WPI ECONOMICS

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Workforce planning for clean heat: Where will the heat pump workforce come from?

Supplementary Annex

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About Us

We are an economics, data insights, policy and impact consultancy, but one that is a little different to many others. We draw on backgrounds in government and the private and charitable sectors to produce work designed to make a difference. We do not do research for research's sake. We are committed to ensuring that everything we do has an impact - which is part of the reason why we recently became a verified B Corporation.

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Technical Annex

Heat pump labour market analysis

A list of heat pump-related keywords was used to identify the Lightcast Occupation Taxonomy (LOT) occupations relevant to heat pumps, and the number of job postings in each of the identified LOT occupations were retrieved. Job postings between June 2024 and June 2025 were searched with the following keywords:

Heat pump installer	Heat pump prototype development
Heat pump engineer	Heating engineer
Heat pump technician	Plumbing and heating
Heat pump service engineer	Heating services and maintenance
Heat pump	Building services
HVAC contractor	Heating technician
HVAC technician	Renewables installer, servicing, repair
HVAC installer	Heat pump system designer
Heating and cooling specialist	HVAC system designer
Residential HVAC services	Renewable heating system designer
Heat pump maintenance	Sustainable HVAC design specialist
HVAC mechanical engineer	Building energy system designer
Thermal systems engineer	Low-carbon HVAC system designer
Heat pump R&D	Thermal systems design consultant
HVAC product development	Heat pump layout designer
Refrigeration cycle engineering	Eco-friendly HVAC planner

Using the list of heat pump-related keywords, job postings text in each of the identified LOT occupations were filtered to find the number of heat pump-specific job postings per LOT occupation. The resulting number was used to calculate the heat pump relevance weights for each LOT occupation. The resulting dataset is an estimate of demand for heat pump roles in each LOT occupation.

Since UK employment and education data are available at the Standard Occupational Classification (SOC) level, each LOT occupation is mapped to its corresponding SOC code using Lightcast's taxonomy relationships. The heat pump relevance weight calculated at the LOT level is carried through to the SOC level via this mapping.

After this mapping process, the resulting dataset shows educational attainment and employment estimates in each heat pump-relevant occupation. It is important to note that employment estimates are not full-time equivalent (FTE), meaning our estimates of the size of the heat pump workforce do not take into account the amount of time members of the workforce spend on heat pump jobs.

This LOT-SOC mapping process also allows for demographic estimates of the heat pump workforce, split by age, gender and region using Lightcast's Core Labour Market Information, which uses data from a range of datasets including the Annual Population Survey (APS), the Annual Survey of Hours and Earnings (ASHE), the Business Register and Employment Survey (BRES) and the Labour Force Survey (LFS).

The LOT-SOC mapping also forms the basis on which job growth projections are also derived. These projections are based on the Department for Education's SOC-level baseline labour market and skills projections to 2035, which assume existing technological trends and environmental transitions will continue at a similar pace into the future.[1] Heat pump relevance weights are applied to these projections to estimate future demand for heat pump-related roles.

Skills, occupation and industry similarity analysis

The similarity analysis identifies the sectors with the highest degrees of similarity to the heat pump industry by their associated skills and capabilities. Because the term 'heat pump industry' is not officially recognised under the UK's Standard Industrial Classification (SIC), a synthetic sector was constructed using all job postings in which the job description contained any of the heat pump-related keywords. Analysis was performed at both SIC-3 and SIC-4 level and from June 2024 to June 2025.

Occupation similarity

For the occupational similarity analysis, a Doc2Vec machine learning model was used to represent the semantic similarity between occupations as vectors based on keywords in their

[1] Department for Education (2024) Labour market and skills projections: 2020 to 2035

job descriptions. Once this representation is obtained, the cosine similarity between occupation vectors is computed to quantify how semantically similar two occupations are. Similarity scores are presented on a 0–1 scale. Occupations with higher similarity scores share comparable linguistic and contextual characteristics - indicating overlap in required skills, tasks, or functional roles, and can thus be grouped or analysed to reveal patterns of occupational relatedness and potential career mobility pathways.

