# Hertfordshire's Green Economy

## Low Carbon Environmental Goods and Services Sector

**July 2023** | Report commissioned by Hertfordshire LEP and Herts IQ

# About the Authors

## kMatrix Data Services

kMatrix provides market intelligence to companies, governments and universities worldwide, specializing in hard-to-measure markets, and offering detailed quantitative and qualitative market analysis using the language of the industry.

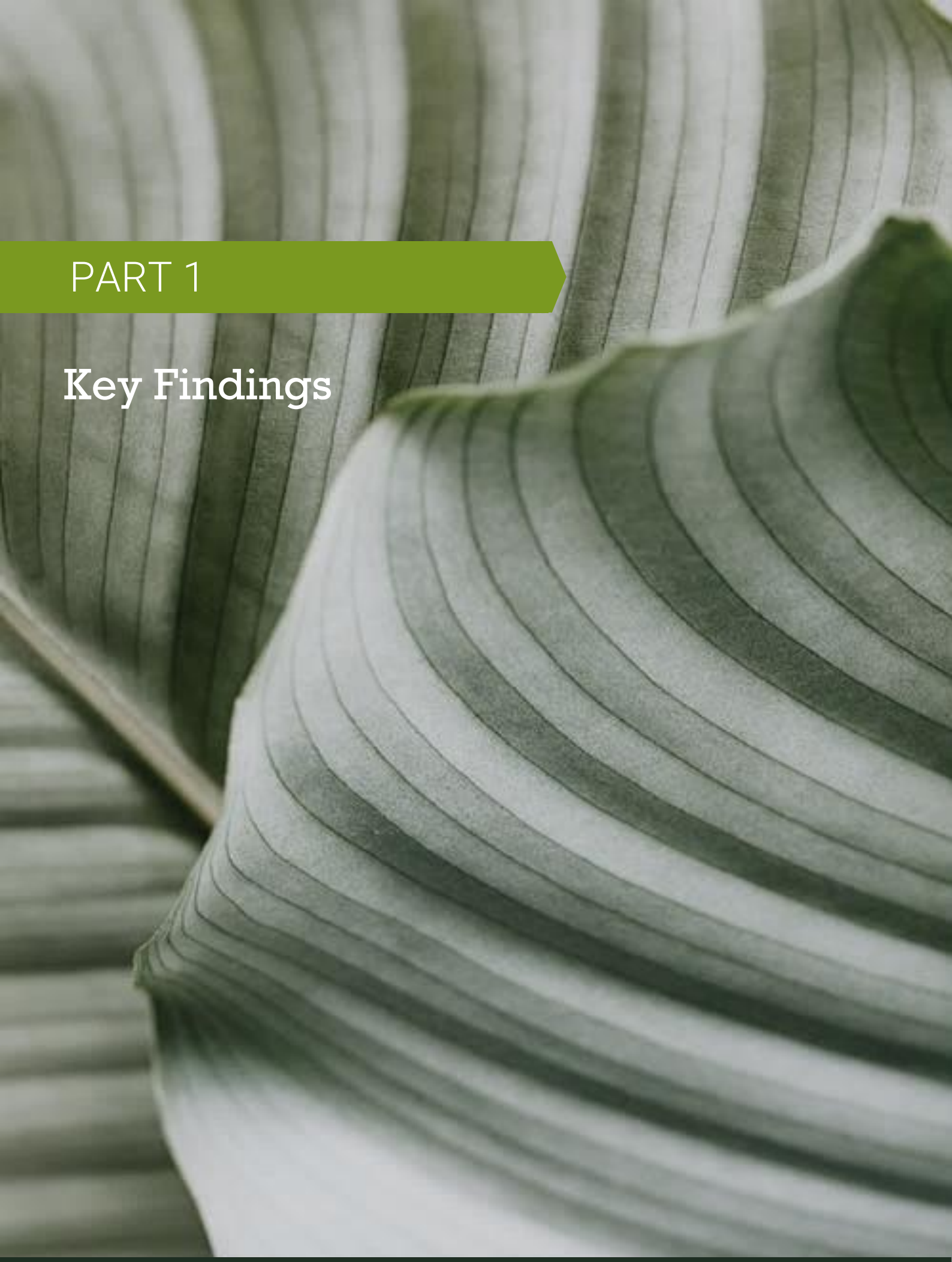
Using a unique multi-source data triangulation methodology which has been in the market place for over 35 years, economic and business data is transformed into actionable intelligence and programmes of business support to improve competitive performance both in domestic and international markets.

This service is applied to a range of scenarios, from independent appraisal of the technological, market, product or operational opportunities and risks associated with an investment prospect, through to authoritative, multi-source and multi-factor analysis for decision making about the development and commercialization of technology.

Within the private sector, corporate development support is provided to global companies, such as identification of commercialization opportunities.

Our Competitive Industry and Market Intelligence is designed for public, private and financial sector clients. Where we assemble, calculate and analyse competitive data on markets, sales, imports, exports and growth for all of the major global economies at a detailed product/service level for a range of industries and sectors. This service allows clients to identify, assess and quantify current and future market opportunities.

## Disclaimer



PART 1

# Key Findings

## Study Overview in Brief:

This market intelligence study provides quantification of the Low Carbon Environmental Goods and Services sector for Hertfordshire.

It is not intended as a policy document but provides data in evidence through a snapshot of the market across a 3-year period, to be used alongside other studies and market intelligence reporting.

The intention of the study is not to answer every question, but to be a tool to understand what is present in Hertfordshire, from which to build further capacity. The dataset and reporting has been designed to provide data in evidence, to answer as many questions as possible within the study boundaries, and to provide data at a level of granulation to enable it to answer most questions not yet asked, e.g., it will provide detail on some aspects of the Circular Economy, such as waste and recycling, but doesn't measure the entire ecosystem.

The focus of the snapshot is the historic market (2019/20 to 2021/22) and four-year forecasts to 2025/26, which indicate the industry interpretation of current policy, giving insight into the current expectation of market trajectory by industry itself.

## What the dataset measures:

The data provides a snapshot of the market for goods and services which improve the environment and/or actively assist in the move to net zero. It measures the goods and services regardless of *where* they are used, e.g., solar panels on a hospital roof are included.

## What the dataset does not measure:

It does not count those activities which the green economy is *applied to*, e.g., the hospital needs to use the solar panels to reach net zero, but the green economy does not include the surgical team within healthcare.

A good analogy is Cybersecurity, which was a niche market 25 years ago, until awareness and need grew. It is now relevant to some extent across every aspect of society, with every online activity having some element of cybersecurity embedded, but not every activity is counted as cybersecurity. Likewise the Green Economy needs to be applied to the whole economy, but the whole economy is not counted in the Green Economy.

## LCEGS Concept:

Within LCEGS and this study, the dataset measures those products and services needed to reach net zero targets and other environmental activities, such as waste water treatment etc.

## Highlighted Key Findings

Key characteristics of the Low Carbon Environmental Goods and Services Sector in Hertfordshire, which was worth £5.8bn in Sales to Hertfordshire's economy in 2021/22, with over 2,000 businesses and employed over 40,000 people, are included in this section.

- **Level 1 Sub-sector Headline Figures**

The performance of the six Level 1 sub-sectors by Sales, Employment and Number of Companies in 2021/22 was:

- Low Carbon (LC) – £2,593m in Sales, 17,741 Employees and 1,026 Companies
- Renewable Energy (RE) – £1,957m in Sales, 13,427 Employees and 742 Companies
- Environmental (E) – £1,125m in Sales, 7,032 Employees and 359 Companies
- District Heat Networks (DHNW) – £26m in Sales, 1,539 Employees and 13 Companies
- Green Infrastructure & Nature Based Solutions (GI&NBI) – £38m in Sales, 259 Employees and 17 Companies
- Sustainable Food Production (SFP) – £103m in Sales, 365 Employees and 11 Companies

- **Top Twelve Level 2 Sub-sectors**

The top twelve sub-sectors (out of a total of 36) by Sales in 2021/22 are:

- Alternative Fuels (LC) – £810m in Sales, 5,277 Employees and 323 Companies
- Wind (RE) – £804m in Sales, 4,391 Employees and 266 Companies
- Building Technologies (LC)– £717m in Sales, 5,849 Employees and 303 Companies
- Alternative Fuel Vehicle (LC) – £665m in Sales, 4,232 Employees and 253 Companies
- Geothermal (RE) – £424m in Sales, 3,504 Employees and 188 Companies
- Photovoltaic (RE) – £323m in Sales, 2,521 Employees and 138 Companies
- Energy from Waste (E) – £322m in Sales, 1,093 Employees and 35 Companies
- Biomass (RE) – £276m in Sales, 1,989 Employees and 92 Companies
- Recovery & Recycling (E) – £264m in Sales, 1,784 Employees and 107 Companies
- Water & Waste Water Treatment (E) – £255m in Sales, 1,985 Employees and 101 Companies
- Waste Management (E) – £174m in Sales, 1,325 Employees and 70 Companies
- Carbon Finance (LC) – £148m in Sales, 395 Employees and 33 Companies

- **Hertfordshire's LCEGS2023 as a Proportion of GDP**

Comparisons with the latest GDP data released by the ONS for Local Authority GDP, which is for 2020, are with LCEGS2023 Sales for the fiscal year 2020/21 (not 2021/22 as per the rest of the report), for comparative purposes.

Hertfordshire's LCEGS2023 2020/21 Sales of £5.6bn accounted for 12.4% of Hertfordshire's

£44.8bn GDP in 2020[1]. This compares with the UK LCEGS2023 2020/21 Sales of £244.8bn which accounted for 11.4% of the UK's £2,144.7bn GDP in 2020.

Four of the five largest Level 2 sub-sectors in Hertfordshire contribute a larger proportion of GDP than the UK average, with the largest three within the Low Carbon Level 1 sub-sector. These are contributing a larger proportion than the national average, with none demonstrating significant scalability barriers, and so should be considered strengths. They are:

| **Level 2 Sub-sector (Ordered by 2020/21 Sales)** | **Hertfordshire 2020/21 Sales as % of Hertfordshire GDP** | **UK 2020/21 Sales as % of UK GDP** |
|---|---|---|
| Alternative Fuels (£767m) | 1.7% | 1.4% |
| Building technologies (£695m) | 1.6% | 1.3% |
| Alternative Fuel Vehicle (£630m) | 1.4% | 1.2% |
| Geothermal (£398m) | 0.9% | 0.7% |

- **Hertfordshire's LCEGS2023 Resilience to the Economic Shock of the Covid-19 Pandemic**

By 2021/22, the LCEGS2023 sector in Hertfordshire saw 94.7% recovery in Sales from the economic shock of the Covid-19 pandemic, which is in line with the UK average (also 94.7%).

Although the contraction of the sector was similar to the UK average across the 3-year reporting period, 20 of the 36 Level 2 sub-sectors performed marginally better than the UK. Most sub-sectors contracted in-line with the UK average, however, there is some deviation from the national average within some small sub-sectors. Deviation is not as significant as some other areas of the country, which vary by 3 percentage points or more. Level 2 sub-sectors with less contraction in Sales than the UK and could be more resilient than the UK include:

- Carbon Capture & Storage accounts for only 0.3% of sector Sales in Hertfordshire (0.3% UK average) and contracted by -5.8% vs. the UK average of -6.0%
- Hydro accounts for only 0.3% of sector Sales in Hertfordshire (0.2% UK average) and contracted by -5.8% vs. the UK average of UK -6.4%
- Wave & Tidal accounts for only 0.1% of sector Sales in Hertfordshire (0.1% UK average) and contracted by -2.7% vs. the UK average of UK -3.4%
- Contaminated Land accounts for only 0.5% of sector Sales in Hertfordshire (0.5% UK average) and contracted by -5.9% vs. the UK average of UK -6.5%
- Biodegradable Food Packaging accounts for only 0.04% of sector Sales in Hertfordshire (0.04% UK average) and contracted by -5.5% vs. the UK average of UK -5.9%

One medium-sized sub-sector saw growth across the three-year reporting period:

- Carbon Finance accounts for 2.5% of sector Sales in Hertfordshire (9.1% UK average) grew by 1.1% (UK 2.2%) *

*Growth in Carbon Finance is potentially because of some activity moving out of London

[1] https://www.ons.gov.uk/economy/grossdomesticproductgdp/datasets/regionalgrossdomesticproductlocalauthorities

- **Forecast Sales**

The LCEGS2023 sector in Hertfordshire is forecast to see consistent growth in Sales of 5.8% growth between 2021/22 and 2022/23, growing year-on-year to reach 12.1% growth between 2024/25 and 2025/26. This compares with UK sector growth of 6.4% growth between 2021/22 and 2022/23, growing year-on-year to reach 12.9% growth between 2024/25 and 2025/26. The stronger growth forecasts for the UK are due to the size and nature of the sector in London.

Sales in Hertfordshire's LCEGS2023 sector are forecast to grow from £5.8bn in 2021/22 to £8.3bn in 2025/26.

- **Potential LCEGS Employment in Hertfordshire in order for the County to Reach Net Zero Targets**

Forecasts to reach net zero indicate employment requirements needing to increase by 20-30 times from current levels, from 40,000 across the whole sector 2021/22 to at least 770,000 without policy, and up to 1.2 million people with current policy[2] employed in 2050 under a net zero scenario, representing significant employment potential under national Government targets.

Employment forecasts estimate the ***total employment required for Hertfordshire to meet Net Zero in 2050***; in the core sector and the chains and networks of supply, which might be outside of Hertfordshire.

How Hertfordshire's sector responds to the opportunity presented by Net Zero, will determine the ***proportion of this expected employment to be based in Hertfordshire itself***. *

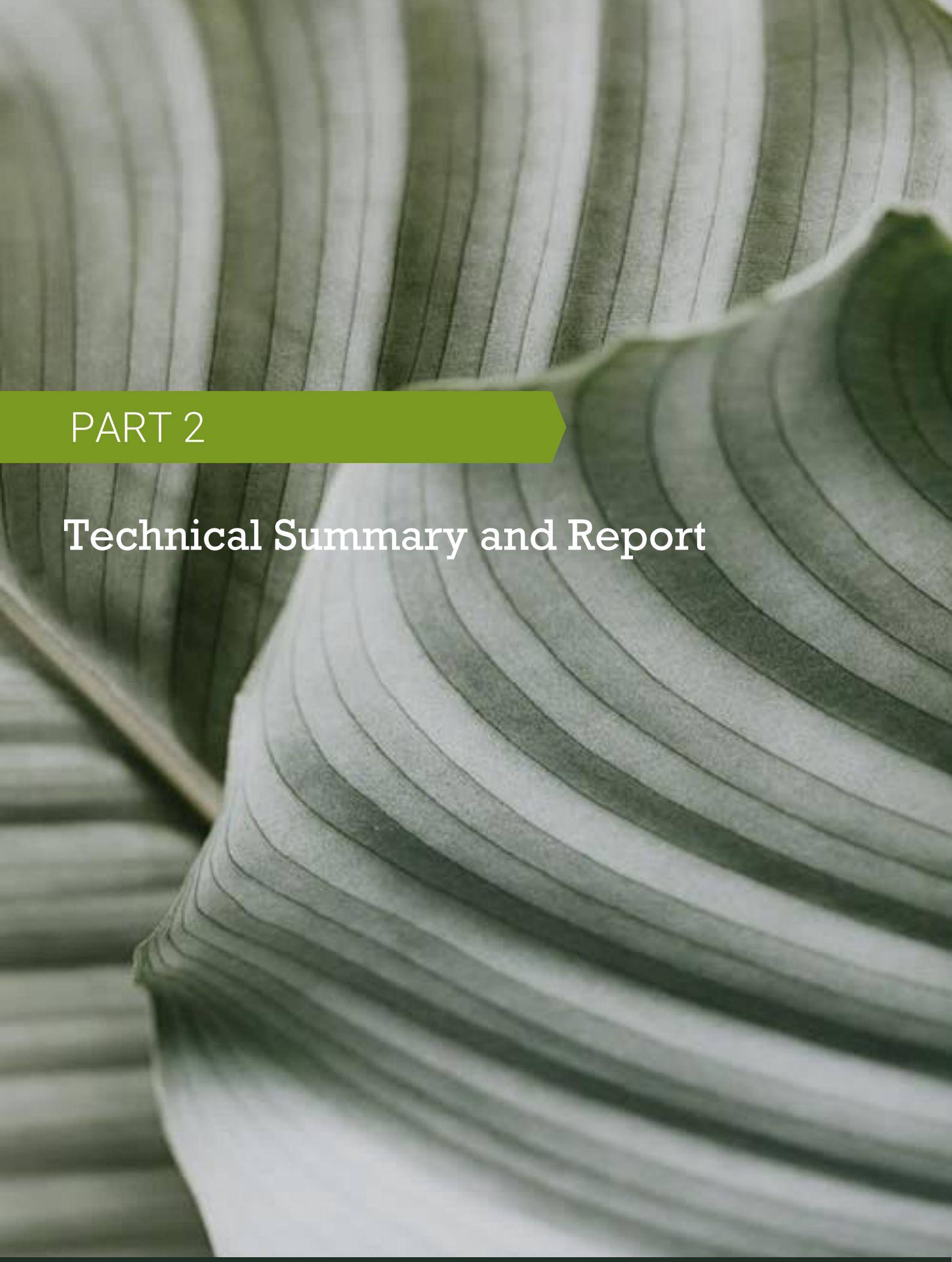
*See page 37 for more detail

- **Relevance of LCEGS and the Hertfordshire Innovation Quarter**

The synergies between the largest Level 2 LCEGS sub-sectors (such as Alternative Fuels, Wind, Building Technologies, Alternative Fuel Vehicles etc.) within the county, and opportunities for Green Economy businesses to locate to Herts IQ provide clear competitive opportunities.

Other sub-sectors that could benefit from a focus in Hertfordshire also include Carbon Finance, which has historically been located in London with 97% of the sector located in the Capital in 2017/18, which had reduced to 92% by 2019/20, indicating the expansion of the sub-sector into other areas of the country. Hertfordshire is ideally suited to taking advantage of this trend, with the benefits of being close to London and major transport routes, but with more a more competitive cost base and strong existing financial services presence.

[2] Forecasting description on page 37



PART 2

# Technical Summary and Report

## Contents

## Study Overview and Definitions

### Evolution of the LCEGS taxonomy to LCEGS2023

This study was commissioned by Hertfordshire Local Enterprise Partnership to provide a baseline analysis and growth potential of Hertfordshire's Green Economy. The overriding aim of the study is to provide data in evidence for the Green Economy in Hertfordshire.

### History of the LCEGS Dataset

The LCEGS taxonomy includes 2,769 activities from across the economy which provides goods or services which contribute to the reduction in carbon, improve energy efficiency, provide renewable energy or environmental benefits. It has been used by the Department for Business Innovation and Skills (which became the Department for Business, Energy & Industrial Strategy[3]) and then continued by Greater London Authority, providing continuous reporting of the UK and London since 2007/08. Alongside this timeline data, Greater Manchester has commissioned LCEGS measurements for the last nine years, and several Local Enterprise Partnerships across England have commissioned their own reports, culminating in 2020 with the Midlands Energy Hub (now Midlands Net Zero Hub) commissioning detailed reporting for the 65 Local Authorities, within 9 LEPs of the Midlands Net Zero Hub area.

The continued reporting of the same definition has the benefit of longevity, has been rigorously tested and is widely accepted as a robust definition of the sector. It allows comparison of market across the UK, because the same activities are measured. Despite these advantages, the LCEGS dataset does have limitations due to its longevity, ironically because of the market desire for directly comparable datasets, i.e., how and when do you or can you update the definition?

The LCEGS definition was developed in 2008, when Air Source Heat Pumps, Electric Vehicles, Hydrogen and District Heat Networks were niche, low value markets. Although elements of all of these markets are within LCEGS, they are not easy to find and, in some cases, such as Electric Vehicles, measured economic output is limited to early-stage activities such as R&D and Manufacture, missing the more developed-market activities of supply and maintenance, which are an aspect of the same market in 2022.

### The Introduction of the LCEGS2023 Dataset

The LCEGS dataset was updated through work with Glasgow City Council in the Autumn of 2022, establishing the LCEGS2022 dataset. The dataset has been further extended within this study to include Sustainable Food Production and Energy from Waste, resulting in an updated LCEGS dataset, referred to a LCEGS2023. Within this dataset, there are 6 Level 1 sub-sectors: Low Carbon, Renewable Energy, Environmental, District Heat Networks, Green Infrastructure & Nature Based Solutions and Sustainable Food Production. Collectively, these now encompass 36 Level 2 sub-sectors.

LCEGS2023 extends the LCEGS dataset from 2,769 to 5,133 activities, through the addition of District Heat Networks, Green Infrastructure & Nature Based Building and Sustainable Food Production at Level 1. Existing Level 1 sub-sectors Low Carbon, Renewable Energy and Environmental have been extended to include more detailed activities.

The implication of the taxonomy development is to provide a standard definition of the sector, with bespoke reporting for clients. The dataset used is thus the most up to date and relevant to

[3] From February 2023 the British Government made changes, disbanding the Department for Business, Energy & Industrial Strategy during Departmental re-structuring. LCEGS activities are now relevant to three of the four new Departments: Department for Energy Security & Net Zero; Department for Science, Innovation and Technology; and Department for Business and Trade.

Hertfordshire and the UK. Further detail on the taxonomy is provided in Section 1, with full description in Appendix 1.

The kMatrix methodology is based around the production of a taxonomy, similar to that used for biological taxonomic ranking, with similar products and services being grouped together. In Table 1a, the LCEGS2023 sector is broken down into six Level 1 sub-sectors, one of which is Renewable Energy, which is in turn broken down into eight Level 2 sub-sectors, one of which is Wind, that is then broken down into a further five Level 3 sub-sectors, then Level 4 and so on:

**Table 1a: LCEGS2023 Sector Disaggregated into the First Two Levels of Sub-sector:**

| Sector | Level 1 | Level 2 | Level 3 |
|---|---|---|---|
| **LCEGS2023** | Low Carbon | Additional Energy Sources | 9 sub-sectors |
| | | Alternative Fuel Vehicle | 2 sub-sectors |
| | | Alternative Fuels | 6 sub-sectors |
| | | Building Technologies | 4 sub-sectors |
| | | Carbon Capture & Storage | 11 sub-sectors |
| | | Carbon Finance | 5 sub-sectors |
| | | Energy Management | 6 sub-sectors |
| | | Nuclear Power | 7 sub-sectors |
| | Renewable Energy | Air Source Heat Pumps | 3 sub-sectors |
| | | Biomass | 5 sub-sectors |
| | | Geothermal | 3 sub-sectors |
| | | Hydro | 4 sub-sectors |
| | | Photovoltaic | 5 sub-sectors |
| | | Renewable Consultancy | 2 sub-sectors |
| | | Wave & Tidal | 6 sub-sectors |
| | | Wind | 5 sub-sectors |
| | Environmental | Air Pollution | 6 sub-sectors |
| | | Contaminated Land | 2 sub-sectors |
| | | Energy from Waste | 11 sub-sectors |
| | | Environmental Consultancy | 4 sub-sectors |
| | | Environmental Monitoring | 3 sub-sectors |
| | | Marine Pollution Control | 3 sub-sectors |
| | | Noise & Vibration Control | 3 sub-sectors |
| | | Recovery and Recycling | 18 sub-sectors |
| | | Waste Management | 4 sub-sectors |
| | | Water & Waste Water Treatment | 4 sub-sectors |
| | District Heat Networks | DHNW Construction & Maintenance | 5 sub-sectors |
| | | DHNW Energy Centres | 2 sub-sectors |
| | | DHNW Operation | 6 sub-sectors |
| | Green Infrastructure & Nature Based Solutions | Green Infrastructure | 5 sub-sectors |
| | | Nature Based Solutions | 2 sub-sectors |
| | Sustainable Food Production | Biodegradable Food Packaging | 1 sub-sector |
| | | Food Waste Reduction Activities | 2 sub-sectors |
| | | Low Carbon Agriculture | 3 sub-sectors |
| | | Low Carbon Meat Alternatives | 2 sub-sectors |
| | | Low Carbon Milk Alternatives | 2 sub-sectors |

This compartmentalisation of the sector, through Level 1 sub-sectors which are comprised of Level 2 sub-sectors which in turn comprise Level 3 sub-sectors, continues to Level 5, which are then split by activity codes. Activity codes enable the relative importance of different activities within sub-sectors to be demonstrated, for example, the significance of Manufacturing in Renewable Energy, where Manufacturing accounts for 39% of Sales, compared with Manufacturing in Low Carbon, which only accounts for 12% of Sales (Figure 8). Activity codes relevant to the different Level 1 sub-sectors are provided in table 1b:

**Table 1b: LCEGS2023 Level 1 Sub-sectors with Constituent Activity Codes:**

| Level 1 Sub-sector | Activity Codes Applied at Level 5 |
|---|---|
| Low Carbon | Consulting |
| | Engineering Services |
| | Fuel Production |
| | Fuel Supply & Distribution |
| | Installation |
| | Maintenance |
| | Manufacture |
| | R&D |
| | Services |
| | Software |
| | Supply |
| | Training |
| Renewable Energy | Consulting |
| | Engineering Services |
| | Installation |
| | Maintenance |
| | Manufacture |
| | R&D |
| | Services |
| | Software |
| | Supply |
| | Training |
| Environmental | Consulting |
| | Engineering Services |
| | Installation |
| | Maintenance |
| | Manufacture |
| | R&D |
| | Recycling & Resale |
| | Services |
| | Software |
| | Supply |
| | Training |

| | |
|---|---|
| District Heat Networks | Consulting Services |
| | Installation |
| | Maintenance |
| | Manufacture |
| | R&D |
| | Services |
| | Supply |
| | Training |
| Green Infrastructure and Nature Based Solutions | Consulting |
| | Engineering Services |
| | Installation |
| | Maintenance |
| | Manufacture |
| | R&D |
| | Services |
| | Supply |
| | Training |
| Sustainable Food Production | Consulting |
| | Engineering Services |
| | Installation |
| | Maintenance |
| | Manufacture |
| | R&D |
| | Services |
| | Supply |
| | Training |

## Hertfordshire's Economic Overview

Over the past ten years Hertfordshire LEP has developed a strong strategic approach for Hertfordshire.

Through successive strategic statements – including an early Growth Strategy (in 2011/12); a Strategic Economic Plan (in 2014, and then updated in 2017); a draft Local Industrial Strategy (2019); and the Hertfordshire Recovery Plan (2020); real opportunities have been identified to benefit businesses and communities across Hertfordshire, but also both the risks and the responsibilities that come with them. Post pandemic and outside the EU, strategic statements are being developed that will guide the County through to the 2030s. Technological change will continue apace but environmental considerations will be prominent as will commitments to inclusivity. Economic growth will still be essential, but will increasingly need to be led through partnerships, working with neighbouring areas, and across key clusters. Clean growth, inclusive growth, and growth which embraces the possibilities of digital technology in an informed and responsible manner will become essential rather than desirable.

Integral to emerging strategies will be the Green Economy and the Low Carbon Environmental Goods and Services (LCEGS) sector. Alongside our existing sector strengths (Agri-tech, Life Sciences (particularly Cell and Gene Therapy) Advanced Manufacturing and Film and TV production, businesses in the Green Economy will become increasingly important, linked as they are to greater sustainability.

To deliver and grow a greener economy and support Hertfordshire's Zero Carbon 2050 target the LEP has produced 'Toward Net Zero – A Strategy for Clean Growth in Hertfordshire'.

The overarching goal of this new strategy is to enable clean growth and achieve a greener, more sustainable, economy across Hertfordshire. The Clean Growth Strategy's first pillar of activity is concerned with accelerating enterprise and innovation, collaboration, and skills development to grow and attract the Low Carbon Environmental Goods and Services sector (LCEGS). Currently, the scale and character of the LCEGS sector in Hertfordshire is not well understood and if we are to grow our existing LCEGS and/or attract new LCEGS businesses to Hertfordshire effectively, we first need to fully understand Hertfordshire's current LCEGS economic environment, including its scale and character. This will allow us to bring the full range of the LEP's levers to bear, unlocking Hertfordshire's green economy potential and supporting this sector's growth.

To support its Clean Growth Programme, and Herts IQ's (Hertfordshire's Innovation Quarter) low carbon environment clustering activities, Hertfordshire has commissioned this deep-dive economic analysis research study of Hertfordshire's LCEGS sector.

The output from this work will be to provide a comprehensive research-based report outlining the scale, growth potential and specialisms for the Low Carbon Environmental Goods and Services sector (LCEGS) within the Hertfordshire LEP area. The report should be suitable to be included in the evidence base for future local sector growth plans, support Herts IQ's clustering role, and allow Hertfordshire to benchmark and compare this market sector in future years.

This report comprises of a quantitative analysis of LCEGS in Hertfordshire area showing its scale (such as value, number of companies, number of employees), composition (including Hertfordshire's main sub sector strengths and weaknesses), and growth potential within the UK and global marketplace. The analysis shows historical market size comparisons with the UK and the scope and scalability potential of the sector in Hertfordshire. The report will inform what is required to support sector growth and identify opportunities and corresponding actions that the LEP and Partners can facilitate to build our competitive advantages.

## Technical Summary

Hertfordshire's Low Carbon and Environmental Goods and Services (LCEGS2023) sector was worth £5.8bn to Hertfordshire's economy in 2021/22, as indicated by the value of sales in the sector. These sales were generated by over 2,000 businesses that employed over 40,000 people in the sector in 2021/22.

**Note:** Sales in this report refer to economic activity by companies and their supply chain, delivered from Hertfordshire and is comparable to turnover, excluding publicly funded research, pre-commercial consumption of funds, except where those result in the purchase of products or services from third parties

This Executive Summary includes the following sections:

- Sector Sales and Growth
- Sector Employment and Growth
- Number of Companies and Growth in the Sector
- Sector Investment
- Hertfordshire's Sector as a Proportion of GDP
- Sector Split by Activity Code
- Hertfordshire's Level 1 Sub-sector (Sales, Employees and Companies)
- Hertfordshire's Level 2 Sub-sector Strengths
- Level 2 Sub-sector Contraction/Growth and Economic Recovery
- Level 2 Sub-sector Strengths and Weaknesses
- Potential Employment Growth to Net Zero 2050
- Scalability of Level 2 Sub-sectors
- Hertfordshire's Exports
- Hertfordshire's Imports
- Exports Imports Compared
- Looking Forward – Sub-sectors of Strategic Importance

**Sector Sales and Growth**

The Low Carbon and Environmental Goods and Services sector in the Herts LEP contracted between 2019/20 and 2020/21, from £6.2bn to £5.6bn and then grew to £5.8bn between 2020/21 and 2021/22, representing 94.7% recovery of sales after the economic shock.

The contraction was of -10.1% during the financial year 2019/20 to 2020/21, with growth of 4.8% during 2020/21 to 2021/22. This is consistent with UK sales growth in LCEGS, which was -9.8% (2019/20 to 2020/21) and 5.0% during 2020/21 to 2021/22; a 94.7% recovery.

**Sector Employment and Growth**

Employment in Hertfordshire's Low Carbon and Environmental Goods and Services sector was 44,335 in 2019/20, it then contracted to 38,973 in 2020/21 before recovering to 40,364 in 2021/22, representing 91.0% recovery of employment after the economic shock.

Annual growth rate in employment was -12.1% between 2019/20 and 2020/21 and 3.6% between 2020/21 and 2021/22. In comparison, UK Employment growth in LCEGS was -12.1%

and 3.7% with a 91.2% recovery.

**Number of Companies and Growth in the Sector**

The number of companies in Hertfordshire's Low Carbon and Environmental Goods and Services sector was 2,368 in 2019/20, which contracted to 2,053 in 2020/21 before recovering to 2,169 in 2021/22, representing a 91.6% recovery in number of companies after the economic shock.

Annual growth rate in the number of companies was -13.3% between 2019/20 and 2020/21 and 5.7% between 2020/21 and 2021/22. In comparison, UK company growth in LCEGS was -13.5% and 5.9% with a 91.6% recovery.

