Green Jobs and the Green Economy in York

A report prepared for
York City Council

By

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Acknowledgments

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Glossary

APS	Annual Population Survey
BRES	Business Register and Employment Survey
CASCOT	Computer Assisted Structured Coding Tool
CYC	City of York Council
FTE	Full-time equivalent
IER	Institute for Employment Research, Warwick University
ISCO	International Stanard Occupational Classification
LAD	Local Authority District
LCREE	Low Carbon and the Renewable Energy Economy
LGA	Local Government Association
nec	Not elsewhere classified
ONS	Office for National Statistics
O*NET	US Occupational Information Network
pp	Percentage point
SIC	Standard Industrial Classification
SOC	Standard Occupational Classification
TTWA	Travel to Work Area

1. Introduction

This report focuses on green jobs and green skills in York. Analysis covers both residents and people who work in the city. Its purpose is to inform the Council in its decision-making to support the growth of a greener economy. Its main objective is to provide City of York Council with better understanding of York's green economy so that the Council can best support its development and understand the key economic opportunities it brings to York and its wider region.

The context is the Council's' Climate Change Strategy[1] to create new employment and investment opportunities, provide additional labour market information to support the net zero ambition in the 10-year Skill Plan[2] and support the next generation of jobs and skills as part of York's Economic Strategy.[3]

The policy aims require evaluation of green jobs. Until recently there was little agreement on how to define and measure 'green jobs'. In the past a 'purist' approach was used that centred on industries with economic activities directly focused on producing environmental and climate change related goods and services, e.g., wind turbines. Now, a consensus has emerged that a broader, more inclusive definition is needed that incorporates recognition that some jobs are 'greening' because of the transition to net zero, e.g., lawyers.[4] This approach is one accepted by the UK Government, which now appreciates that evaluation of green jobs should encompass new 'green' industries, i.e. those directly related to green products as well as those existing industries where jobs are 'greening' because of net zero ambitions.

In undertaking the analysis of York, we use a robust definition of green jobs based on the new GreenSOC developed by IER and that is based on the broader, more inclusive approach to definition. To this end, the GreenSOC distinguishes three types of green-related occupations:

1) new and emerging green occupations;
2) green enhanced skills and knowledge occupations; and,
3) green increased demand occupations.

This broader typology is used to evaluate the green economy of York. For the purposes of this report, York is defined by the boundaries of the City of York Council and the city's travel to work area (TTWA), which covers the local authority districts of Hambleton, Harrogate, Ryedale, Selby and York.[5]

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[1] https://www.york.gov.uk/big-conversation-2/10YearStrategies/2

[2] https://www.york.gov.uk/YorkSkillsPlan

[3] https://www.york.gov.uk/EconomicStrategy#:~:text=York%27s%20Economic%20Strategy%202022%20to,and%20maintaining%20our%20skills%20advantage

[4] Sofroniou, N. & Anderson, P. (2021). The green factor: Unpacking green job growth. International Labour Review, 160(1), 21-41

[5] The exclusion of Leeds authority district in this TTWA was made on the basis that it's inclusion would significantly affect the estimates of job numbers and job types due to the size and sectoral make-up of the Leeds economy.

Using the GreenSOC, the analysis examines which industries in York are most and least developing their net zero ambitions in terms of the number of green jobs. It also reveals the skills (and knowledge) inherent of these jobs. The analysis also examines the recent and current demand from employers for green jobs and again extrapolates data on their skills and knowledge requirements. The analysis provides insights that generate better understanding of the extent and demand for green jobs in York and actions for the Council to maximise its effort to support the transition to net zero.

The remainder of this report is structured as follows:

- The next section, Section 2, outlines the methodology adopted in the analysis of green jobs and skills in York. It provides information on both the definition and its rationale. It also outlines the data used to undertake the analysis.
- Section 3 presents analysis of the current extent of green jobs in York. It offers data on these jobs using both the purist and inclusive definitions to show how different calculations provide very different results.
- Section 4 presents analysis of recent and current demand for green jobs evidenced by job vacancy postings made by employers. Where data allows, it highlights developments in two priority sectors for York: rail and the bioeconomy.
- Section 5 focuses on the skills and knowledge inherent in both current green jobs and those jobs being advertised to be filled. It also makes comparisons between the skills and knowledge of green and non-green jobs.
- The final section, the conclusion with actions, summarises the findings for York and indicates potential future labour market developments in the UK relevant to green jobs. It also suggests a number of actions that might be pursued by the Council to support its net zero ambitions in terms of promoting green jobs and green skills.

It should be noted that analysis using the GreenSOC is only as robust as its underpinning data, and that data still has limitations in the UK. Nonetheless, the information from the analysis makes a significant contribution to helping the Council better understand and best support its greener economic development and the opportunities this greening as part of the net zero transition might bring to York and its wider region.

2. Methodology

2.1. Introduction

This section outlines the methodology used to analyse green jobs and skills in York. It starts with a brief discussion of the challenges in measuring green jobs. It then outlines the definition adopted for this analysis and the supportive data used.

2.2. Some of the challenges measuring green jobs[6]

Despite widespread calls from government about a green industrial revolution - as part of the new zero transition, as well as broader economic development aspirations - such calls do not include a definition of those green jobs. Evaluation of green job growth nationally and locally is therefore hampered.

In measuring green jobs, an important distinction needs to be recognised between 'product' and 'production process'. Businesses are concerned with production processes that create a product – that is, a good or service. This distinction has shaped attempts to measure green jobs.

2.2.1. Products approach

The UK's Standard Industry Classification (SIC) is a classification of the principal economic activity of a production unit, usually a business. To date, this approach has been commonly used to classify green jobs. The task is to identify a 'green sector' or 'green economy' consisting of a selection of industries that have a high proportion of businesses focused on producing environmental goods and services. To estimate the number of green jobs, some researchers added up the number of employees within the selected industries or sector. This narrow or 'purist' approach is used by the UK Office for National Statistics (ONS) in its annual Low Carbon and Renewable Energy (LCREE) Survey. The LCREE Survey is sent out only to those businesses in industries likely to have low carbon and renewable energy economic activity and asks them about the extent of their activities in the low carbon sector. This survey is the basis for estimates of green jobs used by the Local Government Association (LGA).

However, this narrow, 'purist' approach can create 'false positives' as current industrial classification schemes, such as SIC, are not able to sufficiently distinguish between businesses producing green and non-green products.[7] Moreover, what this products-to-industries/sector approach fails to acknowledge is that there can be jobs within traditional, non-green industries, such as legal services, that also produce goods or services that contribute to net zero. In this respect, to return to the LCREE example, it is telling that the LCREE Survey was not sent to businesses in all industries and therefore it is not able to deduce if other businesses also contain green jobs. Such jobs thus escape detection and so are not counted, potentially giving 'false negatives' in the number of jobs classified as green.

[6] This section draws on Cardenas Rubio, J., Warhurst, C. and Anderson, P. (2022) Green Jobs in Scotland: An inclusive approach to definition, measurement and analysis, https://www.skillsdevelopmentscotland.co.uk/media/49807/green-jobs-in-scotland-report_final-1.pdf

[7] Peters, D.J., Eathington, L. & Swenson, D. (2011). An exploration of green job policies, theoretical underpinnings, measurement approaches, and job growth expectations. Staff General Research Papers 32787, Department of Economics, Iowa State University

2.2.2. Production approach

A second approach focuses on the production process. This focus is important. Ideally, all production processes in whatever industry, whether part of a supposed green sector or not, should contribute to net zero aims. It might be that the production process used in businesses making green products is not itself green. Conversely, there can be production processes in traditional, non-green industries that are environmentally friendly. Indeed, traditional industries, such as steel manufacturing, also need to change and are being encouraged to change with the push to net zero. Not including 'greening' jobs in these traditional industries, as they support the transition to net zero, will result in another form of 'false negative' in the estimation of the extent of green jobs.

2.2.3. Products and production processes matter

There cannot be a simple binary divide between, on the one hand, new, green industries and on the other hand, traditional, non-green industries. All industries need to contribute to net zero targets and the green agenda must be mainstreamed in all economic activity.[8] As such the production processes, not just the products, of the new green industries must comply with net zero aims. Likewise, the production processes of traditional non-green industries must also change to become more environmentally friendly through the use of renewable energy and/or energy efficiency for example.

2.3. Challenges in capturing green skills

All jobs comprise a bundle of tasks underpinned by skills and knowledge for their competent execution. The transition to net zero is altering demand for jobs and thereby skills. Measuring green jobs can also capture and anticipate changing skill and knowledge requirements in jobs.

2.3.1. The importance of skills and knowledge

A first problem is that skills and knowledge are sometimes conflated, in part because being skilled at work involves 'knowledgeable practice'.[9] However, skills and knowledge are conceptually and practically distinct. *Knowing what* needs to be done (knowledge) can be different from *knowing how* to do it (skill). Both the skills and knowledge needed of green jobs needs to be understood.

2.3.2. Recognising what types of skills are demanded

A second problem is that 'skill' is a very loose term. It can refer to *achieved skills* acquired through formal education and training and usually codified in a qualification. It can also refer to *ascribed skill*, which is people's capacities and capabilities that are socially categorised as a skill e.g., 'teamworking' or 'communication' skills. Traditionally, these skills are less easy to quantify and are often called 'soft' skills.[10] Employers typically want both types of skills from

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[8] This expectation is manifest in the UK Government's criteria that businesses tendering for major UK Government contracts should have carbon reduction plans, see Procurement Policy Note 06/21: Taking account of Carbon Reduction Plans in the procurement of major government contracts - GOV.UK (www.gov.uk)

[9] Thompson (1989). The Nature of Work, Basingstoke: Macmillan.

[10] Warhurst, C., Tilly, C., & Gatta, M. (2017). A new social construction of skill. In C. Warhurst, K. Mayhew, D. Finegold & J. Buchanan (eds), The Oxford Handbook of Skills and Training. Oxford, Oxford University Press.

their employees. If achieved skills can be captured through qualifications, ascribed skills can now be more easily captured through data-scraping web-based adverts.

2.4. The GreenSOC – an inclusive definition of green jobs

The GreenSOC was developed by IER in conjunction with colleagues at Strathclyde University to address these challenges. It has been used in analyses of the green economy in Scotland, Liverpool City Region, and Sheffield City Region.

This approach draws on work undertaken by the US Bureau of Labor Statistics and is based on O*NET, which is a well-resourced classification of occupations that identifies occupations' tasks, skill sets and knowledge use.

The GreenSOC uses three green jobs categories:

- **Green New and Emerging Occupations:** these are occupations that have unique requirements for working in or on the decarbonisation of goods, processes and services, such as electric vehicle power unit designers. These jobs are closest to the definition used by LCREE;
- **Green Enhanced Skills and Knowledge Occupations:** occupations that currently exist but require a change in their competencies and/or context for working in or on the decarbonisation of goods, processes and services e.g., maintenance of electric vehicles (EVs);
- **Green Increased Demand Occupations:** those occupations whose demand is increased due to the decarbonisation of goods, processes and services, but do not entail significant changes to their competencies or context e.g., example electric power line installers.

This approach to defining green jobs is thus broad. It envelops what are regarded as purist green jobs but also include jobs that are contributing to the greening of the economy. 'Green' occupations are identified depending on whether they are undertaking tasks in:[11]

- businesses that produce goods or provide services that benefit the environment or conserve natural resources; and/or,
- which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

The GreenSOC makes three adaptations to the work of the US Bureau of Labor Statistics:

1. O*NET is US-focused and therefore not necessarily sensitive to non-US labour market contexts. Some tasks' skills and knowledge vary for the same occupation in different countries due to differing regulatory regimes, and training and education systems. For this reason, UK expert input was used as part of our previous work for Skills Development Scotland to sense check a range of UK-based occupations.[12]
2. The O*NET categorisation of green occupations focuses only on the skills of those occupations. Knowledge too needs to be included. Making this addition helps explain why any particular job is classified as green, greening or otherwise.

[11] US Bureau of Labor Statistics https://www.bls.gov/green/home.htm

[12] Cardenas Rubio e al. (2022) op cit.

3. Whilst data gathering for O*NET in the US is well-resourced compared to similar classification systems in the UK and elsewhere, its classification update can still be limited. Using web-scraped job vacancy data can help deliver more effective, timely understanding of changes to jobs.

This triple adaption provides a new GreenSOC that is more inclusive, more responsive and more sensitive to UK circumstances. It includes a broader range of jobs (such as electricians, facilities managers and accountants) who might be involved in the establishment, product manufacture, management, maintenance and financing of, for example, the electrical power network to which all different types of energy generation – green and non-green - are connected. It covers those jobs directly related to preserving or restoring the environment and a broad range of jobs that support the transition to a greener economy.

2.5. The data used to support the GreenSOC

To support use of the GreenSOC, a number of different datasets are used.

2.5.1. Analysis of the extent of green jobs in York City and its TTWA

To assess the extent of green jobs in York and its TTWA, first using a purist approach, it draws on the methodology of the LCREE Survey. The survey asks respondents to report their activity (including employment and turnover) in 17 LCREE sectors. The ONS LCREE survey provides numbers of jobs (full-time equivalent [FTE]) by SIC for the 17 green sectors for the UK. We have taken this national distribution of green jobs for each SIC and applied it to the numbers employed in the York TTWA in 2019 (which is the methodology used by the LGA).

Our inclusive approach provides employment data for York City and TTWA including: broad and 4-digit occupation; green job; and skills and knowledge. This approach 'translates' O*NET for the UK. O*NET is a database of 923 occupations and their underpinning skills and knowledge. As O*NET is a US system it uses a different Standard Occupation Classification (SOC) system which needs to be converted into the UK SOC.[13] IER has developed a conversion system which translates US SOC into the UK SOC classification. Whilst there is generally a lot of similarity between the two, occasional differences do arise which affect the conversion, especially where the three green occupation types are concerned. For example, the UK SOC 1161 Managers and directors in transport and distribution equates to three O*NET occupations (because O*NET is more detailed): Hydroelectric production managers (which is a green new and emerging occupation); Logistics managers (which is a green increased demand occupation); and Storage and distribution managers (which is a green enhanced skills and knowledge occupation). Therefore, in the following sections, some occupations may have more than one green classification associated with them.