Additionally, the missing skills between heat pump occupations and similar occupations were assigned a relevance score between 1 and 5, where values closer to 5 represent skills with a higher degree of relevance to the heat pump occupation.

Industry similarity

For the industry analysis, similarity was assessed using a Revelated Comparative Advantage (RCA) framework to determine the degree of overlapping skills. The method integrates data on job postings by industry and by skill to identify which industries disproportionately demand particular skills compared to the overall labour market. Total job postings per industry, total postings mentioning each skill, and postings are combined where both an industry and a skill are jointly observed. The RCA is then calculated as the ratio between the share of a skill within an industry's total postings and the share of that skill in the overall economy. Values greater than 1 indicate that a skill is relatively overrepresented within an industry, reflecting a form of specialisation or competitive advantage. To enable comparability across industries, RCA values are normalised to a 0–5 scale. The resulting dataset is organised as an industry–skill matrix, which provides a detailed representation of skill intensity patterns across sectors.

Then, pairwise cosine similarity between industries' RCA profiles is computed to assess how similar industries are in their skill composition. The resulting similarity score ranges from 0-1, where values closer to 1 indicate that two industries have very similar patterns of skill specialisation. In practical terms, cosine similarity captures the structure rather than the intensity of skill demand - two industries can be considered highly similar if they rely on the same mix of skills, even if one employs those skills more extensively. By applying this technique to the RCA matrix, the analysis generates a network of inter-industry relationships that reveals clusters of industries with comparable skill compositions and potential for workforce transferability or structural proximity.

Heat pump company size analysis

The company size analysis was conducted using the same underlying data pool as the labour market trends analysis. Job postings were filtered to include only the selected occupations and heat pump–related keywords, covering the period from June 2024 to June 2025. The resulting dataset was aggregated both at the company level and at the company–occupation level.

To enrich the dataset, company identifiers were matched with company profile information available through Lightcast's access to Rhetorik data. This matching process did not achieve complete coverage, with additional manual research and verification undertaken to

supplement missing information. In total, 93.3% of job postings were successfully classified with company data. The remaining unclassified companies each had fewer than five heat pump–related postings during the analysis period.

The company-level data captured whether the company was a "staffing" (those that hire individuals for placement at a different company) or "non-staffing" company (direct employers, hiring individuals to work for themselves) as well as the number of employees. These number of employees were then categorised in the following groupings for the purpose of analysis: fewer than 10, 10–49, 50–199, 200–499, 500–999, 1,000–4,999, 5,000–9,999 and 10,000 and above.

Data aggregation allowed for the following analysis to be carried out:

- Number of companies and their breakdown by staffing versus non-staffing status
- Number of postings and their breakdown by staffing versus non-staffing status
- Company count and posting breakdown by company size (non-staffing companies only)
- Distribution of postings by occupation and company size (both in absolute numbers and percentages)
- Distribution of postings by occupation and company size, excluding staffing agencies and unclassified companies (percentages only)

This approach enabled the identification of key patterns in company size distribution and the role of staffing agencies within the heat pump–related labour market.

Annex 1: LOT to SOC mapping

LOT Occupation	SOC Code
Building and general maintenance technician	Engineering technicians
CAD designer / draughtsperson	CAD, drawing and architectural technicians
Chemical / process engineer	Production and process engineers
Civil engineer	Civil engineers
	Skilled metal, electrical and electronic trades supervisors
Electrical engineer	Electrical engineers
Electrician	Electricians and electrical fitters
Energy broker	Buyers and procurement officers
Energy engineer	Engineering professionals, not elsewhere classified (n.e.c.)
	Production and process engineers
	Construction and building trades, n.e.c.
Engineering manager	Engineering project managers and project engineers
	Production managers and directors in manufacturing
	Civil engineers
Heating engineer / boiler operator	Energy plant operatives