**Sector Investment**

Investment within Hertfordshire was varied across the three categories of investment:

- Private Equity Investment contracted -0.6% from £1,561.5m in 2019/20 to £1,552.9m in 2020/21, and then contracted a further -0.9% to £1,539.2m in 2020/21
- Venture Capital Investment grew 1.8% from £1,983.3m in 2019/20 to £2,019.5m in 2020/21, and then contracted -1.2% to £1,994.7m in 2020/21.
- Other Investment grew 0.6% from £698.0m in 2019/20 to £693.3m in 2020/21, and then contracted -1.3% to £684.3m in 2020/21

**Note:** Other Investment refers to all other investment routes outside of Private Equity and Venture Capital, including government investment, philanthropic and ethical investment

**Hertfordshire's Sector as a Proportion of GDP**

This section compares the latest GDP data released by the ONS for Local Authority GDP, which is for 2020, with LCEGS2023 Sales for the fiscal year 2020/21 (not 2021/22 as per the rest of the report), for comparative purposes.

Hertfordshire's LCEGS2023 Sales in 2020/21 of £5.6bn accounted for 12.4% of Hertfordshire's £44.8bn GDP in 2020[4]. This compares with the UK LCEGS2023 2020/21 Sales of £244.8bn which accounted for 11.4% of the UK's £2,144.7bn GDP in 2020.

Four of the five largest Level 2 sub-sectors in Hertfordshire contribute a larger proportion of GDP than the UK average, with the largest three within the Low Carbon Level 1 sub-sector. These are contributing a larger proportion than the national average, with none demonstrating significant scalability barriers, and so should be considered strengths. They are:

| Level 2 Sub-sector (Ordered by 2020/21 Sales) | Hertfordshire 2020/21 Sales as % of Hertfordshire GDP | UK 2020/21 Sales as % of UK GDP |
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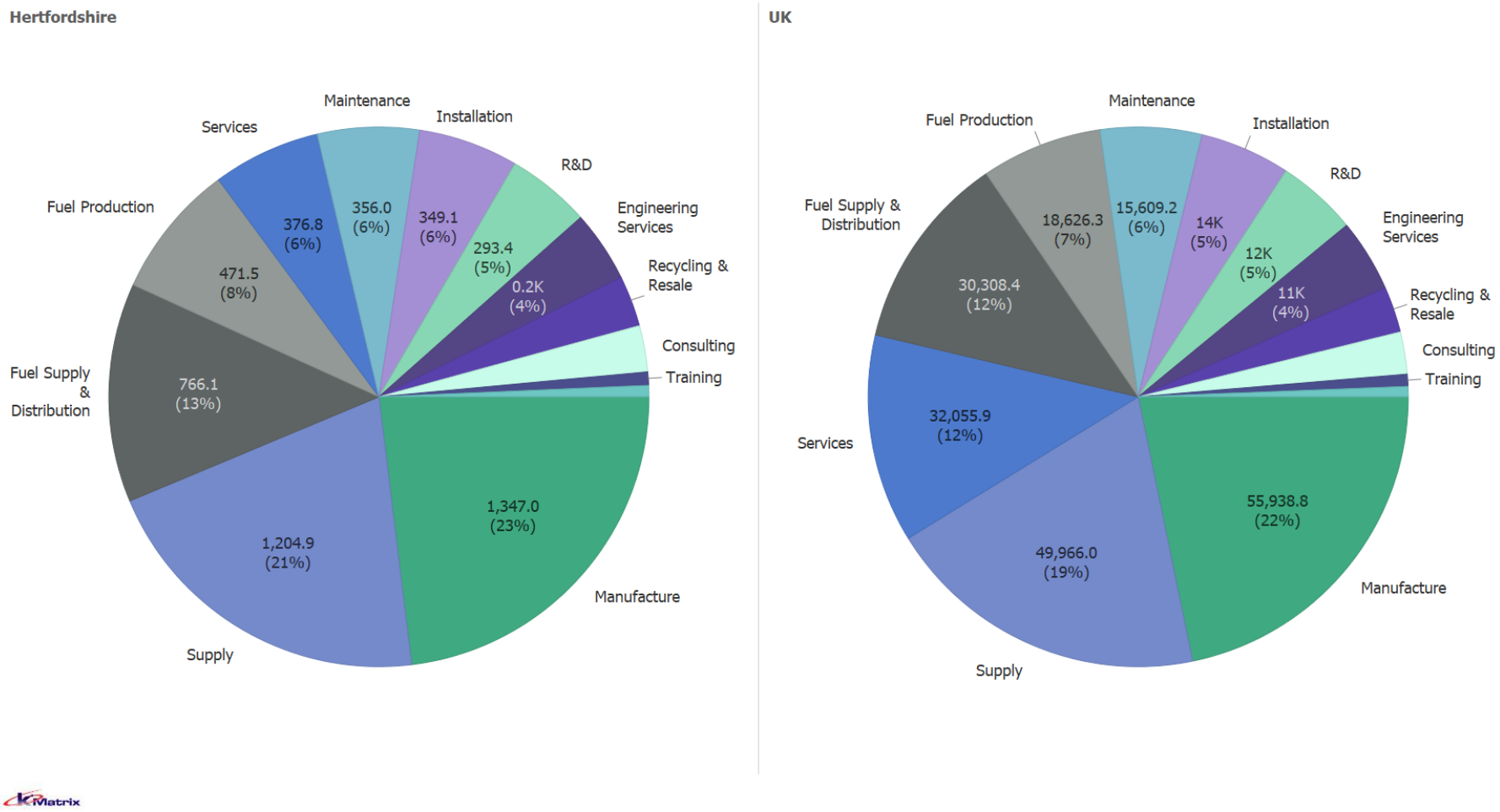
| Building technologies (£695m) | 1.6% | 1.3% |
| Alternative Fuel Vehicle (£630m) | 1.4% | 1.2% |
| Geothermal (£398m) | 0.9% | 0.7% |

[4] https://www.ons.gov.uk/economy/grossdomesticproductgdp/datasets/regionalgrossdomesticproductlocalauthorities

**Sector Split by Activity Code**

Hertfordshire's £5.8bn 2021/22 Sales in the LCEGS2023 Sector were comprised of 23% (£1.35bn) Manufacturing, 21% (£1.20bn) Supply, 13% (£766m) Fuel Supply & Distribution, 8% (472m) Fuel Production and 6% (377m) Services. Hertfordshire (left) is less strong than the UK (right) in Services which account for 6% of Sales in Hertfordshire and 12% in the UK but is stronger in Supply which accounts for 21% of Sales in Hertfordshire and 19% in the UK.



**Hertfordshire's Level 1 Sub-sector**

In 2021/22 Hertfordshire and the UK's Low Carbon and Environmental Goods and Services sector was made up by the following proportions:

| Level 1 Sub-sectors - Sales | Sales Split Hertfordshire | Sales Split UK |
|---|---|---|
| • Low Carbon | 44% | 47% |
| • Renewable Energy | 34% | 33% |
| • Environmental | 19% | 18% |
| • Sustainable Food Production | 2% | 1% |
| • Green Infrastructure & Nature Based Solutions | 1% | 1% |
| • District Heat Networks | ~0% | ~0% |

The Hertfordshire LCEGS2023 sector has a lower proportion of Low Carbon (by three percentage points) than the UK average due to the current size of the Carbon Finance sub-sector in London. The proportion of the UK Carbon Finance sub-sector located outside of London is growing, representing a potential opportunity for Hertfordshire. There is also a greater proportion of Sales in Geothermal (in Renewable Energy) and marginally stronger large Environmental sub-sectors than the UK average.

| Level 1 Sub-sectors - Employment | Employment Hertfordshire | Employment UK |
|---|---|---|
| • Low Carbon | 44% | 45% |
| • Renewable Energy | 33% | 34% |
| • Environmental | 17% | 16% |
| • District Heat Networks | 4% | 4% |
| • Sustainable Food Production | 1% | 1% |
| • Green Infrastructure & Nature Based Solutions | 1% | 1% |

The proportionality of Level 1 sub-sectors within Employment in Hertfordshire is within one percentage point of the sector average, indicating that the differences in proportion for Sales do not transfer through to Employment.

| Level 1 Sub-sectors – Number of companies | Companies Hertfordshire | Companies UK |
|---|---|---|
| • Low Carbon | 47% | 49% |
| • Renewable Energy | 34% | 34% |
| • Environmental | 17% | 15% |
| • Sustainable Food Production | 2% | ~0% |
| • Green Infrastructure & Nature Based Solutions | 1% | 1% |
| • District Heat Networks | 1% | 1% |

The proportionality of Level 1 sub-sectors for the number of Companies is within two percentage points of the UK average.

**Hertfordshire's Level 2 Sub-sector Strengths**

The six largest Level 2 sub-sectors in the Low Carbon and Environmental Goods and Services sector by Sales account for 64% of the Hertfordshire's LCEGS2023 Sales (Shaded blue in the table below), and the next twelve largest Level 2 sub-sectors account for a further 32% of Hertfordshire's LCEGS2023 Sales. Collectively, these eighteen sub-sectors account for 96% of Hertfordshire's LCEGS2023 Sales and are:

| Sales Ranking | Level 2 Sub-sector | 2021/22 | Description |
|---|---|---|---|
| 1 | **Alternative Fuels** (Low Carbon) | Sales: £810m<br>Employees: 5,277<br>Companies: 323 | Includes R&D functions, alternative fuel providers, designers and consultancy, process implementation, sales and accounting and application development specialists |
| 2 | **Wind** (Renewable Energy) | Sales: £804m<br>Employees: 4,391<br>Companies: 266 | Includes manufacture, supply, installation and maintenance of systems components, grid entry cables, insulators and fittings, switching systems and towers and gantries, central controls systems and integration systems, along with energy management consulting services and production of publications |
| 3 | **Building Technologies** (Low Carbon) | Sales: £717m<br>Employees: 5,849<br>Companies: 303 | Includes building systems design and consultancy and building systems providers and installers |
| 4 | **Alternative Fuel Vehicle** (Low Carbon) | Sales: £665m<br>Employees: 4,232<br>Companies: 253 | Include selling agencies, alternative fuel development companies and consulting and applications development for vehicle conversion specialists |
| 5 | **Geothermal** (Renewable Energy) | Sales: £424m<br>Employees: 3,504<br>Companies: 188 | Includes mid-chain sub-componentry manufacture and supply, along with whole systems assembly and supply. Also includes lateral geothermal systems providers and installers at the domestic and small commercial level, and vertical control systems developers and supplier |
| 6 | **Photovoltaic** (Renewable Energy) | Sales: £323m<br>Employees: 2,521<br>Companies: 138 | Includes systems developers, providers and installers, along with manufacturing of frames and ancillary equipment |
| 7 | **Energy from Waste** (Environmental) | Sales: £322m<br>Employees: 1,093<br>Companies: 35 | Includes Energy Extraction Processes, Mechanical and Biological Treatment (MBT), Pre-treatment, Autoclaving, Incineration, Gasification, Conversion Treatment, Waste Incineration Directive (WID) Compliant Biomass and Pyrolysis |

| | | | |
|---|---|---|---|
| 8 | **Biomass**<br>(Renewable Energy) | Sales: £276m<br>Employees: 1,989<br>Companies: 92 | Includes manufacture of biomass mid-chain and processing equipment, developers, installers and consultancies |
| 9 | **Recovery and Recycling**<br>(Environmental) | Sales: £264m<br>Employees: 1,784<br>Companies: 107 | Includes waste collection, glass stock processing and paper feedstock processing |
| 10 | **Water & Waste Water Treatment**<br>(Environmental) | Sales: £255m<br>Employees: 1,985<br>Companies: 101 | Includes development and implementation by utilities along with supply, consultancy and implementation by independent consulting engineers |
| 11 | **Waste Management**<br>(Environmental) | Sales: £174m<br>Employees: 1,325<br>Companies: 70 | Includes process development and new process implementation and consulting, public and private operations management and supply and installation of operational equipment |
| 12 | **Carbon Finance**<br>(Low Carbon) | Sales: £148m<br>Employees: 395<br>Companies: 33 | Includes financial advisory organisations who then connect to carbon trading houses, in London and other financial centres |
| 13 | **Energy Management**<br>(Low Carbon) | Sales: £106m<br>Employees: 886<br>Companies: 51 | Includes registered gas engineers, measurement and control systems and fitting and maintenance |
| 14 | **Air Source Heat Pumps**<br>(Renewable Energy) | Sales: £97m<br>Employees: 755<br>Companies: 42 | Includes manufacturing of mid-chain componentry, supply of imported whole systems and consulting services, with some installation |
| 15 | **Nuclear Power**<br>(Low Carbon) | Sales: £78m<br>Employees: 586<br>Companies: 36 | Includes management operations, engineering services, consulting and other services |
| 16 | **Additional Energy Sources**<br>(Low Carbon) | Sales: £51m<br>Employees: 367<br>Companies: 20 | Includes predominantly R&D, with manufacturing, services and installation of Fuel Cells and Hydrogen produced through electrolysis |
| 17 | **Low Carbon Agriculture**<br>(Sustainable Food Production) | Sales: £45m<br>Employees: 165<br>Companies: 5 | Includes manufacture and supply of mid-chain componentry for predominantly Biogas Low Carbon Agricultural Vehicles, mainly Off-road Utility Vehicles, with some Tractors and Large Farm Vehicles |

| | | | |
|---|---|---|---|
| 18 | **Green Infrastructure**<br>(Green Infrastructure and Nature Based Solutions) | Sales: £34m<br>Employees: 242<br>Companies: 14 | Includes supply of aggregates, soil and planting materials, along with fish ladders, banks stabilization material etc. Note: this sub-sector is important for biodiversity |

**Level 2 Sub-sector Contraction/Growth and Economic Recovery**

Hertfordshire's six largest Level 2 sub-sectors by sales all contracted between 2019/20 and 2020/21 and then experienced some recovery between 2020/21 and 2021/22 for sales, number of employees and number of companies:

**Alternative Fuels**

- Sales in 2021/22 had recovered to 96% of their 2019/20 value after contracting from £841m to £767m, then growing to £810m (-8.8% then 5.6% growth)
- Number of Employees recovered to 91% of their 2019/20 value after contracting from 5,908 to 5,132, then growing to 5,277 (-13.1% then 2.8% growth)
- Number of Companies recovered to 92% of their 2019/20 value after contracting from 350 to 313, then growing to 323 (-10.6% then 3.1% growth)

**Wind**

- Sales in 2021/22 had recovered to 92% of their 2019/20 value after contracting from £874m to £770m, then growing to £804m (-11.8% then 4.3% growth
- Number of Employees recovered to 93% of their 2019/20 value after contracting from 4,708 to 4,182, then growing to 4,391 (-11.2% then 5.0% growth)
- Number of Companies recovered to 97% of their 2019/20 value after contracting from 275 to 244, then growing to 266 (-11.1% then 8.9% growth)

**Building Technologies**

- Sales in 2021/22 had recovered to 94% of their 2019/20 value after contracting from £762m to £695m, then growing to £717m (-8.8% then 3.1% growth),
- Number of Employees recovered to 89% of their 2019/20 value after contracting from 6,445 to 5,593 then growing to 5,849 (-13.2% then 4.6% growth)
- Number of Companies recovered to 88% of their 2019/20 value after contracting from 344 to 292, then growing to 303 (-13.2% then 4.6% growth)

**Alternative Fuel Vehicle**

- Sales in 2021/22 had recovered to 91% of their 2019/20 value after contracting from £729m to £630m, then growing to £665m (-13.6% then 5.6% growth),
- Number of Employees recovered to 95% of their 2019/20 value after contracting from 4,480 to 4,089, then growing to 4,232 (-8.7% then 3.5% growth)
- Number of Companies recovered to 93% of their 2019/20 value after contracting from 272 to 217, then growing to 253 (-20.2% then 16.8% growth)

**Geothermal**

- Sales in 2021/22 had recovered to 96% of their 2019/20 value after contracting from £443m to £398m, then growing to £424m (-10.1% then 6.4% growth
- Number of Employees recovered to 93% of their 2019/20 value after contracting from 3,785 to 3,341, then growing to 3,504 (-11.7% then 4.9% growth)
- Number of Companies recovered to 93% of their 2019/20 value after contracting from 202 to 180, then growing to 188 (-10.9% then 4.4% growth)

**Photovoltaic**

- Sales in 2021/22 had recovered to 96% of their 2019/20 value after contracting from £336m to £300m, then growing to £323m (-10.7% then 7.7% growth)
- Number of Employees recovered to 94% of their 2019/20 value after contracting from 2,690 to 2,304, then growing to 2,521 (-14.4% then 9.4% growth)
- Number of Companies recovered to 95% of their 2019/20 value after contracting from 146 to 130, then growing to 138 (-11.1% then 6.3% growth)

**Level 2 Sub-sector Strengths and Weaknesses**

Some Level 2 sub-sectors in Hertfordshire had less contraction in Sales across the three-year reporting period than the UK and should be considered strengths of the region:

- Carbon Capture & Storage accounts for only 0.3% of sector Sales in Hertfordshire (0.3% UK average) and contracted -5.1% (UK -6.0%)
- Hydro accounts for only 0.3% of sector Sales in Hertfordshire (0.2% UK average) and contracted -5.8% (UK -6.4%)
- Wave & Tidal accounts for only 0.1% of sector Sales in Hertfordshire (0.1% UK average) and contracted -2.7% (UK -3.4%)
- Contaminated Land accounts for only 0.5% of sector Sales in Hertfordshire (0.5% UK average) and contracted -5.9% (UK -6.5%)
- Biodegradable Food Packaging accounts for only 0.04% of sector Sales in Hertfordshire (0.04% UK average) and contracted -5.5% (UK -5.9%)

One sub-sector had significantly more contraction across the three-year reporting period than the UK:

- Food Waste Reduction Activities accounts for only 0.2% of sector Sales in Hertfordshire (0.1% UK average) contracted -6.6% (UK -5.6%)

One sub-sector saw growth across the three-year reporting period:

- Carbon Finance accounts for 2.5% of sector Sales in Hertfordshire (9.1% UK average) grew 1.1% (UK 2.2%)

**Note:** Although currently relatively small, Carbon Capture and Storage is a strategically important sub-sector to the UK Government, and significant to net zero targets.

Likewise, Biodegradable food Packaging is also a relatively small sub-sector, but integral to removing plastic packaging from the food chain and the associated market opportunity that presents.

Food Waste Reduction Activities are relevant to the move to net zero, but also to the current cost of living crisis, so contraction in this area could be of concern and should be monitored.

Although Carbon Finance has slower growth than the UK average, the UK average is higher due to the dominance of London, growth within Hertfordshire is illustrative of its competitiveness

**4-Year Sales Forecasts**

The LCEGS2023 sector in Hertfordshire is forecast to see consistent growth in Sales of 5.8% growth between 2021/22 and 2022/23, growing year-on-year to reach 12.1% growth between 2024/25 and 2025/26. This compares with UK sector growth of 6.4% growth between 2021/22 and 2022/23, growing year-on-year to reach 12.9% growth between 2024/25 and 2025/26. The stronger growth forecasts for the UK are due to the size and nature of the sector in London.

Sales in Hertfordshire's LCEGS2023 sector are forecast to grow from £5.8bn in 2021/22 to £8.3bn in 2025/26.

Sales for all Level 1 sub-sectors are forecast to grow year-on-year between 2021/22 and 2025/26:

- Renewable Energy: 59% growth in Sales from £2.0bn to £3.1bn
- Green Infrastructure and Nature Based Solutions: 47% growth in Sales from £36.7m to £53.9m
- Low Carbon - 38% growth in Sales from £2.6bn to £3.6bn
- District Heat Networks - 37% growth in Sales from £26.0m to £35.6m
- Sustainable Food Production - 27% growth in Sales from £102.5m to £130.3m
- Environmental - 23% growth in Sales from £1.1bn to £1.4bn

Sales for all Level 2 sub-sectors are forecast to grow year-on-year between 2021/22 and 2025/26. The twelve Level 2 sub-sectors with the strongest forecast for Sales are:

- Carbon Finance (LC) - 94% growth in Sales from £147.6m to £286.4m
- Geothermal (RE) - 81% growth in Sales from £423.7m to £766.0m
- Air Source Heat Pumps (RE) - 74% growth in Sales from £96.7m to £168.5m
- Biomass (RE) - 60% growth in Sales from £275.8m to £441.5m
- Wind (RE) - 51% growth in Sales from £803.8m to £1.2bn
- Nature Based Building (GI&NBS) - 48% growth in Sales from £34.2m to £50.2m
- Wave & Tidal (RE) - 45% growth in Sales from £3.5m to £5.1m
- Alternative Fuel Vehicle (LC) - 38% growth in Sales from £665.0m to £920.1m
- DHNW Operation (DHNW) - 38% growth in Sales from £6.9m to £9.5m
- Building Technologies (LC) – 37% growth in Sales from £716.8m to £985.1m
- DHNW Energy Centres (DHNW) - 37% growth in Sales from £5.8m to £8.0m
- DHNW Construction & Maintenance (DHNW) - 36% growth in Sales from £13.3m to £18.1m

**Potential Employment Growth to Net Zero 2050**

Net Zero 2050 forecasts for the LCEGS2023 sector employment are:

- No policy employment is forecast to increase from 38,973 in 2021/22 to 767,588 (20x) employment in 2050 under a net zero scenario
- Current Policy employment is forecast to increase from 38,973 in 2021/22 to 1,215,357 (31x) employment in 2050 under a net zero scenario

**Note:** Employment forecasts estimate the ***total employment required for Hertfordshire to meet Net Zero in 2050***; in the core sector and the chains and networks of supply, which might be outside of Hertfordshire.

How Hertfordshire's sector responds to the opportunity presented by Net Zero, will determine the ***proportion of this expected employment to be based in Hertfordshire itself.***

Employment forecasts include 'No policy' and 'Current Policy' scenarios. The purpose of providing this distinction is to provide detail to policy makers of the likely impact of current policy, but also to provide the likely baseline minimal growth of the sector if those policies were not in place.

The 'No Policy' forecast essentially provides a baseline growth, which represents an average of the forecasts from within the sector, while 'Current Policy' forecast uses the policies and implications drawn from the Heat & Buildings Strategy (2021), Net Zero Strategy (2021), the Prime Minister's Ten Point Plan (2020), Industrial and Clean Growth Strategies (2016), Energy White Paper (2020), Energy Security Policy (2021) and Industrial Decarbonisation Strategy (2022). These have been overlaid on the baseline 'No Policy' forecasts, to provide insight into the impacts of those policies.

Forecasts are based on national government net zero policies. Further description is provided on page 37.

The Sector is forecast to have high employment needs to reach Net Zero Targets in 2050 under No Policy and Current Policy Net Zero Scenarios, with Sector Employment growth factors of 19.7 for No Policy and 31.2 for Current Policy. This means employment will need to increase 19.7 times the employment in 2021/22 to reach Net Zero in 2050 with No Policy, and will need to increase 31.2 time the employment in 2021/22 to reach Net Zero in 2050 with Current Policy. Within the Level 1 sub-sectors, the growth factors vary, with Renewable Energy requiring the largest growth factor of 20.2 under No Policy and 31.9 with Current Policy:

| Level 1 | 2021/22 Employment | No Policy Employment Growth Factor | No Policy 2050 Employment | Current Policy Employment Growth Factor | Current Policy 2050 Employment |
|---|---|---|---|---|---|
| Renewable Energy | 12,647 | 20.2 | 255,344 | 31.9 | 403,986 |
| Low Carbon | 17,075 | 19.8 | 337,711 | 31.4 | 535,417 |
| Environmental | 7,016 | 19.0 | 133,406 | 30.1 | 211,068 |
| DHNW | 1,566 | 18.7 | 29,226 | 29.6 | 46,294 |
| GI&NBS | 268 | 18.6 | 4,982 | 29.7 | 7,692 |
| Sust. Food Prod'n | 403 | 17.2 | 6,919 | 27.0 | 10,900 |
| **Total** | **38,973** | **19.7** | **767,588** | **31.2** | **1,215,357** |

Level 2 sub-sectors also vary in terms of their employment requirements to reach Net Zero targets. The Level 2 sub-sector with the lowest employment growth requirement is within Food Waste Reduction Activities (within Sustainable food Production), requiring 16.9 times the employment in 2021/22 for Net Zero 2050 with No Policy and 27.0 times the 2021/22 employment for Current Policy. The highest growth requirement is within Carbon Finance (LC) of 21.9 and 43.9; Photovoltaic

(RE) with 20.8 and 33.1; and Biomass (RE) with 20.6 and 32.5. the twelve Level 2 sub-sectors with the highest employment growth requirement are:

| Level 2 | 2021/22 Employment | No Policy Employment Growth Factor | No Policy 2050 Employment | Current Policy Employment Growth Factor | Current Policy 2050 Employment |
|---|---|---|---|---|---|
| Carbon Finance | 351 | 21.9 | 7,674 | 34.9 | 12,232 |
| Photovoltaic | 2,304 | 20.8 | 48,003 | 33.1 | 76,150 |
| Biomass | 1,835 | 20.6 | 37,834 | 32.5 | 59,578 |
| Wave & Tidal | 18 | 20.3 | 368 | 32.3 | 587 |
| Energy Management | 836 | 20.2 | 16,873 | 31.6 | 26,415 |
| Wind | 4,182 | 20.0 | 83,458 | 31.8 | 132,856 |
| Geothermal | 3,341 | 19.9 | 66,639 | 31.4 | 104,827 |
| Building Technologies | 5,593 | 19.9 | 111,213 | 31.4 | 175,614 |
| Additional Energy Sources | 354 | 19.8 | 7,015 | 31.0 | 10,990 |
| Alternative Fuel Vehicle | 4,089 | 19.8 | 80,893 | 31.8 | 129,852 |
| Air Source Heat Pumps | 724 | 19.7 | 14,294 | 31.1 | 22,547 |
| Environmental Monitoring | 44 | 19.7 | 872 | 31.2 | 1,379 |

**Scalability of Level 2 Sub-sectors**

**Note:** Sector scalability refers to the scalability of the economic growth in sub-sectors, it does not necessarily refer to the ability of ***individual companies*** to scale, as each individual company will experience their own limiting factors and factors promoting growth. Scalability refers to the combination of:

- ✓ Existence of appropriate available market – the non-dominated portion of the market, not 'locked' by long-term contracts and realistically available to new market entrants
- ✓ The ability of existing, operational technology to increase capacity
- ✓ Affordability of new technology – the cost/benefit of increasing capacity through adoption of new technology
- ✓ Availability of appropriate skill sets in the locality
- ✓ Historic growth
- ✓ Accessibility of networks and chains of supply

Scalability of the economic growth in the Level 2 sub-sectors within the Hertfordshire is variable.

Highly scalable sub-sectors include:

- Carbon Finance (£148m in Sales)
- Nuclear Power (£78m)
- Air Source Heat Pumps (£97m)
- Water & Waste Water Treatment (£255m)
- Recovery & Recycling (£364m)

Moderately scalable sub-sectors include:

- Alternative Fuels (£810m in Sales)
- Building Technologies (£717m)

- Alternative Fuel Vehicle (£665m)
- Geothermal (£424m)
- Photovoltaic (£323m)
- Energy from Waste (£322m)
- Biomass (£276m)

**Hertfordshire's Exports**

Exports are a portion of the Sales value and the value of exports in Hertfordshire's Low Carbon and Environmental Goods and Services sector in 2021/22 was £370m, an increase from £349m in 2020/21, after contraction from £390m in 2019/20. This accounted for 2.3% of the UK's LCEGS2023 exports in 2021/22 and is in-line with Hertfordshire's 2.3% share of the overall UK LCEGS2023 Sales.

Hertfordshire's Exports accounted for 6.3% of the £5.8bn Sales for the LCEGS2023 sector in Hertfordshire, with variation between sub-sectors including Energy from Waste where 20.1% of the Sales value of £322m is Exports (£65m) and Low Carbon agriculture with 19.6%, to Geothermal with 1.1% and Wind with 3.0%.

Hertfordshire's LCEGS exports contracted by -10.6% between 2019/20 and 2020/21, then grew by 6.0% between 2020/21 and 2021/22, representing a 95% recovery from the economic shock. This compares with the UK growth of -15.0% and 8.2% with a 92% recovery during the same period.

Hertfordshire's top Export Level 2 sub-sectors with larger export markets and growth between 2020/21 and 2021/22 include:

- Alternative Fuels - £68m and 17.9% growth (Exports as percentage of Sales 8.4%)
- Building Technologies - £33m and 4.6% growth (Exports as percentage of Sales 4.6%)
- Wind - £24m and 6.0% growth (Exports as percentage of Sales 3.0%)
- Recovery & Recycling - £19m and 16.6% growth (Exports as percentage of Sales 7.2%)
- Photovoltaic - £18m and 3.8% growth (Exports as percentage of Sales 5.6%)
- Low Carbon Agriculture - £9m and 7.3% growth (Exports as percentage of Sales 19.6%)
- Carbon Finance - £8m and 67.9% growth (Exports as percentage of Sales 5.1%)

Hertfordshire's top Export sub-sectors with large export market but static growth between 2020/21 and 2021/22 include:

- Energy from Waste - £65m and 1.9% growth (Exports as percentage of Sales 20.1%)
- Alternative Fuel Vehicle - £39m and -1.5% growth (Exports as percentage of Sales 5.8%)
- Water & Waste Water Treatment - £17m and -0.3% growth (Exports as percentage of Sales 6.5%)

Hertfordshire's top Export sub-sectors with large export markets but further contraction between 2020/21 and 2021/22 include:

- Biomass - £16m and -14.7% growth (Exports as percentage of Sales 5.9%)
- Waste Management - £10m and -3.3% growth (Exports as percentage of Sales 5.8%)

**Hertfordshire's Imports**

The value of imports in Hertfordshire's Low Carbon and Environmental Goods and Services sector in 2021/22 was £232m, a contraction from £236m in 2020/21, after contraction from £262m in 2019/20. This value of imports accounted for 1.8% of the UK's LCEGS2023 imports in 2021/22 and is slightly lower than Hertfordshire's 2.3% share of the overall UK LCEGS2023 Sales. This is representative of Hertfordshire's strength in the sector as it imports a lower proportion than the UK average.

Hertfordshire's LCEGS imports contracted by -10.6% between 2019/20 and 2020/21, then -1.6% between 2020/21 and 2021/22, representing an 89% reduction in imports and no recovery from the economic shock. This compares with the UK growth of -10.6% and -1.0% with a 92% reduction during the same period.

**Exports Imports Compared**

Overall, Hertfordshire is a net Exporter, exporting £370m compared with £232m of Imports, which is in line with the UK average.