[13] SOC gives every occupation in the UK a descriptor and number. The SOC system also disaggregates the same occupation by level, adding a number as the disaggregation drills down. So Professionals are Group 2. Within Professionals, the Science, Research, Engineering and Technology Professionals are sub-group 21. Within 21, Engineering Professionals are 212. Within 212, Mechanical Engineers are 2122. The use of this last, '4-digit' level is common in analyses of occupations and their skills, and helpful in classifying green jobs.

Employment data for the York TTWA and York City residents is not available at the 4-digit SOC level from the UK Annual Population Survey (APS).[14] This unavailability is because the APS is a survey and does not have sufficient responses to enable detailed occupational analysis. Moreover, the level of detail required was not available for the YNYLEP area because its sample size was also too small. This lack of detail can lead to an over-estimation of the number of green jobs. Aggregating several years of the APS was explored but did not resolve the issue. In discussion with ONS and York City Council, it was decided to use the closest available geographic area that provided sufficient detail at the 4-digit SOC level. This was an aggregation of the YNYLEP and Leeds City Region and combining three year's (2018-2020) APS data. This distribution was then applied to the numbers working in the York TTWA area in 2022, and the number of York City residents in employment also in 2022.

The analysis also covers green jobs by sector, including two of York's priority sectors - rail and the bioeconomy. The analysis is based on the employment distribution by sector as provided by Business Register and Employment Survey (BRES) data.[15] Because BRES statistics are workplace based (and not residency) the analysis applies only to the York TTWA.

2.5.2. Analysis of demand for green jobs in York

To capture the demand for green jobs, we primarily use the inclusive definition and this is applied to online job vacancies in the York TTWA. A purist analysis is also presented based on green terms used within job adverts.

Since February 2019, IER has been developing a large job vacancy posting database from the main UK job portals. In job vacancy posting websites, employers provide details of those jobs, such as job title, wage, and experience and skills requirements.

Using web scraping techniques developed by IER, information is automatically collected from the main UK job portals. IER then cleans and standardises this information to ensure its consistency. As information is downloaded, the job postings are coded for statistical analysis using a number of variables e.g., experience required, wage offered, geographical area, sector and job titles. This data provides an up to date, as well as a time series, analysis of demand for occupations as well as the skills required by recruiting employers, and wages. IER utilises the Computer Assisted Structured Coding Tool (CASCOT) to identify occupational groups. CASCOT facilitates the classification of a large amount of job titles information into the International Standard Classification of Occupations (ISCO) 08 classification. With the ISCO 08 variable, postings are the classified into green job type. The designation of green and non-green jobs is based on the O*NET classification (see above).

It should be noted, however, that vacancies advertised through internet job portals are more reflective of certain types of jobs. Job portal vacancies better represent certain types of jobs, for example, formal (as opposed to casual) jobs and those in urban labour markets. They are also less representative of jobs that are recruited by informal means (such as word of mouth) and in geographical areas where internet access is poor.

[14] The APS is the four quarter aggregation of the Labour Force Survey (LFS). The LFS is a quarterly survey of the UK population that has been undertaken for three decades. It captures a range of data about people's employment (as well as other information). Even though it is a large survey (36,000 respondents) analysis of sub regional labour markets can be problematic due to sampling error.

[15] BRES is an annual survey of employers (85,000) undertaken by ONS and provides employment estimates at detailed geographical and industrial levels.

2.6. Summary

Definitions of green jobs vary and influence how green jobs are measured. The purist definition of green jobs is narrow in scope, typically focusing on those sectors and their occupations at the forefront of net zero emissions growth e.g., low carbon energy production and carbon capture. However, this definition can distort attempts to capture the number of greens jobs that are involved in the net zero transition. A broader, inclusive definition enables capture of the same types of jobs included in the purist definition but extend to recognise that some other jobs are greening, and other jobs show greater demand because of the transition to net zero and support that transition. It is this latter definition that is now gaining acceptance and used in the York analysis. To support the analysis a number of datasets are used, including: ONS's LCREE Survey, APS and BRES, and IER's web-scraped job vacancy data.

3. The extent of green jobs in York

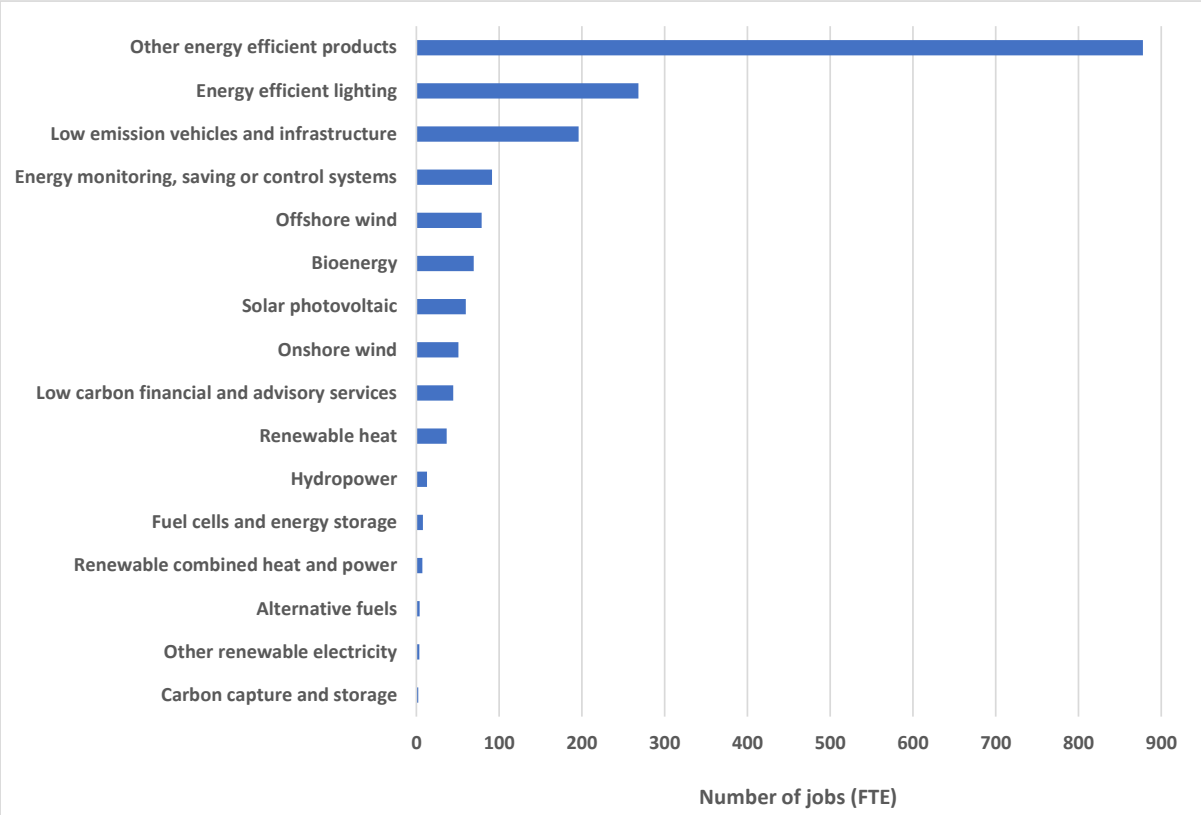
3.1. Introduction

This section presents data on the extent of green jobs in York. It mainly presents data based on the broader, more inclusive, GreenSOC diminution of green jobs. It starts, however, with data based on the narrower, purist, definition of green jobs as exemplified by the LCREE method.[16]

3.2. The extent of green jobs in York using the purist definition

Using the LCREE method, the shows the number of jobs by specific green sectors and the relative size of employment by SIC. It is estimated that in 2019 there were 1809 people working in green sectors in York TTWA[17]. Figure 1 shows the distribution by specific green sector.

Figure 1: York TTWA employment by specific green sector, 2019



Source: Warwick IER. ONS LCREE estimates accessed June 2022; BRES 2019 employment data accessed June 2022

The largest number of people (878) work in the other energy efficiency products[18] sector which accounts for about half of all green sector jobs using this definition (49%). The other most

[16] ONS (2020). Low Carbon and Renewable Energy Economy (LCREE) Survey QMI.

[17] Nationally, 16,900 (8%) work in the nuclear industry but jobs in this industry are not applicable to the York TTWA and have been excluded from the calculation.

[18] This sector involves the design, development, manufacture, specialised consultancy services and installation of energy efficient products. It includes: double glazing, insulation, energy efficient building materials or technologies, sustainable building and architecture activities amongst other activities.

significant green sectors are: energy efficient lighting (268 or 15%); low emission vehicles and infrastructure (196 or 11%); and energy monitoring, saving or control systems (91 or 5%). Therefore, at present, employment in these purist green sectors is very low level.

Table 1 shows that as a proportion of total employment in York TTWA, the number of green sector jobs (as defined by LCREE) is very small. In 2019, green sector jobs accounted for only 1% of total employment. Only in the utilities – power sector does green sector employment account for at least one in 20 jobs within the sector (5%). The other largest sectors are construction (4%) and manufacturing (3%). In all other sectors green sector employment represents 1% or fewer workers.[19]

Table 1: York TTWA sectoral size of green jobs by SIC, 2019 (purist definition)

SIC[20]	No. of green jobs	Green jobs as % of sector
A Agriculture, forestry and fishing	-	-
B Mining and quarrying	-	-
C Manufacturing	735	3%
D Utilities - power	68	5%
E Utilities - water and waste	14	1%
F Construction	661	4%
G Wholesale, retail and repair	78	0%
H Transportation and storage	-	-
J Information and communication	7	0%
L Real estate activities	9	0%
M Professional/scientific/technical	191	1%
N Admin. and support services	18	0%
P Education	2	0%
S Other activities	3	0%
All	1809	1%

Source: ONS LCREE estimates accessed June 2022; BRES employment data accessed June 2022

Again, using the purist definition, and based on the Local Government Association employment projections, the number of green jobs in in the York TTWA is forecast to be around 9000 in 2030 and almost 25,000 in 2050. Based on current employment levels, this latter figure would equate to about one in ten jobs in 2050 (12%).

3.3. The extent of green jobs using the inclusive definition

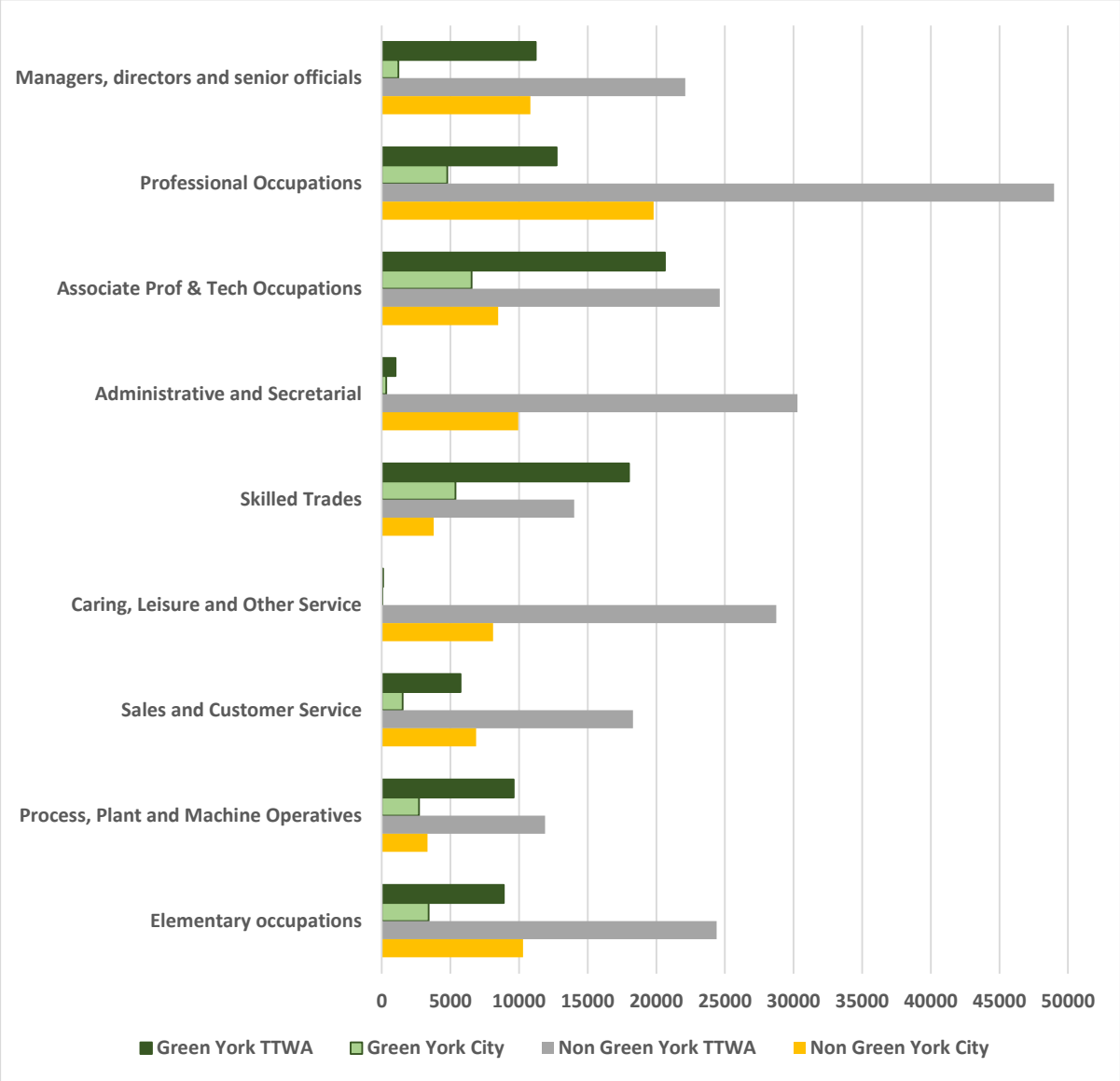
[19] Five sectors did not have any green sector jobs according to the LCREE survey: I Accommodation and food service activities; K Financial and insurance activities; O Public administration and defence; compulsory social security; Q Human health and social work activities; and, R Arts, entertainment and recreation.

[20] BRES data in three sectors is not included because of low numbers: agriculture, forestry and fishing; mining and quarrying; and other activities.

