it was noted by interviewees that they have the capacity to pivot and build competence relatively quickly – with examples of consultancies focussed on utility-scale solar switching to wind power, and competence within the hydrogen sector building quickly to meet emerging opportunities.
Key considerations for local authorities	Whilst these companies do critically work with local authorities on a range of projects and initiatives, including on Climate Action Plans, local authorities would likely be less involved in specific support for skills provisions. Broadly speaking, ensuring that younger generation are educated on ways to participate in low-carbon sector from school level would support this sector, and indeed all low-carbon sectors, to draw on a qualified workforce towards 2050.

Table 13 – electric vehicles

High level outlook	Expectation is that there will be significant scale-up of the sector in the near-term due to the 2035 phase out of ICE vehicles, future demand towards 2050 is uncertain due to considerations around autonomous vehicles, integrated public transport and the competition with Hydrogen Fuel Cell Vehicles.
Regional demand on jobs	Demand for jobs will likely be focussed in regional hubs where existing manufacturing capacity lies; this could be in the North West and West Midlands where automotive manufacturing supply chains are already well developed, to South Wales where there is proximity to raw material suppliers.
Skills	Primarily there will be job preservation for lower-skilled workers in the short to medium term as there is a structural change in the automotive sector from ICE to electric motors. There will be ongoing requirements for those high-skilled workers involved in research and innovation.
Key considerations for local authorities	The notable and rapid downsizing of the existing automotive sector in the UK jeopardises a significant number of jobs and risks seeing unemployment levels within the sector rise sharply in certain local authority regions. They can therefore play a key role in signposting opportunities and engaging with activities that will reskill the workforce to ensure that these individuals can play a role in the future low-carbon automotive industry to deliver multiple benefits for local economies and the climate.

The insight contained within the ten tables in this chapter serve to overlay an additional level of context for readers. The evidence collected suggests that there are some key sub-sectors that require additional intervention from industry, local government, central Government and/or the country's education institutions to ensure that the work force is sufficiently well resourced to deliver on emerging demand. Sub-sectors that will require early intervention from this research are considered to be the heat pump supply chain, the nuclear sector and professional services. Ensuring that existing resources are managed effectively, and specific problem areas have additional resources made available to them will reduce the burden on industry to manage challenges independently.

The other sub-sectors considered in this research are expected to face some unique challenges in the longer-term, however the specifics of these challenges are not yet fully clear and will also likely be influenced by the low-carbon pathways that are defined by both local authorities, central government and at the whole energy system level. Furthermore, it is noted that innovations and changing market conditions may be critical to the future job and skill requirements of these industries. Whilst automation within manufacturing could ultimately reduce the number of jobs only requiring low qualifications, demand for certain technologies that currently remains unknown could create 'booms' in certain sub-sectors – such events could require entire supply chains rapidly mobilise to build capacity and capitalise on the opportunity. Thus, ensuring that ongoing analysis is undertaken to assess industry specific challenges associated with skills and employment will enable them to be overcome.

Interviews with industry stakeholders and the local authorities demonstrate that there is consensus that local authorities are indeed well placed to support the transition to a low carbon economy through their place shaping role. They can keep ahead of the curve by:

1) ***Understanding local implications of national low carbon policy***

At the high-level, local authorities should remain abreast of emerging policy opportunities to leverage support that will benefit their local low-carbon supply chains; this could range from engaging with the Compulsory Food Waste regulation to support the anaerobic digestion sub-sector to access necessary feedstocks, or engaging with government to understand how new funding for skills can be pulled down and best put to use within their regions.

2) A pipeline of skills to support a low carbon economy

Local authorities also have a role to play in identifying and drawing down funding for skills and training from a variety of sources to support the local economy. These include existing European funding, its successor UK Shared Prosperity Fund, other national initiatives and programmes as well as securing private investment. It is crucial that they can identify how these funds can be maximised locally to support the creation of new jobs and develop a pipeline of skills locally. Funding is limited and uncoordinated however, which has been cited by local authority stakeholders as a key challenge today.