**Looking Forward – Level 2 Sub-sectors of Strategic Importance**

Level 2 sub-sectors with a combination of strengths such as large Sales (above £75m), contributing a larger proportion of GDP than the UK average, large Export market and Scalability and which are therefore strategically important to Hertfordshire include:

**Alternative Fuels** (Low Carbon, with £810m in Sales in 2021/22)

***Large Size in terms of Sales***, Higher proportion of GDP than UK average, ***Moderately Scalable*** and ***largest Export Market*** (£68m) with the strongest growth in Exports (17.9%) between 2020/2021 and 2021/22

**Building Technologies** (Low Carbon, with £717m in Sales in 2021/22)

***Large Size in terms of Sales***, Higher proportion of GDP than UK average, ***Moderately Scalable*** and ***large Export Market*** (£39m) with growth in exports (4.6%) between 2020/21 and 2021/22

**Alternative Fuel Vehicle** (Low Carbon, with £665m in Sales in 2021/22)

***Large Size in terms of Sales***, Higher proportion of GDP than UK average, ***Moderately Scalable*** and ***large Export Market*** (£39m) in 2021/22

**Geothermal** (Renewable Energy, with £424m in Sales in 2021/22)

***Large Size in terms of Sales***, Higher proportion of GDP than UK average and ***Moderately Scalable***

**Wind** (Renewable Energy, with £804m in Sales in 2021/22)

***Large Size in terms of Sales***, ***large Export Market*** (£24m) with growth in exports (6.0%) between 2020/21 and 2021/22 but low Scalability

**Recovery & Recycling** (Environmental, with £364m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Highly Scalable***, with ***large Export Market*** (£19m) with very strong growth in Exports (16.6%) between 2020/21 and 2021/22

**Carbon Finance** (Low Carbon, with £148m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Highly Scalable***, with ***good Export Market*** (£8m) with very strong growth in Exports (67.9%) between 2020/21 and 2021/22

**Photovoltaic** (Renewable Energy, with £323m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Moderately Scalable*** and ***large Export Market*** (£18m) with growth in exports (3.8%) between 2020/21 and 2021/22

**Energy from Waste** (Environmental, with £322m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Moderately Scalable*** and ***large Export Market*** (£65m) in 2021/22

**Water & Waste Water Treatment** (Environmental, with £255m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Highly Scalable***, with ***large Export Market*** (£17m) in 2021/22

**Air Source Heat Pumps** (Renewable Energy, with £97m in Sales in 2021/22)

***Large Size in terms of Sales*** and ***Highly Scalable***

**Nuclear Power** (Low Carbon, with £78m in Sales in 2021/22)

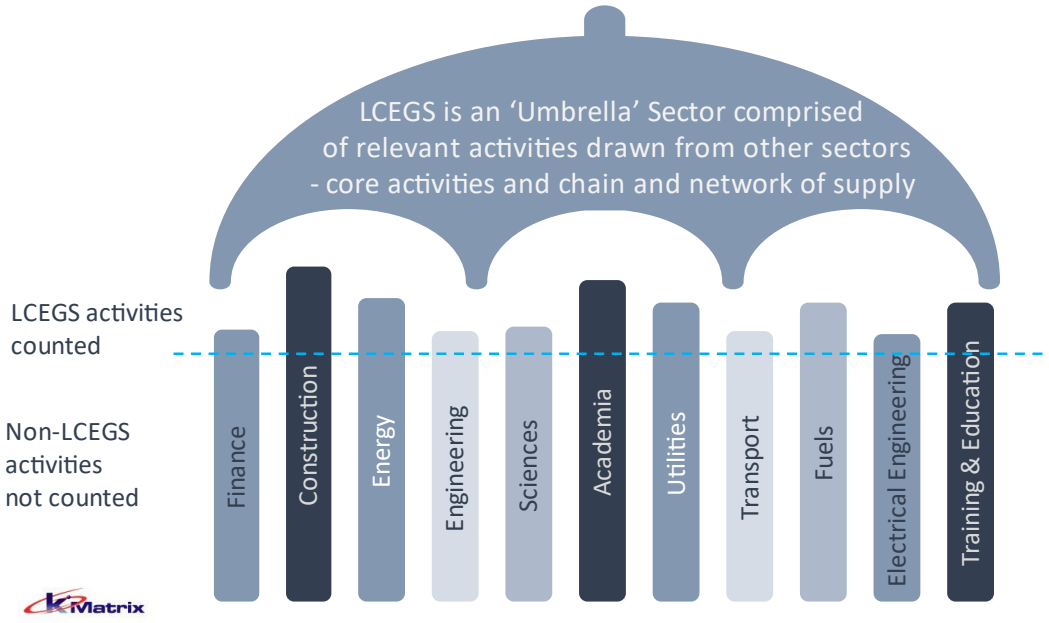
***Large Size in terms of Sales*** and ***Highly Scalable***

# Section 1: Introduction to the Low Carbon and Environmental Goods and Services Sector

This section includes a summary definition of the Low Carbon Environmental Goods Services sector, followed by a detailed description of the dataset that sits behind the data analysis and detail regarding the types of activities measured.

## Section 1.1: Summary Sector Definition

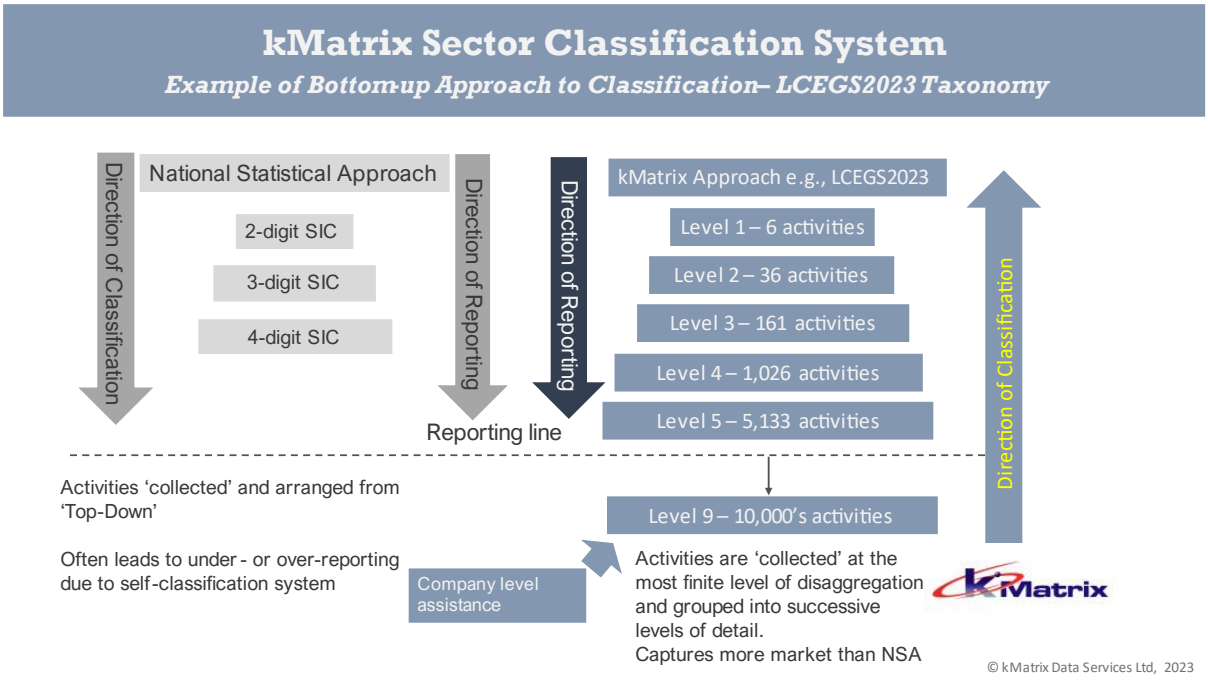
The Low Carbon Environmental Goods and Services sector comprises products and services from across the economy, which actively enable a shift towards a green economy. The LCEGS sector is considered an 'umbrella' or horizontal sector, crossing many other traditional sectors, counting products and services from those sectors which can reduce carbon emissions and improve the environment:




The sector is comprised of both core elements and those in the chain and network of supply, without whom the sector could not function.

## Section 1.2: Brief Methodology

kMatrix uses a unique data triangulation methodology, developed with Professor R. Jaikumar of Harvard University over 35 years ago. The process was originally developed to look at individual companies, providing evidenced data for development. As such, sectors are classified from the 'bottom up', collecting activities from the most finite level of granulation and grouping them into successive levels of detail.




This is quite different to the National Statistical Approach, which classifies from the 'top down', with a company choosing their 2-digit code, then successive codes down through the classification system. The SIC system is very good as a national accounting system, but it struggles with hard to measure sectors such LCEGS. Here, the kMatrix system of data collection, which triangulates transactional data from many sources, up to 70,000 for this study, provides the flexibility of a definition tailored to the sector being studied. Although the sector is classified from the bottom up, the sector taxonomy is reported from the sector level down, through a series of levels of complexity.

This process has measured the LCEGS sector for the Greater London Authority and the UK for over a decade. kMatrix also collaborate with academic colleagues in several fields, co-authoring academic papers, which are peer-reviewed and published in academic journals including Nature, Climate Services and the Lancet.

Example sectors the process has been applied to, where evidence is available in the public domain via published peer-reviewed academic journals include:

- Carbon Finance – Nature (2012): https://www.nature.com/articles/nclimate1492?draft=marketing
- Adaptation Economy – Nature (2016): https://www.nature.com/articles/nclimate2944
- Weather and Climate – Science Advances (2017): https://www.science.org/doi/10.1126/sciadv.1602632
- The Green Economy – Geo: Geography and Environment (2017): https://rgs-ibg.onlinelibrary.wiley.com/doi/pdf/10.1002/geo2.36
- The Green Economy – Nature (2019): https://www.nature.com/articles/s41599-019-0329-3
- Climate Services (2020): https://www.sciencedirect.com/science/article/pii/S2405880719300494?via%3Dihub
- **The Lancet (annually 2017-current):** https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(21)01787-6.pdf

The Lancet Countdown is a global collaboration of academics and represents the consensus of 43 academic institutions and UN agencies and has used the kMatrix A&RCC dataset for annual updates since 2017.

### Section 1.3: The LCEGS2023 Dataset

The dataset measures the core activities of the sector along with those in the supply chain, without whom the LCEGS sector could not operate. For example, the Wind sector includes those companies which develop the systems integration software enabling the power generated through turbines to be integrated into the National Grid, but it also includes those companies installing and maintaining the system integration software itself. Another example would be the collection of household waste, where the collection, processing and recycling of the waste is included, along with those companies who design, manufacture and supply the waste collection equipment itself.

Although the taxonomy is reported and organised 'top down' as it goes from the sector to Level 1, to Level 2 etc., the data is gathered and organised from the 'bottom up'. The data is collected at the most finite disaggregation and then 'rolled up' to form the different levels. The current LCEGS2023 sector definition, includes 5,133 product and service activities at level 5 that are derived from sector supply chain activities (componentry & assemblies) and value chain activities (R&D, Supply & Training).

A glossary of economic activities included for each sub-sector of LCEGS2023 is included as Appendix 1, a brief explanation of the LCEGS methodology as Appendix 2 and then a high-level comparison of data and methodologies between the Office of National Statistics (ONS) Environmental Goods and Services sector and LCEGS is presented in Appendix 3.

### Section 1.4: What is actually measured?

The dataset measures the core activities of the sector along with enabling activities in the supply chain, without whom the LCEGS2023 sector could not operate. For example, the Wind sector includes those companies which develop the systems integration software enabling the power generated though turbines to be integrated into the National Grid, but it also includes those companies installing and maintaining the system integration software itself. Another example would be the collection of household waste, where the collection, processing and recycling of the waste is included, along with those companies who design, manufacture and supply the waste collection equipment itself.

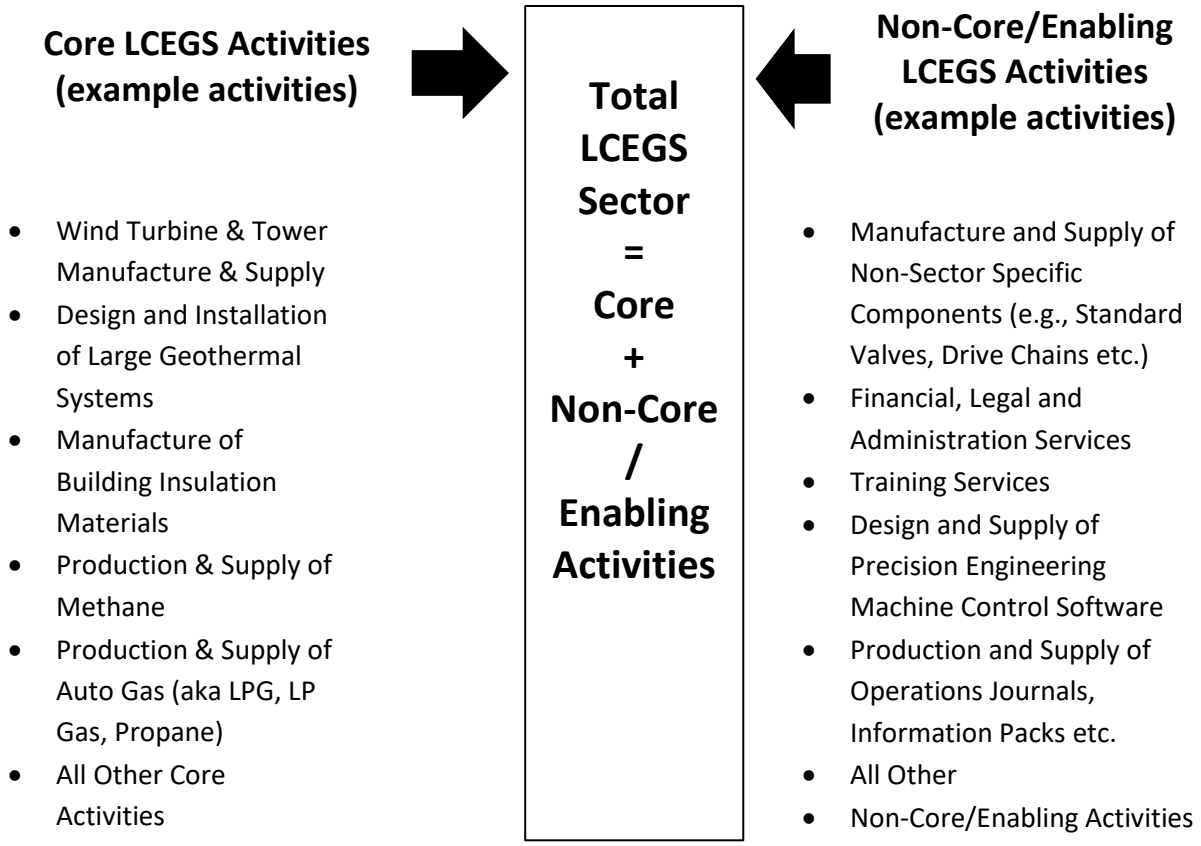
The purpose of the LCEGS dataset is to provide a standardized measure of the complete LCEGS sector. The whole dataset includes those 'core' activities, which would immediately come to mind such as the manufacture of a wind turbine blade, but also the less obvious 'non-core' activities, such as the manufacture of the bearings for the turbine. Non-Core activities can be considered "enablers" for the Core sector and are often companies who have diversified from existing strengths into new sector activities. Non-core activities also include mid-stream activities, R&D, finance, training and other activities which cross multiple other sectors, but without which the LCEGS sector could not function.


The definition of a sector is almost always open to debate, in terms of what is, or is not, considered to be part of the sector in question. The kMatrix methodology includes all aspects that could realistically be considered part of the LCEGS sector, as per the definition in 2023. The taxonomy is built and interrogated by assembling activities and services which are then grouped together under different headings.

The following picture illustrates the two distinctive sides of the LCEGS market, the smaller Core market and the much larger Non-Core market, provided by enablers within the LCEGS sector. Examples give a simplistic overview of the types and differences between activities, with the Core

side including activities such as manufacture of wind turbines and building insulation materials. The enablers providing Non-Core activities are offering components that are non-sector specific, such as valves, gaskets, drive chains etc., alongside financial, legal and administration activities.

In essence, Core activities are those products and services which are generally LCEGS specific, whereas the Non-Core activities, provided by enablers are products and services which are not LCEGS specific and can generally be found in other sectors. Core activities are considered vertical in nature, being sector specific, whereas Non-Core activities are horizontal, crossing other sectors. Both sides of the market are required for the sector to function.




The economic values provided are Sales values, which are transactions made within the sector, which have an economic footprint that can be measured. For companies which service multiple sectors, for example in finance, the sales value is the value of sales that company has in the LCEGS market, it does not include finance sales into other sectors.

### Section 1.5: Employment Forecasts to Net Zero 2050 and the Impact of Policy

An important element of this supply chain market intelligence report is the provision of forecasts for the size of the sector, in terms of employment required to reach Net Zero 2050 under different forecasting scenarios.

Employment forecasts estimate the ***total employment required for Hertfordshire to meet Net Zero in 2050***; in the core sector and the chains and networks of supply, which might be outside of Hertfordshire.

How Hertfordshire's sector responds to the opportunity presented by Net Zero, will determine the ***proportion of this expected employment to be based in Hertfordshire itself***.

The forecasts reflect the scale of the employment opportunity i.e., the number of people who will be employed as a ***direct result*** of Hertfordshire's Net Zero targets, regardless of location.

The proportion of this employment ***based in Hertfordshire*** will be determined by local policy, business mix, working practices, specialisms, external economic factors etc.

The UK employment challenge for Net Zero target is significant. Hertfordshire should therefore aim to ***create and maintain Green Economy employment in key Sub-sectors***. This will enable ***Hertfordshire-based businesses to benefit from Hertfordshire's Net Zero targets***, and to potentially provide those services to the wider UK, strengthening Hertfordshire's economy.

The baseline measurement for 2021/22, together with the historical trends of 2019/20 and 2020/21 were used to forecast the likely growth of the sectors and sub-sectors within the LCEGS2023 sector.

Forecasts are provided for:

- Forecasting size of industry needed to deliver net zero by 2050 with no policy overlay
- Forecasting size of industry needed to deliver net zero by 2050 applying current policies

The purpose of providing a distinction between 'No Policy' and 'Current Policy' is to provide detail to policy makers of the likely impact of current policy, but also to provide the likely baseline minimal growth of the sector if those policies were not in place.

The 'No Policy' forecast essentially provides a baseline growth, which represents an average of the forecasts from within the sector and provides the minimum size the sector would need to be to achieve Net Zero targets for 2050.

The 'Current Policy' forecast uses the policies and implications drawn from the Heat & Buildings Strategy (2021), Net Zero Strategy (2021), the Prime Minister's Ten Point Plan (2020), Industrial and Clean Growth Strategies (2016), Energy White Paper (2020), Energy Security Policy (2021) and Industrial Decarbonisation Strategy (2022). These have been overlaid on the baseline 'No Policy' forecasts, to provide insight into the impacts of those policies and provide the size the sector would need to be to achieve Net Zero targets for 2050 under current policy.

The impact of policy on the sector is both direct through funding, and indirect such as the increase in consumer awareness through increased reporting on polices, which drives an organic increase in demand for energy efficiency.

In addition to the more general boost to the sector through awareness and cultural movement, there are also specific policies which focus on social housing and assistance to those in fuel poverty which alter the supply chain needs of the sector, for example increase the need for painters and decorators.

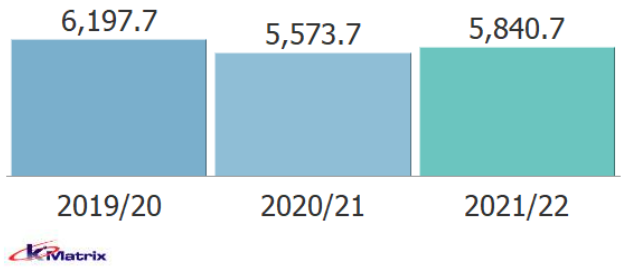
The Low Carbon Environmental Goods and Services sector has been growing steadily for the last decade, however a significant effect of policy on the sector is to front-load the growth, specifically within areas of market such as domestic energy retrofit, with immediate policy interventions causing significant growth over the next couple of years as the sector rapidly increases capacity. This would then be followed by more usual sectoral growth, resulting in a larger market overall.

## Section 2: Hertfordshire's LCEGS2023 Sector

In this section of the report Hertfordshire LEP's (Hertfordshire) LCEGS2023 performance is compared for the last three years for the three key measures of Sales, Employment and Growth.

## Section 2.1: LCEGS2023 Compared by Year

**Figure 1: Hertfordshire's Total Sales (£m) for 2019/20 to 2021/22**

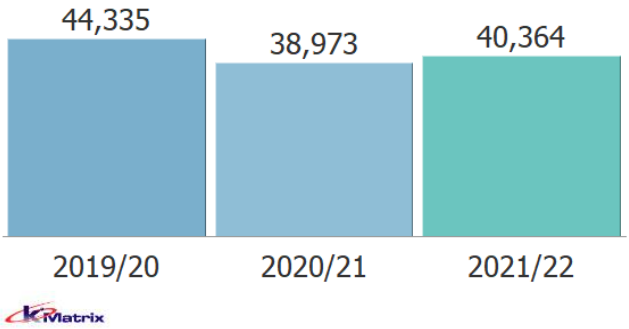



Hertfordshire's LCEGS2023 sales in 2021/22 were £5.8bn, up from £5.60bn in 2020/21, after falling from £6.2bn in 2019/20. This represents a 94.2% recovery of sales after the economic shock.

Annual sales growth in Hertfordshire's LCEGS2023 was -10.1% from 2019/20 to 2020/21 and 4.8% from 2020/21 to 2021/22.

In comparison, UK sales growth in LCEGS2023 was -9.8% and 5.0% with a 94.7% recovery.

**Figure 2: Hertfordshire's Employment 2019/20 to 2021/22**

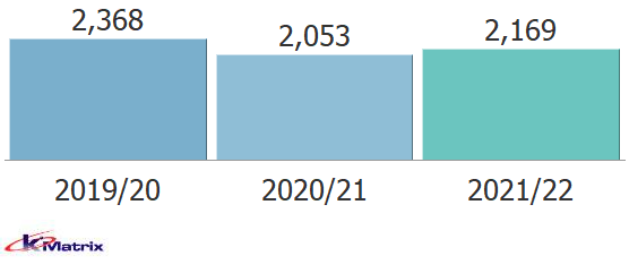



Hertfordshire's LCEGS2023 employment in 2021/22 was 40,364, up from 38,973 in 2020/21, after falling from 44,335 in 2019/20. This represents a 91.0% recovery of employment.

Annual employment growth in Hertfordshire's LCEGS2023 was -12.1% from 2019/20 to 2020/21 and 3.6% from 2020/21 to 2021/22

In comparison, UK Employment growth in LCEGS2023 was -12.1% and 3.7% with a 91.2% recovery.

**Figure 3: Hertfordshire's Companies 2019/20 to 2021/22**



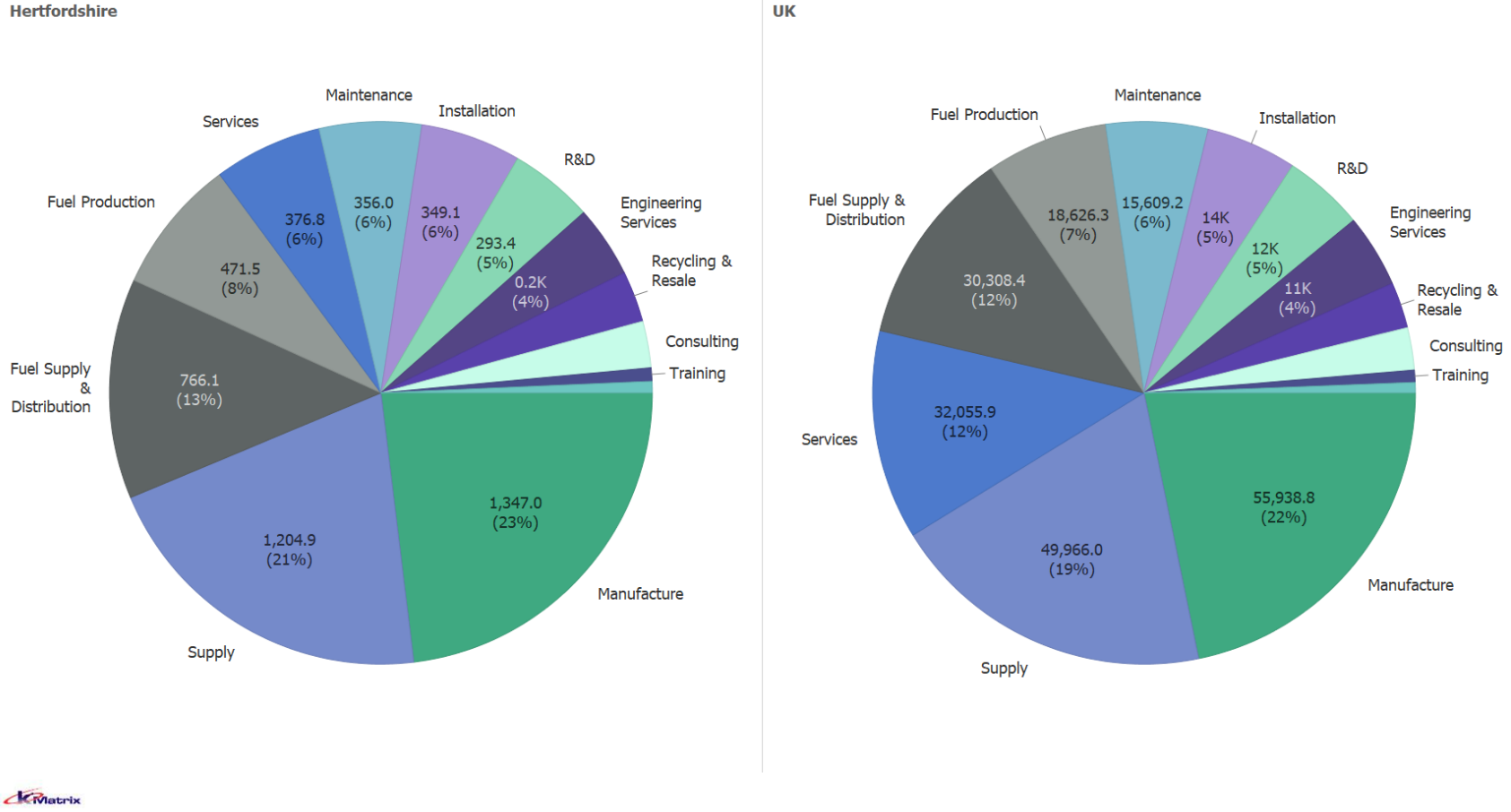

Hertfordshire's LCEGS2023 company count in 2021/22 was 2,169, up from 2.053 in 2020/21, after falling from 2,368 in 2019/20. This represents a 91.6% recovery in companies.

Annual company growth in Hertfordshire's LCEGS2023 was -13.3% from 2019/20 to 2020/21 and 5.7% from 2020/21 to 2021/22.

In comparison, UK company growth in LCEGS2023 was -13.5% and 5.9% with a 91.6% recovery.

## Section 2.2: LCEGS2023 Sector by Activity Code

**Figure 4: Hertfordshire's LCEGS2023 Sales Split by Activity Code 2021/22 (Level 1)**




**Activities** (Figure 4) in Hertfordshire's £5.8bn 2021/22 Sales in the LCEGS2023 Sector were comprised of 23% (£1.35bn) Manufacturing, 21% (£1.20bn) Supply, 13% (£766m) Fuel Supply & Distribution, 8% (472m) Fuel Production and 6% (377m) Services. Hertfordshire (left) is less strong than the UK (right) in Services which account for 6% of Sales in Hertfordshire and 12% in the UK but is stronger in Supply which accounts for 21% of Sales in Hertfordshire and 19% in the UK.

## Section 2.3: LCEGS2023 Level 1 Sub-sectors

The analysis in this section of the report focuses on the Level 1 split of LCEGS2023 in Hertfordshire for each of the last three years.

**Figure 5: Hertfordshire's Total Sales (£m) for 2019/20 to 2021/22**

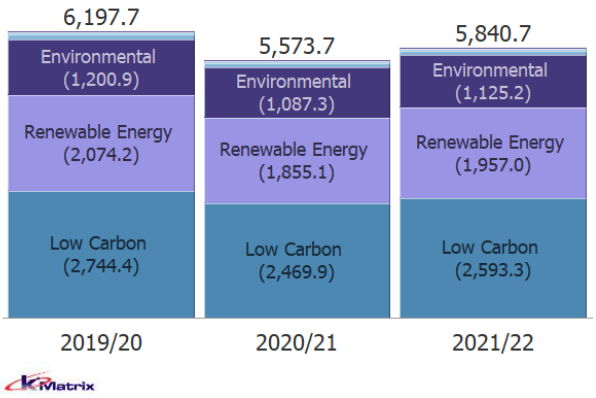



Figure 5 shows the three-year LCEGS2023 sales split by Level 1.

In 2021/22 the split was 44% Low Carbon, 34% Renewable Energy, 19% Environmental, 2% Sustainable Food Production, 1% Green Infrastructure & Nature Based Solutions and ~0% District Heat Networks. The split was similar in 2019/20, with 44%, 33%, 19%, 2%, 1% and ~0%.

**Figure 6: Hertfordshire's Employment 2019/20 to 2021/22**

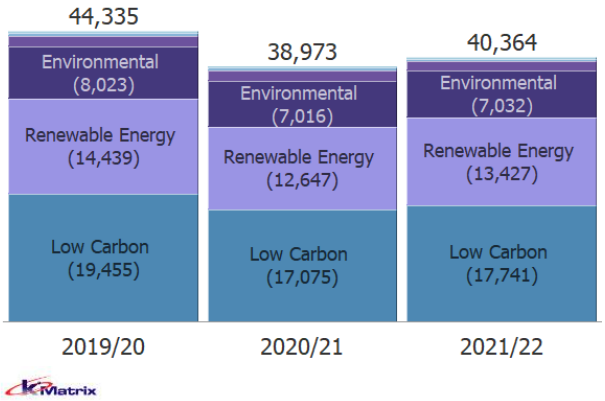



Figure 6 shows the three-year LCEGS2023 Employment split by Level 1.

In 2021/22 the split was 44% Low Carbon, 33% Renewable Energy, 17% Environmental, 4% District Heat Networks, 1% Sustainable Food Production and 1% Green Infrastructure & Nature Based Solutions. The split was similar in 2019/20, with 44%, 33%, 18%, 4%, 1% and 1%.

**Figure 7: Hertfordshire's Companies 2019/20 to 2021/22**

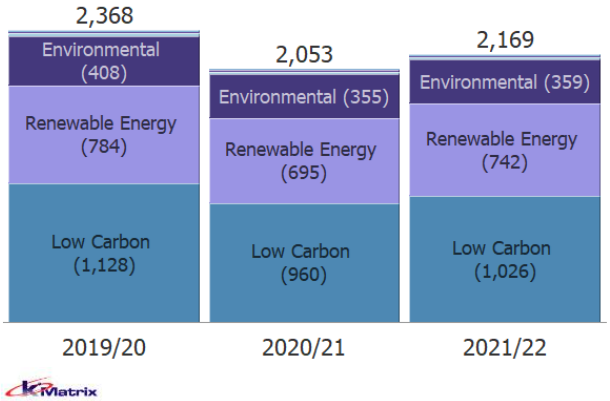



Figure 7 shows the three-year LCEGS2023 Companies split by Level 1.

In 2021/22 the split was 47% Low Carbon, 34% Renewable Energy, 17% Environmental, 1% Green Infrastructure & Nature Based Solutions, 1% District Heat Networks, and 1% Sustainable Food Production. The split was similar in 2019/20, with 48%, 33%, 17%, 1%, 1% and 1%.

In 2021/22 UK LCEGS2023 sales were split: 47% Low Carbon, 33% Renewable Energy, 17% Environmental, 1% Sustainable Food Production, 1% Green Infrastructure & Nature Based Solutions and ~0% District Heat Networks. The split was similar in 2021/22, with 47%, 33%, 18%, 1%, 1% and ~0%.

Sales values are ~0% for District Heat Networks but register a percentage for Employment because the sub-sector has a relatively low turnover-to-employees ratio.

## Section 2.4: LCEGS2023 Level 1 Sub-sectors by Activity Code

**Figure 8: Hertfordshire's LCEGS2023 Sales Split by Activity Code 2021/22 (Level 1)**


**Activities** vary by Level 1 sub-sector (Figure 8), with the largest activity code being ***Fuel Supply & Distribution*** in Low Carbon (30%), ***Manufacture*** in Renewable Energy (39%), Environmental (21%) and District Heat Networks (28%) and ***Supply*** in Green Infrastructure & Nature Based Solutions (50%) and Sustainable Food Production (42%).

## Section 3: LCEGS2023 Level 1 Sub-sectors

In this section we look at the six Level 1 sub-sectors in more detail. Level 1 sub-sectors are: of Low Carbon; Renewable Energy; Environmental; District Heat Networks; Green Infrastructure and Nature Based Solutions; and Sustainable Food Production.