This section provides an estimate of the extent of green jobs based on the inclusive definition using the new GreenSOC. It includes the three types of green jobs: green new and emerging occupations; green enhanced skills and knowledge; and green increased demand occupations. In 2022 there were just over 310,000 people employed in the York TTWA area and in York City about 110,000 residents were in employment. The data shows that 28% of York TTWA employees (88,000) and one quarter (24%) of York City residents (26,000) were working in green jobs broadly defined. These figures also indicate that in both areas around three quarters of people were working in non-green jobs.

Figure 2 shows that in 2022, most people working in these broad occupation groups were working in non-green jobs. People working in green jobs were most likely to be in associate professional and technical, skilled trades, professional and managerial occupations. Together these four broad occupations accounted for around 70% of all green jobs in York TTWA and York City.

Figure 2: York TTWA and York City employment by broad occupation (no.) 2022



Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

Figure 3 shows the proportion of each broad occupation group that are green jobs. Over half of skilled trade jobs are green jobs in both areas (56% York TTWA and 59% York City). More than two in five of associate professional and technical jobs (46% and 44%), and a similar proportion of process, plant and machine operatives (45% in both areas) are green jobs.

The distribution of green jobs by occupation is similar for both areas. The most significant difference is in managerial occupations, in which green jobs account for around one third of employees in York TTWA and around one in ten in York City. This difference is likely to be because managers in the York TTWA area are more likely to be managers of production processes (which are green jobs) whilst those living in York tend to be chief executives and senior officials (which are non-green jobs).

Very few people working in administrative and clerical, and caring, leisure and other service occupations are in green jobs.

Figure 3: York TTWA and York City employment by broad occupation (%), 2022

Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

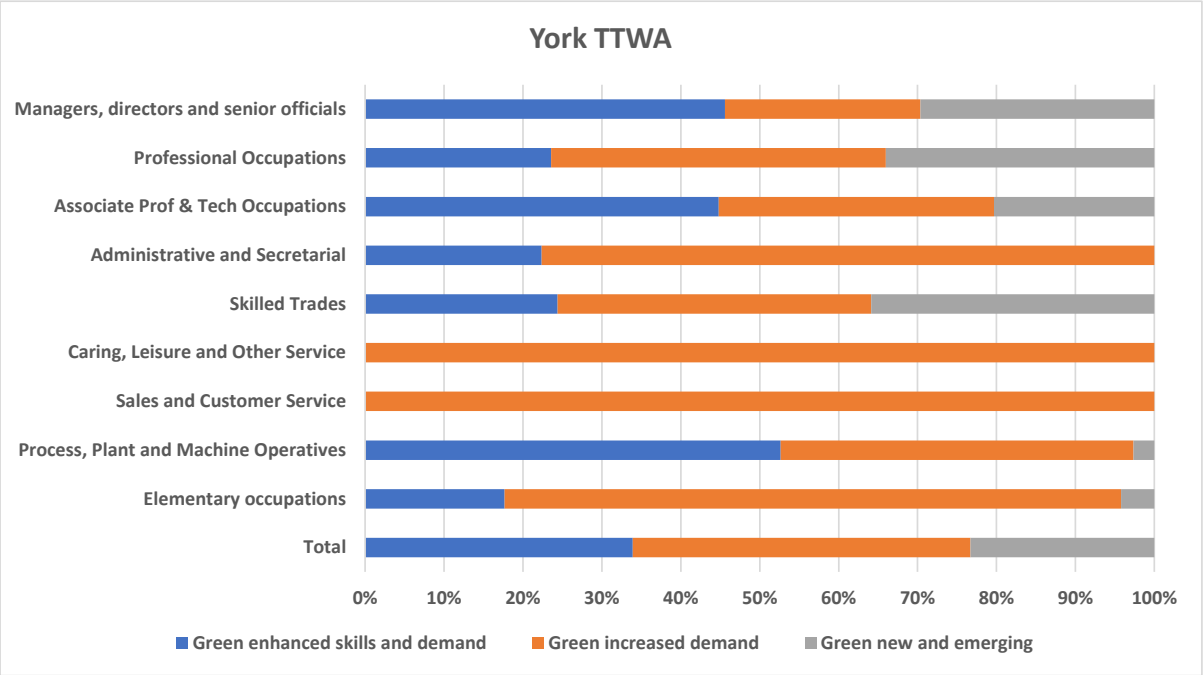
Figure 4 shows the percentage distribution of green jobs by type in York TTWA and York City in 2022.

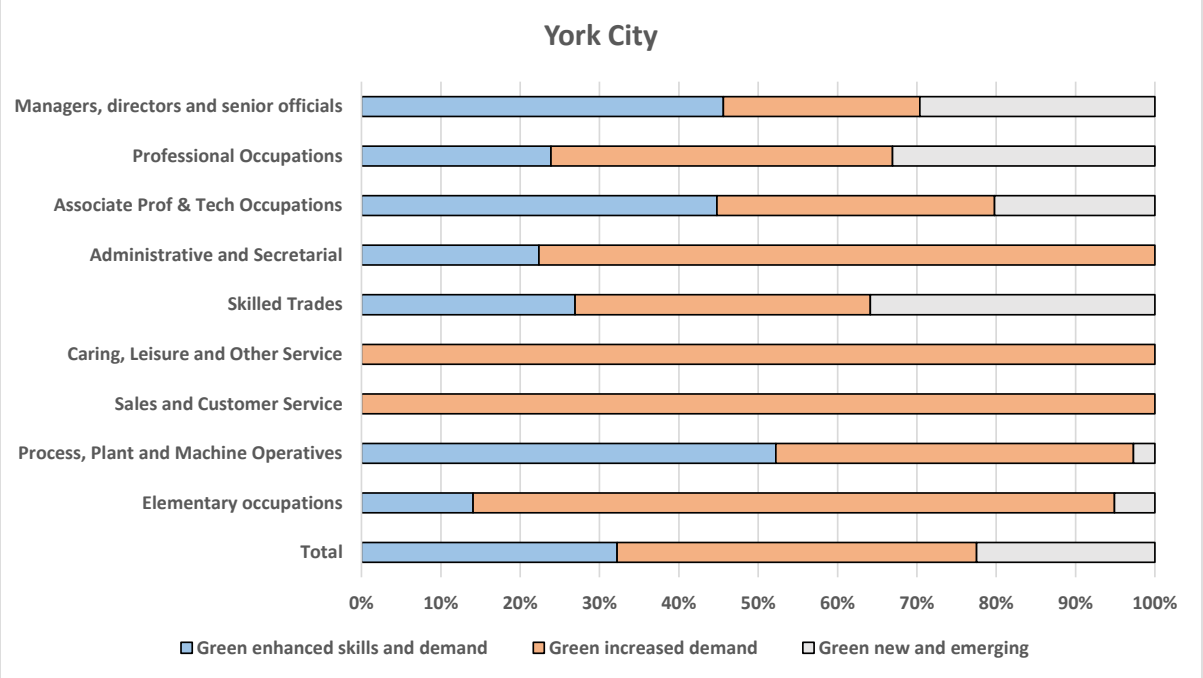
Around 45% of green jobs are green increased demand in both areas. Of the remainder, about one third in both areas are green enhanced skills and knowledge, and one in five are green new and emerging jobs.

The proportion of green job type, however, varies between the broad occupation group. More than three quarters of administrative and clerical, caring, leisure and other service, sales and customer service, and elementary occupations are green increased demand. However, the numbers of workers in green jobs in the first three of these occupations are very small.

Of the largest occupations numerically, more than 40% of professional and skilled trades are green increased demand jobs. Forty per cent or more of managerial, and associate professional, and more than half of process and operative jobs are green enhanced skills and knowledge. Green new and emerging jobs account for about one third of managerial, professional and skilled trade jobs.

Figure 4: York TTWA and York City green job type (%), 2022





Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

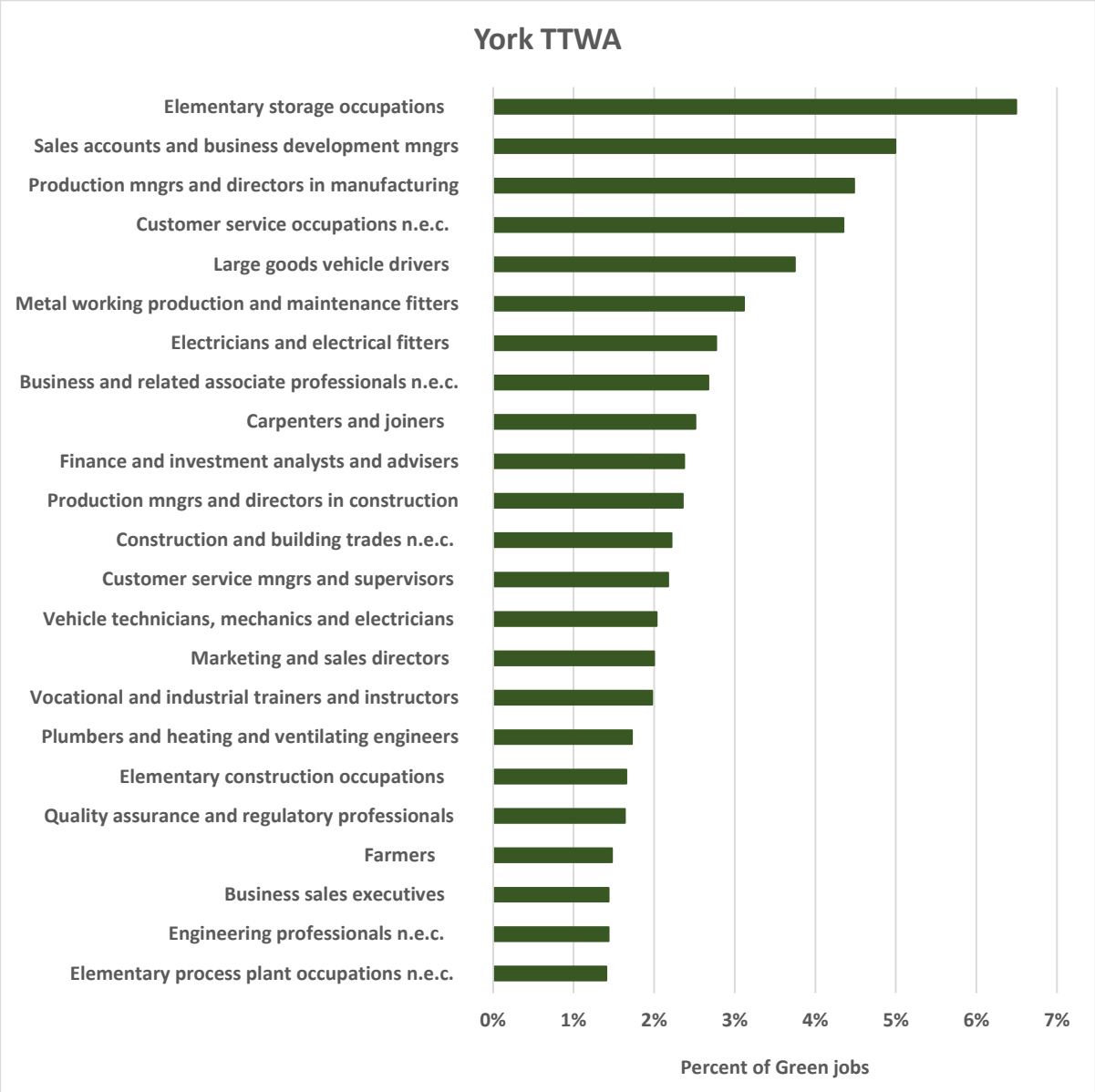
3.3.1. Analysis by detailed occupation using the broader definition

Using the 4-digit level of SOC, Figure 5 shows green occupations that account for 2% or more of green jobs in York TTWA. This focus reveals that there are 19 specific occupations accounting for just over half (55%) of all green jobs. Most of these detailed occupations are green increased demand jobs.

The most sizeable green occupation is elementary storage (6% of green jobs), followed by sales accounts and business development managers (5%), production managers & directors

in manufacturing (4%), customer service occupations (4%), and large goods vehicle drivers (4%).

Figure 5: Detailed green occupations with at least 2% of green jobs, York TTWA 2022

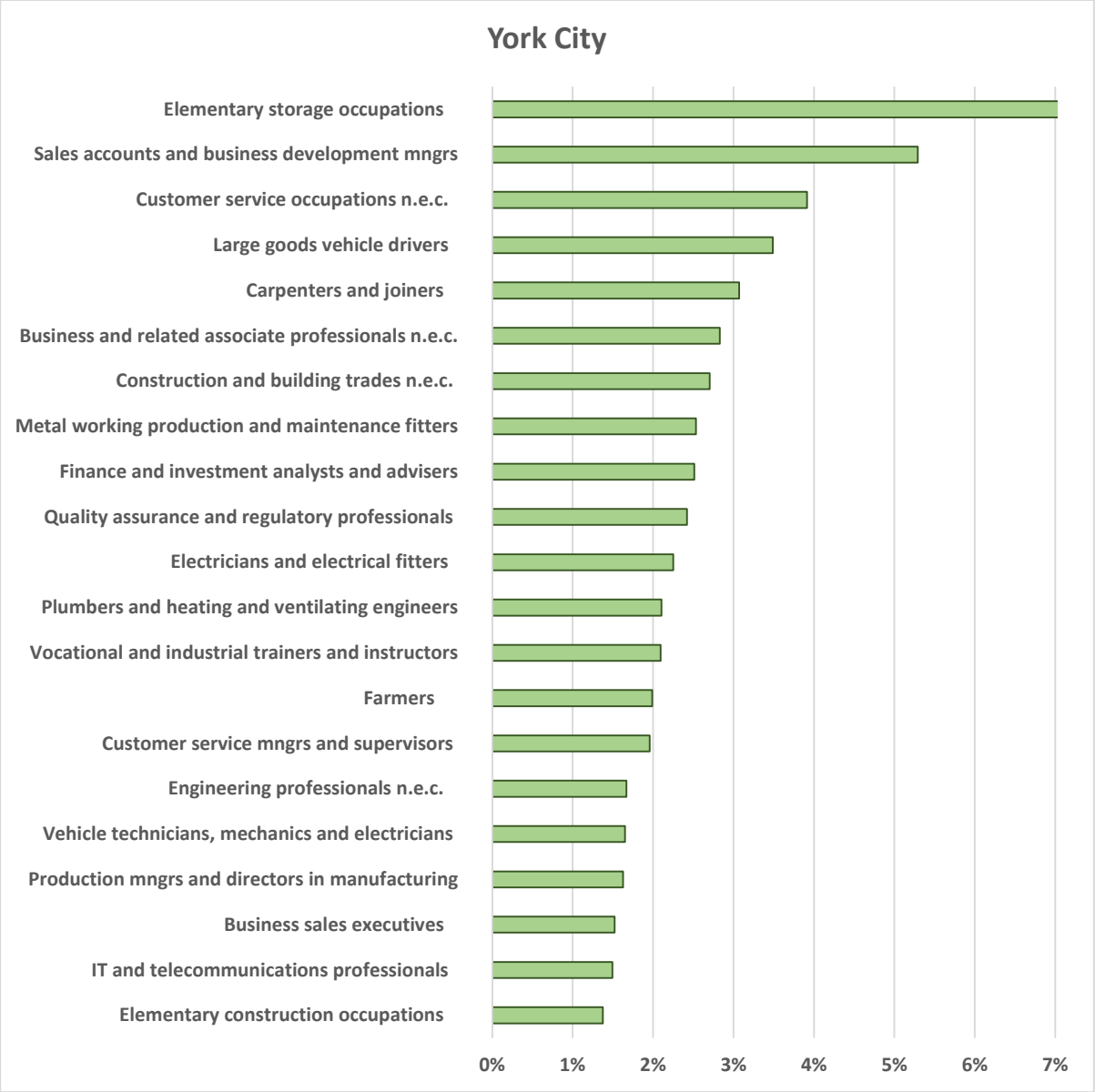


Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

Figure 6 shows the detailed green occupations that account for 2% or more of green jobs in York City. As in York, TTWA, there are 19 occupations which together account for 55% of all green jobs using the broader definition. These jobs are mostly green increased demand jobs.