Local authorities are place shapers and bring together a wide range of stakeholders(including between industry and further education institutions) within their areas. This can ensure that local areas take an integrated and forward-looking approach to skills and training within the low-carbon sector.

By playing this role, local authorities can provide certainty to the supply chain and other stakeholders to take the lead on activities that have been traditionally demand-led in their approach to allocating resources. This type of activity also enables local authorities to build their own internal understanding of the opportunities within the sector to inform low-carbon strategies.

The work underway in Portsmouth (see Box 2) where the maritime and marine sector is working with schools, universities and the local authority to share resources and capacity, and ensure that the workforce is able to engage with low-carbon opportunities is an example of productive collaboration across stakeholder groups, pursuing this approach in other localities based on specific sector strengths would be beneficial.

3) Leading by example

By taking an early lead in investing in low-carbon technologies, local authorities stand to gain not only by reducing their own carbon emissions and savings costs (e.g. by securing low-cost solar energy for their own needs), but also to promote technologies to the public within their local areas and to position themselves as leaders within the energy transition in their own right. This can build internal understanding of low-carbon within the local authority itself and strengthen working relationships. Moreover, it also serves to benefit industry and the wider supply chain by providing the early market for new technologies that may not otherwise materialise immediately within an area.

Warrington Borough Council's solar project in York and Hull is cited by industry as being a progressive project which deployed new technologies in the UK to support decarbonisation efforts and was supportive of cross-sector collaboration and the supply chain. Further, the deployment of Hydrogen Fuel Cell Vehicles in Swindon is also cited as an example of mutually beneficial activity that helped some of the UK's first hydrogen vehicles to be deployed and develop the town as a hydrogen hub that has one of the country's first electrolysers through capitalising on a local industrial strength[14].

Finally, local authorities should strive to be innovative where possible to capitalise on highly localised opportunities; there are certain location specific activities such as those associated with the nuclear supply chain that could benefit local regions and the wider industry significantly if forward-thinking local collaboration can be undertaken. As new technologies approach market-readiness there will be more scope to be innovative to support supply chain and skill development, in rural regions identifying local communities that may benefit from heat pumps could prepare the early market here; in city centre regions there could be ways to support low-carbon vehicle markets which are yet to scale in the UK.

[14] Hydrogen Hub (2020) *Accessed on 10th April 2020*. Available from: https://www.hydrogenhub.org/

Box 2 – West Yorkshire Combined Authority Case Study

City characteristics impacting clean growth outlook:

The West Yorkshire Combined Authority has declared a climate emergency and, with the Leeds City Region Enterprise Partnership (the LEP), has made the commitment to achieve net zero by 2038 at the latest. The energy sector is identified as fundamental to the region's success, offering the highest level of productivity of any sector whilst being a relatively small employer of less than 1% of the workforce. Decarbonisation could therefore bring growth to the energy sector and make a strategic contribution to the performance of the West Yorkshire economy.. Work is ongoing to define the low-carbon pathway to achieve net zero and a Clean Growth Audit has been produced, which makes early suggestions of sub-sectors where there may be a skills gap including construction, smart cities and agri-tech. Other sub-sectors including the financial sector and retrofit services are also recognised as being influential in the transition of the region.