## Section 3.1: LCEGS2023 Level 1 – Low Carbon

In this section we look at the Low Carbon market in greater detail. Initially we split the market into eight further sub-sectors (Level 2) and then look at the highest performing Level 2 sub-sectors in more detail by highlighting activity happening within them at Level 3.

Table 2 provides details on activities within the Level 2 sub-sectors of the Low Carbon market in Hertfordshire.

**Table 2: LCEGS2023 Level 1 Sub-sector Description – Low Carbon**

| Level 1 | Level 2 | Description |
|---|---|---|
| **Low Carbon** | Additional Energy Sources | R&D, Design and Prototyping activities relating to a range of new Low Carbon energy sources.<br><br>These energy sources include: Fuel Cells, Hydraulic Accumulators, Hydrogen (not vehicle fuel), Molten Salt, Thermal Mass, Compressed Air, Superconducting Magnets and more general energy storage research.<br><br>This is a small sub-sector (in value and impact) because only energy sources that have a current economic footprint (i.e., trading) are included. |
| | Alternative Fuel Vehicle | Low Carbon Fuel and technology activities that relate to (predominantly) automotive transport. It is divided into Alternative Fuels (main stream) for Vehicles Only, and Other Fuels and Vehicles.<br><br>Alternative Fuels (main stream) for Vehicles Only includes the production, supply and distribution of Natural Gas (Compressed or Liquefied), Synthetic Fuel and Auto Gas (LPG, LP Gas or Propane). This sub-sector does not include bio diesel (see Alternative Fuels).<br><br>Other Fuel Vehicles includes Research, Design, Engineering, Maintenance, Manufacture, Services, Supply and Training activities are included for: Hydrogen fuel cells and hydrogen internal combustion cars and non-cars; ***Electric; Hybrid Electric, Plug-in Hybrid Electric,*** Organic waste fuel, MAGLEV, Solar powered and Air powered vehicles and Prototyping fuel and vehicle technologies |
| | Alternative Fuels | Wide range of Low(er) carbon fuel sources that are not included under Renewable Energy. It includes the manufacture, production, supply and distribution of:<br><br>• ***EV Batteries, including cables, charge controllers, charge points, chargers, chemicals, connectors, containers, suppliers and testing equipment*** |

| | | |
|---|---|---|
| | | • Non-EV Batteries - chemicals, chargers, controllers, cables, connectors, containers, suppliers and testing equipment<br>• Hydrogen – non-vehicle hydrogen<br>• Bio fuels for Alternative Vehicles only - bio diesel, butanol, ethanol and vegetable oils<br>• Mainstream Bio fuel applications (non-transport) - bio diesel, butanol and ethanol<br>• Other Bio fuels - biomass, methane, peanut oil, vegetable oil, wood and wood gas<br>• Other fuels - Hydrogen |
| | Building Technologies | Main stream building materials and systems that contribute to reduced energy use and to lowering the carbon footprint of buildings. It includes:<br>• Windows<br>• Doors<br>• Insulation and heat retention materials, with some split by Domestic and Non-domestic<br>• Monitoring and control systems |
| | Carbon Capture & Storage | Activities that store carbon emissions - from locations like power plants and prevent them entering the atmosphere. It includes manufacturing, supply, distribution, installation, maintenance, development and design of:<br>• Ocean storage equipment and services<br>• Mineral storage equipment and services<br>• Geological storage equipment and services<br>• Engineering, project management and consulting services<br>• Pre combustion capture systems<br>• Post combustion capture systems<br>• Oxy-Fuel combustion systems<br>• Pipeline systems and services<br>• Ship storage and discharge systems |
| | Carbon Finance | includes investment activities and financial instruments for emission reduction projects and carbon trading |
| | Energy Management | Energy saving and power management activities for industrial and domestic use. Includes Industrial Solutions |

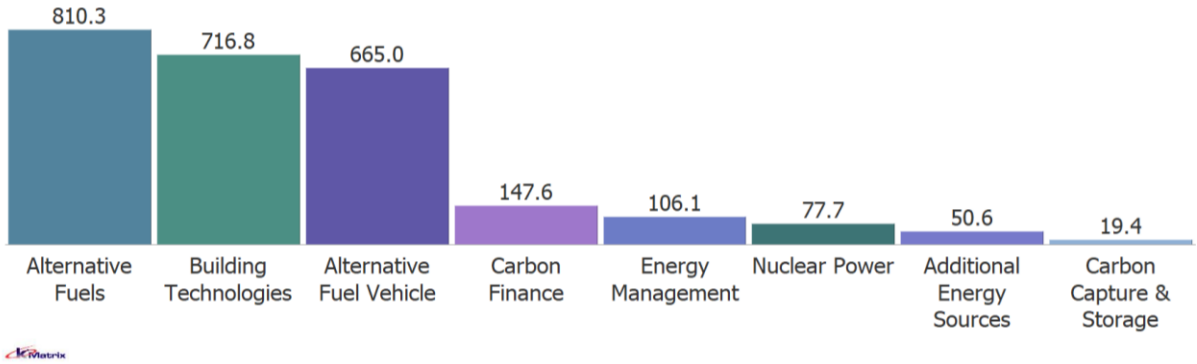
| | | |
|---|---|---|
| | Nuclear Power | all activities that relate to the generation of nuclear power, excluding decommissioning of nuclear sites |

Further detail is provided in Appendix 1.

### Section 3.1.1: Low Carbon (Level 2)

In 2021/22, the Low Carbon Level 1 sub-sector was worth £2,593m in Sales, had 17,741 Employees and 1,026 Companies. Section 3.1 analyses the Level 2 sub-sectors within Low Carbon.

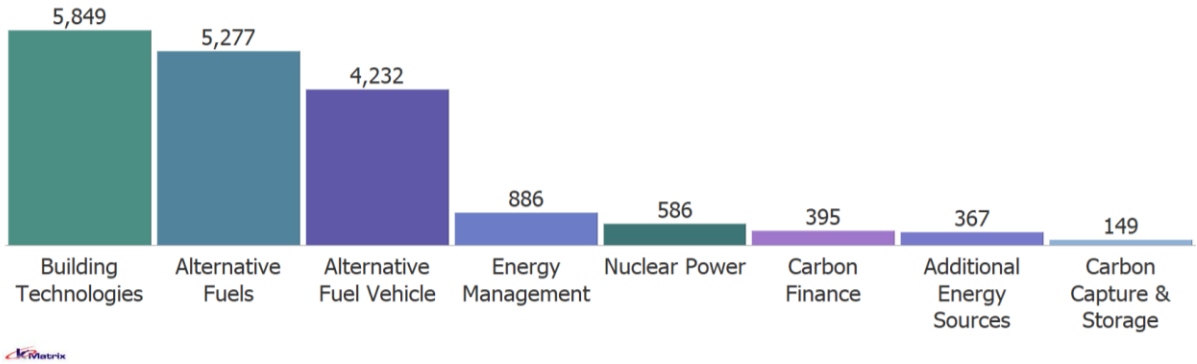
**Figure 9: Hertfordshire's Low Carbon Sales 2021/22 in £m (Level 2)**




Low Carbon is further sub-divided into eight sub-sectors, of which four account for 90% of sales (Figure 9). These four are made up of Alternative Fuels 31% (34% in 2019/20), Building Technologies 28% (31% in 2019/20), Alternative Fuel Vehicle 26% (29% in 2019/20), and Carbon Finance 6% (6% in 2019/20).

Carbon Finance is the only sub-sector to have a larger Sales value in 2021/22 than 2019/20. The other three of the largest sub-sectors have seen Sales values in 2021/22 almost recover to 2019/20 values after the 2019/20 to 2020/21 economic shock. Alternative Fuels sales were £841.0m in 2019/20 and were £810.3m in 2021/22 (96.3% of 2019/20); Building Technologies £761.9m in 2019/20 and £716.8m in 2021/22 (94.1% of 2019/20); Alternative Fuel Vehicle £728.9m in 2019/20 and £665.0m in 2021/22 (91.2% of 2019/20); and Carbon Finance £145.9m in 2019/20 and £147.6m in 2021/22 (1.2% growth since 2019/20).

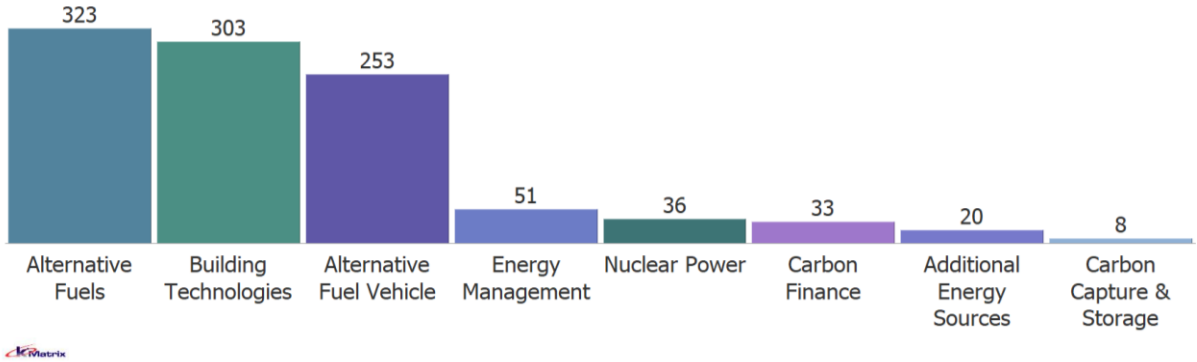
**Figure 10: Hertfordshire's Low Carbon Employment 2021/22 (Level 2)**



A different four sub-sectors account for 92% of employment (Figure 10). These four are made up of Building Technologies 33% (33% in 2019/20), Alternative Fuels 30% (30% in 2019/20), Alternative Fuel Vehicle 24% (23% in 2019/20), and Energy Management 5% (5% in 2019/20).

These four of the largest sub-sectors have seen Employment in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. Alternative Fuels employed 6,445 in 2019/20 and 5,849 in 2021/22 (90.8% of 2019/20); Building Technologies employed 5,908 in 2019/20 and 5,277 in 2021/22 (89.3% of 2019/20); Alternative Fuel Vehicle employed 4,480 in 2019/20 and 4,232 in 2021/22 (94.5% of 2019/20); and Energy Management employed 982 in 2019/20 and 886 in 2021/22 (90.2% of 2019/20).

**Figure 11: Hertfordshire's Low Carbon Companies 2021/22 (Level 2)**

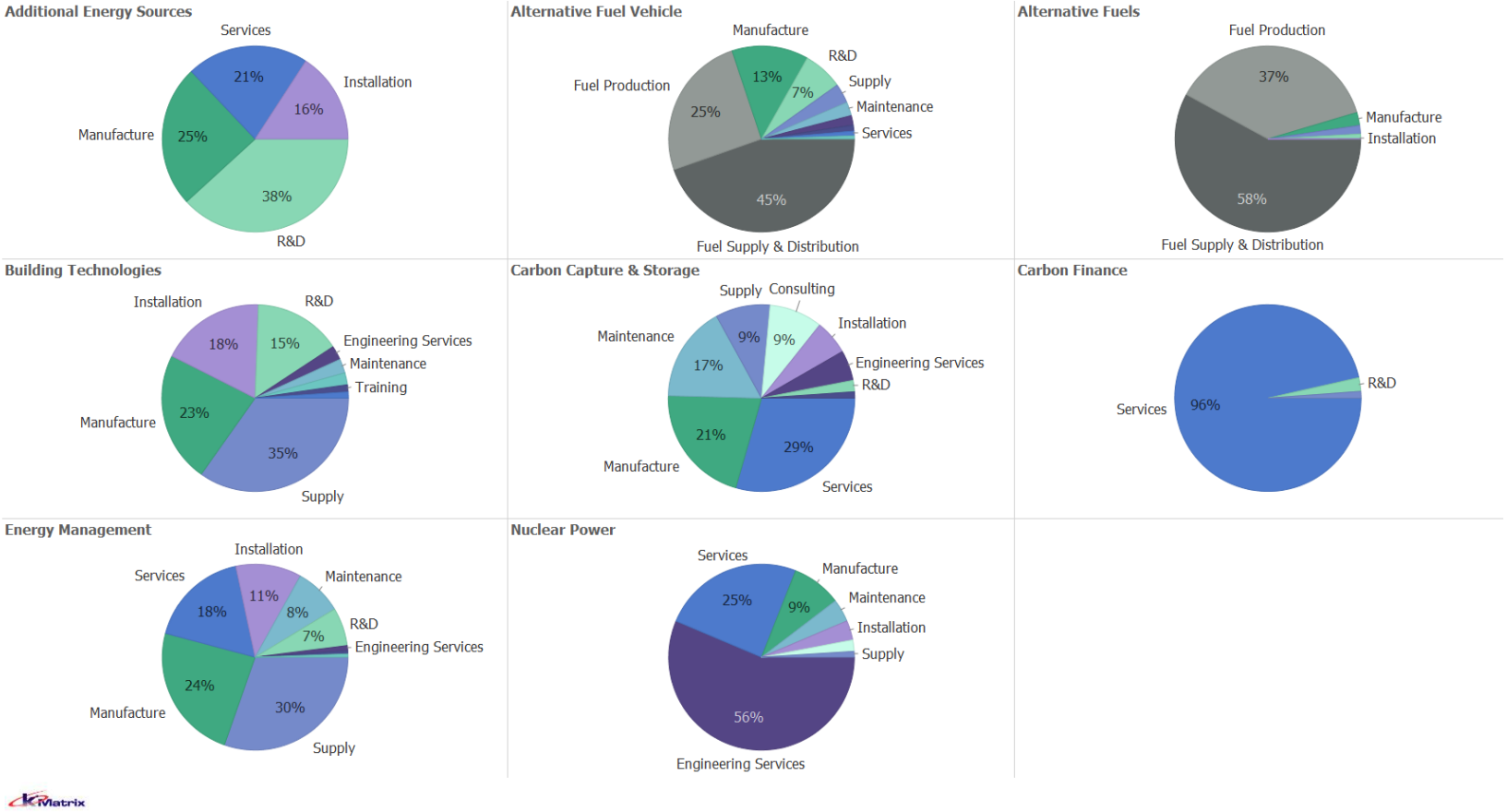



The same four sub-sectors as Figure 9 account for 91% of companies (Figure 11). They are Alternative Fuels 31% (31% in 2019/20), Building Technologies 30% (30% in 2019/20), Alternative Fuel Vehicle 25% (24% in 2019/20), and Energy Management 5% (5% in 2019/20).

These four of the largest sub-sectors have seen the number of Companies in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. The number of companies in Alternative Fuels was 350 in 2019/20 and 323 in 2021/22 (92.3% of 2019/20); Building Technologies was 344 in 2019/20 and 303 in 2021/22 (88.1% of 2019/20); Alternative Fuel Vehicle was 272 in 2019/20 and 253 in 2021/22 (93.0% of 2019/20); and Energy Management was 58 in 2019/20 and 51 in 2021/22 (93.8% of 2019/20).

## Section 3.1.2: Low Carbon by Activity Code (Level 2)

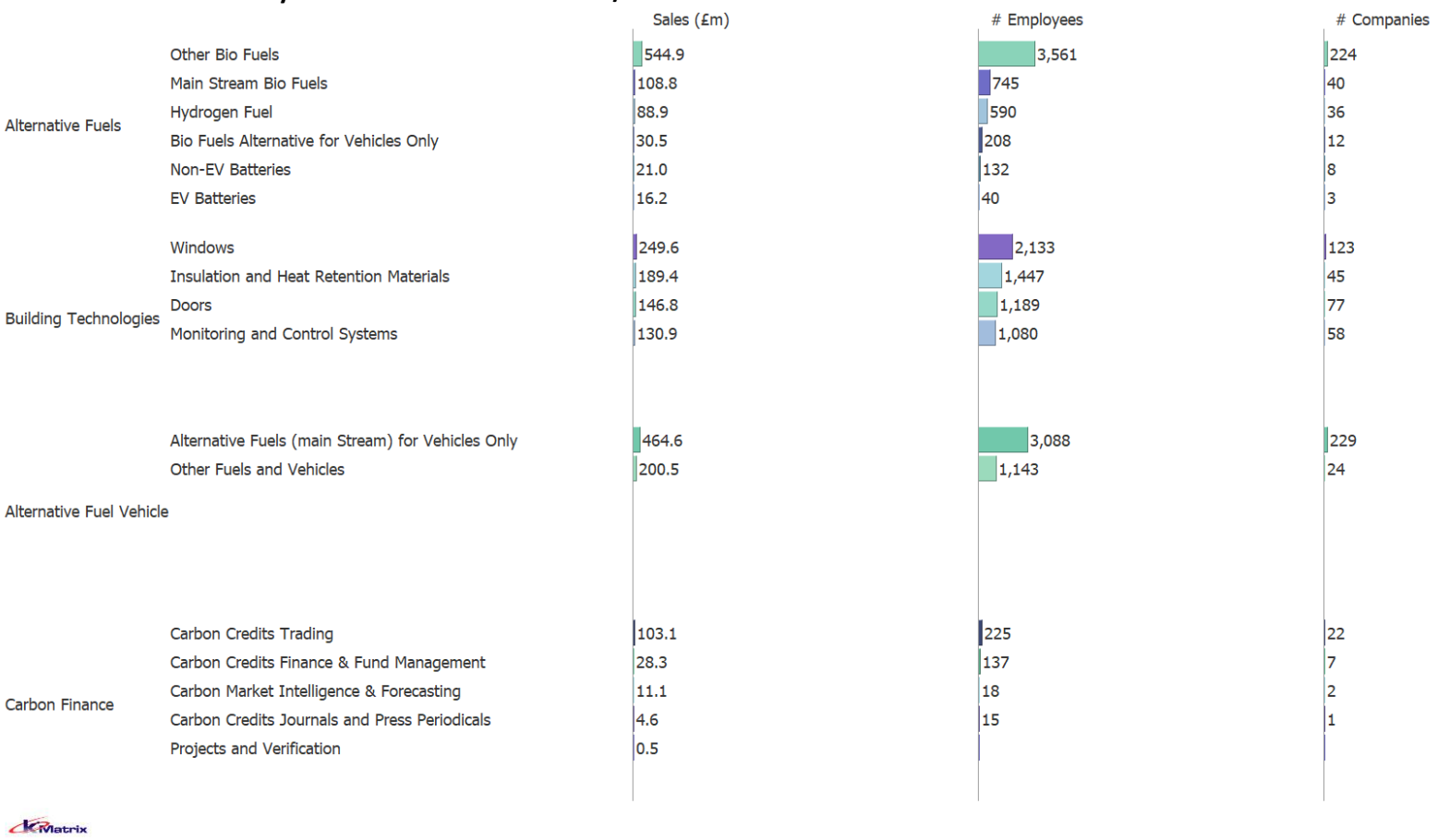
**Figure 12: Hertfordshire's Low Carbon Split by Activity Code 2021/22 (Level 2)**




**Activities** vary by Level 2 sub-sector (Figure 12), with the largest activity code being ***R&D*** for Additional Energy Sources 38%; ***Fuel Supply & Distribution*** for Alternative Fuel Vehicle 45% and Alternative Fuels 58%; ***Supply*** for Building Technologies 35% and Energy Management 30%; ***Services*** for Carbon Capture & Storage 29% and Carbon Finance 96%; and ***Engineering Services*** for Nuclear Power 56%. This is within one percentage point of the split in 2019/20, except for Alternative Fuels, where ***Fuel Supply & Distribution*** 42% in 2019/20 and 45% in 2021/22; while ***Fuel Production*** was 27% in 2019/20 and 25% in 2020/21.

## Section 3.1.3: Low Carbon at Level 3

**Figure 13: Hertfordshire's Summary of Selected Metrics for 2021/22 for Selected Low Carbon Level 2 Sub-sectors at Level 3**




The top four Level 2 sub-sectors in terms of Sales for Low Carbon are Alternative Fuels, Alternative Fuel Vehicle, Building Technologies, and Carbon Finance, making up 90% of Sales in the Low Carbon market in Hertfordshire. Figure 13 shows a summary of the Sales, Companies and Employees for these Level 2 sub-sectors, broken out into their Level 3 sub-sectors.

Alternative Fuels has five sub-sectors at level 3, of which, Other Biofuels accounts for 67% of Sales, equivalent to £544.9m of the £810.3m Level 2 total Sales (67% in 2019/21) with an emphasis on Methane. Example companies of this sub-sector would include process designers and consultancy, process implementation and sales and application development specialists.

Building Technologies has four sub-sectors at Level 3, with the largest being Windows, making up 35% of the market (34% in 2019/20). Example companies in this sub-sector would include window manufacturers, agents and installers.

Alternative Fuel Vehicle has only two sub-sectors at level 3, with Alternative Fuels (main stream) for Vehicles Only holding 70% of the market share (69% in 2019/20). Example companies in this sub-sector would include selling agencies, alternative fuel vehicle development companies and consulting and applications development for vehicle conversion specialists.

Carbon Finance has five sub-sectors at level 3 and the largest is Carbon Credits Trading, with 70% of the market (70% in 2019/20). Example companies in this sub-sector include financial advisory organisations who then connect to carbon trading houses, in London and other financial centres.

## Section 3.2: LCEGS2023 Level 1 - Renewable Energy

In this section we look at the Renewable Energy market in greater detail. Initially we split the market into eight further sub-sectors, Level 2, and then look at the highest performing Level 2 sub-sectors in more detail by highlighting activity happening within them at Level 3.

Table 3 provides details on activities within the Level 2 sub-sectors of the Renewable Energy market in Hertfordshire.

**Table 3: LCEGS2023 Level 1 Sub-sector Description – Renewable Energy**

| Level 1 | Level 2 | Description |
|---|---|---|
| **Renewable Energy** | Air Source Heat Pumps | Activities relating to the R&D, Manufacture, Supply, Engineering Services, Consulting and Installation of Commercial/Large Scale, Community and Domestic Air Source Heat Pumps split by:<br>• Ancillary Equipment<br>• Architectural Services<br>• Components<br>• Project Development Services<br>• Whole Systems |
| | Biomass | All activities that convert biomass into energy but excludes biomass materials (see Alternative Fuels, Low Carbon).<br>• Biomass furnace systems<br>• Biomass energy systems<br>• Manufacture of biomass boilers and systems<br>• Biomass boilers and related systems<br>• Technical and operational consulting |
| | Geothermal | Activities relating to the extraction and use of heat generated from the earth. Activities relating to the R&D, Manufacture, Supply, Engineering Services, Consulting and Installation of Commercial/Large Scale, Community and Domestic. It includes:<br>• Ground Source Heat Pumps<br>• Specialist Systems and Equipment<br>• Water Source Heat Pumps |
| | Hydro | Hydroelectric. Activities that help to extract energy from river and other water sources held in dams (as opposed to wave or tidal energy) that is used to drive turbines and generators. Large scale civil engineering/construction activities associated |

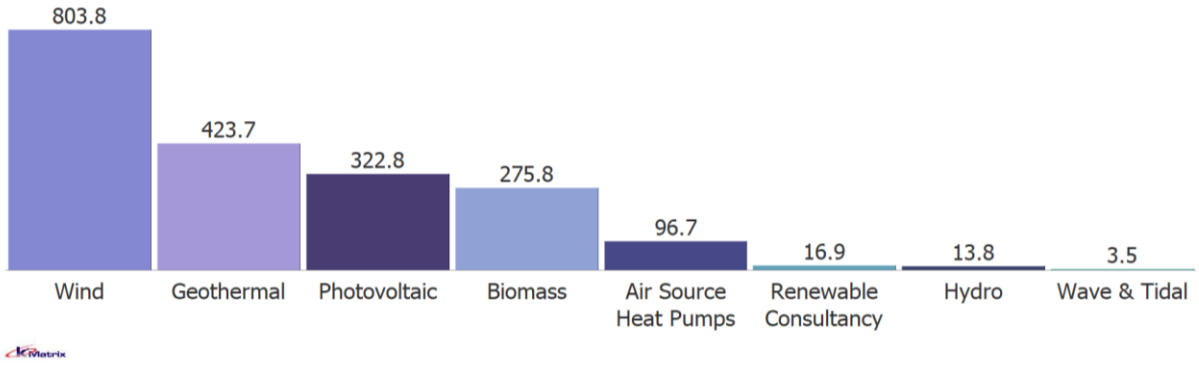
| | | |
|---|---|---|
| | | with dam building have not been included in this analysis.<br>• Turbines<br>• Dams & structures<br>• Pumping & lubrication<br>• Electricity supply |
| | Photovoltaic | Activities that help to convert solar radiation into useable energy. It includes:<br>• Chemicals<br>• Systems & equipment<br>• R&D<br>• Photovoltaic cells<br>• Other equipment & chemicals |
| | Renewable Energy Consultancy | Consulting and legal services specific to Renewables i.e., not included in general or specific environmental consulting. It includes:<br>• Legal services<br>• Consulting |
| | Wave & Tidal | Activities that help to convert the energy from waves and tides into usable power (also known as marine renewable energy). It includes:<br>• Turbines & generators<br>• Pumps & equipment<br>• Two basin schemes<br>• Ebb & flow systems<br>• Assessment & Measurement<br>• Other general services |
| | Wind | Activities that convert wind power into usable energy. This includes wind farm systems, large and small wind turbines. It includes:<br>• Offshore Large Wind Turbine<br>• Offshore Wind Farm Systems<br>• Onshore Large Wind Turbine<br>• Onshore Wind Farm Systems<br>• Small Wind Turbine |

Further detail is provided in Appendix 1.

### Section 3.2.1: Renewable Energy at Level 2

In 2021/22, the Renewable Energy Level 1 sub-sector was worth £1,957m in Sales, had 13,427 Employees and 742 Companies. Section 3.2 analyses the Level 2 sub-sectors within Renewable Energy.

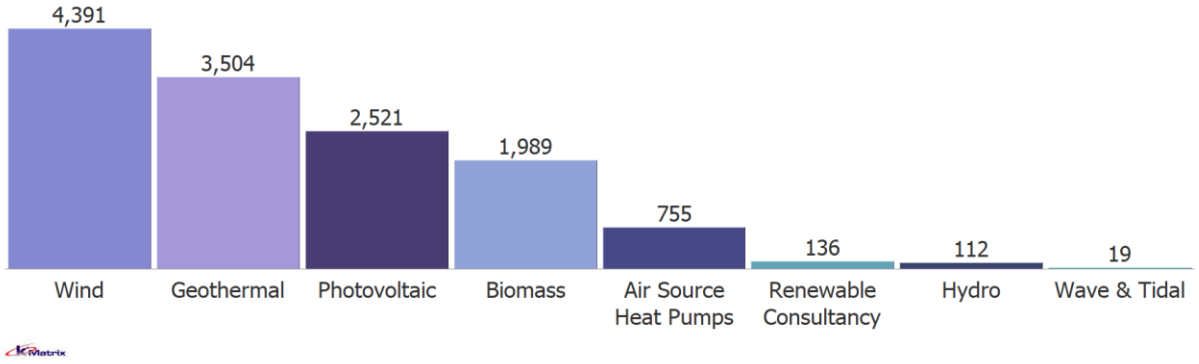
**Figure 14: Hertfordshire's Renewable Energy Sales 2021/22 in £m (Level 2)**




Renewable Energy is split into eight sub-sectors, of which five account for 98% of sales (Figure 14). These five are made up of Wind 41% (42% in 2019/20), Geothermal 22% (21% in 2019/20), Photovoltaic 16% (16% in 2019/20), Biomass 14% (14% in 2019/20) and Air Source Heat Pumps 5% (5% in 2019/20).

All five of the largest sub-sectors saw Sales values in 2021/22 almost recovering to 2019/20 values after the 2019/20 to 2020/21 economic shock. Wind sales were £873.7m in 2019/20 and were £803.8m in 2021/22 (92.0% of 2019/20); Geothermal £443.0m in 2019/20 and £423.7m in 2021/22 (95.6% of 2019/20); Photovoltaic £335.7m in 2019/20 and £322.8m in 2021/22 (96.2% of 2019/20), Biomass £282.0m in 2019/20 and £275.8m in 2021/22 (97.7 of 2019/20) and Air Source Heat Pumps £103.3m in 2019/20 and £96.7m in 2021/22 (93.6% of 2019/20).

**Figure 15: Hertfordshire's Renewable Energy Employment 2021/22 (Level 2)**

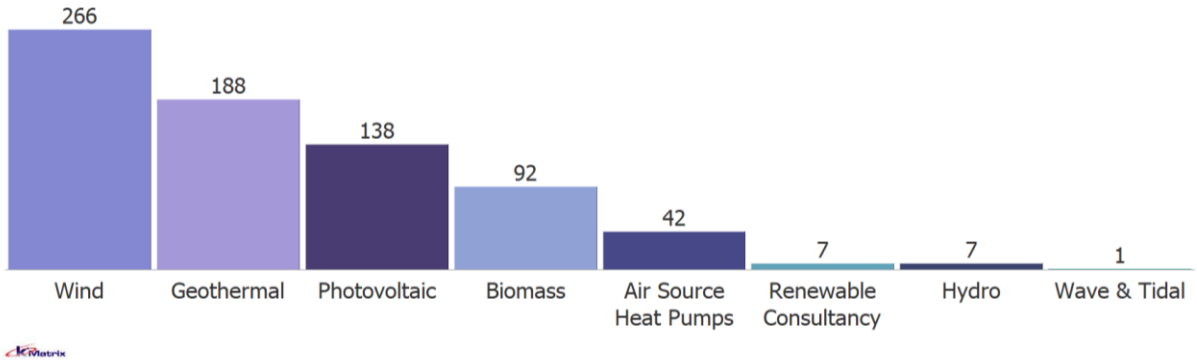



The same five sub-sectors account for 98% of employment (Figure 15). These five are made up of Wind 33% (33% in 2019/20), Geothermal 26% (26% in 2019/20), Photovoltaic 19% (19% in 2019/20), Biomass 15% (15% in 2019/20) and Air Source Heat Pumps 6% (6% in 2019/20).

All five of the largest sub-sectors have seen Employment in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. Wind employed 4,708 in 2019/20 and 4,391 in 2021/22 (93.3% of 2019/20); Geothermal employed 3,785 in 2019/20 and 3,504 in 2021/22 (92.6% of 2019/20); Photovoltaic employed 2,690 in 2019/20 and 2,521 in 2021/22 (93.7% of

2019/20); Biomass employed 2,119 in 2019/20 and 1,989 in 2021/22 (93.9% of 2019/20); and Air Source Heat Pumps employed 835 in 2019/20 and 755 in 2021/22 (90.4% of 2019/20).