	Plant and machine operatives, n.e.c.
HVAC mechanic / installer	Air-conditioning and refrigeration installers and repairers
Industrial mechanic	Engineering technicians
Manufacturing engineer	Production and process engineers
	Assemblers and routine operatives, n.e.c.
	Engineering project managers and project engineers
Mechanical engineer	Mechanical engineers
Pipe fitter	Pipe fitters
	Plumbers & heating and ventilation installers and repairers
Plumber	Plumbers & heating and ventilation installers and repairers
Pump worker / operator	Mining and quarry workers and related operatives
Refrigeration technician	Air-conditioning and refrigeration installers and repairers
Repair / service technician	Engineering technicians
	Boat and ship builders and repairers
	Engineering technicians
Reservoir / petroleum engineer	Production and process engineers
Roofing / siding worker	Roofers, roof tilers and slaters

Safety manager	Health and safety managers and officers
Safety specialist / coordinator	Quality assurance and regulatory professionals
	Health and safety managers and officers
	Other researchers, unspecified discipline
Sales engineer	Sales-related occupations, n.e.c.
Sales representative	Sales-related occupations, n.e.c.
Sustainability specialist	Business, research and administrative professionals, n.e.c.

Annex 2: Categorisation of LOT occupations

Heat pump occupational category	LOT occupation name	Number of jobs	Job share
Heat pump design and manufacturing	CAD designer / draughtsperson	848	1.1%
	Chemical / process engineer	304	0.4%
	Civil engineer	3,641	4.8%
	Electrical engineer	5,643	7.4%
	Engineering manager	13,083	17.2%
	Industrial mechanic	168	0.2%
	Manufacturing engineer	136	0.2%
	Mechanical engineer	3,122	4.1%
Heat pump installation	Building and general maintenance technician	1,887	2.5%
	Electrician	10,827	14.2%
	Energy engineer	3,554	4.7%
	Heating engineer / boiler operator	636	0.8%
	HVAC mechanic / installer	2,143	2.8%
	Pipe fitter	899	1.2%
	Plumber	21,514	28.3%
	Pump worker / operator	2,164	2.8%
	Refrigeration technician	254	0.3%

	Repair / service technician	639	0.8%
	Reservoir / petroleum engineer	1,986	2.6%
	Roofing / siding worker	469	0.6%
Heat pump safety and sustainability	Safety manager	429	0.6%
	Safety specialist / coordinator	393	0.5%
	Sustainability specialist	679	0.9%
Heat pump sales	Energy broker	301	0.4%
	Sales engineer	84	0.1%
	Sales representative	274	0.4%

Annex 3: Occupation similarity analysis

Our analysis found that there are 81 occupations which have a high degree of similarity to the 26 LOT occupations that make up the potential heat pump workforce. Notably, this includes considerable crossover between many of the 26 LOT occupations, some with a high degree of similarity. For example, refrigeration technicians and HVAC mechanics / installers have a 0.95 similarity score.

Table 1 shows the top three newly-emerging similar LOT occupations for each of the four heat pump occupational categories. There is a high degree of similarity between occupations that could make up the heat pump installation, design and manufacturing and sales workforce – as represented by similarity scores of above 0.9. There is less similarity amongst the most similar occupations to the heat pump safety and sustainability (with similarity scores of 0.75-0.78), suggesting these safety and sustainability roles have a higher degree of specialisation and unique skills compared to other parts of the heat pump workforce.

Table 1: Occupations most similar to heat pump occupations by heat pump category

Heat pump occupational category	Heat pump occupation	Most similar occupations	Occupational similarity (0–1)
Heat pump installation	Building and general maintenance technician	Maintenance helper / assistant	0.95
	Electrician	Electrician's assistant	0.91
	Heating engineer / boiler operator	Boilermaker	0.91
Heat pump design and manufacturing	Computer-Aided Design (CAD) designer / draughtsperson	Mechanical / electrical draughter	0.97
	Industrial mechanic	Millwright	0.97
	Electrical engineer	Power systems engineer	0.91
Heat pump sales	Sales representative	Sales supervisor	0.94
	Sales representative	Sales assistant	0.91

	Energy broker	Account manager / representative	0.9
Heat pump safety and sustainability	Safety manager	Health and safety engineer	0.78
	Safety manager	Mining manager / supervisor	0.77
	Sustainability specialist	Environmental compliance specialist	0.75

However, despite the similarity between occupations, key skills gaps currently exist. Table 2 shows the most important skills that are currently missing if workers were to transition into heat pump occupations. The relevance score shows how relevant each skill is on a 1-5 scale, with scores closer to 5 indicating a higher degree of relevance to the heat pump occupation. The analysis shows many adjacent occupations would need to gain either relevant green skills (such as renewable energy or environmental, social and corporate governance) or core "specialised skills" (such as electrical engineering or plumbing) in order to occupy roles in the heat pump sector.