Many of the most numerous green occupations are the same as in York TTWA i.e. elementary storage (10% of green jobs), followed by sales accounts and business development managers (5%), customer service occupations (4%), and large goods vehicle drivers (3%), as well as carpenters and joiners (3%).

Figure 6: Detailed green occupations with at least 2% of green jobs, York City 2022



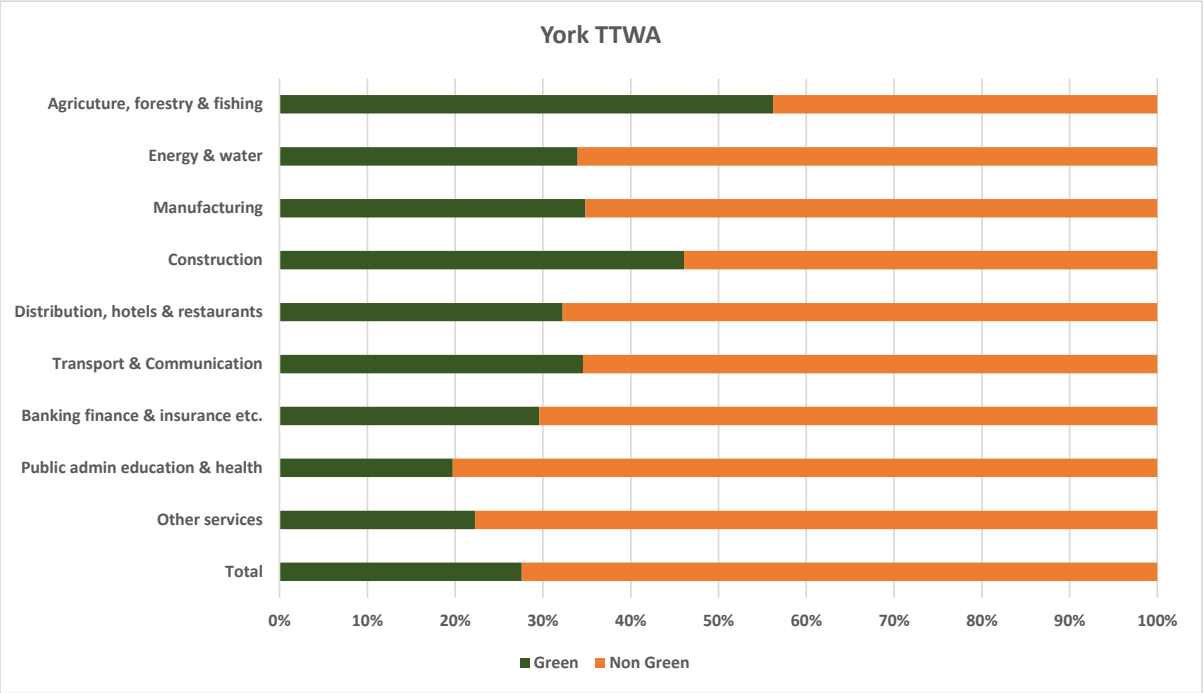
Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

3.1. Green jobs by sector

Using the broad definition, this section provides the distribution of green jobs by sector, including two of CYC's priority sectors - rail and the bioeconomy. This section is based on the employment distribution by sector as provided by BRES data. As this is workplace-based data the analysis is only undertaken for York TTWA because BRES does not provide data for residents.

Figure 7 shows the proportion of green and non-green jobs by sector in York TTWA in 2022. Overall, green jobs accounted for 28% of all jobs in the York TTWA. Green jobs accounted for the largest proportion of all jobs in agriculture, forestry and fishing (56%), construction (45%), manufacturing (35%), and transport and communication (35%).

Figure 7: Green and non-green jobs by sector (%), York TTWA 2022

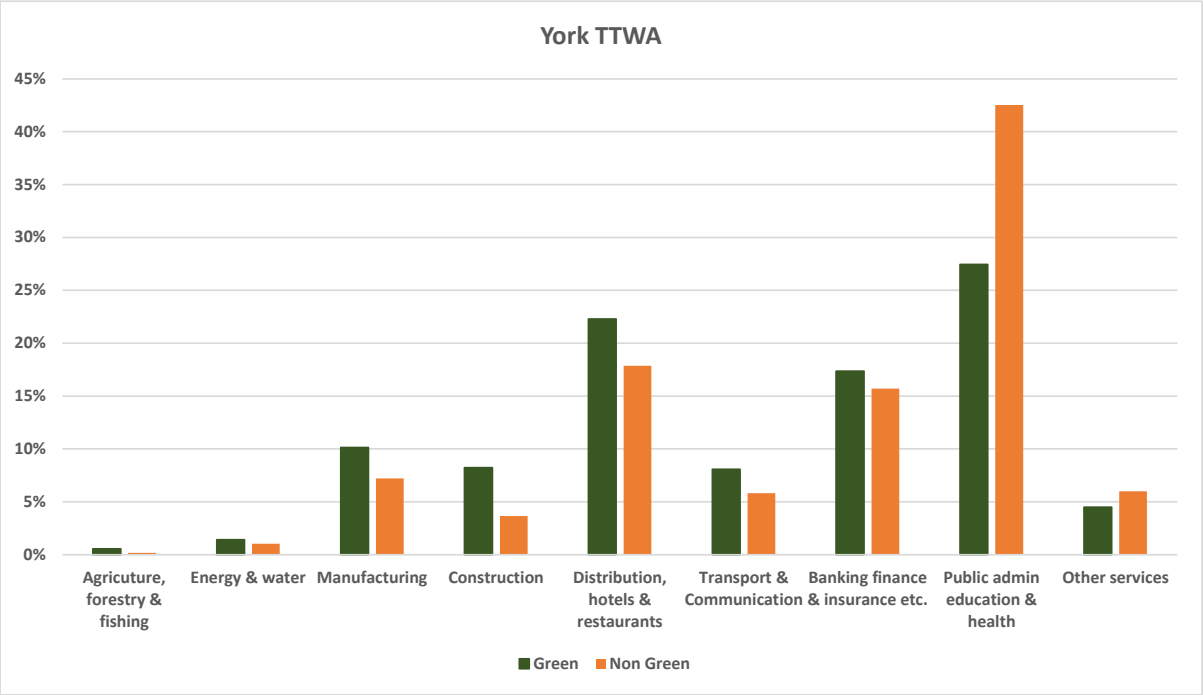


Source: Warwick IER analysis of ONS APS occupation, BRES 2019 data and O*NET green job classification

The sectors with the most jobs are in public administration, education and health (22,000), distribution, hotels and restaurants (17,900), and banking finance and insurance (13,900). Figure 8 presents the percentage distribution by sector of green and non-green jobs.

The largest proportion of green jobs are in the public administration, education and health sector (27% of all green jobs), followed by distribution, hotels and restaurants (22%), banking, finance and insurance (17%).

Figure 8: Green and non-green jobs by sector percentage distribution, York TTWA 2022



Source: Warwick IER analysis of ONS APS occupation, BRES 2019 data and O*NET green job classification

3.2. Green jobs by priority sector

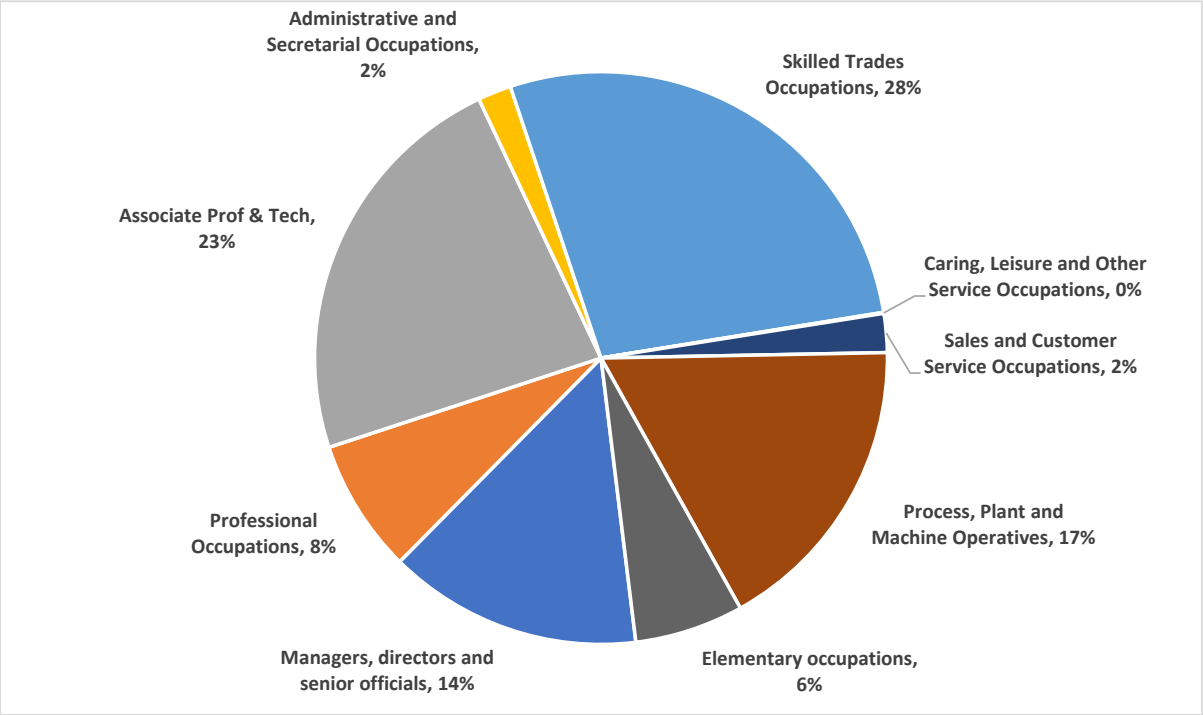
This section focuses on two of York City Council's priority sectors: rail[21] and the bioeconomy[22].

In 2019, there were approximately 30,000 people working in the rail sector in the York TTWA. Around one quarter (28%) were working in green jobs. Figure 9 shows that most of these jobs were being undertaken by people working in skilled trades (28%), associate professional and technical (23%), process and operative (17%) and managerial occupations (14%). These occupations made up four out of five green jobs in the rail sector.

[21] For a definition of the rail sector, see: Economic Growth Team (2022). Great British Railway (GBR) Data Modelling. York City Council.

[22] The definition used in the appendices of Holroyd, McQuilkin, C. and Chapman, F, (2017). The Bioeconomy in the North of England. A Science and Innovation Audit Report sponsored by the Department for Business, Energy & Industrial Strategy.

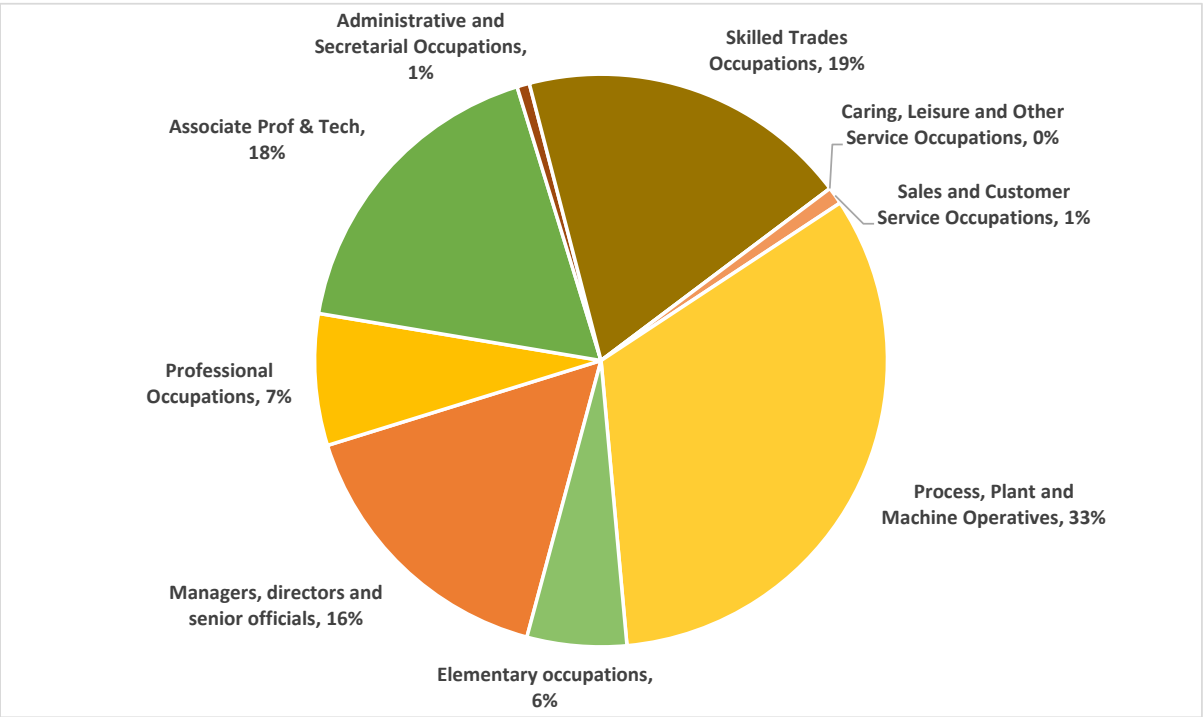
Figure 9: Green jobs in the rail sector by occupation, York TTWA 2019



Source: Warwick IER analysis of ONS APS occupation, BRES 2019 data and O*NET green job classification

In 2022, there were about 22,000 jobs in York TTWA's bioeconomy sector, over one third (36%) were green jobs. The largest occupations were process, plant and machine operatives (33%), skilled trades (19%), associate professional and technical (18%), and managerial (16%) occupations. Together these occupations comprised 85% of jobs in the sector.