**Figure 16: Hertfordshire's Renewable Energy Companies 2021/22 (Level 2)**

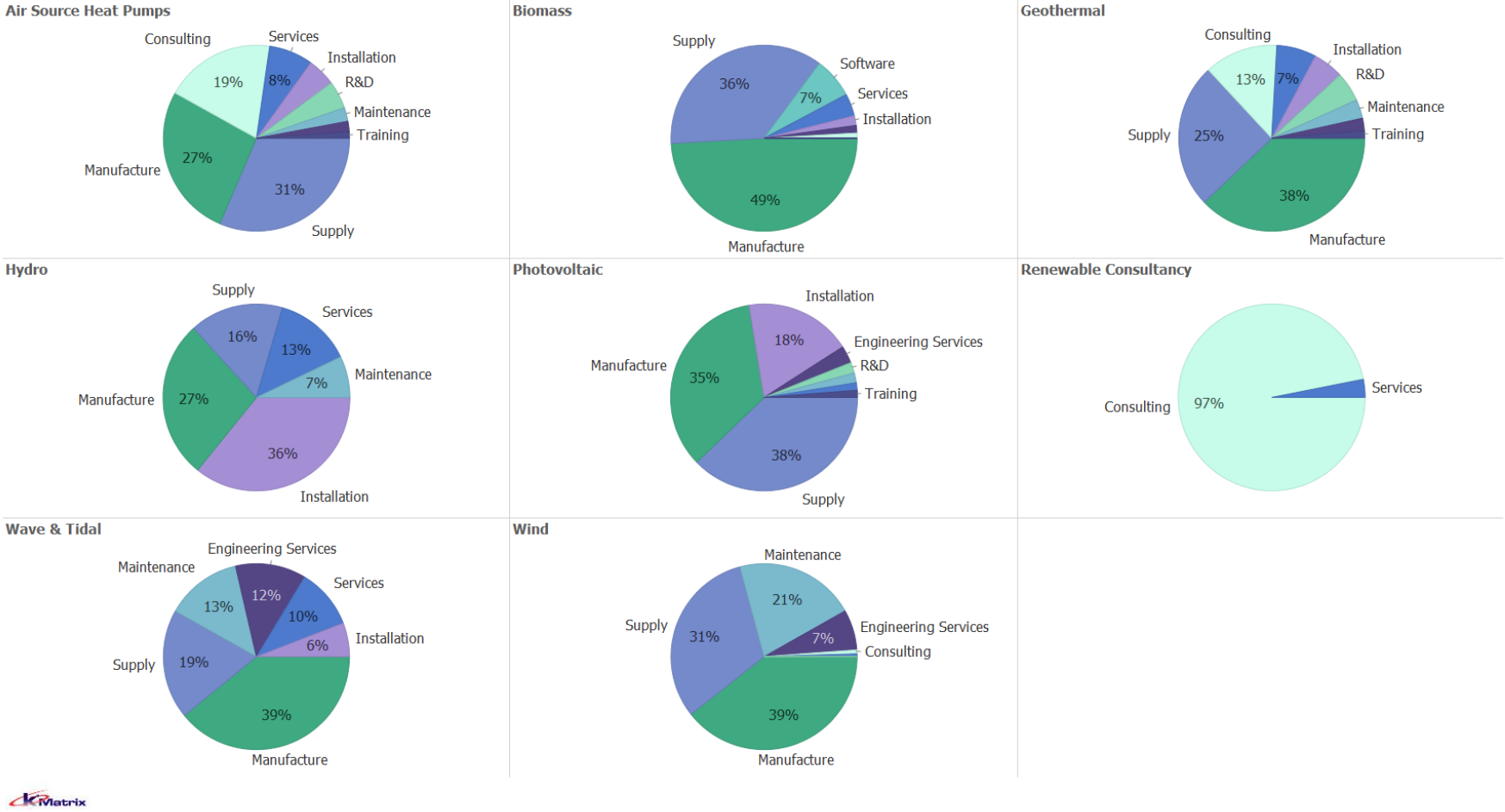



And the same five sub-sectors also account for 98% of companies (Figure 16). These five are made up of Wind 36% (35% in 2019/20), Geothermal 25% (26% in 2019/20), Photovoltaic 19% (19% in 2019/20), Biomass 12% (13% in 2019/20) and Air Source Heat Pumps 6% (6% in 2019/20).

All five of the largest sub-sectors have seen number of Companies in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. The number of companies in Wind was 275 in 2019/20 and 266 in 2021/22 (96.7% of 2019/20); Geothermal was 202 in 2019/20 and 188 in 2021/22 (93.1% of 2019/20); Photovoltaic was 146 in 2019/20 and 138 in 2021/22 (94.5% of 2019/20); Biomass was 100 in 2019/20 and 92 in 2021/22 (92.0% of 2019/20) and Air Source Heat Pumps was 45 in 2019/20 and 42 in 2021/22 (93.3% of 2019/20).

## Section 3.2.2: Renewable Energy by Activity Code (Level 2)

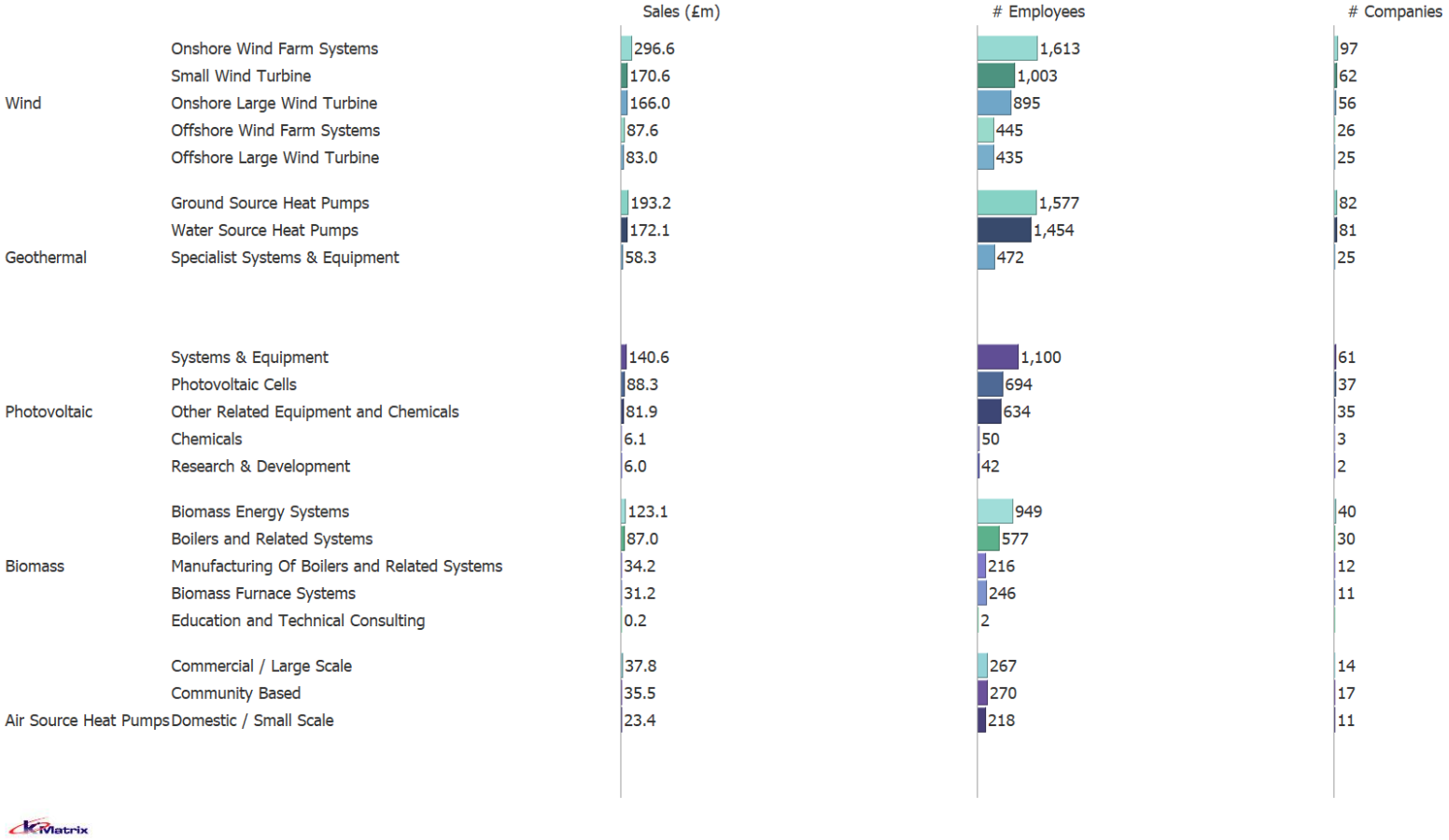
**Figure 17: Hertfordshire's Renewable Energy Split by Activity Code 2021/22 (Level 2)**




**Activities** vary by Level 2 sub-sector (Figure 17), with the largest activity code being ***Supply*** for Air Source Heat Pumps 31% and Photovoltaic 38%; ***Manufacture*** for Biomass 49%, Geothermal 38%, Wave & Tidal 39% and Wind 39%; ***Installation*** for Hydro 36%; and ***Consulting*** for Renewable energy General Consulting 97%. This is within two percentage points of the split in 2019/20.

## Section 3.2.3: Renewable Energy at Level 3

**Figure 18: Hertfordshire's Summary of Selected Metrics for 2021/22 for Selected Renewable Energy Level 2 Sub-sectors at Level 3**




The top five Level 2 sub-sectors for Low Carbon are Wind, Geothermal, Photovoltaic and Biomass, making up 98% of the Renewable Energy market in Hertfordshire. Figure 18 shows a summary of the Sales, Companies and Employees for these Level 2 sub-sectors, broken out into their Level 3 sub-sectors.

Wind is the largest Level 2 sub-sector with 41% of sales and has five sub-sectors at Level 3, the largest being Onshore Wind Farm Systems which makes up 37% of sales in this market (34% in 2019/20), equivalent to £296.6m of the £803.8m Level 2 total Sales. Example companies include manufacture, supply, installation and maintenance of systems components, grid entry cables, insulators and fittings, switching systems and towers and gantries, central controls systems and integration systems, along with energy management consulting services and production of publications.

Geothermal has three sub-sectors at Level 3, the largest being Ground Source Heat Pumps 46% (45% in 2019/20) and Water Source Heat Pumps which makes up 41% of the sales in this market (41% in 2019/20). Example companies for Ground Source and Water Source Heat Pumps include mid-chain sub-componentry manufacture and supply, along with whole systems assembly and supply. Also includes lateral geothermal systems providers and installers at the domestic and small commercial level, and vertical control systems developers and suppliers.

Photovoltaic has five sub-sectors at level 3, the largest being Systems & Equipment which makes up 44% of sales in this market (43% in 2019/20). Example companies include systems developers, suppliers and installers. Manufacturing refers to frames and ancillary equipment.

Biomass has five sub-sectors at level 3, the largest being Biomass Energy Systems which makes up 45% of the sales in this market (44% in 2019/20), example companies include manufacture of biomass mid-chain and processing equipment, developers, installers and consultancies.

Air Source Heat Pumps has three sub-sectors at level 3, which are relatively even in size, with the largest being Commercial/Large Scale which makes up 39% of the sales in this market (37% in 2019/20), followed by Community Based which makes up 37% of the sales in this market (36% in 2019/20), and Domestic/Small Scale which makes up 24% of the sales in this market (27% in 2019/20), example companies include manufacturing of mid-chain componentry, supply of imported whole systems and consulting services, with some installation.

## Section 3.3: LCEGS2023 Level 1 - Environmental

In this section we look at the Environmental market in greater detail. Initially we split the market into ten further sub-sectors, Level 2, and then look at the highest performing Level 2 sub-sectors in more detail by highlighting the activity happening within them at Level 3.

Table 4 provides details on activities within the Level 2 sub-sectors of the Environmental market in Hertfordshire.

**Table 4: LCEGS2023 Level 1 Sub-sector Description – Environmental**

| Level 1 | Level 2 | Description |
|---|---|---|
| **Environmental** | Air Pollution | Includes a range of manufacturing, operations, consulting and engineering functions relating to improving and maintaining air quality. It includes:<br>• Emission Control sensing and monitoring systems and technologies<br>• Indoor Air Quality Control<br>• Dust & Particulate Control<br>• Process Engineering<br>• Industrial Emission Control<br>• Emission Control through manufacture, installation and operation of sampling, control and evaluation systems |
| | Contaminated Land | Activities that bring land back into agricultural, industrial, community or commercial use. This includes longer term activities like the decommissioning of nuclear sites. |
| | Energy From Waste | End-user industries for Energy from Waste i.e. Automotive, Chemicals, Domestic, Farming, Food & Drink, Landfill, Transport, Manufacturing, Processing Industries and Secondary Sewage.<br>Energy extractive technologies and processes i.e. autoclave, conversion treatment, gasification, incineration, MBT, pyrolysis, pre-treatment and compliant biomass. |

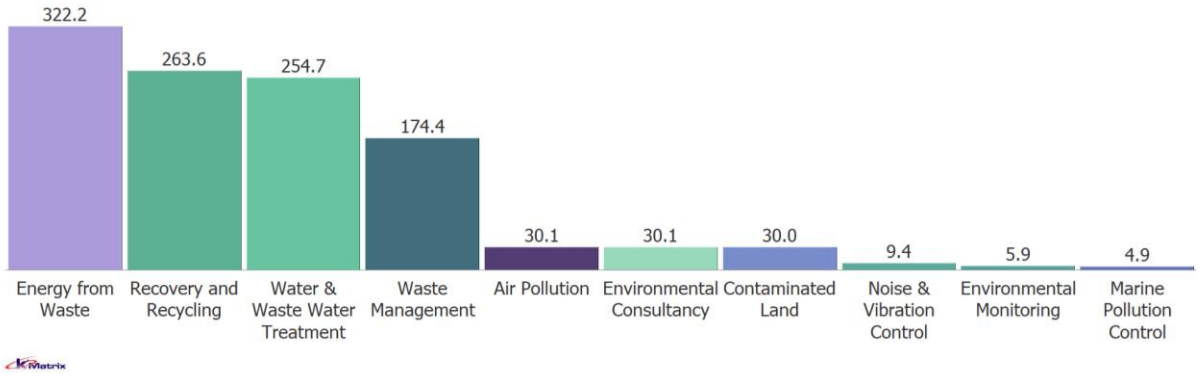
| | | |
|---|---|---|
| | Environmental Consultancy | Consulting, training and management services that are specific to the environmental sector. |
| | Environmental Monitoring | Activities that measure water, soil and air quality, and that support wider pollution control activities in other land, water, marine or air-based environmental sub-sectors. |
| | Marine Pollution Control | Responses to pollution hazards at sea and also discharged from land-based sources. It includes the following products and services for deep sea, coastal waters and inland waterways. It includes:<br>• Marine pollution abatement<br>• R&D<br>• Specialist consulting and training |
| | Noise & Vibration Control | Activities that prevent or control noise and vibration pollution. It includes:<br>• Noise abatement<br>• R&D<br>• Consulting and training |
| | Recovery & Recycling | Activities relating to the collection and processing of domestic and industrial waste products. It includes:<br>• Waste collection<br>• Engineering & equipment<br>• Consulting & training<br>• R&D |
| | Waste Management | Treatment/management of domestic and industrial waste that cannot otherwise be recycled. It includes:<br>• Construction & operation of waste treatment facilities<br>• Equipment for Waste treatment<br>• R&D |
| | Water & Waste Water Treatment | Activities relating to the treatment of pollutants in the water supply. Including water treatment and distribution, engineering and R&D |

Further detail is provided in Appendix 1.

### Section 3.3.1: Environmental at Level 2

In 2021/22, the Environmental Level 1 sub-sector was worth £1,125m in Sales, had 7,032 Employees and 359 Companies. Section 3.3 analyses the Level 2 sub-sectors within Environmental.

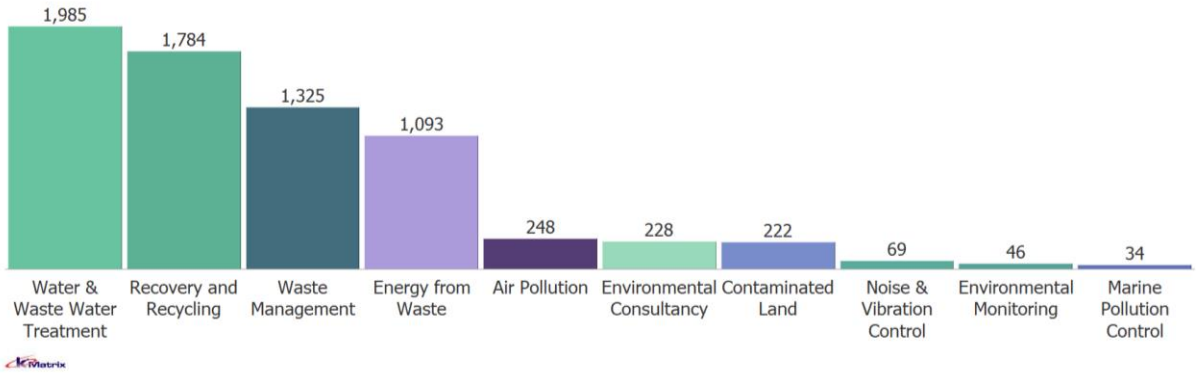
**Figure 19: Hertfordshire's Environmental Sales 2021/22 in £m (Level 2)**




Environmental is split into ten sub-sectors, of which four account for 90% of sales (Figure 19). These four are made up of Energy from Waste 29% (29% in 2019/20), Recovery & Recycling 23% (23% in 2019/20), Water Supply & Waste Water Treatment 23% (23% in 2019/20), and Waste Management 15% (15% in 2019/20).

All four of the largest sub-sectors have seen Sales values in 2021/22 almost recover to 2019/20 values after the 2019/20 to 2020/21 economic shock. Sales for Energy from Waste were £342.8m in 2019/20 and £322.2m in 2021/22 (94.0% of 2019/20); Recovery & Recycling sales £278.9m in 2019/20 and £263.6m in 2021/22 (94.5% of 2019/20); Water Supply & Waste Water Treatment were £275.8m in 2019/20 and were £254.7m in 2021/22 (92.3% of 2019/20); and Waste Management £186.0m in 2019/20 and £174.4m in 2021/22 (93.8% of 2019/20).

**Figure 20: Hertfordshire's Environmental Employment 2021/22 (Level 2)**

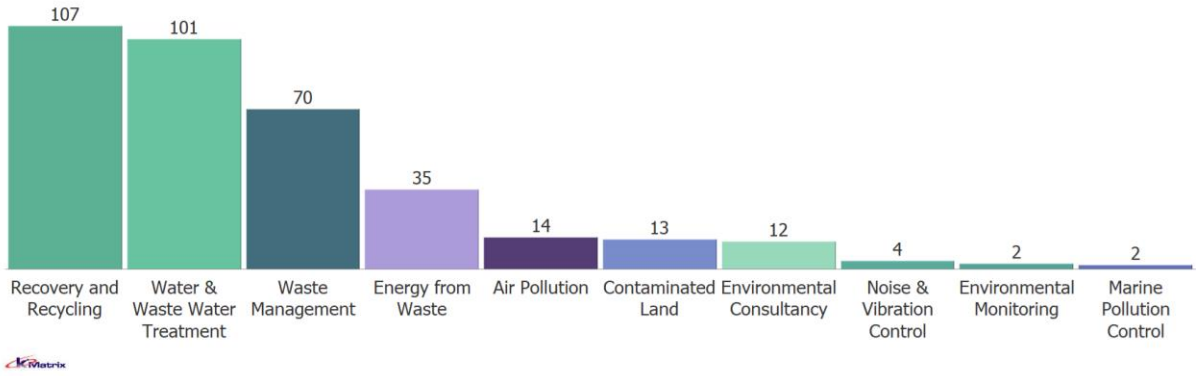



The same four sub-sectors account for 88% of employment (Figure 20). They are made up of Water & Waste Water Treatment 28% (28% in 2019/20), Recovery & Recycling 25% (25% in 2019/20), Waste Management 19% (18% in 2019/20) and Energy from Waste 16% (17% in 2019/20).

All four of the largest sub-sectors have seen Employment in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. Water & Waste Water Treatment employed 2,269 in 2019/20 and 1,985 in 2021/22 (87.5% of 2019/20); Recovery & Recycling employed 1,988 in 2019/20 and 1,784 in 2021/22 (89.7% of 2019/20); Waste Management employed 1,479 in 2019/20

and 1,325 in 2021/22 (89.6% of 2019/20) and Energy from Waste employed 1,338 in 2019/20 and 1,093 in 2021/22 (81.7% of 2019/20).

**Figure 21: Hertfordshire's Environmental Companies 2021/22 (Level 2)**




The same four sub-sectors also account for 87% of companies (Figure 21). They are made up of Recovery & Recycling 30% (29% in 2019/20), Water & Waste Water Treatment 28% (28% in 2019/20), Waste Management 19% (19% in 2019/20) and Energy from Waste 10% (11% in 2019/20).

All four of the largest sub-sectors have seen the number of Companies in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. The number of companies in Recovery & Recycling was 119 in 2019/20 and 107 in 2021/22 (89.9% of 2019/20); Water & Waste Water Treatment was 115 in 2019/20 and 101 in 2021/22 (87.8% of 2019/20); Waste Management was 78 in 2019/20 and 70 in 2021/22 (89.7% of 2019/20) and Energy from Waste was 43 in 2019/20 and 35 in 2021/22 (81.4% of 2019/20).

## Section 3.3.2: Environmental by Activity Code (Level 2)

**Figure 22: Hertfordshire's Environmental Energy Split by Activity Code 2021/22 (Level 2)**


**Activities** vary by Level 2 sub-sector (Figure 22), with the largest activity code being ***Manufacture*** for Air Pollution 36% and Waste Management 21%; ***Services*** for Contaminated Land 38% and Environmental Monitoring 44%; ***Supply*** for Energy from Waste 38%; ***Consulting*** for Environmental Consulting 69%; ***R&D*** for Marine Pollution Control 28% and Noise & Vibration Control 33%; ***Recycling & Resale*** for Recovery and Recycling 68%; and ***Engineering Services*** for Water & Waste Water Treatment 29%. This is within one percentage point of the split in 2019/20.

## Section 3.3.3: Environmental at Level 3

**Figure 23: Hertfordshire's Summary of Selected Metrics for 2021/22 for Water & Waste Water Treatment and Waste Management at Level 3**

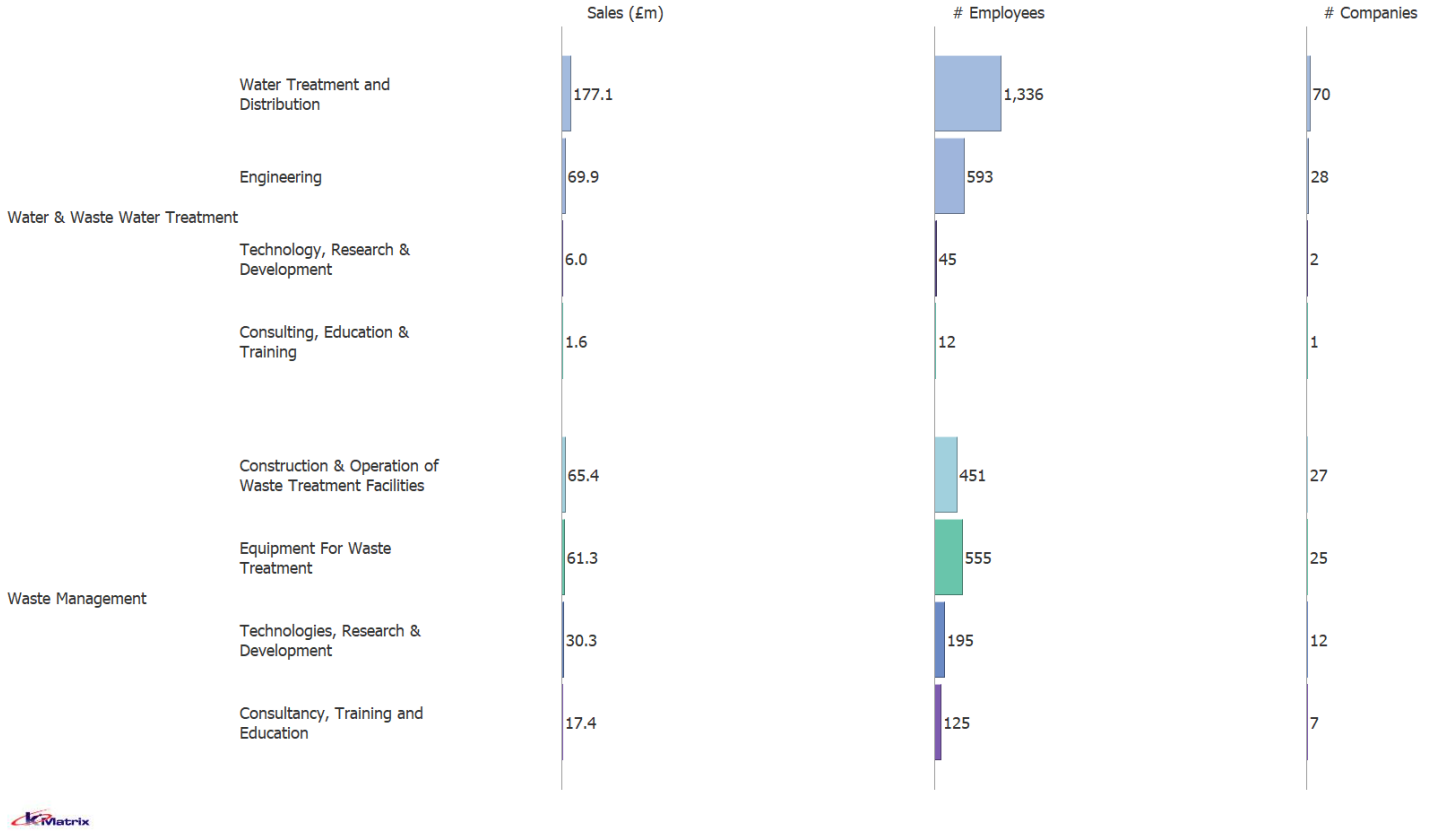



Figure 23 shows the Sales, Companies and Employees the Level 2 Water & Waste Water Treatment and Waste Management sub-sectors broken down into their Level 3 sub-sectors.

Water & Waste Water Treatment is made up of four Level 3 sub-sectors, the largest being Water Treatment and Distribution which makes up 70% of sales, equivalent to £177.m of the £254.7m Level 2 total Sales (70% in 2019/20). Example activities include development and implementation by utilities along with supply, consultancy and implementation by independent consulting engineers.

Waste Management is made up of four Level 3 sub-sectors, with the largest being Construction & Operation of Waste Treatment Facilities which makes up 38% of sales (38% in 2019/20). Example companies are those involved in both public and private operations management and supply and installation of operational equipment. The next largest sub-sector is Equipment for Waste Treatment which makes up 35% of sales in the market (35% in 2019/20). Example companies are those involved in development, manufacture and supply.

**Figure 24: Hertfordshire's Summary of Selected Metrics for 2021/22 for Recovery and Recycling Sub-sector at Level 3**

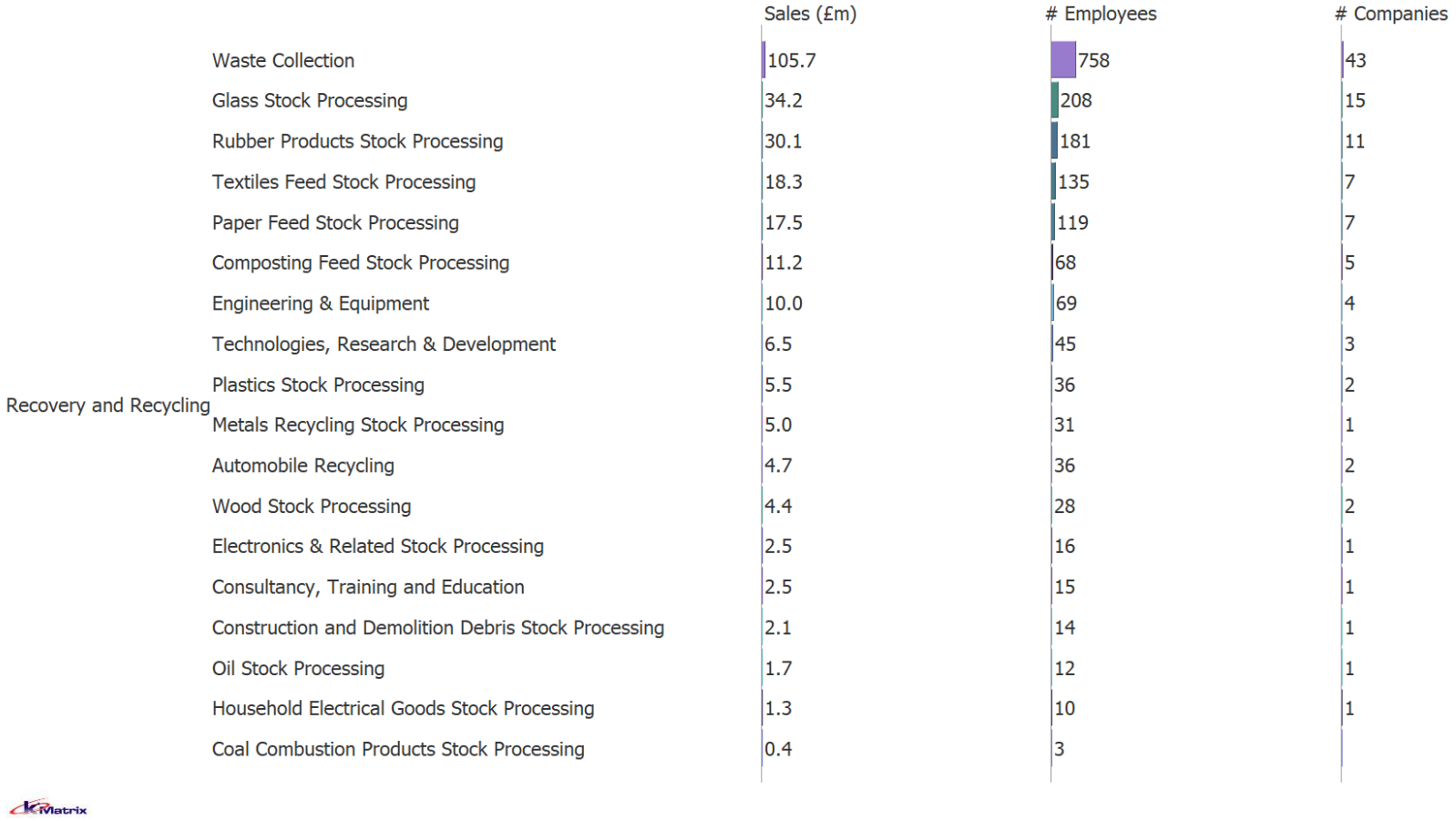
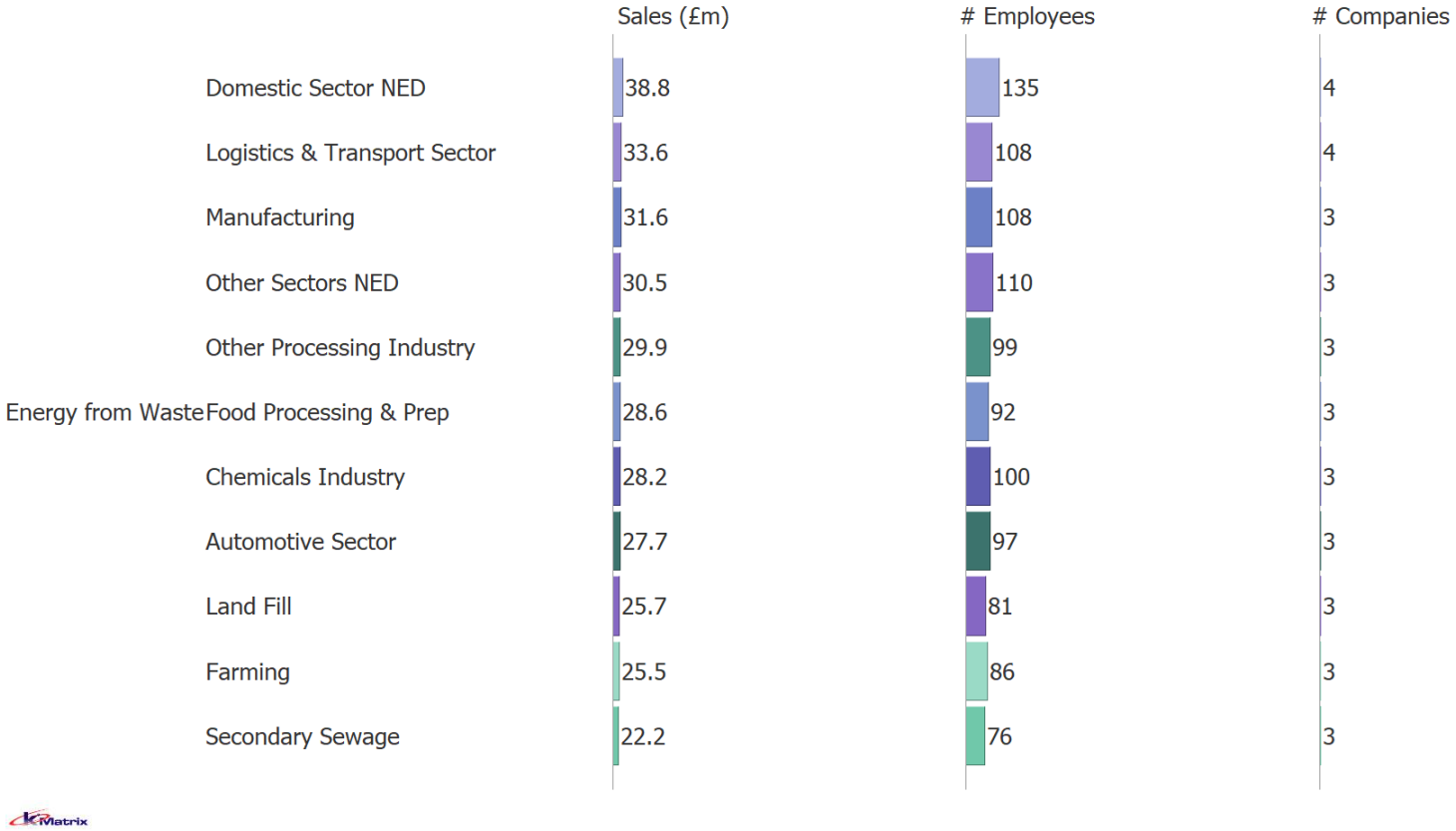



Figure 24 shows the Sales, Companies and Employees for the Recovery & Recycling Level 2 sub-sector broken down into Level 3 sub-sectors. There are eighteen Level 3 sub-sectors and Waste Collection, including the collection of all waste, both municipal and commercial (landfill and recyclates), is clearly the largest sub-

sector making up 40% of all sales in the Recovery and Recycling sub-sector, equivalent to £105.7m of the £263.6m Level 2 total Sales (40% in 2019/20). There are then a number of waste stream stock processing sub-sectors with the largest ones being Glass, Rubber Products, Textiles, Paper and Composting.