Table 2: Skills gap between similar occupations and heat pump occupations, ranked by the skill's relevance

Heat pump occupational category	Similar occupation	Top missing skill	Relevance score (1-5)
Heat pump safety and sustainability	Environmental compliance specialist	Environmental, social and corporate governance	4.94
	Mining manager / supervisor	Auditing	4.71
	Compliance officer / analyst	Environmental health and safety	4.7
Heat pump design and manufacturing	Electronics engineer	Electrical engineering	5
	Project manager	Engineering management	5
	Transportation engineer	Structural engineering	4.96

Heat pump installation	Field service technician	Plumbing	4.91
	Oil / gas field service technician	Wastewater	4.91
	Construction helper / worker	Pipe (fluid conveyance)	4.88
Heat pump sales	Account manager / representative	Renewable energy	5
	Technical sales representative	Sales engineering	4.96
	Product demonstrator / promoter	Energy management	4.76

Annex 4: Heat pump training pathways analysis

Further Education

For Further Education, our analysis of current training pathways captures the potential new entrants to each heat pump occupation by summarising the number of training enrolments and achievements across relevant subject areas at all National Vocational Qualification levels. It is important to note that each subject area can lead to multiple career paths. Therefore, enrolment and achievement figures are not exclusive to each occupation.

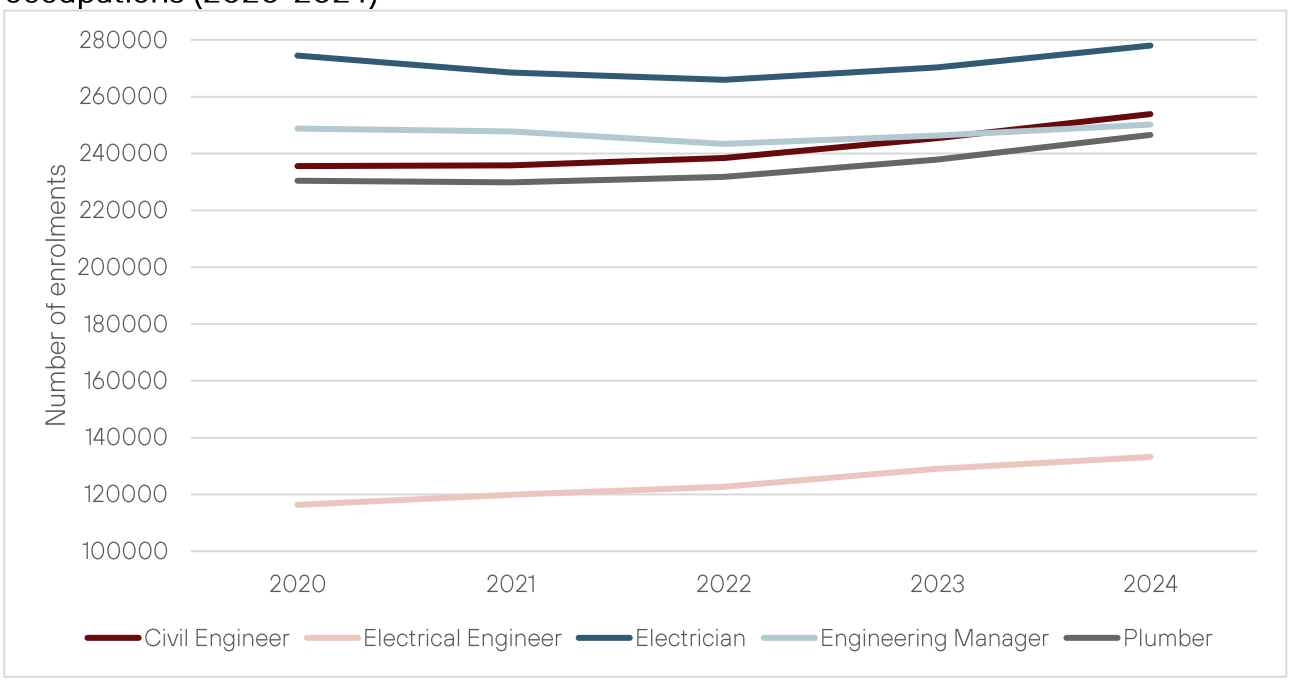
The five occupations with the largest share of the potential heat pump workforce are plumbers, engineering managers, electricians, electrical engineers, and civil engineers. As shown in Table 3, the subject areas most relevant to these occupations are building and construction, engineering, manufacturing technologies, engineering, architecture, transportation operations & maintenance, and business management.