Figure 10: Green jobs in the bioeconomy sector by occupation, York TTWA 2019



Source: Warwick IER analysis of ONS APS occupation, BRES 2019 data and O*NET green job classification

3.3. Summary

Based on the narrow, purist definition of green jobs, there were 1,809 green jobs in the York TTWA in 2019. The largest specific green sector was other energy efficiency products which accounted for almost half of all green sector jobs. Only 1% of York TTWA jobs are green jobs in the purist sense. Estimates suggest this figure could rise to 12% of all jobs by 2050.

By contract the broader, inclusive definition of green jobs shows that around one quarter of people were working in green jobs in York TTWA and York City in 2022. People working in these green jobs were most likely to be in associate professional and technical, skilled trades, professional, and managerial occupations. Over 40% of people in both areas working in skilled trade, associate professional and technical, and process, plant and machine operative occupations were working in green jobs. Very few people working in administrative and clerical, and caring, leisure and other service occupations are employed in green jobs.

Just under half of green jobs in both York TTWA and York City are green increased demand jobs, about one third in both areas are green enhanced skills and knowledge jobs, and one in five are green new and emerging jobs. However, differences vary significantly by occupation.

Analysis by sector shows that green jobs accounted for about half of jobs in agriculture, forestry and fishing, and construction, and about one third in manufacturing, and transport and communication. However, the largest *number* of green jobs are in the public administration, education and health, and distribution, hotels and restaurants.

Data is also presented for two of CYCs priority sectors – rail and the bioeconomy. In 2019, there were approximately 30,000 people working in the rail sector and 22,000 in the bioeconomy sector in York TTWA. Around one quarter of rail and one third of bioeconomy jobs were green.

4. The skills and knowledge of green jobs in York

4.1. Introduction

This section examines the skills and knowledge inherent in green jobs. O*NET, from which the GreenSOC is developed, provides details of the underpinning skills and knowledge for each 4-digit occupation.[23] This section focuses on those occupational skills and knowledge for green jobs using the broader definition. It draws on the occupation profile from the APS 2022.

As we have seen, around three quarters of green jobs will either be existing jobs for which demand will expand without affecting the core skills and knowledge of the job (green increased demand) or existing occupations whose skills and knowledge can be bolstered (green enhanced skills and knowledge) to meet the needs of a net zero transition. The implication is that most of the jobs, and most of the skills and knowledge, required for a sustainable future already exist.

Furthermore, many of the skills and knowledge requirements of green new and emerging occupations are those required in non-green jobs. For example, the main skills required by a green focused job (such as a recycling and reclamation worker, and industrial ecologist) are very similar to those required by a similar process operative or industrial engineer in a non-green job. Analysis of these two sets of occupations shows that of the top 20 skills required, 16 are exactly the same.

4.2. Green skills

O*NET uses 35 categories of skills which cover functional (e.g., maths), transferable (such as problem solving) and technical (for example, engineering) skills[24]. Within the O*NET system information on skills tends to focus on the first two (functional and transferable skills) whilst information on knowledge relates more to technical skills.

Table 2 shows the top ten skills required for green jobs by broad occupation.[25] These are for all green occupations in York TTWA and York City in 2022. The skills profiles are the same for both areas.

Table 2 shows that there are a number of skills that cut across all broad occupation groups: active listening, judgment and decision making, reading comprehension, critical thinking, speaking, and monitoring. However, there are also a limited number of skills are specific to certain occupations such as: service orientation, systems analysis and troubleshooting.

[23] For example, see https://www.onetonline.org/link/summary/47-2111.00

[24] "The 35 O*NET skills cover performance applicable to a broad range of jobs in the world's economy and are grouped into seven categories within the O*NET content model: content, process, social, complex problem solving, technical, systems, and resource management". https://www.onetcenter.org/dl_files/AOSkills_21.pdf

[25] Administrative and secretarial, and caring, leisure and other service occupations have not been included because they have small numbers of green jobs.

Table 2: Top ten skills required by green jobs in broad occupation types (SOC 1-digit), York TTWA and York City 2022

Managers , direcrs and senior officials	Professional Occupations	Associate Prof essional& Technical Occupations	Skilled Trades
Speaking	Reading Comprehension	Reading Comprehension	Critical Thinking
Critical Thinking	Critical Thinking	Critical Thinking	Speaking
Monitoring	Active Listening	Active Listening	Active Listening
Active Listening	Judgment and Decision Making	Speaking	Monitoring
Reading Comprehension	Complex Problem Solving	Writing	Time Management
Coordination	Writing	Monitoring	Operations Monitoring
Judgment and Decision Making	Speaking	Complex Problem Solving	Quality Control Analysis
Complex Problem Solving	Systems Analysis	Judgment and Decision Making	Reading Comprehension
Time Management	Active Learning	Active Learning	Judgment and Decision Making
Writing	Monitoring	Time Management	Coordination
Sales and Customer Service Occupations	**Process, Plant and Machine Operatives**	**Elementary occupations**	**All green occupations**
Speaking	Operations Monitoring	Speaking	Critical Thinking
Social Perceptiveness	Critical Thinking	Active Listening	Active Listening
Active Listening	Operation and Control	Operation and Control	Reading Comprehension
Reading Comprehension	Monitoring	Coordination	Speaking
Service Orientation	Active Listening	Operations Monitoring	Monitoring
Coordination	Reading Comprehension	Monitoring	Judgment and Decision Making
Critical Thinking	Speaking	Critical Thinking	Complex Problem Solving
Persuasion	Quality Control Analysis	Time Management	Writing
Time Management	Judgment and Decision Making	Reading Comprehension	Time Management
Writing	Troubleshooting	Judgment and Decision Making	Active Learning

Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

Some skills are inherent to many jobs (see Table 3). Of the eleven skills identified in Table 3, nine are common across all three green job types: speaking; monitoring; active learning; active listening; reading comprehension; complex problem solving; writing; critical thinking; and judgment and decision making.

Not only are those skills most relevant to green jobs they are also most relevant to non-green jobs. In fact there is only one skill difference. Social perceptiveness is a key skill in non-green jobs (due to personal service and care, and sales occupations) and replaces active learning (more relevant for green jobs) as a top ten skill.

Table 3: Top ten skills required in green jobs by the three green job types, York TTWA and York City 2022

Green enhanced skills and knowledge	Green increased demand	Green new and emerging
Critical Thinking	Reading Comprehension	Active Listening
Active Listening	Critical Thinking	Reading Comprehension
Speaking	Active Listening	Speaking
Reading Comprehension	Speaking	Critical Thinking
Monitoring	Complex Problem Solving	Monitoring
Judgment and Decision Making	Judgment and Decision Making	Complex Problem Solving
Complex Problem Solving	Writing	Judgment and Decision Making
Writing	Monitoring	Writing
Active Learning	Active Learning	Coordination
Time Management	Time Management	Active Learning

Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

4.3. Green knowledge

O*NET uses a 33 categorisation of knowledge. The knowledge requirements are the details which most correspond to technical skills e.g., engineering, marketing and management. Knowledge also includes English and maths as basic skills.

Table 4 shows the top ten knowledge requirements for green jobs by broad occupation. These are for all green occupations in the two areas in 2022. The profiles for York TTWA and York City are the same. The top five knowledge types required by green jobs are: English language, mathematics, engineering and technology, computers and electronics, and customer and personal service.

Table 4 also shows that there are a number of knowledge requirements that cut across a number of occupations: English language, mathematics, administration and management, customer and personal service, and education and training are required in most broad occupations.

Table 4: Top ten knowledge requirements required by green jobs in broad occupation, York TTWA and York City 2022

Managers, diretcors and senior officials	Professional Occupations	Associate Prof & Tech Occupations	Skilled Trades
Administration and Management	English Language	English Language	Mechanical
English Language	Mathematics	Mathematics	Building and Construction
Mathematics	Engineering and Technology	Computers and Electronics	Customer and Personal Service
Customer and Personal Service	Computers and Electronics	Engineering and Technology	English Language
Production and Processing	Design	Customer and Personal Service	Mathematics
Personnel and Human Resources	Administration and Management	Mechanical	Design
Public Safety and Security	Physics	Education and Training	Engineering and Technology
Engineering and Technology	Customer and Personal Service	Administration and Management	Administration and Management
Computers and Electronics	Law and Government	Design	Education and Training
Economics and Accounting	Education and Training	Production and Processing	Public Safety and Security
Sales and Customer Service Occupations	**Process, Plant and Machine Operatives**	**Elementary occupations**	**All green occupations**
Customer and Personal Service	Mechanical	Customer and Personal Service	English Language
English Language	English Language	Public Safety and Security	Mathematics
Sales and Marketing	Production and Processing	Mechanical	Engineering and Technology
Administrative	Public Safety and Security	Administration and Management	Computers and Electronics
Administration and Management	Mathematics	Transportation	Customer and Personal Service
Mathematics	Education and Training	Education and Training	Administration and Management
Computers and Electronics	Computers and Electronics	English Language	Mechanical
Education and Training	Engineering and Technology	Production and Processing	Design
Law and Government	Chemistry	Mathematics	Education and Training
Mechanical	Physics	Building and Construction	Production and Processing

Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

Table 5 shows the top ten knowledge requirements by green job type. English language and mathematics are the main knowledge requirement in all green job categories. As we noted above, skills and knowledge can be common across a range of jobs. Of the twelve knowledge requirements identified in Table 5, eight are common across all green job types: mechanical; administration and management; engineering and technology; computers and electronics; customer and personal service; production and processing; design; as well as mathematics; and English language. Physics, public safety and security, and education and training are the only knowledge requirements not common to all types of green jobs.

As with skills, knowledge requirements necessary for green jobs are also most relevant to non-green jobs. Eight knowledge requirements are also required for non-green jobs.

Table 5: Top ten knowledge requirements required by green jobs by green job type, York TTWA and York City 2022

Green enhanced skills and knowledge	Green increased demand	Green new and emerging
English Language	Mathematics	English Language
Mathematics	English Language	Mathematics
Engineering and Technology	Engineering and Technology	Engineering and Technology
Computers and Electronics	Computers and Electronics	Administration and Management
Customer and Personal Service	Design	Computers and Electronics
Administration and Management	Customer and Personal Service	Customer and Personal Service
Mechanical	Administration and Management	Mechanical
Design	Mechanical	Design
Education and Training	Physics	Education and Training
Public Safety and Security	Production and Processing	Public Safety and Security

Source: Warwick IER analysis of ONS APS occupation data applied to O*NET green job classification

4.4. Summary

Many of the skills and knowledge requirements of green jobs are also those necessary in non-green jobs. Therefore, as with occupations, most skill and knowledge requirements already exist in the workforce. For example, English language, mathematics, administration and management, active listening, judgment and decision making, critical thinking, customer and personal service, and monitoring.

5. Demand for green jobs in York

5.1. Introduction

This section focuses on the demand for green jobs in the York TTWA area in 2021. It is based on a broad definition of green jobs and an analysis of online job vacancy posting data collected by IER.

5.2. York TTWA green job vacancy postings

Table 6 shows the number and proportion of job postings in York TTWA and the rest of the UK in 2021. In York TTWA there were just under 10,000 postings (9,218) which represents 3% of the total number of jobs in the York TTWA area.

Around one third (35%) of all job postings were green jobs and 65% were non-green jobs[26].

Table 6: Green and non-green job postings in York TTWA (2021)

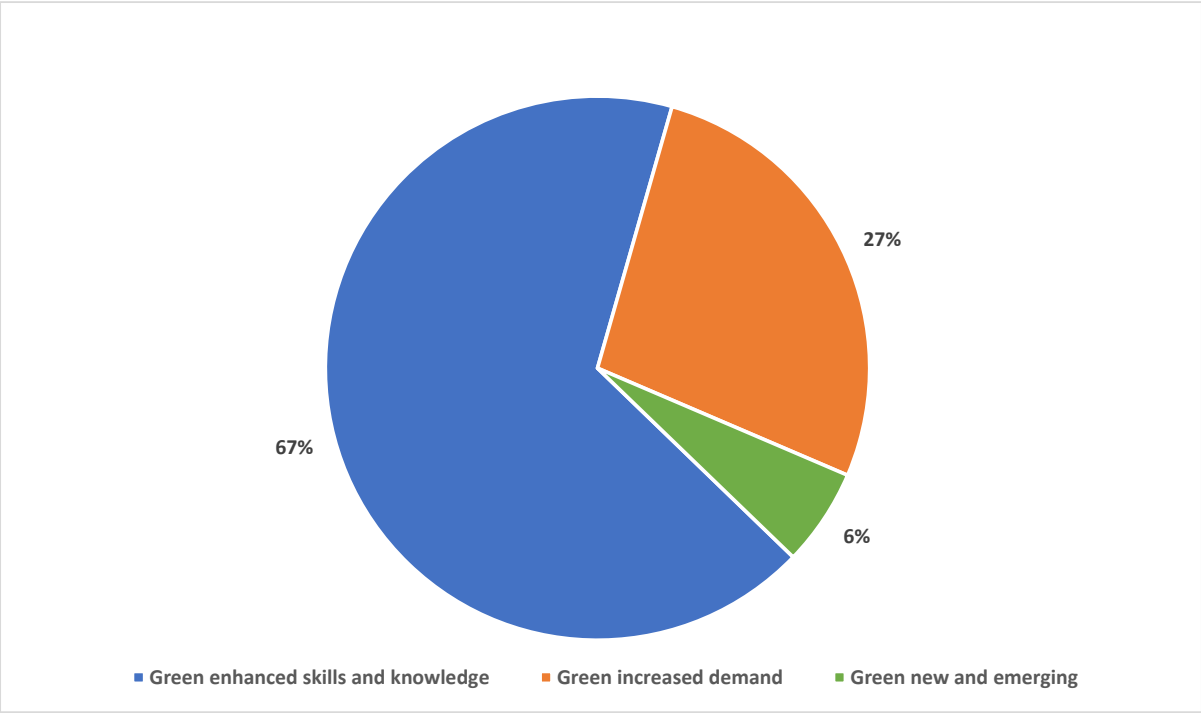
	York TTWA	
	No.	%
Non-green	6,026	65%
Green	3,192	35%
Total postings	9,218	100%

Source: IER-LMI

Figure 11 shows that in York TTWA two thirds of the 9,218 green job postings were those classed as green enhanced skills and knowledge, just over one quarter were green increased demand (27%) and one in twenty green new and emerging (6%).