**Figure 25: Hertfordshire's Summary of Selected Metrics for 2021/22 for Energy from Waste Sub-sector at Level 3**




*Note: NED means Not Elsewhere Determined

Figure 25 shows the Sales, Companies and Employees for the Energy from Waste Level 2 sub-sector broken down into Level 3 sub-sectors. There are eleven Level 3 sub-sectors, relating to the origin of waste, with the Domestic Sector being the largest sub-sector making up 12% of all sales, equivalent to £38.8m of the £322.2m Level 2 total Sales (12% in 2019/20). This is followed in size by Logistics & Transport Sector with 10% (10% in 2019/20) and Manufacturing with 10% (10% in 2019/20). The smallest sub-sector is Secondary Sewage with 7% (7% in 2019/20). Example activities within Energy from Waste Level 2 subsector include Energy Extraction Processes, Mechanical and Biological Treatment (MBT), Pre-treatment, Autoclaving, Incineration, Gasification, Conversion Treatment , Waste Incineration Directive (WID) Compliant Biomass and Pyrolysis.

## Section 3.4: LCEGS2023 Level 1 – District Heat Networks

In this section we look at the District Heat Network (DHNW) market in greater detail. Initially we split the market into three further sub-sectors, Level 2, and then look at the highest performing Level 2 sub-sectors in more detail by highlighting the activity happening within them at Level 3.

Table 5 provides details on activities within the Level 2 sub-sectors of the District Heat Network market in Hertfordshire.

**Table 5: LCEGS2023 Level 1 Sub-sector Description – District Heat Networks**

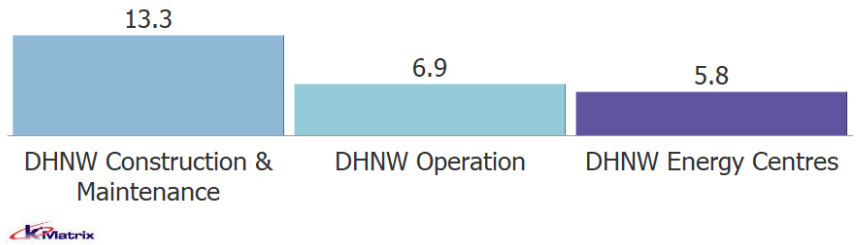
| Level 1 | Level 2 | Description |
|---|---|---|
| **District Heat Networks** | DHNW Construction & Maintenance | Measures the infrastructure for Heat Networks but excludes heat source. It includes:<br>• Consumer Side Heat Network Connections<br>• Grid Connections<br>• Ground Works<br>• Project Consulting Services<br>• Underground DHNW Assets |
| | DHNW Energy Centres | Measures the infrastructure and maintenance of Energy Centres. It includes:<br>• Energy Centre and Sub-station Buildings<br>• Energy Centre Equipment |
| | DHNW Operation | Measures the operation of Heat Networks. It includes:<br>• DHNW Ownership and Operational Management<br>• DHNW System Energy Measurement & Monitoring<br>• DHNW-supplied Energy Sales<br>• Energy Storage for DHNW<br>• Fuel Supply & Storage at DHNW Energy Centres<br>• Heat Supply (sales of waste heat from industrial and commercial processes) |

Further detail is provided in Appendix 1.

### Section 3.4.1: District Heat Networks at Level 2

In 2021/22, the District Heat Networks Level 1 sub-sector was worth £26m in Sales, had 1,539 Employees and 13 Companies. Section 3.4 analyses the Level 2 sub-sectors within District Heat Networks.

**Figure 26: Hertfordshire's District Heat Networks Sales 2021/22 in £m (Level 2)**




District Heat Networks is split into three sub-sectors (Figure 26). These are DHNW Construction & Maintenance 51% (51% in 2019/20), DHNW Operation 27% (27% in 2019/20), and DHNW Energy Centres 22% (23% in 2019/20).

All three of the sub-sectors have seen Sales values in 2021/22 almost recover to 2019/20 values after the 2019/20 to 2020/21 economic shock. Sales for DHNW Construction & Maintenance were £14.2m in 2019/20 and were £13.3m in 2021/22 (93.7% of 2019/20); DHNW Operation sales £7.5m in 2019/20 and £6.9m in 2021/22 (92.0% of 2019/20) and DHNW Energy Centres £6.3m in 2019/20 and £5.8m in 2021/22 (92.1% of 2019/20).

**Figure 27: Hertfordshire's District Heat Networks Employment 2021/22 (Level 2)**

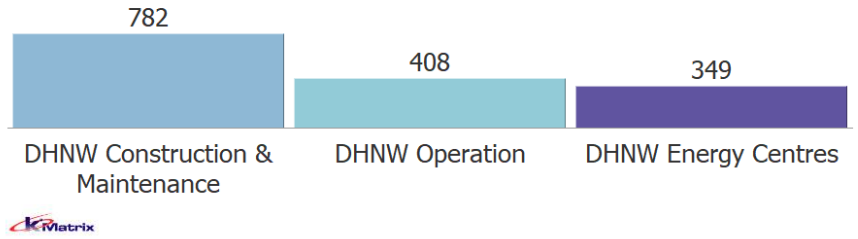



Figure 27 shows the employment within the three sub-sectors for District Heat Networks, DHNW Construction & Maintenance 51% (50% in 2019/20), DHNW Operation 27% (27% in 2019/20), and DHNW Energy Centres 23% (23% in 2019/20).

All three sub-sectors have seen Employment in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. DHNW Construction & Maintenance employed 844 in 2019/20 and 782 in 2021/22 (92.7% of 2019/20); DHNW Operation employed 447 in 2019/20 and 408 in 2021/22 (91.3% of 2019/20); and DHNW Energy Centres employed 383 in 2019/20 and 349 in 2021/22 (91.1% of 2019/20).

**Figure 28: Hertfordshire's District Heat Networks Companies 2021/22 (Level 2)**

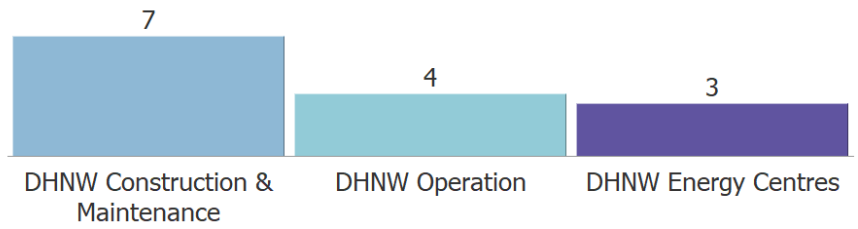


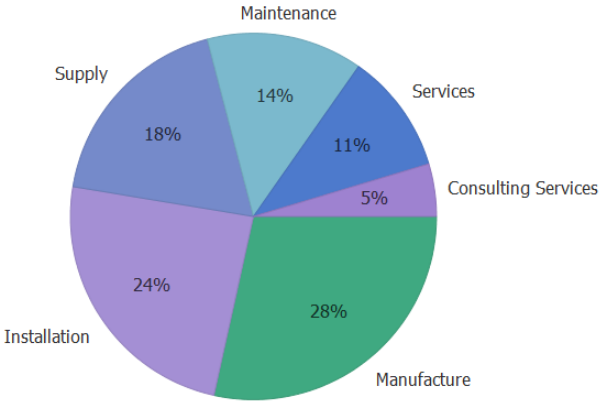

Figure 28 shows the companies within the three sub-sectors for District Heat Networks, DHNW Construction & Maintenance 54% (50% in 2019/20), DHNW Operation 23% (29% in 2019/20), and DHNW Energy Centres 23% (21% in 2019/20).

Two of the three sub-sectors have retained the same number of Companies, after the 2019/20 to 2020/21 economic shock. DHNW Construction & Maintenance had 7 companies in 2019/20 and 2021/22; DHNW Operation had 4 companies in 2019/20 and 3 in 2021/22 (75.0% of 2019/20); and DHNW Energy Centres had 3 Companies in 2019/20 and 2021/22.

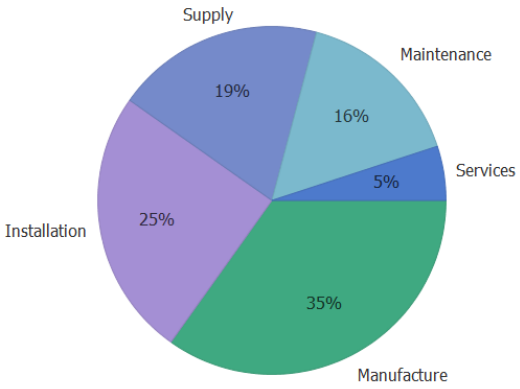
## Section 3.5.2: District Heat Networks by Activity Code (Level 2)

**Figure 29: Hertfordshire's District Heat Networks Sales Split by Activity Code 2021/22 (Level 2)**

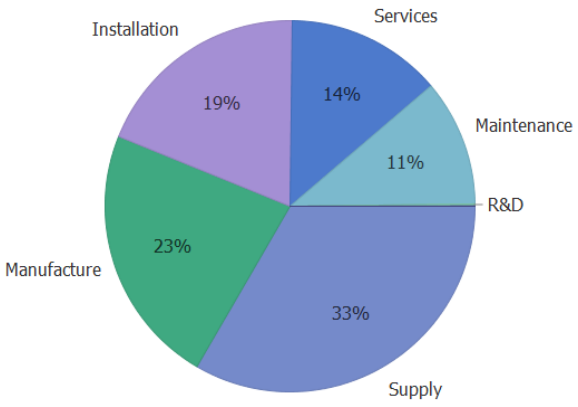
**DHNW Construction and Maintenance**




**DHNW Energy Centres**




**DHNW Operation**




**Activities** vary by Level 1 sub-sector (Figure 29), with the largest activity code being ***Manufacture*** for DHNW Construction and Maintenance 28% and DHNW Energy Centres 35%; and ***Supply*** for DHNW Operation 33%, which refers a combination of the Level 3 sub-sectors of Fuel Supply and Storage at DHNW Energy Centres and Heat Supply (Sales of waste heat from industrial and commercial processes).

## Section 3.4.3: District Heat Networks at Level 3

**Figure 30: Hertfordshire's Summary of Selected Metrics for 2021/22 for District Heat Networks at Level 3**

| | | Sales (£m) | # Employees | # Companies |
|---|---|---|---|---|
| DHNW Construction & Maintenance | Ground works | 8.0 | 469 | 4 |
| | Underground DHNW assets | 3.5 | 202 | 2 |
| | Grid connections | 0.7 | 43 | |
| | Consumer side heat network connections | 0.6 | 36 | |
| | Project consulting services | 0.5 | 31 | |
| DHNW Operation | DHNW System energy measurement and monitoring | 2.5 | 149 | 1 |
| | Fuel supply and storage at DHNW Energy Centres | 2.4 | 139 | 1 |
| | DHNW ownership and operational management | 1.0 | 65 | 1 |
| | DHNW-supplied energy sales | 0.4 | 23 | |
| | Energy storage for the DHNW | 0.3 | 18 | |
| | Heat supply (Sales of waste heat from industrial... | 0.3 | 14 | |
| DHNW Energy Centres | Energy Centre equipment | 4.4 | 264 | 2 |
| | Energy Centre and sub-station buildings | 1.4 | 85 | 1 |

Figure 30 shows the Sales, Companies and Employees the Level 2 District Heat Network sub-sectors broken down into their Level 3 sub-sectors.

DHNW Construction & Maintenance is made up of five Level 3 sub-sectors, the largest being Ground works which makes up 60% of sales, equivalent to £8.0m of the £13.3m Level 2 total Sales (61% in 2019/20). Example activities include underground assets installation and testing; groundworks equipment, tools, supplies and consumables, specialist contracting and site management.

DHNW Operation is made up of six Level 3 sub-sectors, the largest being DHNW system energy measurement and monitoring which makes up 36% of sales (36% in 2019/20). Example activities include energy and fuel meters, asset condition monitoring and safety sensors and non-domestic energy monitoring and control systems. This is followed by Fuel supply and storage at DHNW energy centres, which makes up 35% (35% in 2019/20). Example activities include fuel storage and supply of fuels used to generate heat for DHNWs in dedicated energy centres only.

DHNW Energy Centres is made up of two Level 3 sub-sectors, with the largest being Energy Centre Ground works which makes up 76% of sales (75% in 2019/20). Example activities include heat generation equipment, back-up and top-up boilers, back-start generation sets (gas or diesel), water pumping equipment, electrical switchgear and controls and cooling systems.

## Section 3.5: LCEGS2023 Level 1 – Green Infrastructure & Nature Based Solutions

In this section we look at the Green Infrastructure & Nature Based Solutions (GI&NBS) market in greater detail. Initially we split the market into two further sub-sectors, Level 2, and then look at the highest performing Level 2 sub-sectors in more detail by highlighting the activity happening within them at Level 3.

Table 6 provides details on activities within the Level 2 sub-sectors of the GI&NBS market in Hertfordshire.

**Table 6: LCEGS2023 Level 1 Sub-sector Description – GI&NBS**

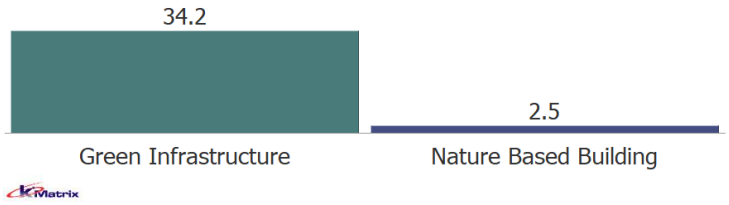
| Level 1 | Level 2 | Description |
|---|---|---|
| **Green Infrastructure & Nature Based Solutions** | Green Infrastructure | Green Infrastructure relates to the R&D, Consulting, Engineering Services, Installation, Maintenance, Supply and Training related to the management of Green Infrastructure including:<br>• Agricultural Land<br>• Coastal Habitats<br>• Forest & Woodland<br>• Freshwater Systems (Fish Ladders etc.)<br>• Green Linkages |
| | Nature Based Solutions | Nature Based Solutions relates to the R&D, Consulting, Engineering Services, Installation, Maintenance, Supply and Training related to the management of:<br>• Green Roofing<br>• Green Walls |

Further detail is provided in Appendix 1.

### Section 3.5.1: GI&NBS at Level 2

In 2021/22, GI&NBS Level 1 sub-sector was worth £38m in Sales, had 259 Employees and 17 Companies. Section 3.4 analyses the Level 2 sub-sectors within GI&NBS.

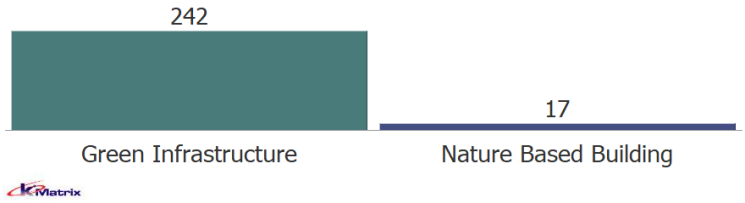
**Figure 31: Hertfordshire's GI&NBS Sales 2021/22 in £m (Level 2)**




The sub-sectors within Green Infrastructure & Nature Based Solutions are shown in Figure 31. Sales were split: Green Infrastructure 93% (93% in 2019/20) and Nature Based Solutions 7% (7% in 2019/20).

Both sub-sectors have seen Sales values in 2021/22 almost recover to 2019/20 values after the 2019/20 to 2020/21 economic shock. Sales for Green Infrastructure were £38.4m in 2019/20 and were £34.2m in 2021/22 (89.1% of 2019/20); and Nature Based Solutions £2.8m in 2019/20 and £2.5m in 2021/22 (89.3% of 2019/20).

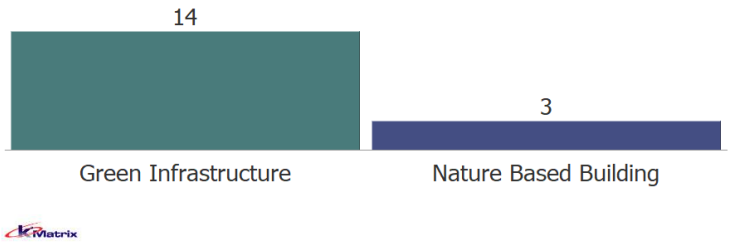
**Figure 32: Hertfordshire's GI&NBS Employment 2021/22 (Level 2)**




The sub-sectors within Green Infrastructure & Nature Based Solutions are shown in Figure 32. Employment was split: Green Infrastructure 93% (93% in 2019/20) and Nature Based Solutions 7% (6% in 2019/20).

Both sub-sectors have seen Employment in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. Green Infrastructure employed 281 in 2019/20 and 242 in 2021/22 (86.1% of 2019/20); and Nature Based Solutions employed 19 in 2019/20 and 17 in 2021/22 (89.5% of 2019/20).

**Figure 33: Hertfordshire's GI&NBS Companies 2021/22 (Level 2)**

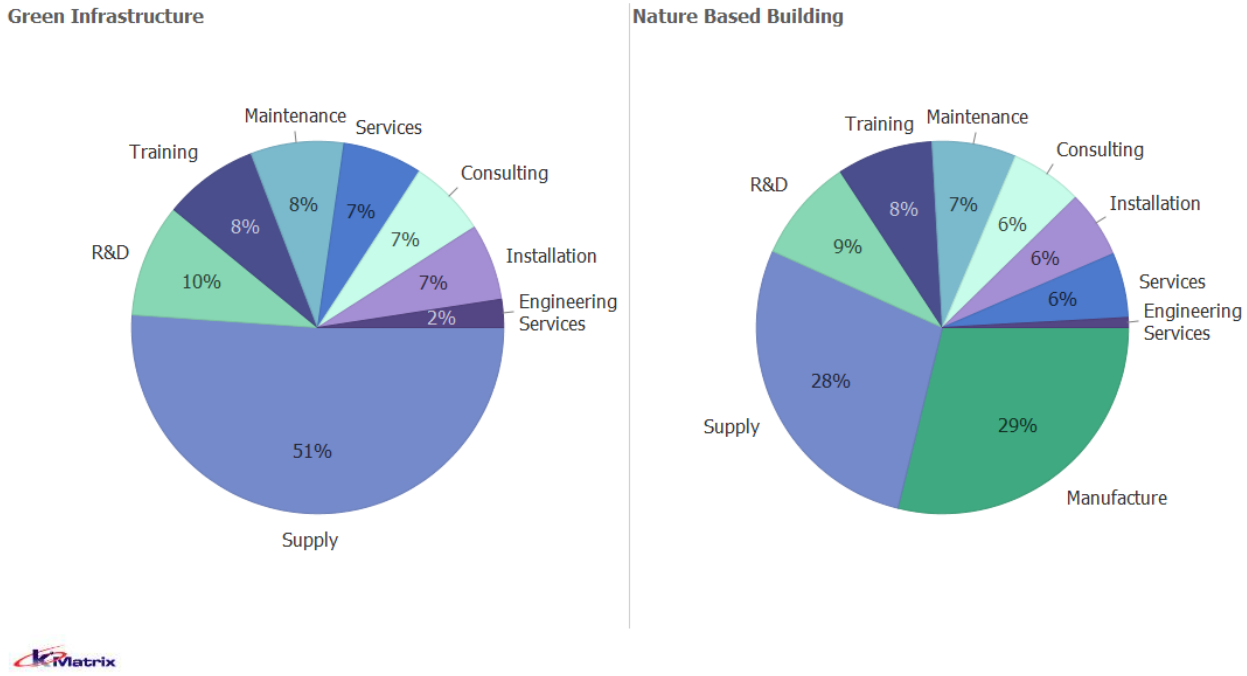



The sub-sectors within Green Infrastructure & Nature Based Solutions are shown in Figure 33. Number of companies were split: Green Infrastructure 82% (80% in 2019/20) and Nature Based Solutions 18% (20% in 2019/20).

Both sub-sectors have seen the Number of Companies almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. Green Infrastructure had 16 Companies in 2019/20 and 14 in 2021/22 (87.5% of 2019/20); and Nature Based Solutions had 4 Companies in 2019/20 and 3 in 2021/22 (75.0% of 2019/20).

### Section 3.5.2: GI&NBS by Activity Code (Level 2)

**Figure 34: Hertfordshire's GI&NBS Energy Split by Activity Code 2021/22 (Level 2)**




**Activities** vary by Level 2 sub-sector (Figure 34), with the largest activity code for Green Infrastructure being ***Supply*** 51% (51% in 2019/20); followed by ***R&D*** 10% (9% in 2019/20); and ***Training*** 8% (9% in 2019/20); while the largest activity codes for Nature Based Solutions are ***Manufacture*** 29% (33% in 2019/20); ***Supply*** 28% (24% in 2019/20); and ***R&D*** 9% (10% in 2019/20). This is within one percentage point of the split in 2019/20

## Section 3.5.3: GI&NBS at Level 3

**Figure 35: Hertfordshire's Summary of Selected Metrics for 2021/22 for GI&NBS at Level 3**

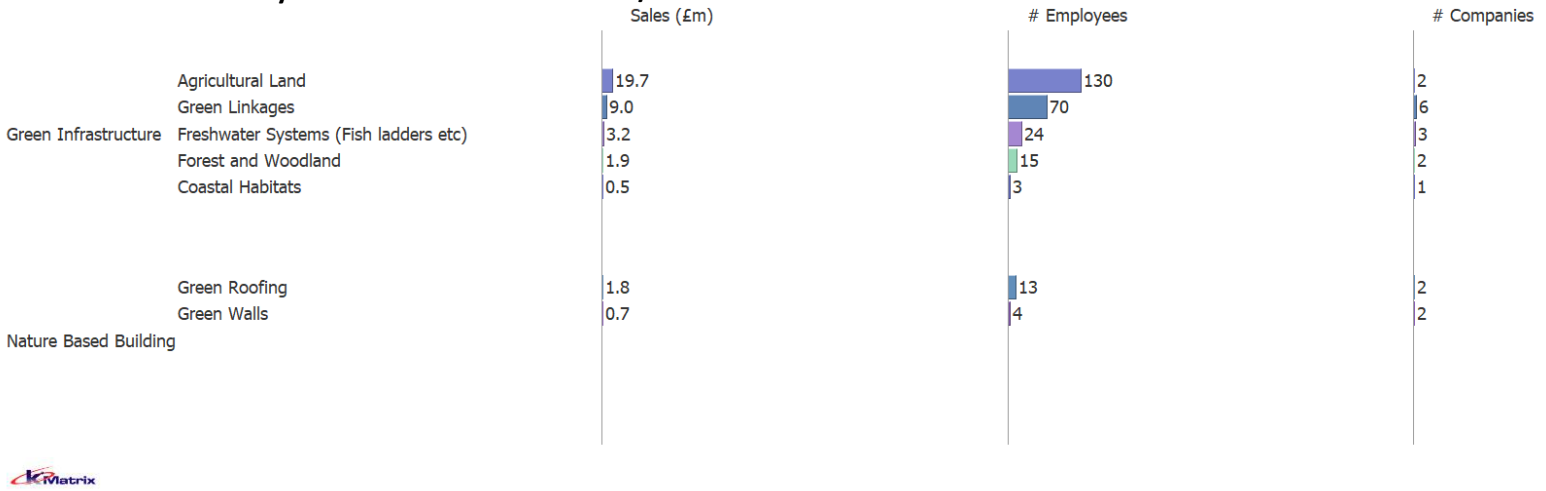



Figure 35 shows the Sales, Companies and Employees of the Level 2 Green Infrastructure & Nature Based Solutions sub-sectors broken down into their Level 3 sub-sectors.

Green Infrastructure is made up of five Level 3 sub-sectors, the largest being Agricultural Land which makes up 58% of sales, equivalent to £19.7m of the £34.2m Level 2 total Sales (57% in 2019/20), followed by Green Linkages which makes up 26% of sales (27% in 2019/20). Example activities include the supply of aggregates, soil and planting materials, along with fish ladders, banks stabilization material etc.

Nature Based Solutions is made up of two Level 3 sub-sectors, the largest being Green Roofing which makes up 72% of sales (71% in 2019/20), followed by Green Walls which makes up 28% of sales (29% in 2019/20). Example activities include the supply and installation of both hard infrastructure and planting material.

## Section 3.6: LCEGS2023 Level 1 – Sustainable Food Production

In this section we look at the Sustainable Food Production market in greater detail. Initially we split the market into five further sub-sectors, Level 2, and then look at the highest performing Level 2 sub-sectors in more detail by highlighting the activity happening within them at Level 3.

Table 7 provides details on activities within the Level 2 sub-sectors of the Sustainable Food Production market in Hertfordshire.

**Table 7: LCEGS2023 Level 1 Sub-sector Description – Sustainable Food Production**

| Level 1 | Level 2 | Description |
|---|---|---|
| **Sustainable Food Production** | Biodegradable Food Packaging | Includes the R&D, Consulting, Manufacture, Services, Supply and Training for Biodegradable Food Packaging |
| | Food Waste Reduction Activities | Includes the R&D, Consulting, Engineering Services, Manufacture, Installation, Maintenance, Services, Supply and Training for:<br>• Zero waste Catering – includes Food Recycling (unsold food to restaurants), Unsold Food Apps (catering), Zero Waste Cafes & Restaurants<br>• Zero Waste Food Retail – End of Shelf Life Food & Drink Sales, Extended Shelf Life R&D and Unsold Food Apps (retail) |
| | Low Carbon Agriculture | Includes the R&D, Consulting, Engineering Services, Manufacture, Installation, Maintenance, Services, Supply and Training for:<br>• Low Carbon Agricultural Vehicles – Biogas, Electric and Hydrogen<br>• Low Carbon Farming Consultancy and Related Services – Consultancy and Training<br>• Low Carbon Farming Equipment – Low Carbon Grain Dryers and Specialist Low Carbon Farming Equipment (incl. Agri-robots, remote imaging, vertical farming systems etc.) |
| | Low Carbon Meat Alternatives | Includes the R&D, Consulting, Engineering Services, Manufacture, |

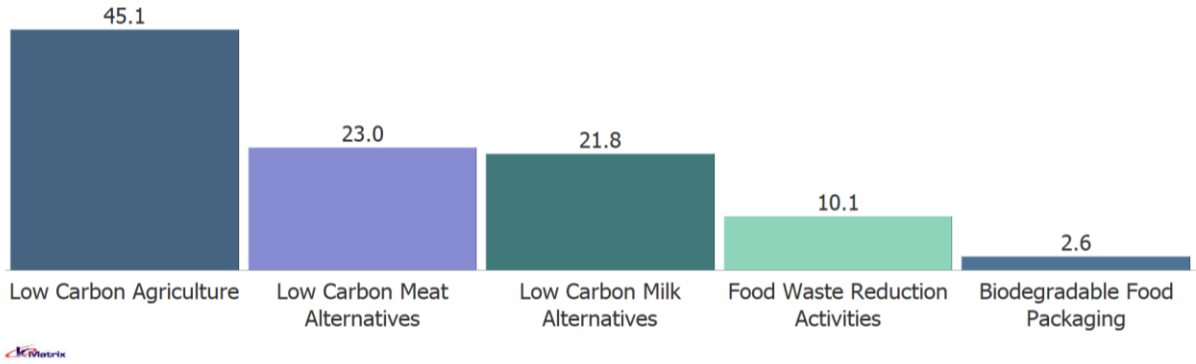
| | | |
|---|---|---|
| | | Installation, Maintenance, Services, Supply and Training for:<br>• Low Carbon Meat Alternatives Production Equipment – Mycoprotein, Pea-based, Soy-based, Wheat-based and Other<br>• Low Carbon Meat Alternatives Products – Mycoprotein, Pea-based, Soy-based, Wheat-based and Other |
| | Low Carbon Milk Alternatives | Includes the R&D, Consulting, Engineering Services, Manufacture, Installation, Maintenance, Services, Supply and Training for:<br>• Low Carbon Milk Alternatives Production Equipment – Almond, Coconut, Hazelnut, Hemp, Oat, Pea and Soya<br>• Low Carbon Milk Alternatives Products – Almond, Coconut, Hazelnut, Hemp, Oat, Pea and Soya |

Further detail is provided in Appendix 1.

### Section 3.6.1: Sustainable Food Production at Level 2

In 2021/22, Sustainable Food Production Level 1 sub-sector was worth £103m in Sales, had 365 Employees and 11 Companies. Section 3.4 analyses the Level 2 sub-sectors within Sustainable Food Production.

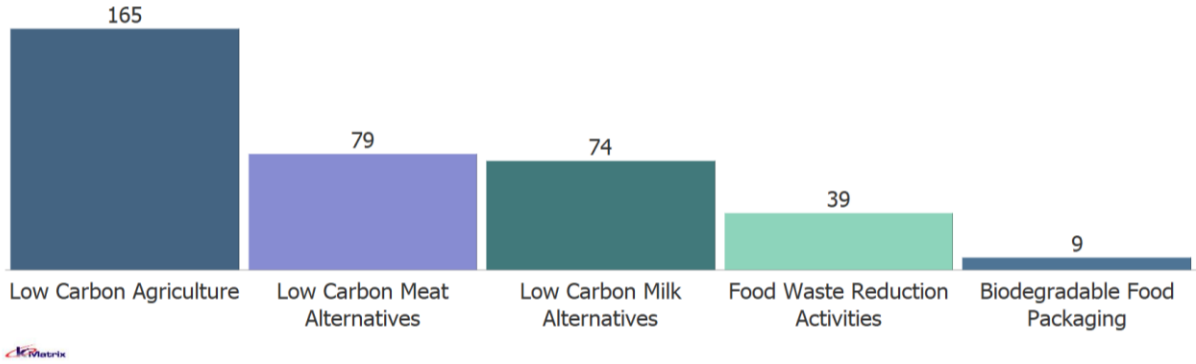
**Figure 36: Hertfordshire's Sustainable Food Production Sales 2021/22 in £m (Level 2)**




Sustainable Food Production is split into five sub-sectors, of which three account for 88% of sales (Figure 36). These three are made up of Low Carbon Agriculture 44% (44% in 2019/20), Low Carbon Meat Alternatives 22% (22% in 2019/20), and Low Carbon Milk Alternatives 21% (21% in 2019/20).