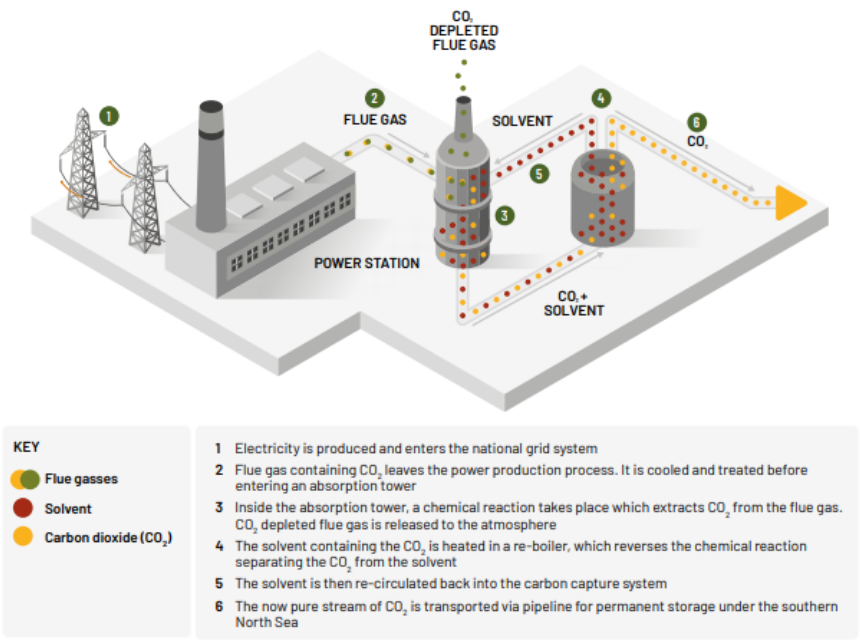
Low-carbon activities in the Leeds City Region are underway in response to the climate emergency which indicates other sub-sectors that may demand skills in the future. Flagship work includes Drax's operations which are being decarbonised via fuel switching to biomass and Combined Cycle Gas Turbines (CCGT). Over the next decade, the power plant will trial world-leading Carbon Capture Usage and Storage (CCUS) technology to enable the power station to deliver net emissions reductions. The opportunity and required expertise here means there is scope for the region to be instrumental in the UK's wider decarbonisation efforts as part of the negative emissions policy for Bio Energy with Carbon Capture and Storage (BECCS). Furthermore, some of the region's core manufacturing operations including glass manufacturing, agrochemicals and food and drink will be required to transition to low-carbon solutions in the future if the net zero target is to be achieved – this represents a distinct challenge for the region, but also an opportunity to scale-up low-carbon competences.

Existing resources/opportunities:

The Combined Authority has a small Energy and Sustainability team working on clean growth and tackling the climate emergency. There are a range of skills provisions and resources contained within the Combined Authority, however it is recognised that these skills programmes remain relatively non-specific and are not targeted specifically at the low-carbon transition. Existing resources include support for individuals via the LEP's Future Goals programme, and from West Yorkshire Consortium of Colleges' (WYCC) Higher Performing Workplaces and Progression From Low Pay projects. WYCC also offers targeted support for businesses to upskill their workforce via The Skills Service and for career changers through re[boot]. WYCC's Let's Talk Real Skills project takes a more sector specific approach and will ring-fence support for the low-carbon sector with work ongoing to define the critical sub-sectors that will require support.

Future outlook:

The Combined Authority is working to scope out the specific pathway to deliver on net zero, part of this is quantifying the scale of change within the energy sector and identifying sub-sectors that will require skills and training support, e.g. in scaling up domestic energy efficiency retrofit and increasing the pace and scale of deployment of heat pumps. Ensuring collaboration between stakeholders (including further education, employers and individuals) will increase the understanding of the low-carbon sector challenges and continued coordination with the LEP and WYCC will be ensure skills provisions are available and that the low carbon sector is considered a cornerstone of regional activity.



The Drax power station is the UK's largest power station and is transitioning from coal to lower carbon alternatives via CCGT and biomass. The power station has an ambition to be carbon negative by 2030. This diagram illustrates how carbon dioxide (CO_2) is captured from biomass generation at the Drax power station ***Picture source:*** *Capture for Growth*

Methodology

Ecuity utilised the Office for National Statistics (ONS) classification of low-carbon jobs and identified six high-level sectors ranging from low-carbon electricity to energy efficiency and low-emission vehicles and infrastructure. These six sectors were split further into 23 sub-sectors to ensure broad coverage of the low-carbon energy spectrum.