[26] By green job vacancies we mean that there are vacancies in those jobs which have a green job designation i.e. they are either green enhanced skills and knowledge, increased demand, or new and emerging 4-digit occupations.

Figure 11: Percentage of green job vacancy postings by green job type in York TTWA (2021)



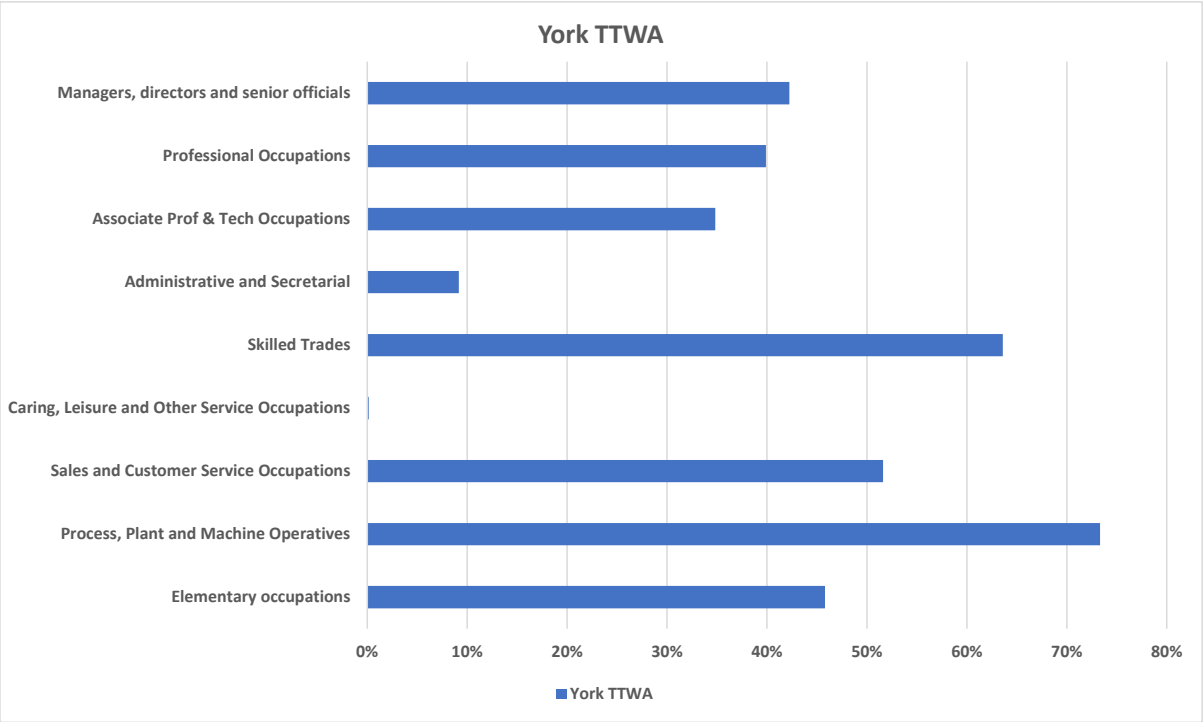
Source: IER-LMI

Figure 12 shows the proportion of broad occupation job postings for green jobs. For example, 42% of managerial postings in York TTWA were for green job.

Within York TTWA, green jobs account for more than a half of postings within the process, plant and machine operative (73%), skilled trades (64%), and sales, and customer service (52%) occupations.

There are very few green job postings in administrative and secretarial, and caring, leisure and other service occupations because there are few occupations defined as green.

Figure 12: Percentage of job vacancy postings for green job occupations by broad occupation in York TTWA (2021)[27]



Source: IER-LMI

Table 7 shows the proportion of green job postings by sector (SIC) for York TTWA. In the York TTWA, more than two in five postings in the following sectors were for green occupations: manufacturing (51%); information and communication (45%); administrative and support services (42%); utilities – power (41%); and wholesale and retail (40%).

[27] The reason why there are sales occupations in this chart but not in the analysis of green jobs in the previous section is because of the different coding of occupations between the UK SOC and ISCO. In the former, sales jobs such as brokers and sales representatives are coded in the associate professional and technical occupation group whereas the ISCO codes them within the sales and customer service occupations group.

Table 7: Green job vacancy postings by sector in York TTWA (2021)

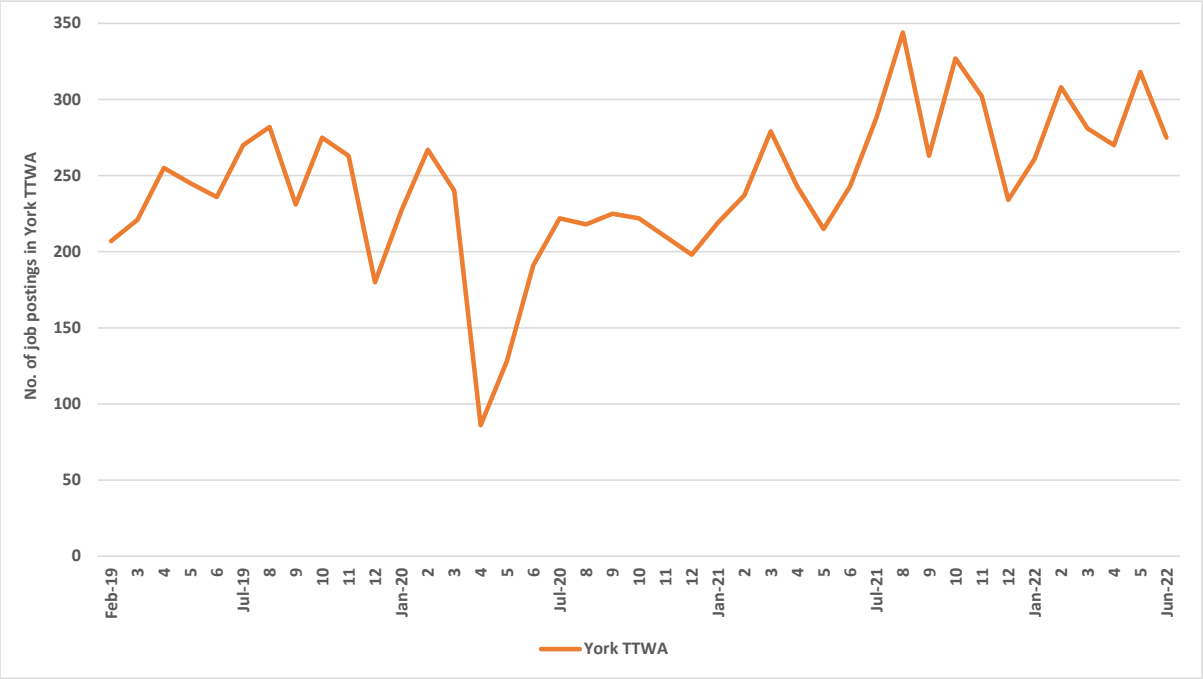
Sector (SIC)	York TTWA
Agriculture, forestry and fishing	27%
Mining And Quarrying	0%
Utilities - power	41%
Utilities - water	0%
Manufacturing	51%
Construction	7%
Wholesale, retail	40%
Transportation and storage	34%
Accommodation and food	23%
Information and communication	45%
Finance and insurance	29%
Real estate activities	37%
Professional, scientific and technical	35%
Administrative and support service	42%
Public administration and defence	38%
Education	39%
Human health and social work	10%
Arts, entertainment and recreation, and other	23%
Other services	25%

Source: IER-LMI

Figure 13 provides a time series of green job postings from February 2019 to December 2021.

The chart shows the large fall in job postings at the end of March 2020 which is likely to be due to the first lockdown. It also shows the gradual (albeit uneven) recovery in job postings until July 2021. Since then, the trend in York TTWA has been a levelling off in the number of green job vacancy postings.

Figure 13: Total job postings for green jobs in York TTWA (Feb 2019-June 2022)



Source: IER-LMI

Figure 14 shows green and non-green job postings from February 2019 to June 2022. Prior to the pandemic there was an upward trend in the postings for green (all three types) and non-green jobs with the latter more pronounced. Both types of job posting were affected by COVID-19. Since the low point in April 2020, both increased to the summer of 2021. Then postings for green occupations flattened, whilst those for non-green occupations increased.

Figure 14: Total green and non-green job postings, York TTWA (Feb 2019-June 2022)

Source: IER-LMI

Table 8 shows the top 20 green occupations (4-digit SOC) for postings in York TTWA in 2021. Fifteen of the top 20 green occupations are green enhanced skills and knowledge jobs. The

remaining five occupations are green increased demand. Warehouse operatives is the green occupation with the most postings (7%). These 20 occupations account for 58% of all green job postings.

Table 8: Top 20 green job vacancy postings by green job type, York TTWA (2021)

Occupation (4-digit SOC)	Green job type	% of green job vacancy postings	Total vacancy postings
Warehouse operatives	Increased demand	7%	211
Customer service occupations n.e.c.	Increased demand	6%	200
Programmers and software development professionals	Enhanced skills and knowledge	5%	175
Higher education teaching professionals	Enhanced skills and knowledge	5%	145
Finance and investment analysts and advisers	Enhanced skills and knowledge	4%	118
Delivery drivers and couriers	Enhanced skills and knowledge	4%	115
Chartered and certified accountants	Enhanced skills and knowledge	4%	115
Primary education teaching professionals	Enhanced skills and knowledge	2%	79
Solicitors and lawyers	Enhanced skills and knowledge	2%	79
IT user support technicians	Increased demand	2%	74
Metal working production and maintenance fitters	Enhanced skills and knowledge	2%	64
Other vocational and industrial trainers	Enhanced skills and knowledge	2%	59
Management consultants and business analysts	Enhanced skills and knowledge	2%	58
Market research interviewers	Increased demand	2%	58
Records clerks and assistants	Increased demand	2%	56
Financial and accounting technicians	Enhanced skills and knowledge	2%	52
IT business analysts, architects and systems designers	Enhanced skills and knowledge	2%	52
Managers and directors in retail and wholesale	Enhanced skills and knowledge	1%	47
Production managers and directors in manufacturing	Enhanced skills and knowledge	1%	46
Legal professionals n.e.c.	Enhanced skills and knowledge	1%	40

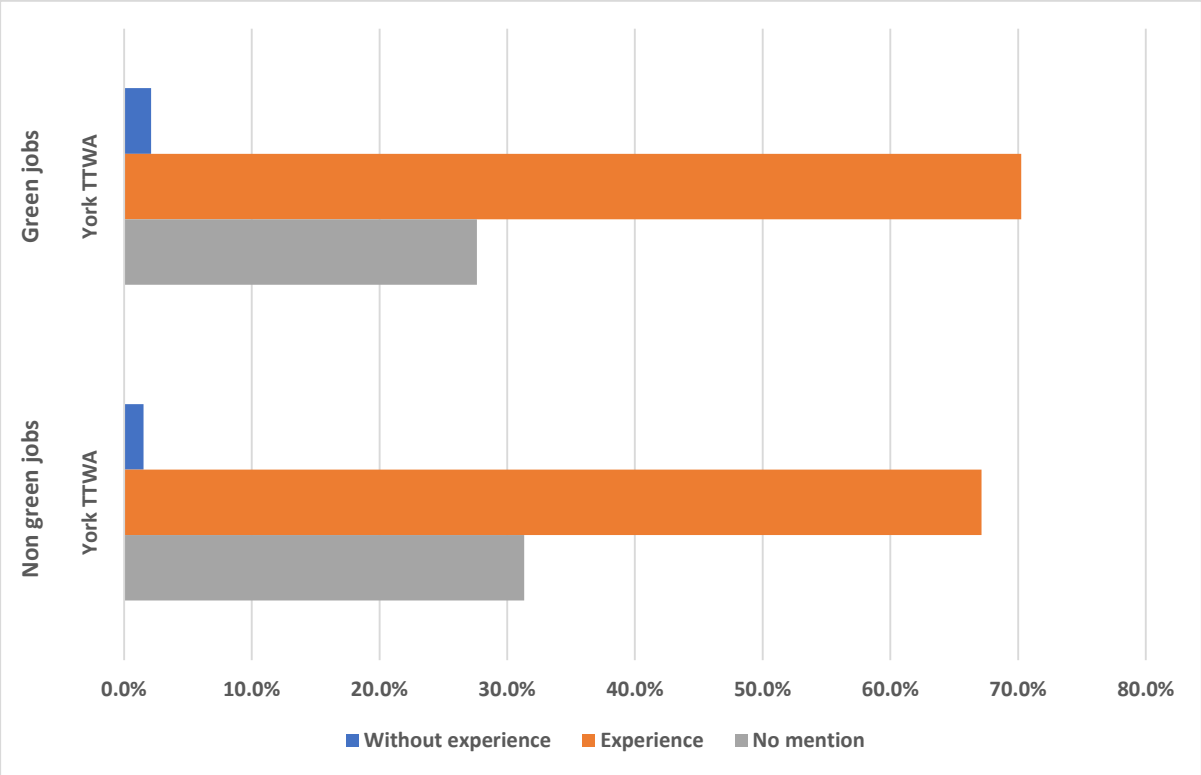
Source: IER-LMI

5.3. Employers' green job hiring criteria

This section uses information in the job vacancy posting data to explore employers' hiring criteria. Data is presented on work experience and skills requirements to better understand the detail of employer demands.