All three of the largest sub-sectors have seen Sales values in 2021/22 almost recover to 2019/20 values after the 2019/20 to 2020/21 economic shock. Sales for Low Carbon Agriculture were £47.9m in 2019/20 and were £45.1m in 2021/22 (94.2% of 2019/20); Low Carbon Meat Alternatives sales £24.4m in 2019/20 and £23.0m in 2021/22 (94.3% of 2019/20); and Low Carbon Milk Alternatives £23.2m in 2019/20 and £21.8 in 2021/22 (94.0% of 2019/20).

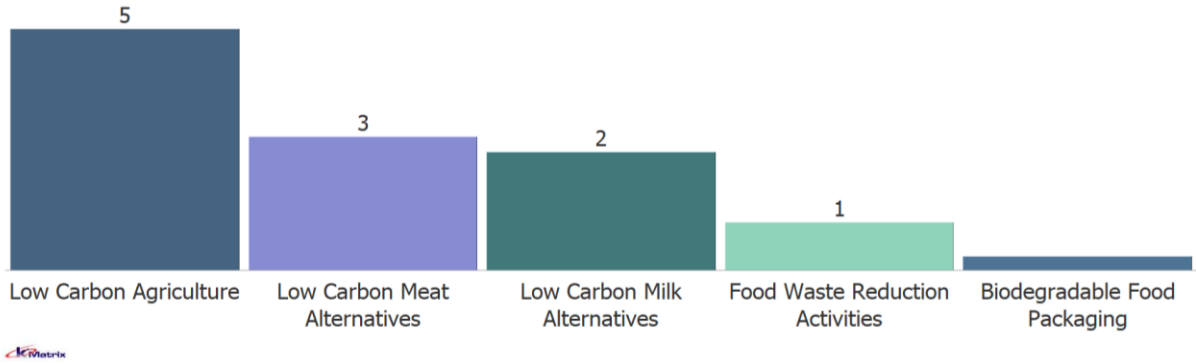
**Figure 37: Hertfordshire's Sustainable Food Production Employment 2021/22 (Level 2)**




The same three sub-sectors account for 87% of employment (Figure 37). These three are made up of Low Carbon Agriculture 45% (45% in 2019/20), Low Carbon Meat Alternatives 22% (22% in 2019/20), and Low Carbon Milk Alternatives 20% (20% in 2019/20).

All three of the largest sub-sectors have seen Employment in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock. Low Carbon Agriculture employed 201 in 2019/20 and 165 in 2021/22 (82.1% of 2019/20);Low Carbon Meat Alternatives employed 96 in 2019/20 and 79 in 2021/22 (82.3% of 2019/20); and Low Carbon Milk Alternatives employed 90 in 2019/20 and 74 in 2021/22 (82.2% of 2019/20).

**Figure 38: Hertfordshire's Sustainable Food Production Companies 2021/22 (Level 2)**




The same three sub-sectors account for 91% of companies (86% in 2019/20) (Figure 38). They are split Low Carbon Agriculture 45% (43% in 2019/20), Low Carbon Meat Alternatives 27% (21% in 2019/20), and Low Carbon Milk Alternatives 18% (21% in 2019/20).

Two of the three largest sub-sectors have seen the number of Companies in 2021/22 almost recover to 2019/20 figures after the 2019/20 to 2020/21 economic shock and one has fully recovered. The number of companies in Low Carbon Agriculture was 6 in 2019/20 and 5 in 2021/22 (83.3% of 2019/20); Low Carbon Meat Alternatives was 3 in 2019/20 and 3 in 2021/22 (100.0% of 2019/20); and Low Carbon Milk Alternatives was 3 in 2019/20 and 2 in 2021/22 (66.7% of 2019/20).

Biodegradable Food Packaging have a company count of 0 because these are services from various companies, delivered by the equivalent of 9 employees from various organisations, however counting all of those organisations as companies would give a false impression of the sub-sector being larger than it is.

## Section 3.6.2: Sustainable Food Production by Activity Code (Level 2)

**Figure 39: Hertfordshire's Sustainable Food Production Split by Activity Code 2021/22 (Level 2)**


**Activities** vary by Level 2 sub-sector (Figure 39), with the largest activity code for all sub-sectors being ***Supply***, with Biodegradable Food Packaging being 43%, Food Waste Reduction Activities 67%, Low Carbon Agriculture 38%, Low Carbon Meat Alternatives 42% and Low Carbon Milk Alternatives 39%. This is within one percentage point of the split in 2019/20.

## Section 3.6.2: Sustainable Food Production at Level 3

**Figure 40: Hertfordshire's Summary of Selected Metrics for 2021/22 for Sustainable Food Production at Level 3**


Figure 40 shows the Sales, Companies and Employees of the Level 2 Sustainable Food Production sub-sectors broken down into their Level 3 sub-sectors.

Low Carbon Agriculture is made up of three Level 3 sub-sectors, the largest being Low Carbon Farming Equipment which makes up 50% of sales, equivalent to £22.6m of the £45.1m Level 2 total Sales (50% in 2019/20), followed by Low Carbon Agricultural Vehicles which makes up 48% of sales (48% in 2019/20).

Example activities include the manufacture and supply of mid-chain componentry for Specialist low carbon Farming equipment, such as agri-robots, milking machinery, potting and filling machines, cultivation and seeding and grain dryers; and predominantly Biogas Low Carbon Agricultural Vehicles, mainly Off-road Utility Vehicles, with some Tractors and Large Farm Vehicles for Low Carbon Agricultural Vehicles.

Low Carbon Meat Alternatives is made up of two Level 3 sub-sectors, the largest being Low Carbon Meat Alternatives Production Equipment which makes up 63% of sales (62% in 2019/20), followed by Low Carbon Meat Alternatives Products which makes up 37% of sales (37% in 2019/20). Example activities include food manufacturing equipment across the chain of supply, both componentry and whole systems assembly. Low Carbon Meat Alternative Products include food production and packaging of meat alternatives, along with ingredients for animal protein replacement products such as protein powders, i.e., plant-based ingredients intended to increase the protein content of foods.

Low Carbon Milk Alternatives is made up of two Level 3 sub-sectors, the largest being Low Carbon Milk Alternatives Production Equipment which makes up 67% of sales (67% in 2019/20), followed by Low Carbon Milk Alternatives Products which makes up 33% of sales (33% in 2019/20). Example activities include milk alternative manufacturing equipment across the chain of supply, both componentry and whole systems assembly. Low Carbon Milk Alternative Products include milk production and packaging of milk alternatives.

Food Waste Reduction Activities is made up of two Level 3 sub-sectors, the largest being Zero Waste Food Retail which makes up 54% of sales (54% in 2019/20), followed by Zero Waste Catering which makes up 46% of sales (46% in 2019/20). Example activities of Zero Waste Food Retail include End of Shelf Life Food & Drink Sales, through a combination of Online, Retail and Wholesale outlets. Example activities of Zero Waste Catering include the recycling of unsold food from restaurants into non-food products and into meals through soup kitchens; also Zero Waste Cafes and community cafes – the dataset returns a ~0 company count for this activity, because the café-side of these businesses are generally a very small proportion of a larger company, involved in the re-distribution of food, including charitable donations etc, which are not registered within the dataset, resulting in a ~0 count.

Biodegradable Food Packaging is not split by further sub-sectors. Example activities include manufacture and supply.

## Section 3.7: Hertfordshire's LCEGS2023 Level 2 Summary

In 2021/22, Hertfordshire's LCEGS2023 Sector was worth £5.8bn in Sales, had 40,364 Employees and 2,169 Companies across 36 Level 2 sub-sectors.

**Figure 41: Hertfordshire's LCEGS2023 Summary 2021/22 for Sales, Number of Companies and Number of Employees**

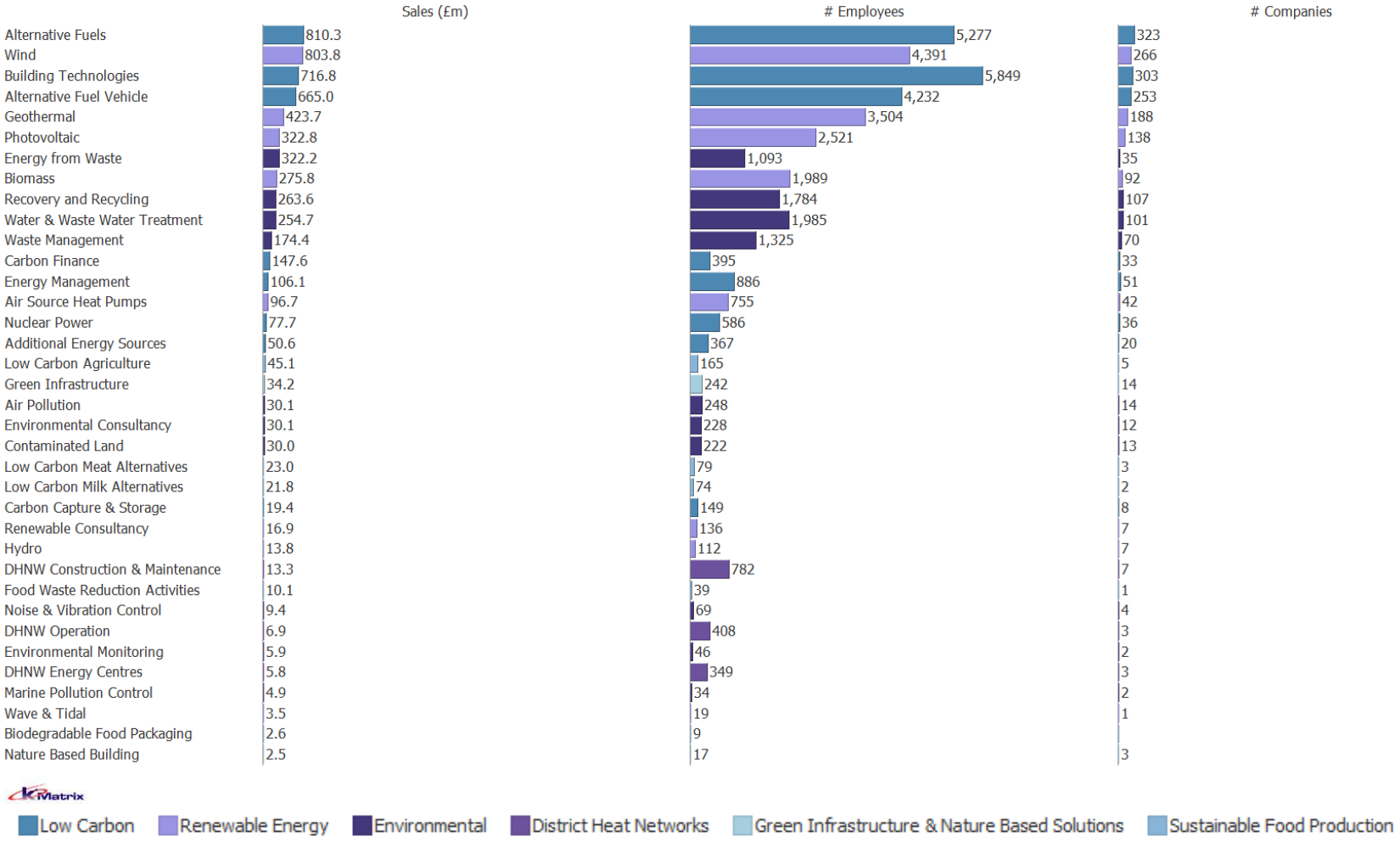


Figure 41 compares all 36 sub-sectors of LCEGS2023, coloured by Level 1 sub-sectors for Sales, Employment and Companies illustrating:

**Sales**

The six leading sub-sectors: Alternative Fuels (14%), Wind (14%), Building Technologies (12%), Alternative Fuel Vehicles (10%), Geothermal (7%) and Photovoltaic (6%) have the largest share in terms of sales (although not company numbers or employment) and accounted for 64% of Hertfordshire's LCEGS2023 sector Sales in 2020/21 (66% in 2019/20).

There is a second grouping of twelve sub-sectors that are: Energy from Waste 6%, Biomass 5%, Recovery and Recycling 5%, Water and Waste Water Treatment 4%, Waste Management 3%, Carbon Finance 3%, Energy Management 2%, Air Source Heat Pumps 2%, Nuclear Power 1%, Additional Energy Sources 1%, Low Carbon Agriculture 1%, and Green Infrastructure 1%, make up a further 32% of the LCEGS2023 sector sales in 2020/21 (31% in 2019/20).

These 18 sub-sectors dominate the LCEGS2023 sector sales and together made up 96% of its overall sales in 2020/21 (97% in 2019/20).

**Employment**

Analysis of Employment shows Low Carbon Agriculture and Green Infrastructure are not within the top 18 sub-sectors and are replaced by DHNW Construction and Maintenance and DHNW Operation. There are six leading sub-sectors: Building Technologies (14%), Alternative Fuels (13%), Wind (11%), Alternative Fuel Vehicles (10%), Geothermal (9%) and Photovoltaic (6%) have the largest share in terms of employment and accounted for 64% of Hertfordshire's LCEGS2023 sector employment in 2020/21 (63% in 2019/20).

There is a second grouping of twelve sub-sectors that are: Biomass 5%, Water and Waste Water Treatment 5%, Recovery and Recycling 4%, Waste Management 3%, Energy from Waste 3%, Energy Management 2%, DHNW Construction and Maintenance 2%, Air Source Heat Pumps 2%, Nuclear Power 1%, DHNW Operation 1%, Carbon Finance 1% and Additional Energy Sources 1%, and make up a further 31% of the LCEGS2023 sector employment in 2020/21 (31% in 2019/20).

These 18 sub-sectors dominate the LCEGS2023 sector employment and together made up 94% of its overall employment in 2020/21 (94% in 2019/20).

**Companies**

Analysis of Companies shows Low Carbon Agriculture is not within the top 18 sub-sectors and is replaced by Air Pollution. There are six leading sub-sectors: Alternative Fuels (15%), Building Technologies (14%), Wind (12%), Alternative Fuel Vehicles (12%), Geothermal (9%) and Photovoltaic (6%) have the largest share in terms of companies and accounted for 68% of Hertfordshire's LCEGS2023 sector companies in 2020/21 (67% in 2019/20).

There is a second grouping of twelve sub-sectors that are: Recovery and Recycling 5%, Water and Waste Water Treatment 5%, Biomass 4%, Waste Management 3%, Energy Management 2%, Air Source Heat Pumps 2%, Nuclear Power 2%, Energy from Waste 2%, Carbon Finance 2%, Additional Energy Sources 1%, Green Infrastructure 1% and Air Pollution 1%, make up a further 28% of the LCEGS2023 sector employment in 2020/21 (29% in 2019/20).

These 18 sub-sectors dominate the LCEGS2023 sector companies and together made up 96% of its overall companies in 2020/21 (96% in 2019/20).

## Section 4: Hertfordshire, and the UK's LCEGS2023 Compared

**Figure 42: Hertfordshire and UK Sales, Companies and Employees, 2021/22 by Level 1**

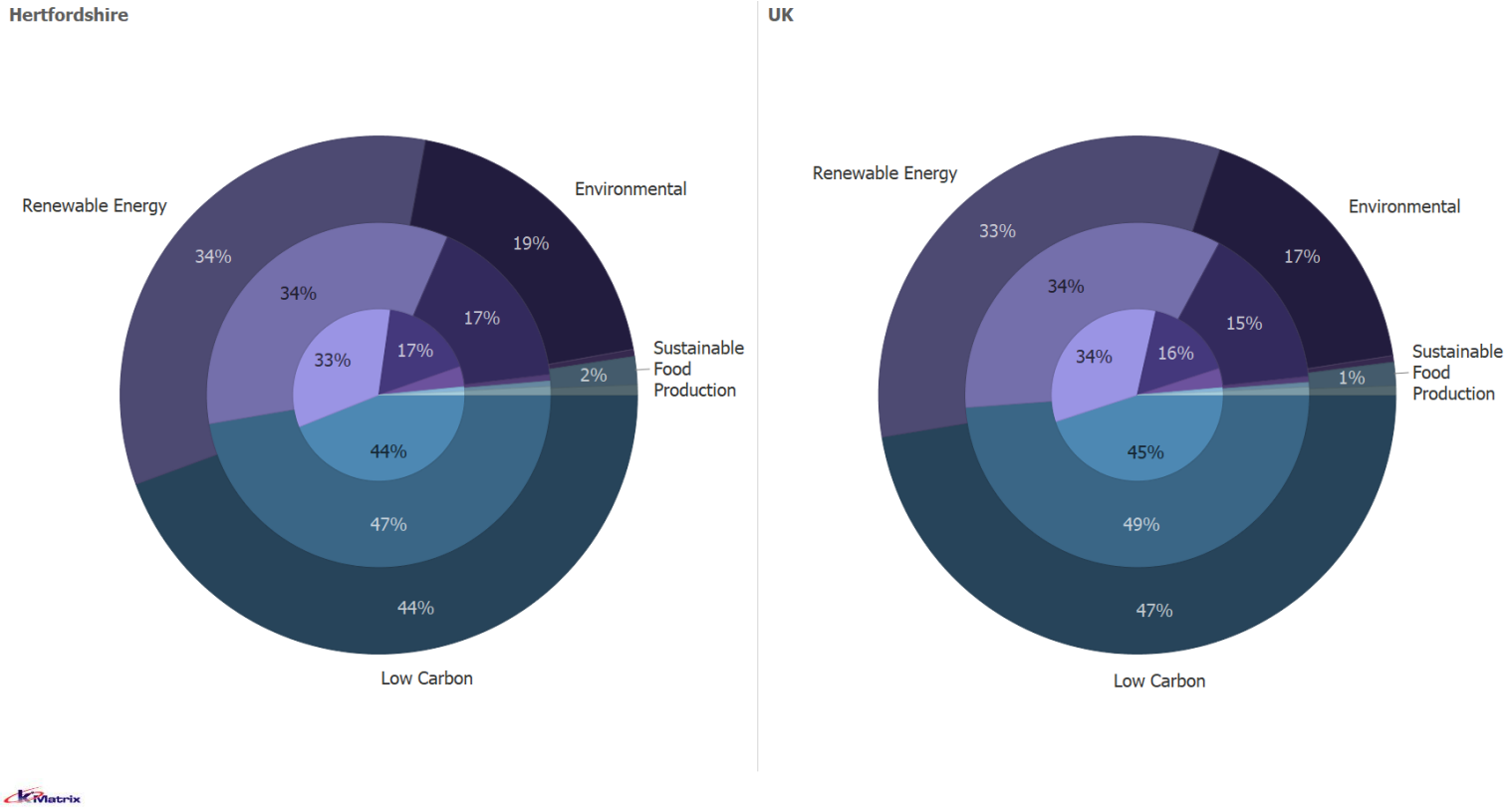



Figure 42 compares the profile of Hertfordshire and the UK's LCEGS2023 activities at Level 1 for sales (outer circle), companies (middle circle) and employment (inner circle). Hertfordshire has a smaller proportion of Low Carbon, being 1-3 percentage points smaller across all measures, Renewable Energy is more similar to the UK, within 1 percentage point of the UK, and Environmental is 1-2 percentage points larger than the UK. The proportion of Sustainable Food Production is higher in Hertfordshire than the UK, with 2% of Sales compared with the UK average of 1%; 1% of Companies compared with 0% for the UK, and 1% for employment for Hertfordshire and the UK. The proportion of Green Infrastructure & Nature Based Building is the same as the UK, being 1% across all measures; and District Heat Networks are also the same as the UK, with 0% for Sales, 1% for Companies and 4% for Employment.

**Figure 43: Hertfordshire's LCEGS2023 Sub-sectors Sales, Companies and Employees, 2021/22 at Level 2**

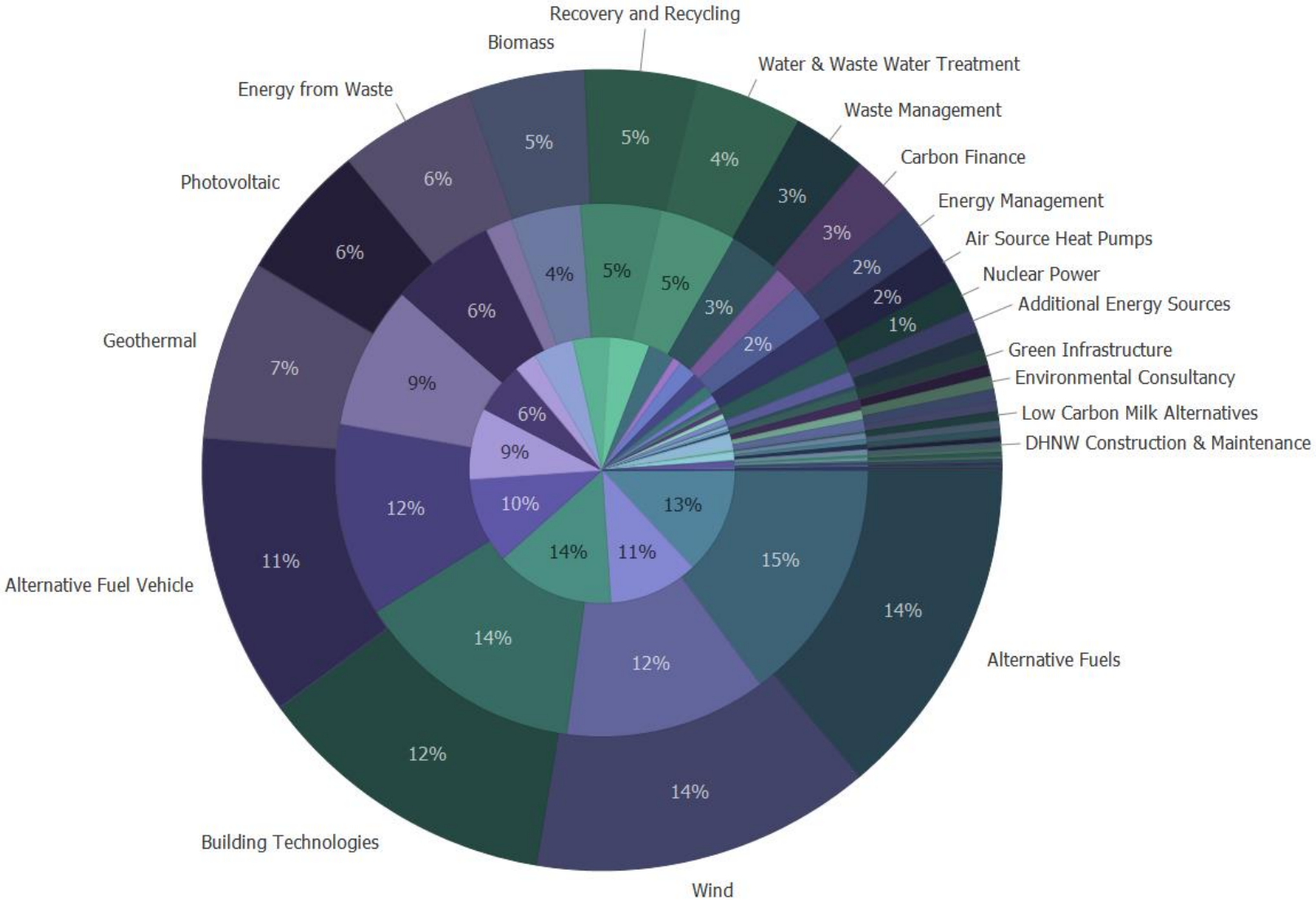
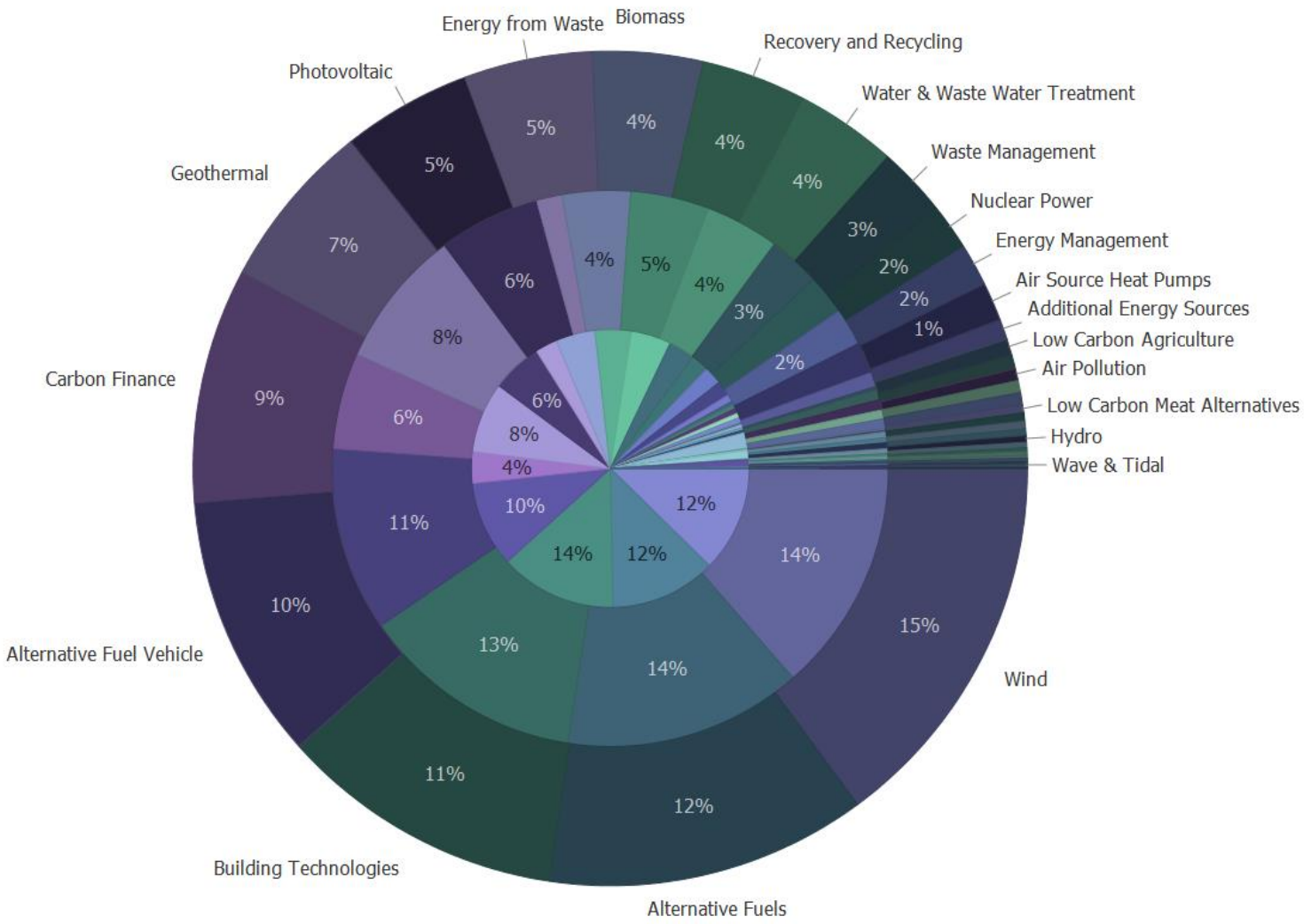


**Figure 44: UK's LCEGS2023 Sub-sector Sales, Companies and Employees, 2021/22 at Level 2**




Figures 43 and 44 extend the analysis by comparing the profile of Hertfordshire and UK's LCEGS2023 activities at Level 2 for sales (outer circle), companies (middle circle) and employment (inner circle).

The most significant differences between Hertfordshire and the UK are:

Alternative Fuels being the largest sub-sector in Hertfordshire, with 14% of Sales in Hertfordshire compared with 12% in the UK

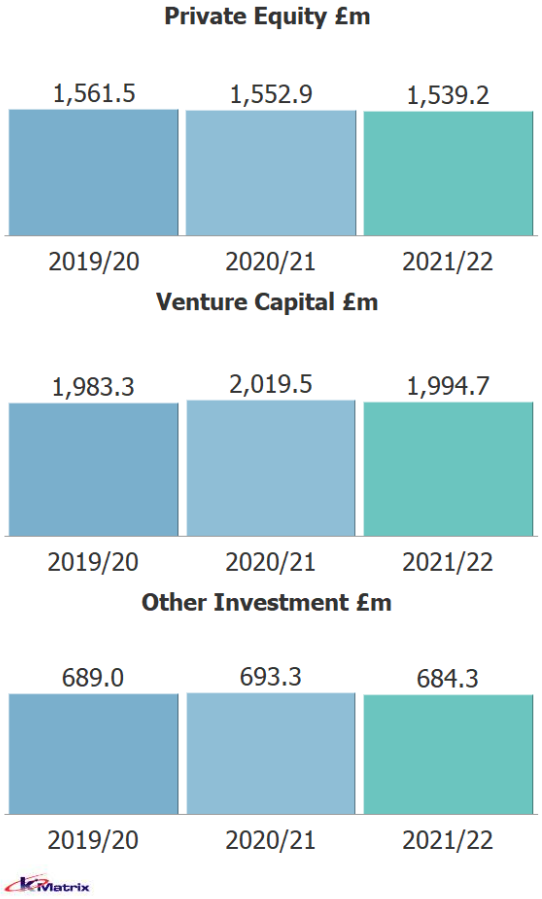
Carbon Finance with 3% of Sales in Hertfordshire 9% in the UK, this is because the sub-sector is predominantly located in London, although is gradually becoming more widespread across the country, so this six-percentage point difference is expected to reduce more over time.

## Section 5: Hertfordshire's LCEGS2023 Investment

This section examines the investment profile of Hertfordshire at the sector level and Level 1 for 2019/20, 2020/21 and 2021/22 and for Level 2 and the top Level 3 subsectors.

**Figure 45: Hertfordshire's Investment by Fiscal Year in LCEGS2023**

Figure 45 shows the investment for the three financial years of the sector study, made into the whole LCEGS2023 sector.




Private Equity Investment contracted -0.6% from £1,561.5m in 2019/20 to £1,552.9m in 2020/21, and then contracted a further -0.9% to £1,539.2m in 2020/21.

Venture Capital Investment grew 1.8% from £1,983.3m in 2019/20 to £2,019.5m in 2020/21, and then contracted -1.2% to £1,994.7m in 2020/21.

Other Investment grew 0.6% from £698.0m in 2019/20 to £693.3m in 2020/21, and then contracted -1.3% to £684.3m in 2020/21.