Table 3: Five largest heat pump occupations and their corresponding subject sector areas

LOT occupation	Subject area
Plumbers	Building and construction
Engineering managers	Engineering
Electricians	Engineering
	Transportation operations & maintenance
	Architecture
	Building and construction
Electrical engineers	Engineering
	Manufacturing technologies
Civil engineers	Engineering
	Building and construction
	Manufacturing technologies

Data on heat pump-related training courses suggests that current educational achievements in the sector are low, only just recovering to pre-pandemic levels. As shown in Figure 1, the COVID-19 pandemic had a significant negative impact on enrolments and achievements in heat pump-related courses. Enrolments – the number of students studying a course in a given year – steadily declined between 2020 and 2022 in electrician-relevant and engineering manager-related subjects. Similarly, subjects relevant to the civil engineering, electrical engineering and plumbing pathways saw slower growth in enrolment during this period compared to the accelerated recovery observed between 2022 and 2024.

Figure 1: Educational enrolments in subject areas relevant to the five largest heat pump occupations (2020-2024)



The impact of lower enrolment since the pandemic has had a delayed effect on the number of achievements which we are witnessing today. As many training courses take several years to complete, achievements in recent years have fallen. However, they are gradually recovering, as shown in Figure 2.

Achievements in subjects relevant to the five largest heat pump occupations were significantly lower in 2020 compared to subsequent years. The sharp increase in achievements observed in 2021 suggests that many training completions originally scheduled for 2020 were delayed due to the pandemic. Following this 2021 rebound, achievements across all five occupations dipped significantly after 2021 due to the slowdown in enrolments in the previous years. Encouragingly, this trend now appears to be gradually reversing, indicating a potential recovery in the training pipeline.

Figure 2: Educational achievements in subject areas relevant to the five largest heat pump occupations (2020-2024)