Part 1 – Estimating the route to net zero

Ecuity analysed the uptake of clean and low-carbon technologies required to meet Net Zero by 2050. To do this, Ecuity used a mix of high quality sources such as the Committee on Climate Change's (CCC) Net Zero report and National Grid's Future Energy Scenario (FES) 2019 workbook. These sources enabled estimation of the uptake of clean and low-carbon technologies by 2050 to meet Net Zero. The CCC's Net Zero report was particular useful for analysing the uptake of low-carbon electricity generation sources (offshore wind, solar PV etc). National Grid's FES workbook provided a detailed overview on the uptake of different low-carbon technologies that could deliver net zero. Ecuity also made use of other credible sources to analyse uptake of low-carbon demand such as the Faraday Institute (for EV battery and production uptake), ScottishPower and the Fuel Cells & Hydrogen Joint Undertaking (FCH JU).

Taken together this enabled Ecuity to make a credible and informed assessment on the uptake of low-carbon technologies and generation sources by 2050 to meet the net zero commitment.

Part 2 – Creating a time series on annual changes in supply and demand

To inform the pathway over the next 30 years, Ecuity developed a time series for the uptake of each low-carbon technology. For example, the annual installed capacity of offshore wind was estimated between 2020 and 2050 based on the trajectory projected by the CCC or National Grid. This method would enable estimation of the annual workforce demand between 2020 and 2050 dependent on the projected installed capacity of each technology.

Part 3 – Employment intensities

Ecuity then sought to research and estimate the employment intensity associated with each technology. This aimed to identify and quantify the number of workers required to manufacture, install and operate, maintain and decommission (where relevant i.e. nuclear) low-carbon generation and infrastructure. A range of sources and internal modelling were used to research and calculate average annual employment intensities for each technology. These intensities captured the number of jobs required to construct, manufacture, install, operate, manage and decommission one unit of installed generation capacity. For low-carbon electricity, the employment intensity captured the jobs required to install one GWh of generation. A review of the relevant literature found that in general, renewable energy technologies are more labour-intensive in terms of electricity produced compared to fossil fuel-fired generation.

Since the time series is over a 30-year period, it is plausible to assume that labour productivity increases as more and more clean energy generation is installed. Research of labour productivity gains across the relevant sectors was conducted and applied to the employment intensities to reflect productivity gains. In the absence of this data and information, proxies such as the projected levelised cost of generation were used to fill the gap.

Part 4 – Estimating the number of jobs to meet net zero

Combining the research and analysis in Part 2 (uptake of each technology) with the analysis in Part 3 (employment intensity) enabled an estimation of the number of new jobs required to construct, install and maintain a particular technology or energy source by 2050. The jobs calculated are known as 'direct' jobs and refer to those jobs that arise directly as result of the investment or installed capacity. In

other words, the jobs related to designing, manufacturing, constructing, operating and maintaining a particular technology or energy source.

Part 5 – Mapping the jobs by region

Once the national estimates for the number of net zero jobs by 2030 and 2050 was complete, the regional picture was developed. Ecuity utilied open access datasets from the Business Register and Employment Survey (BRES). This dataset provides a detailed breakdown of jobs by region and industry. The split of industry was conducted at a four-digit Standard Industrial Classification (SIC) code. This was an important step in order to enable an accurate mapping of the low-carbon sector (and sub-sector) to official industrial classifications. It should be noted that the low-carbon sectors (and sub-sectors) do not map well to the standard industrial classification codes and many of the firms operating in low-carbon also participate in other, non-low-carbon sectors (e.g. oil and gas). However, this is currently the best method of mapping the low-carbon sectors to industry sectors while the ONS develop a new methodology to enable a more accurate split. The split of region was expanded to local authority districts.

For each sector and sub-sector, the employment intensity was broken down by function (e.g. manufacturing, construction/installation and operation & maintenance). This was conducted using existing evidence from a wide-review of the existing literature, expert feedback and interal consultation.

Taken together, the share of industry employment (by local authority district) and the split of jobs by function were computed to produce an accurate picture of the split of low-carbon jobs by sector (and sub-sector) and by local authority district.