Figure 15 shows whether green and non-green job adverts state that prior experience is required.[28] Most job adverts in York TTWA– green and non-green – require job experience, around 70% in all cases, whilst very few job (2%-3%) state that no experience is necessary. Just over one quarter (27%-31%) do not mention whether experience is required. This data reinforces the point that, to a large extent, green jobs are similar to non-green jobs.

Figure 15: Whether prior experience is stated in job postings, York TTWA (2021)



Source: IER-LMI

[28] The 'No mention' category indicates that there is no mention in the vacancy regarding job experience requirements. 'Without experience' means that the employer explicitly mentioned that no experience is required to apply for the vacancy. 'Experience' indicates that the employer explicitly mentioned that experience is required to apply for the vacancy.

Table 9 shows the top 20 skills sought in green and non-green job postings in York TTWA[29]. Each skill is assigned (through ESCO) a category based on the nature of that skill, that is: cross-sector; sector-specific; or transferable.[30]

Half of the top 20 skills are common to green and non-green jobs: communication; customer service; accounting; work as a team; attention to detail; lead a team; manage a team; application process; personal development; and statistics.

The top five skills relevant to green jobs specifically were: JavaScript; SQL; CSS; logistics; and quality standards. Whereas the top five skills relevant to non-green jobs specifically were health and care related: person centred care; physiotherapy; primary care; focus on service; manage a team; and, nutrition. These skills reflect the nature of the occupations in the green and non-green designation.

Most of the green job posting skills are cross-sector (12 of the 20) as are those for non-green jobs (11 of the 20). Green and non-green job postings are as likely to mention sector-specific skills (7 of the 20). Very few job postings – green and non-green – require occupation-specific or transferable skills.

[29] The skill categories presented in this table are based on the ESCO classification (ESCO, 2017). See, ESCO (2017) ESCO Handbook: European Skills, Competences, Qualifications and Occupations. Brussels: European Union. ESCO is used, as opposed to O*NET, because the job postings analysis is part of LMI for All.

[30] Cross-sector skills or knowledge are skills/knowledge that can be applied across a range of sectors, such as communication and team work. Sector specific skills/knowledge refers to skills/knowledge that is specific to one sector but are relevant for more than one occupation within a sector, such as a programming language. Occupation specific skills/knowledge refers to skills/knowledge that is specific for one occupation across several sectors, for example, accountancy skills. Transferable skills refer to those skills that are relevant to a broad range of occupations. This category includes social interaction, attitudes and values, critical and innovative thinking, among other skills (ESCO, 2017, p.6).

Table 9: Top 20 skills in most demand in green and non-green job postings in York TTWA (2021)

Green occupations			Non-green occupations		
Skills	**Frequency (no.)**	**Skill type**	**Skills**	**Frequency (no.)**	**Skill type**
Communication	1459	Cross-sector	Communication	3466	Cross-sector
Customer service	822	Sector-specific	Work as a team	1667	Cross-sector
Work as a team	795	Cross-sector	Personal development	1105	Cross-sector
Attention to detail	390	Cross-sector	Customer service	1061	Sector-specific
Accounting	316	Cross-sector	Attention to detail	868	Cross-sector
JavaScript	274	Sector-specific	Accounting	420	Cross-sector
SQL	273	Sector-specific	Lead a team	418	Cross-sector
CSS	257	Sector-specific	Person centred care	294	Sector-specific
Logistics	245	Cross-sector	Physiotherapy	288	Sector-specific
Lead a team	245	Cross-sector	Primary care	283	Cross-sector
Quality standards	240	Cross-sector	Focus on service	279	Cross-sector
Manage a team	204	Cross-sector	Manage a team	274	Cross-sector
Energy[31]	198	Cross-sector	Nutrition	261	Sector-specific
Application process	190	Occupation-specific	Application process	247	Occupation-specific
PHP	186	Sector-specific	Palliative care	235	Sector-specific
SQL Server	176	Sector-specific	Work independently	206	Transversal
Personal development	175	Cross-sector	Acute care	217	Sector-specific
Statistics	170	Cross-sector	Disability care	235	Sector-specific
Project management	161	Sector-specific	Psychology	234	Cross-sector
Financial management	160	Cross-sector	Statistics	209	Cross-sector

Source: IER-LMI

[31] Knowledge on power capacity in the form of mechanical, electrical, heat, potential, or other energy from chemical or physical resources, which can be used to drive a physical system.

5.4. Employer demand for purist green job skills

In this section we identify purist green job vacancy postings by identifying purist green skills terms specified in job vacancy requirements, for example: recycle, renewable energy, green manufacturing etc.[32]

Table 10 shows that these purist green skills terms are not mentioned frequently in job adverts. There are only 350 mentions of such skills in all of the job vacancy postings between February 2019 and June 2022. Furthermore, none of these purist green skills would make it into the top 20 green job skills (see Table 9 above).

Three skills terms - environmental protection/processes; recycle; and renewable energy – account for more than half (55%) of purist green skills terms mentioned. In addition, decarbonisation/low carbon emissions, solar technologies and climate change together account for around one quarter (23%).

Table 10: Purist green skills terms in green job postings in York TTWA (February 2019-June 2022)

Skills terms (N=350)	%
Environmental protection/processes	26%
Recycle	17%
Renewable Energy (wind, turbine, wave, hydrogen, etc. power generation)	12%
Decarbonisation/ low carbon emissions	9%
Solar technologies	9%
Climate Change	5%
Public Transport Planning	3%
Segregation	3%
Cascading	2%
Waste Monitoring	2%
Biodiesel	2%
Materials Specification	2%
Hazardous Waste Management	2%
Leak Detection	2%
Green Manufacturing	1%
Water Management Systems	1%
Effluent Treatment	1%
Waste Audit	1%
Life Cycle Costing	1%

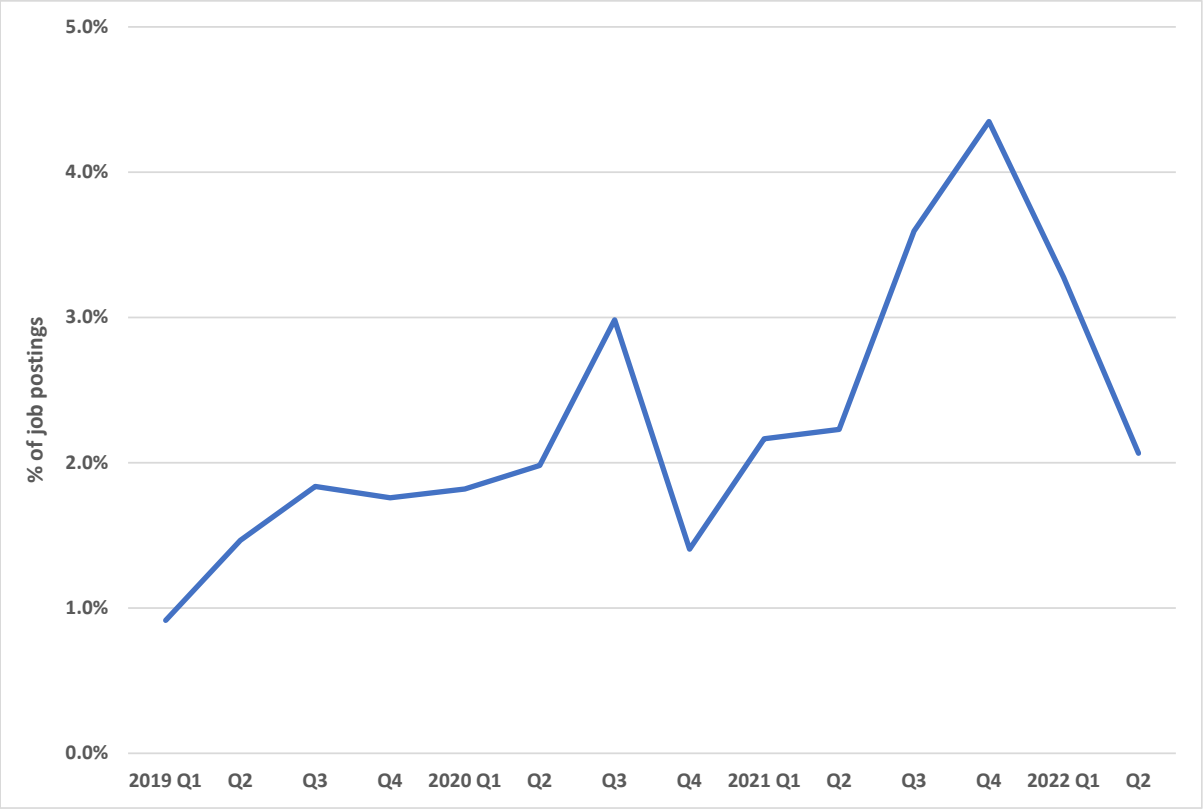
Source: IER-LMI

Figure 16 shows the number of jobs vacancy postings that use purist green skills terms over time. Only a small proportion of job postings, as with the purist definition of green sectors (see

[32] Strietska-Ilina, O., Hofmann, C., Haro, M.D., & Jeon, S. (2012) Skills for green jobs: A global view. Geneva: International Labour Organisation.

Section 2), contain purist green skills terms (a peak of 4% of job postings in Q4 of 2021). More recently, the number of job vacancy postings using green skill terms has fallen, again mirroring the decrease in postings for green occupations (see Figure 15).

Figure 16: Purist green skill terms used in job postings, York TTWA (Feb 2019-June 2022)



Source: IER-LMI

5.5. Priority sectors

The job vacancy posting analysis also focused on two of CYC's priority sectors: rail and the bioeconomy. However, there were very few online job adverts for the bioeconomy sector and so this data has not been included. It is possible that the small number of bioeconomy job vacancy postings reflects the fact that many bioeconomy subsectors (such as, agriculture, and food and drink manufacture) are less likely to use online recruitment methods.

The rail sector in York includes a range of subsectors: construction, maintenance and repair and operation of the rail network; engineering design and testing; head office, and business support activities; and ICT. Table 11 shows that in 2021 there were just under one thousand (999) online job vacancy postings for rail sector jobs (11% of all postings). Of these postings, two out of five were for green occupations (39%) which is marginally higher than for other sectors.

Within green job postings in the rail sector, most were enhanced skills and knowledge jobs (56%). However, compared to non-rail sectors, there was a larger proportion of postings for increased demand jobs (39%).

Table 11: Rail sector job postings in York TTWA (2021)

	Rail sector	Other sectors
Total postings, of which:	**11%**	**89%**
Non-green	61%	64%
Green, of which:	39%	36%
- Enhanced skills and knowledge	56%	71%
- Increased demand	39%	23%
- New and emerging	5%	6%

Source: IER-LMI

5.6. Summary

The section uses an inclusive definition of green jobs. On this basis around one third of York TTWA job postings are for green occupations. Around two thirds of these postings were for green enhanced skills and knowledge occupations. Very few (6%) were for new or emerging green occupations.

York TTWA has relatively high levels of job postings for occupations in skilled trades, customer service, and sales and customer service occupations. And lower proportions in managerial and professional jobs.

Since July 2021, there has been a levelling off in green job postings in York TTWA. Non-green job vacancy postings in York TTWA have increased over this period.

The large majority of green and non-green job postings require people with previous experience. Many of the skills sought in green and non-green job postings are the same. However, green job postings are more likely to require specific software skills. 'Purist' green skills are rarely asked for (mentioned in 3% of postings). When they are: environmental protection/processes; recycle; and renewable energy are the skills most called for.

Rail is one of CYC's priority sectors. In York TTWA, 11% of online job postings were for rail sector posts and, of these posts, two out of five were for green jobs, using the broad definition. Within green job vacancy postings in the rail sector, most were for green enhanced skills and knowledge occupations.

6. Conclusion, discussion and suggested actions

6.1. Introduction

This section offers concluding remarks along with a short discussion of the future of green jobs based on new national employment projections. Drawing on a range research, action points are offered for York to enhance its green jobs potential.

6.2. Summary overview of green jobs and skills in York

For a number of years, a purist definition of green jobs has been used. This definition is proving to be problematic and more inclusive definitions are gaining policy traction. One broader definition has been developed by IER and adopted within the UK – the GreenSOC. This broader definition offers three types of green jobs, one of which aligns loosely with the purist definition.

On the purist definition, there are around 1,800 people working in green sector jobs in York TTWA, this figure represents 1% of the current workforce. Analysis of job vacancy postings that ask for purist green skill terms in their vacancy adverts suggests that 2% of current vacancies ask for such skills. This latter figure has fluctuated between 1% and 4% of total job vacancy postings in York over the past three years.

Employing the inclusive definition, our estimates suggest that there are 28% of people in the York TTWA, and one quarter of York City residents, who are currently working in green jobs. These jobs are mostly green increased demand jobs, which comprise around 45% of green jobs in both areas or 12% of total employment. The next largest green jobs category are green enhanced skills and knowledge jobs, which constitute around one third of green jobs or 9% of all jobs. Finally, green new and emerging jobs (which is closest to the purist definition) account for about one in five green jobs or 6% of total jobs.

The nature of green jobs varies across broad occupational groups. Green enhanced skills and knowledge jobs are most prevalent in plant and machine process operative occupations, associate professional and technical, and managerial occupations. Green new and emerging are more significant in skilled trades, and professional occupations. Green increased demand jobs are sizeable in most broad occupations.

Analysis of occupations at a more detailed level shows that many of these jobs are currently green increased demand, and in occupations that concern the distribution, logistics and financing of the green economy (i.e. service sector jobs), as well as the manufacture, installation and maintenance of green products.

The job vacancy postings data calculates that just over one third of vacancies are for green jobs, and that two thirds of these jobs are green enhanced skills and knowledge (23% of all job postings), one quarter are green increased demand jobs (9%), and 6% are green new and emerging jobs (2%).