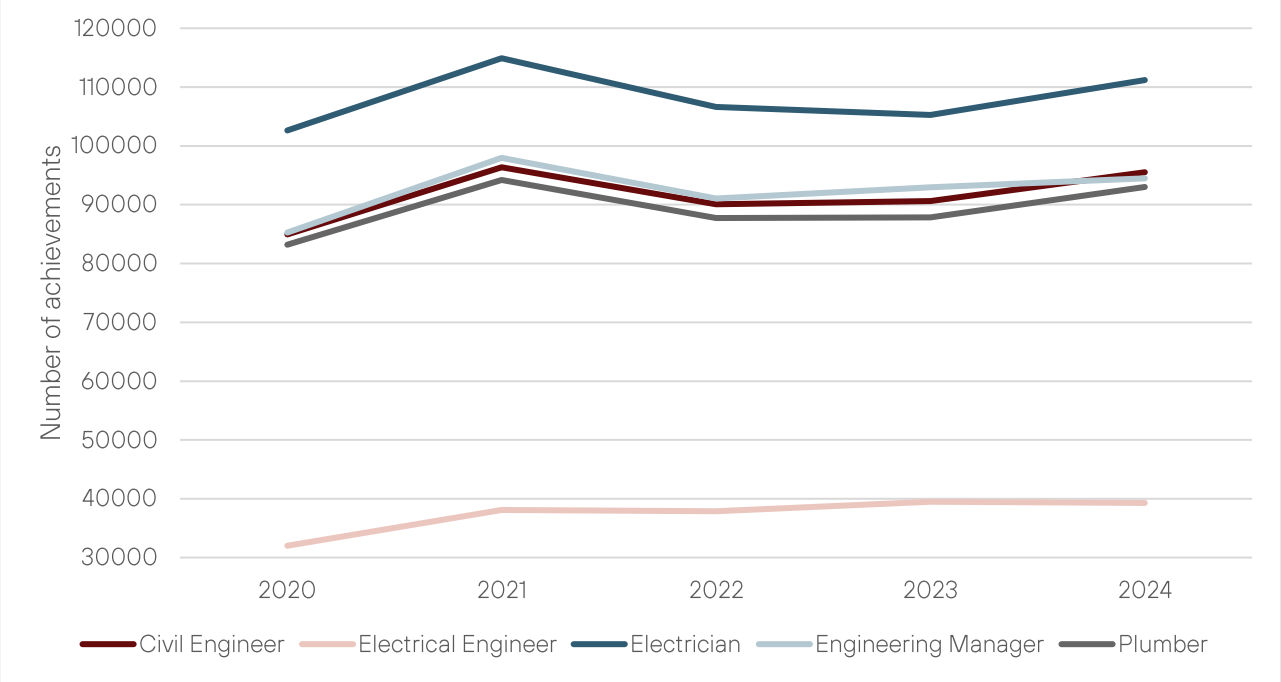


Table 4 below shows the regional variations in enrolments and achievements, revealing that achievements in certain subject areas are highly localised. In 2024, achievements in architecture were most concentrated in the East of England (25% of all architecture achievements). Building and construction saw the most achievements in the North West (17%), whereas engineering and transport operations and maintenance had the most achievements in the West Midlands (16% and 18% respectively). Additionally, London accounted for 18% of business management achievements, and the North East represented 21% of achievements in manufacturing technologies.

Table 4: Educational enrolments and achievements by region (2025)

Region	Enrolments	Achievements
East Midlands	51,935	5,465
East of England	64,116	5,404
London	81,413	8,218
North East	37,294	5,763
North West	10,7929	9,914

South East	97,257	7,597
South West	68,162	6,336
West Midlands	81,903	8,925
Yorkshire and The Humber	69,535	6,993

Apprenticeships

Due to limitations in the data – especially for the two most relevant apprenticeships: the low-carbon heating technician apprenticeship and the plumbing and domestic heating technician apprenticeship – the number of achievements in many apprenticeship standards is unavailable. Additionally, enrolment data is unavailable on the apprenticeship level. Out of the five largest heat pump occupations, 17 out of the 35 relevant apprenticeships have achievement data available, as shown in Table 5.

Table 5: Apprenticeships relevant to the five largest heat pump occupations

LOT occupation	Apprenticeship
Civil engineer	Building services engineer
Electrical engineer	Electrical or electronic technical support engineer (degree)
	Power engineer (integrated degree)
Electrician	Highway electrical maintenance and installation operative
	Highways electrician or service operative
	Building services engineering technician 2022
	Building services engineering installer
	Electrical, electronic product service and installation engineer
	Installation and maintenance electrician
	Dual fuel smart meter installer

	Engineering fitter
	Lightning protection operative
	Marine electrician
Engineering manager	Manufacturing manager (integrated degree)
	Process leader
Plumber	Gas engineering operative
	Gas network operative

Table 6 shows the number of apprenticeship achievements in standards relevant to the five largest heat pump occupations. Achievements were the highest in apprenticeships relevant to the electrician occupation, exceeding 4,300. This reflects the requirement for electricians to complete a formal training programme – such as an apprenticeship – rather than a university degree. Apprenticeships relevant to electrical engineering had the lowest achievement levels in 2024, with just 49. Low achievement rates in engineering-related apprenticeships more broadly are largely attributable to the fact that these pathways typically require a university degree. Many of the relevant apprenticeship occupations are degree-apprenticeships, which are relatively new and still have low uptake amongst students.

Table 6: Apprenticeship achievements in the five largest heat pump occupations (2024)

LOT occupation	Apprenticeship achievements
Civil engineer	86
Electrical engineer	49
Electrician	4,362
Engineering manager	71
Plumber	691