Most green jobs, in both York TTWA and York City, are in skilled trades, associate professional and technical, and plant and machine process operative occupations. The job vacancy postings data indicates that skilled trades, and process, plant and machine operative occupations account for the largest proportion of green jobs in York TTWA. Both the current employment and job vacancy postings data indicate that there are few green jobs in administrative and secretarial, and caring, leisure and service occupations.

A number of the top ten green detailed occupations in the employment and job vacancy postings data are the same. Green job postings tend to include more IT detailed occupations rather than skilled trades, especially in the construction sector.

Analysis of current employment and job vacancy postings by sector shows that it is the public administration, education and health, distribution, hotels and restaurants, and banking, finance and insurance sectors where most green jobs are located. However, as a proportion of jobs within sectors, agriculture, forestry and fishing, construction, and transport and communication have the largest proportion of green jobs.

The skills and knowledge requirements of green jobs are very similar to non-green jobs. This similarity is apparent when examining the skills and knowledge of specific green and non-green occupations as well as the skills, knowledge and skills terms in broader occupation groupings. Analysis of the skills, knowledge and skills terms of green jobs within broad occupation groups shows that there are a number of skills and knowledge requirements that are the same across green and non-green jobs, as well as different types of green jobs.

The reasons for the similarities between green and non-green jobs is because a number of key functional, transferable and technical skills are necessary to perform most jobs. It also reflects the fact that most green jobs are green increased demand jobs or green enhanced skills and knowledge jobs requiring no or incremental changes respectively in the tasks undertaken.

6.3. Green jobs going forward in the transition to net zero?

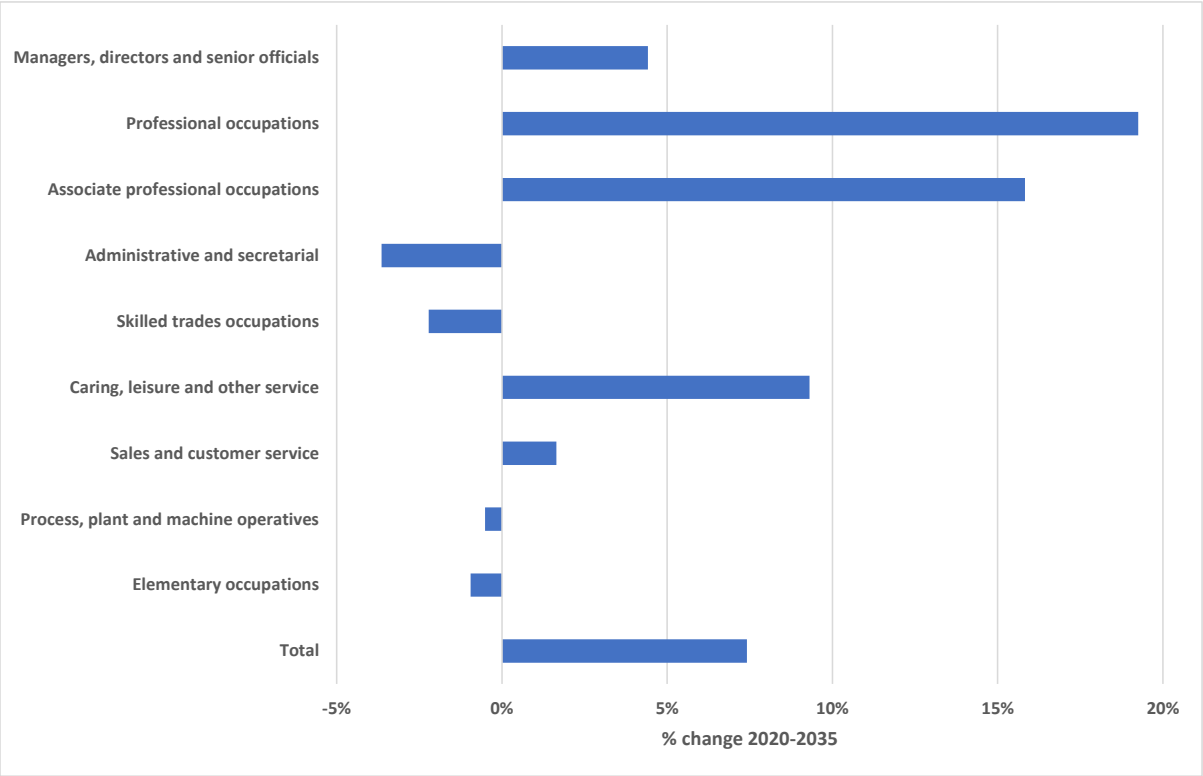
Developments in the local economy will depend on the pace of transition to net zero. Based on the purist definition (and forecasts used by the LGA), the number of green jobs in the York TTWA is estimated to more than quadruple by 2030, and have a six-fold increase by 2050. However, this increase will still only account for 12% of the York TTWA workforce in 2050.

Using a more inclusive definition, the transition to net zero will see most job changes in existing occupations (green increased demand) that will require no change in their skills and knowledge requirements. Most other green jobs (green enhanced skills and knowledge) will require changes but only to some of their skill and knowledge requirements. Relatively few green jobs (green new and emerging) will require significantly different or new skills and knowledge, and these jobs currently account for around 5% of the workforce in York TTWA and York City.

New national employment projections provided by IER with other colleagues based on broad occupation groupings provide an indication of the direction of travel.[33] These projections suggest that employment levels are forecast to decline slightly in two broad occupation groups which account for a large number of green jobs: skilled trades, and process, plant and machine operatives (see Figure 19). However, jobs are expected to increase in two occupations which account for a large number of green jobs: professional, and associate professional and technical occupations.

[33] Wilson, R., Bosworth, D., Bosworth, L., Cardenas-Rubio, J., Day, R., Patel, S., Bui, H., Lin, X., Seymour, D., and Thoung, C., (2022). The Skills Imperative 2035: Occupational Outlook – Long-run employment prospects for the UK, Baseline Projections. Working Paper 2a. Slough: NFER.

Figure 17: Employment forecasts by broad occupation, UK 2020-2035, percentage change



Source: IER Working Futures

Given the nature of most green jobs, it is difficult to predict at which point net zero policy ambitions will impact occupations and sectors. For example, within an occupation such as plumber (a green enhanced skills and knowledge job), only a proportion of people working in such jobs will be affected by the zero carbon transition, at least in the short- to medium term. At the moment, some plumbers may be installing heat pumps all, some or none of their time. The likelihood is that more plumbers, and for more of their time, will be involved in green tasks. However, it is difficult to estimate how this shift will occur over the next five or ten years.

Monitoring job vacancy postings data and engagement with employers in sectors less likely to advertise jobs on-line are ways of monitoring the transition. In addition, analysis of job vacancy postings data will allow the detailed monitoring of the emergence of new green jobs that do not currently exist (such as, greenhouse gas emissions report verifiers), as well as the green enhanced skills and knowledge requirements of existing occupations.

The growth in professional, and associate professional and technical occupations will require a higher-qualified workforce (at Level 4 and above) which is in keeping with trends in the UK over the last two decades. However, in terms of employment opportunities, most job opportunities will arise through replacement demand i.e. replacing workers as they leave the workforce (mostly due to retirement). This dynamic will create the most job opportunities over the next 15 years.[34] Therefore, whilst certain occupations may increase there will still be large numbers of job opportunities for people in occupations forecast to decline, such as the skilled trades.

[34] Ibid.

Because most jobs affected by the transition to net zero already exist, the skills implications are reduced. Most people in green jobs will not need to acquire new skills, at least in the short- to medium term. For those workers who do, new or adapted skill acquisition is likely to involve the 'bolt on' of skills that can be acquired through learning units/modules or micro credentials. By contrast, about one in five green jobs and one in twenty of all jobs are green new and emerging and will require mostly green skills and knowledge. New occupational and competency standards will be required for such jobs. Some workers may be reluctant to reskill or upskill. In order to ensure that training opportunities are engaged with by all will require new provision delivered in a flexible way that can accommodate large volumes of working people, for example, through on the job and on-line provision. It may also require financial and other incentives to encourage people and employers to engage.

6.4. Actions that City of York Council and its partners can take

Drawing on a range of research outwith York, this section provides suggested actions for the City of York Council . They are offered without full knowledge of the policy context within which the City of York Council operates, and the strategic and operational relationships with its main partners. Furthermore, all of these actions require, to a greater or lesser extent, resources, which may be challenging in the current financial climate.

Action 1: Establish a Green Skills Partnership

The transition to net zero is likely to pervade business practice, and many organisations are already working on greening and green jobs. It would be sensible to work on this transition in a collaborative and coordinated way. A Green Skills Partnership was established in London by Unionlearn in 2011. Its purpose was to deliver green skills and support green jobs within the construction, retrofit, horticulture, and waste management sectors. The partnership included: employers, trade unions, training providers, employment support providers, LADs, housing providers and Third Sector organisations. The partnership met on a regular basis to coordinate employment and skills demand and supply in these sectors by identifying employment, work experience, skills training and progression opportunities. The partnership was successful in securing government funding for employment and skills support, providing work placements for unemployed people, apprenticeships and other training opportunities with employers, creating 'green ambassadors', and funding for PTLLS and Assessor training. The Green Skills Partnership currently exists as a Community Interest Company. A Green Skills Partnership does require funding to develop and operate, and it could be led by the City of York Council or by one or several of its partners.

Action 2: Create a Green Jobs Champion(s)

City of York Council has numerous roles within the net zero agenda: as an employer; a provider and consumer of goods and services; as an anchor institution; and as a strategic lead and facilitator. A Green Jobs Champion would be both an advocate of and advisor on change. The champion could coordinate the council's four roles to provide coherence in responding to and developing net zero agenda for the city and its surrounding areas. For example, with the council as a model employer, the champion would work with council departments to help these departments understand the direction of travel towards a net zero economy, and its implications for their services, budgets and staff. The champion might also work with the council's procurement teams to support greener supply chains; and providing a green dimension to the council's strategic role across a number of policy agendas, such as, digital, health, housing, transport and planning.

Furthermore, the council could promote the creation of Green Jobs Champions within other anchor institutions (such as local health service providers, and higher and further education institutions) as well as the YNYLEP, third sector organisations and local businesses to create a broad strategic and operational approach to developing, and responding to, the York green economy.

Action 3: Develop a green jobs audit/checklist for local businesses

The audit/checklist could be used by businesses to identify the employment and skills implications of responding to the net zero transition, for example, understanding and accommodating net zero government policy and legislation. It could be used by businesses to assess the extent to which new green jobs will need to be created, or which of their existing jobs are being 'greened'. This can then be used for them to assess what actions may need to be taken, such as, training and skills provision to develop green competencies in existing jobs. Or how to recruit workers for new and emerging jobs. This checklist could be linked to good and inclusive work practices to enhance recruitment (e.g. recruiting from a broader pool of workers) or retain existing workers (such as by providing flexible working arrangements). Developing the checklist could be undertaken in association with local employer representative organisations, other anchor institutions, and local skills providers.

Action 4: Encourage local education and training providers to develop and deliver micro-credentials

Many green jobs are unlikely to require completely new skill and knowledge sets. Most will need to enhance their existing competencies. Micro-credentials, delivered for example through a short course or training, accredit the learning outcomes of 'bite sized' learning experiences.[35] Such learning offers a flexible, targeted way to help people develop additional skills and knowledge, and can be delivered by local colleges, universities and private training providers in the York area. These providers should be encouraged to develop and deliver such provision, working in partnership with local businesses and public employment services. Courses and training could be delivered to the existing workforce or delivered as 'bolt-ons', options or modules as part of larger training courses including apprenticeships and degrees. Work is being undertaken elsewhere in developing green skill micro-credentials which local providers could incorporate and build on so they are appropriate to local employers and the workforce.

Action 5: Develop and host a web based local LMI facility

Significant LMI exists in the UK[36] which enables careers guidance professionals, for example, to identify local job opportunities and offer advice on the quality of those jobs and access requirements. York should consider developing a bespoke green jobs LMI for this purpose. This action could be undertaken in partnership with YNYLEP and the Local Skills Improvement Plan. Analysis of the green economy, jobs and skills is evolving all the time. The employment analysis included in this report could be a basis for local LMI, explaining the types and levels of green jobs, and their skills and knowledge requirements for individuals, businesses and providers. Web scraping of job vacancy postings provides an ongoing mechanism to identify

[35] Lifelong Education Commission (2022). The Role of Micro-credentials in Modular Learning.

[36] See, for example, Barnes, S-A., Hogarth, T., Cárdenas-Rubio, J., Wright, S., Hawthorne, M., Bosworth, D., & Bosworth, L. (2021). Strategic, Accessible Labour Market Intelligence: Labour market demand and supply of skills, Glasgow: Skills Development Scotland.

local labour market trends, such as growth in the number of green new and emerging occupations, developments within existing jobs such as the enhanced green skills and knowledge occupations. This information could then be linked to local skills provision and funding opportunities. Analysis undertaken elsewhere suggests that green jobs are not distributed evenly across the workforce, in particular there are gender imbalances.[37] Therefore green job growth could be linked to inclusive and good work practices, possibly utilising support resources from those Mayoral Combined Authorities (including West Yorkshire) that have developed Good Work Charters.[38] In this respect, City of York Council might also incorporate, within this local LMI, information on the quality of its green jobs, for example, using pay levels as a marker. Local LMI could also be used to benchmark the quality of those jobs as well as labour market green jobs trends in York against other similar cities and the rest of the UK.

6.5. Final thoughts

The net zero transition is likely to involve significant if often incremental changes to the labour market and jobs. However, in terms of jobs and their underpinning skills and knowledge, much will look familiar. Part of the role the City of York Council is to re-assure its own constituent parts, its partners and other stakeholders that the changes are manageable and can be supported.

The actions in the previous section can be led by City of York Council. However, all other organisations in York and its TTWA will be affected by the transition to net zero to a greater or lesser extent. It makes sense to develop a collaborative and coordinated approach through partnership building across organisations and, working with these partners, mobilise the full range of policy levers to maximise a coherent response. The City of York Council can have a facilitating role amongst its partners to ensure a collective and systematic response.

[37] Cardenas Rubio, J., Warhurst, C. and Anderson, P. (2022) op. cit.

[38] For example, see https://www.gmgoodemploymentcharter.co.uk/support/