**Figure 46: Hertfordshire's Investment in LCEGS2023 2021/22 by Level 1**

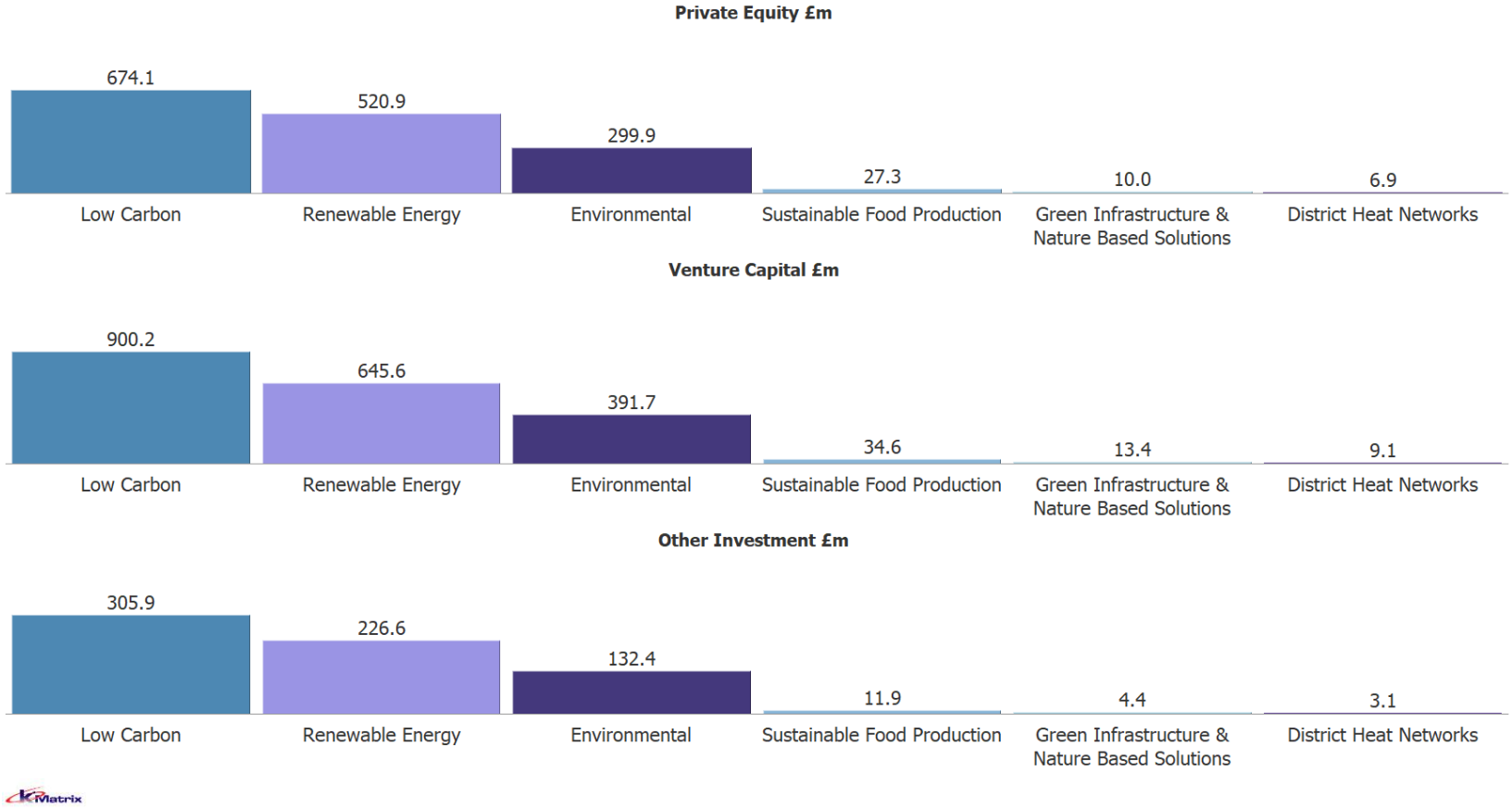



Figure 46 shows the investment made into the LECGE2023 Level 1 sub-sectors in 2021/22:

- Low Carbon received £674m from Private Equity, £900m from Venture Capital and £306m from Other Investment
- Renewable Energy received £521m from Private Equity, £646m from Venture Capital and £227m from Other Investment
- Environmental received £300m from Private Equity, £392m from Venture Capital and £132m from Other Investment
- Sustainable Food Production received £27m from Private Equity, £35m from Venture Capital and £12m from Other Investment
- GI&NBS received £10m from Private Equity, £13m from Venture Capital and £4m from Other Investment
- District Heat Networks received £7m from Private Equity, £9m from Venture Capital and £3m from Other Investment

## Section 6: Hertfordshire's LCEGS2023 Historic Growth

In Section 1.1 annual growth in Hertfordshire's LCEGS2023 sales, companies and employment was compared with growth in the UK's LCEGS2023 sector as a whole for 2019/20 to 2021/22. Table 8 shows Hertfordshire's annual growth in more detail by breaking it down into sub-sectors for those years. Growth between one year and the next is shown in red.

**Table 8: Hertfordshire's LCEGS2023 Sales (£m), Company and Employment Growth 2019/20 to 2021/22**

| Sub-sector Level | | Sales £m | | | | | # Companies | | | | | # Employees | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2019/20 | Growth % | 2020/21 | Growth % | 2021/22 | 2019/20 | Growth % | 2020/21 | Growth % | 2021/22 | 2019/20 | Growth % | 2020/21 | Growth % | 2021/22 |
| Low Carbon | Additional Energy Sources | 53.7 | -8.9% | 48.9 | 3.5% | 50.6 | 22 | -13.5% | 19 | 3.8% | 20 | 410 | -13.6% | 354 | 3.6% | 367 |
| | Alternative Fuel Vehicle | 728.9 | -13.6% | 629.5 | 5.6% | 665.0 | 272 | -20.2% | 217 | 16.8% | 253 | 4,480 | -8.7% | 4,089 | 3.5% | 4,232 |
| | Alternative Fuels | 841.0 | -8.8% | 767.0 | 5.6% | 810.3 | 350 | -10.6% | 313 | 3.1% | 323 | 5,908 | -13.1% | 5,132 | 2.8% | 5,277 |
| | Building Technologies | 761.9 | -8.8% | 695.2 | 3.1% | 716.8 | 344 | -15.1% | 292 | 3.9% | 303 | 6,445 | -13.2% | 5,593 | 4.6% | 5,849 |
| | Carbon Capture & Storage | 20.4 | -8.2% | 18.7 | 3.4% | 19.4 | 8 | -12.4% | 7 | 3.0% | 8 | 167 | -13.2% | 145 | 3.2% | 149 |
| | Carbon Finance | 145.9 | -10.6% | 130.4 | 13.2% | 147.6 | 33 | -12.9% | 28 | 15.2% | 33 | 398 | -11.9% | 351 | 12.6% | 395 |
| | Energy Management | 109.7 | -5.2% | 104.0 | 2.0% | 106.1 | 58 | -17.9% | 48 | 5.9% | 51 | 982 | -14.9% | 836 | 6.0% | 886 |
| | Nuclear Power | 82.8 | -8.2% | 76.0 | 2.2% | 77.7 | 41 | -13.9% | 35 | 3.2% | 36 | 666 | -13.6% | 575 | 1.9% | 586 |
| Renewable Energy | Air Source Heat Pumps | 103.3 | -8.4% | 94.6 | 2.2% | 96.7 | 45 | -12.7% | 39 | 8.7% | 42 | 835 | -13.3% | 724 | 4.2% | 755 |
| | Biomass | 282.0 | -8.2% | 258.9 | 6.5% | 275.8 | 100 | -12.8% | 87 | 5.7% | 92 | 2,119 | -13.4% | 1,835 | 8.4% | 1,989 |
| | Geothermal | 443.0 | -10.1% | 398.1 | 6.4% | 423.7 | 202 | -10.9% | 180 | 4.4% | 188 | 3,785 | -11.7% | 3,341 | 4.9% | 3,504 |
| | Hydro | 14.7 | -8.4% | 13.5 | 2.8% | 13.8 | 7 | -11.6% | 7 | 2.5% | 7 | 126 | -13.2% | 110 | 2.5% | 112 |
| | Photovoltaic | 335.7 | -10.7% | 299.8 | 7.7% | 322.8 | 146 | -11.1% | 130 | 6.3% | 138 | 2,690 | -14.4% | 2,304 | 9.4% | 2,521 |
| | Renewable Consultancy | 18.3 | -9.4% | 16.5 | 2.0% | 16.9 | 8 | -13.2% | 7 | 2.8% | 7 | 155 | -14.0% | 133 | 2.3% | 136 |
| | Wave & Tidal | 3.6 | -8.4% | 3.3 | 6.2% | 3.5 | 1 | -13.6% | 1 | 5.4% | 1 | 21 | -12.7% | 18 | 6.6% | 19 |
| | Wind | 873.7 | -11.8% | 770.4 | 4.3% | 803.8 | 275 | -11.1% | 244 | 8.9% | 266 | 4,708 | -11.2% | 4,182 | 5.0% | 4,391 |
| Environmental | Air Pollution | 32.3 | -8.6% | 29.5 | 2.1% | 30.1 | 16 | -14.0% | 14 | 2.4% | 14 | 281 | -13.5% | 243 | 2.1% | 248 |
| | Contaminated Land | 31.8 | -8.4% | 29.1 | 2.8% | 30.0 | 15 | -13.9% | 13 | 1.8% | 13 | 249 | -13.7% | 215 | 3.2% | 222 |
| | Energy from Waste | 342.8 | -9.7% | 309.5 | 4.1% | 322.2 | 43 | -9.6% | 39 | -9.8% | 35 | 1,338 | -9.6% | 1,209 | -9.6% | 1,093 |
| | Environmental Consultancy | 31.9 | -8.9% | 29.1 | 3.4% | 30.1 | 13 | -13.1% | 12 | 2.9% | 12 | 255 | -13.5% | 220 | 3.5% | 228 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Environmental Monitoring | 6.3 | -8.9% | 5.7 | 3.3% | 5.9 | 3 | -14.0% | 2 | 3.9% | 2 | 51 | -13.6% | 44 | 4.4% | 46 |
| | Marine Pollution Control | 5.2 | -8.5% | 4.8 | 3.6% | 4.9 | 2 | -14.2% | 2 | 3.6% | 2 | 37 | -13.5% | 32 | 4.0% | 34 |
| | Noise & Vibration Control | 10.0 | -9.3% | 9.0 | 3.9% | 9.4 | 4 | -14.8% | 3 | 3.7% | 4 | 77 | -13.5% | 66 | 3.5% | 69 |
| | Recovery and Recycling | 278.9 | -9.2% | 253.1 | 4.1% | 263.6 | 119 | -13.3% | 103 | 3.7% | 107 | 1,988 | -12.7% | 1,735 | 2.8% | 1,784 |
| | Waste Management | 186.0 | -9.4% | 168.5 | 3.5% | 174.4 | 78 | -12.6% | 68 | 2.6% | 70 | 1,479 | -13.1% | 1,285 | 3.2% | 1,325 |
| | Water & Waste Water Treatment | 275.8 | -9.7% | 249.0 | 2.3% | 254.7 | 115 | -14.1% | 99 | 1.8% | 101 | 2,269 | -13.4% | 1,966 | 1.0% | 1,985 |
| **DHNW** | DHNW Construction & Maintenance | 14.2 | -7.2% | 13.2 | 0.8% | 13.3 | 7 | -8.3% | 7 | -0.4% | 7 | 844 | -5.0% | 801 | -2.4% | 782 |
| | DHNW Energy Centres | 6.3 | -4.0% | 6.0 | -3.2% | 5.8 | 3 | -7.2% | 3 | -2.8% | 3 | 383 | -8.2% | 351 | -0.6% | 349 |
| | DHNW Operation | 7.5 | -7.5% | 7.0 | -1.2% | 6.9 | 4 | -6.5% | 4 | -4.6% | 3 | 447 | -7.5% | 413 | -1.4% | 408 |
| **GI&NBS** | Green Infrastructure | 38.4 | -11.6% | 34.0 | 0.7% | 34.2 | 16 | -11.3% | 14 | -0.5% | 14 | 281 | -11.1% | 250 | -3.3% | 242 |
| | Nature Based Building | 2.8 | -11.0% | 2.5 | -0.4% | 2.5 | 4 | -7.4% | 4 | -4.4% | 3 | 19 | -8.8% | 18 | -0.9% | 17 |
| **Sustainable Food** | Biodegradable Food Packaging | 2.7 | -6.5% | 2.5 | 1.1% | 2.6 | 0 | -7.4% | 0 | -8.2% | 0 | 10 | -8.1% | 9 | -9.8% | 9 |
| | Food Waste Reduction Activities | 10.8 | -10.3% | 9.7 | 4.2% | 10.1 | 1 | -10.4% | 1 | -8.4% | 1 | 47 | -8.8% | 43 | -10.0% | 39 |
| | Low Carbon Agriculture | 47.9 | -9.6% | 43.3 | 4.1% | 45.1 | 6 | -9.2% | 5 | -9.8% | 5 | 201 | -9.5% | 182 | -9.3% | 165 |
| | Low Carbon Meat Alternatives | 24.4 | -8.4% | 22.3 | 3.1% | 23.0 | 3 | -8.5% | 3 | -9.7% | 3 | 96 | -9.5% | 87 | -9.1% | 79 |
| | Low Carbon Milk Alternatives | 23.2 | -9.5% | 21.0 | 3.7% | 21.8 | 3 | -9.5% | 3 | -9.7% | 2 | 90 | -8.8% | 82 | -9.0% | 74 |
| **Total** | | **6,197.7** | **-10.1%** | **5,573.7** | **4.8%** | **5,840.7** | **2,368** | **-13.3%** | **2,053** | **5.7%** | **2,169** | **44,334.9** | **-12.1%** | **38,973.4** | **3.6%** | **40,363.9** |

While annual growth in the LCEGS2023 sector as a whole has varied between -13.3 and 5.7% for the three parameters, Table 8 shows that there is considerable variation in growth between the Level 2 sub-sectors. This reflects Hertfordshire's strengths and its share of these sub-sector markets all of which are growing at different rates, it also reflects the varying impact of the Covid-19 pandemic on different sub-sectors. For this section, the growth rates between 2019/20 and 2020/21 will be discussed regarding the impact of market contraction on the sub-sectors, while the growth rates between 2020/21 and 2021/22 will be looked at in respect to the recovery from the impact of the Covid-19 pandemic on the different sub-sectors.

## Section 6.1: 2019/20 to 2020/21 Sales Contraction Comparisons

Sub-sector Sales in Hertfordshire have been impacted by the pandemic to different degrees, varying from -4.0% for DHNW Energy Centres to -13.6% for Alternative Fuel Vehicle. This is similar to the impact across all sub-sectors for the UK, which varied between -3.9% for DHNW Energy Centres, to -13.3% for Alternative Fuel Vehicle. In some sub-sectors, the impact of Covid-19 in Hertfordshire was lower than the UK:

- Carbon Capture & Storage, where the Hertfordshire growth rate was -8.2%, and the UK -8.9% between 2019/20 and 2020/21
- Nuclear, where the Hertfordshire growth rate was -8.2%, and the UK -8.8% between 2019/20 and 2020/21
- Biomass, where the Hertfordshire growth rate was -8.2%, and the UK -8.9% between 2019/20 and 2020/21
- Hydro, where the Hertfordshire growth rate was -8.4%, and the UK -9.0% between 2019/20 and 2020/21
- Wave & Tidal, where the Hertfordshire growth rate was -8.4%, and the UK -8.9% between 2019/20 and 2020/21
- Contaminated Land, where the Hertfordshire growth rate was -8.4%, and the UK -9.1% between 2019/20 and 2020/21
- Nature Based Building, where the Hertfordshire growth rate was -11.0%, and the UK -11.5% between 2019/20 and 2020/21
- Biodegradable Food Packaging, where the Hertfordshire growth rate was -6.5%, and the UK -9.0% between 2019/20 and 2020/21
- Low Carbon Meat Alternatives, where the Hertfordshire growth rate was -8.4%, and the UK -9.1% between 2019/20 and 2020/21

## Section 6.2: 2020/21 to 2021/22 Growth Rate Comparisons

The higher growth rates in Sales for some sub-sectors in Hertfordshire are a reflection of the opportunities that are being created by drivers of growth including policy, regulation and consumer choices. Most sub-sectors in Hertfordshire have growth rates within one percentage point of the UK growth rates. Sub-sectors with higher growth than the UK include:

- Alternative Fuels, where the Hertfordshire growth rate was 5.6%, and the UK 4.6% between 2019/20 and 2020/21
- Building Technologies, where the Hertfordshire growth rate was 3.1%, and the UK 2.5% between 2019/20 and 2020/21
- Carbon Finance, where the Hertfordshire growth rate was 13.2%, and the UK 12.2% between 2019/20 and 2020/21
- Air Source Heat Pumps, where the Hertfordshire growth rate was 2.2%, and the UK 1.7% between 2019/20 and 2020/21
- Waste Management, where the Hertfordshire growth rate was 3.5%, and the UK 2.7% between 2019/20 and 2020/21
- Water & Waste Water Treatment, where the Hertfordshire growth rate was 2.3%, and the UK 1.7% between 2019/20 and 2020/21
- Low Carbon Agriculture, where the Hertfordshire growth rate was 4.1%, and the UK 3.8% between 2019/20 and 2020/21

## Section 6.3: 3-year Growth 2019/20-2021/22 Hertfordshire and UK

Table 8 shows the greatest impact from Covid-19 was seen by the highest contraction in Nature Based Building and Green Infrastructure (GI&NBS), Alternative Fuel Vehicle (Low Carbon), DHNW Operation (DHNW), and Wind (Renewable Energy); while the only sub-sector to see actual growth in Hertfordshire's LCEGS2023 occurred in Carbon Finance (Low Carbon) between 2019/20 and 2021/22.

Some sub-sectors had less contraction across the three-year reporting period than the UK (by 0.5 percentage point or more) and should be considered strengths of the region:

- Carbon Capture & Storage with -5.1% (UK -6.0%)
- Hydro with -5.8% (UK -6.4%)
- Wave & Tidal with -2.7% (UK -3.4%)
- Contaminated Land with -5.9% (UK -6.5%)
- Biodegradable Food Packaging with -5.5% (UK -5.9%)

One sub-sectors had significantly more contraction across the three-year reporting period than the UK (by 0.5 percentage point or more):

- Food Waste Reduction Activities with -6.6% (UK -5.6%)

One sub-sector saw growth across the three-year reporting period:

- Carbon Finance with 1.1% (UK 2.2%)

## Section 6.4: Comparison Graphs for Growth 2019/20-2021/22 Hertfordshire and UK

By overlaying the sales as a proportion of the UK market for each sub-sector, and sub-sector growth compared with the UK as a growth factor, the impact of stronger or weaker sales growth can be examined more closely.

In this section we look at the contraction of the market between 2019/20 and 2020/21, followed by the growth between 2020/21 and 2021/22, and finally the overall performance of sub-sectors compared with the UK between 2019/20 and 2021/22.

### Section 6.4.1: Contraction in Sales of LCEGS2023 Market, by Level 2 Sub-sector, between 2019/20 and 2020/21, Hertfordshire and UK

Table 9 illustrates how Hertfordshire compares with the UK as a whole for the 36 Level 2 sub-sectors, in terms of size of market in 2019/20 and contraction between 2019/20 and 2020/21 and illustrates the impact of contraction.

Hertfordshire as a % of UK Sales has been converted to a Proportionality Factor, where:

- 1.0 equals the sector value (2.3% of the UK total)
- below 1.0 represents a smaller market than the sector total proportion
- above 1.0 represents a market which is larger than the sector total proportion (indicating a strength in Hertfordshire)

Likewise, the Hertfordshire/UK Impact Factor indicates where contraction has been higher in Hertfordshire than the UK, where:

- 1.0 equals the same contraction in Hertfordshire as the UK
- below 1.0 represents a smaller contraction than the UK (indicating resilience in Hertfordshire compared with the UK)
- above 1.0 represents a larger contraction than the UK (indicating a lack of resilience in Hertfordshire)

**Table 9: Comparison of Hertfordshire and UK LCEGS2023 Sales (£m) and Contraction in Sales between 2019/20 and 2020/21**

| Level 1 | Level 2 | UK Sales £m 2019/20 | UK % Contraction 2019/20 to 2020/21 | Hertfordshire Sales £m 2019/20 | Hertfordshire % Contraction 2019/20 to 2020/21 | Hertfordshire Sales as % of UK in 2019/20 | Hertfordshire/ UK Sales Prop. | Hertfordshire/ UK Impact Factor |
|---|---|---|---|---|---|---|---|---|
| **Low Carbon** | Additional Energy Sources | 2,129.7 | -8.8% | 53.7 | -8.9% | 2.5% | 1.1 | 1.0 |
| | Alternative Fuel Vehicle | 28,940.2 | -13.3% | 728.9 | -13.6% | 2.5% | 1.1 | 1.0 |
| | Alternative Fuels | 33,307.7 | -8.3% | 841.0 | -8.8% | 2.5% | 1.1 | 1.1 |
| | Building Technologies | 30,194.9 | -8.2% | 761.9 | -8.8% | 2.5% | 1.1 | 1.1 |
| | Carbon Capture & Storage | 816.0 | -8.9% | 20.4 | -8.2% | 2.5% | 1.1 | 0.9 |
| | Carbon Finance | 22,871.0 | -8.9% | 145.9 | -10.6% | 0.6% | 0.3 | 1.2 |
| | Energy Management | 4,359.0 | -5.5% | 109.7 | -5.2% | 2.5% | 1.1 | 0.9 |
| | Nuclear Power | 4,946.3 | -8.8% | 82.8 | -8.2% | 1.7% | 0.7 | 0.9 |
| **Renewable Energy** | Air Source Heat Pumps | 4,110.7 | -8.1% | 103.3 | -8.4% | 2.5% | 1.1 | 1.0 |
| | Biomass | 11,234.4 | -8.9% | 282.0 | -8.2% | 2.5% | 1.1 | 0.9 |
| | Geothermal | 17,516.0 | -9.5% | 443.0 | -10.1% | 2.5% | 1.1 | 1.1 |
| | Hydro | 703.5 | -9.0% | 14.7 | -8.4% | 2.1% | 0.9 | 0.9 |
| | Photovoltaic | 13,350.9 | -11.1% | 335.7 | -10.7% | 2.5% | 1.1 | 1.0 |
| | Renewable Consultancy | 722.1 | -9.5% | 18.3 | -9.4% | 2.5% | 1.1 | 1.0 |
| | Wave & Tidal | 171.5 | -8.9% | 3.6 | -8.4% | 2.1% | 0.9 | 0.9 |
| | Wind | 41,516.6 | -11.6% | 873.7 | -11.8% | 2.1% | 0.9 | 1.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Environmental** | Air Pollution | 1,283.9 | -8.9% | 32.3 | -8.6% | 2.5% | 1.1 | 1.0 |
| | Contaminated Land | 1,269.2 | -9.1% | 31.8 | -8.4% | 2.5% | 1.1 | 0.9 |
| | Energy from Waste | 13,617.6 | -9.6% | 342.8 | -9.7% | 2.5% | 1.1 | 1.0 |
| | Environmental Consultancy | 1,268.4 | -9.0% | 31.9 | -8.9% | 2.5% | 1.1 | 1.0 |
| | Environmental Monitoring | 247.6 | -9.0% | 6.3 | -8.9% | 2.5% | 1.1 | 1.0 |
| | Marine Pollution Control | 206.3 | -8.9% | 5.2 | -8.5% | 2.5% | 1.1 | 1.0 |
| | Noise & Vibration Control | 394.7 | -9.1% | 10.0 | -9.3% | 2.5% | 1.1 | 1.0 |
| | Recovery and Recycling | 11,071.7 | -9.1% | 278.9 | -9.2% | 2.5% | 1.1 | 1.0 |
| | Waste Management | 7,384.8 | -8.9% | 186.0 | -9.4% | 2.5% | 1.1 | 1.1 |
| | Water & Waste Water Treatment | 10,943.9 | -9.2% | 275.8 | -9.7% | 2.5% | 1.1 | 1.1 |
| **District Heat Networks** | DHNW Construction & Maintenance | 565.1 | -7.2% | 14.2 | -7.2% | 2.5% | 1.1 | 1.0 |
| | DHNW Energy Centres | 248.8 | -3.9% | 6.3 | -4.0% | 2.5% | 1.1 | 1.0 |
| | DHNW Operation | 298.6 | -7.3% | 7.5 | -7.5% | 2.5% | 1.1 | 1.0 |
| **Green Infrastructure & Nature Based Solutions** | Green Infrastructure | 1,525.1 | -11.6% | 38.4 | -11.6% | 2.5% | 1.1 | 1.0 |
| | Nature Based Building | 111.6 | -11.5% | 2.8 | -11.0% | 2.5% | 1.1 | 1.0 |
| **Sustainable Food Production** | Biodegradable Food Packaging | 101.0 | -9.0% | 2.7 | -6.5% | 2.7% | 1.2 | 0.7 |
| | Food Waste Reduction Activities | 391.8 | -9.4% | 10.8 | -10.3% | 2.8% | 1.2 | 1.1 |
| | Low Carbon Agriculture | 1,758.9 | -9.6% | 47.9 | -9.6% | 2.7% | 1.2 | 1.0 |
| | Low Carbon Meat Alternatives | 897.4 | -9.1% | 24.4 | -8.4% | 2.7% | 1.2 | 0.9 |
| | Low Carbon Milk Alternatives | 850.3 | -9.3% | 23.2 | -9.5% | 2.7% | 1.2 | 1.0 |
| | **Total** | **271,327.1** | **-9.8%** | **6,197.7** | **-10.1%** | **2.3%** | | |

Figure 47 illustrates the data in Table 9 and shows how Hertfordshire compares with the UK for the 36 Level 2 sub-sectors, with regards to size of market and contraction in sales between 2019/20 and 2020/21.

The x-axis represents the Hertfordshire/UK sales proportionality factor for 2019/20, which was calculated for each sub-sector by dividing the Hertfordshire sales as a percentage of UK, by 0.7%. This proportionality factor demonstrates where Hertfordshire holds a larger or smaller share of the UK market than the sector proportion as a whole, where:

- 1.0 = 2.3% of the UK market
- >1.0 = larger than 2.3% share

- <1.0 = smaller than 2.3% share

The y-axis represents the contraction of Hertfordshire's Level 2 sub-sectors compared with the UK. This was calculated for each sub-sector by dividing the contraction within Hertfordshire by the contraction for the UK. This growth rate factor demonstrates which sub-sectors have been more strongly impacted by the economic shock, where:

- 1.0 = the same contraction in sub-sector sales as the UK
- >1.0 = larger contraction in sub-sector sales than the UK
- <1.0 = smaller contraction in sub-sector sales than the UK

The graph is split into four quadrants along 1 on each axis, with sub-sectors in each demonstrating:

- Top right = larger market share than expected, but larger contraction in sub-sector sales than the UK
- Bottom Right = larger market share than expected, and smaller contraction in sub-sector sales than the UK ***(Ideal Position)***
- Top left = smaller market share than expected, but larger contraction in sub-sector sales than the UK
- Bottom left = smaller market share than expected, and smaller contraction in sub-sector sales than the UK

The bubbles represent the 36 Level 2 sub-sectors and are sized by the 2019/20 sales £m, illustrating the relative sizes of each sub-sector.

**Reading the bubble graphs (Figures 47-51) - Using Carbon Finance in Figure 47 as an example**

The Hertfordshire Carbon Finance sub-sector holds a smaller proportion of the total UK Carbon Finance sub-sector than the LCEGS sector average for Hertfordshire, this is indicated by the Carbon Finance bubble being to the left of the graph, well below the Hertfordshire/ UK Proportionality factor of 1 on the y-axis.

The Hertfordshire Carbon Finance sub-sector was also impacted to a greater extent than the total UK Carbon Finance sub-sector, indicated by the bubble at the top of the chart, well above the Hertfordshire/ UK impact factor of 1 on the x-axis.

Carbon Finance is considered an 'Outlier' sub-sector, because performance is so distinct from the sector average and can cause grouping of other sub-sectors, affecting chart clarity. Outliers are included for full sector graphs, and then excluded in the following graph to allow remaining sub-sectors to be analysed more clearly. Outliers are only removed to allow clarity of figures.

**Figure 47: Hertfordshire/UK 2019/20 Sales Proportionality Factor vs. Hertfordshire/UK 2019/20 to 2020/21 Impact Factor of Level 2 Sub-sectors – Bubbles Sized by 2019/20 Sales £m**

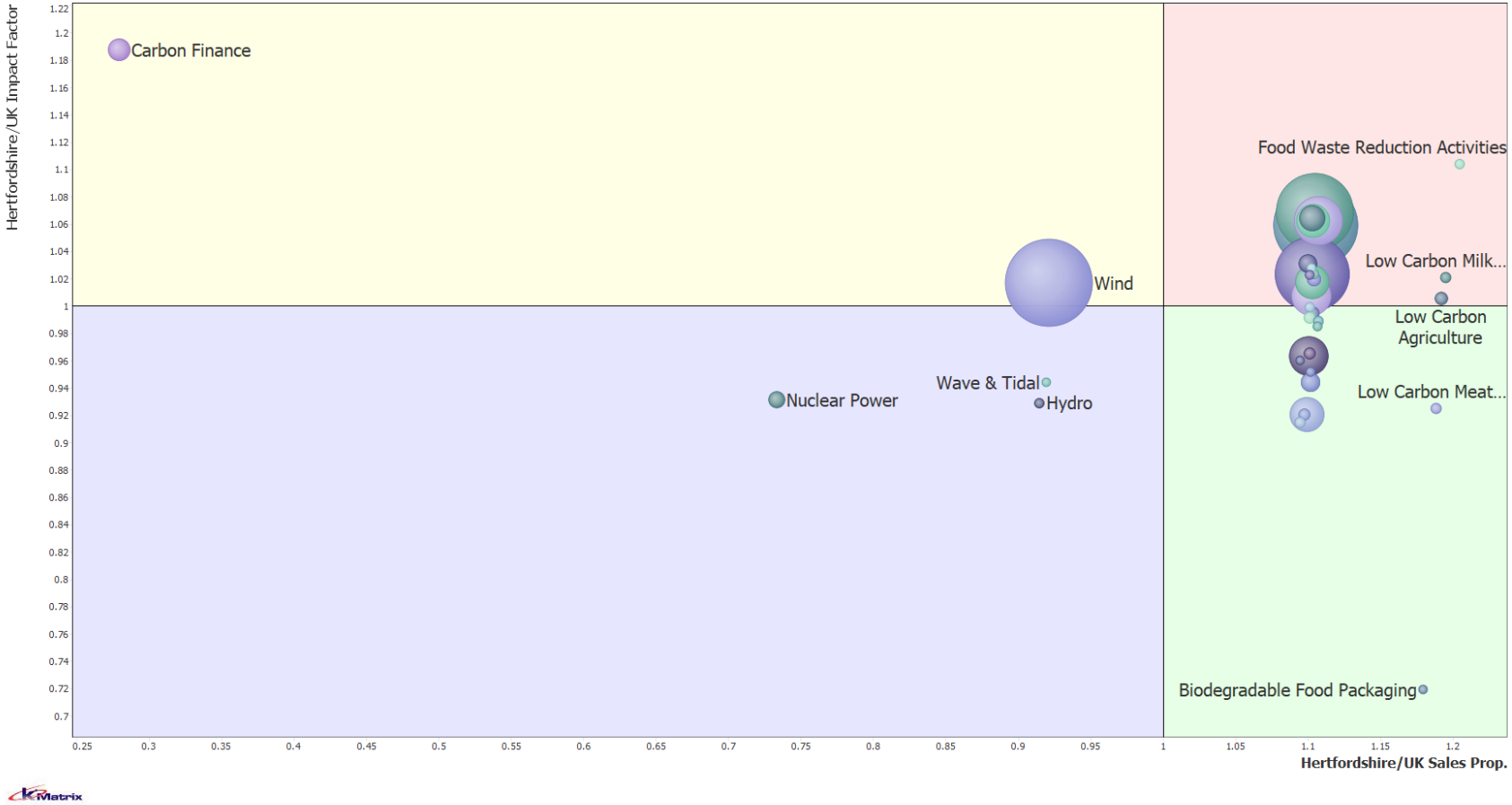



Figure 47 clearly illustrates that Carbon Finance holds a smaller proportion of the UK market compared with the other sub-sectors, with Nuclear Power and to a lesser extent Wind, Wave & Tidal and Hydro also holding a below average proportion of the UK market. In term of impact, Carbon Finance saw greater contraction in Sales than the UK average, while the contraction in Wind was slightly greater than the UK (evidenced by its proximity to the UK average line on the x-axis) and Nuclear Power, Wave & Tidal and Hydro saw less contraction than the UK sub-sector average. Conversely, Food Waste reduction Activities, Low Caron Milk Alternatives are significantly larger than the sector average but saw greater contraction in Sales than the UK average. Low

Carbon Agriculture is significantly larger than the sector average and saw similar contraction to the UK, while Low Carbon Meat Alternatives and Biodegradable Food Packaging are also significantly larger than the sector average but saw much less contraction than the UK sub-sector averages.

These 10 sub-sectors are excluded in Figure 48 to allow further analysis of the remaining 26 sub-sectors, where the green area of the graph is ideal.

**Figure 48: Hertfordshire/UK 2019/20 Sales Proportionality Factor vs. Hertfordshire/UK 2019/20 to 2020/21 Impact Factor of Level 2 Sub-sectors – Bubbles Sized by 2019/20 Sales £m – Outlier Sub-sectors Excluded**

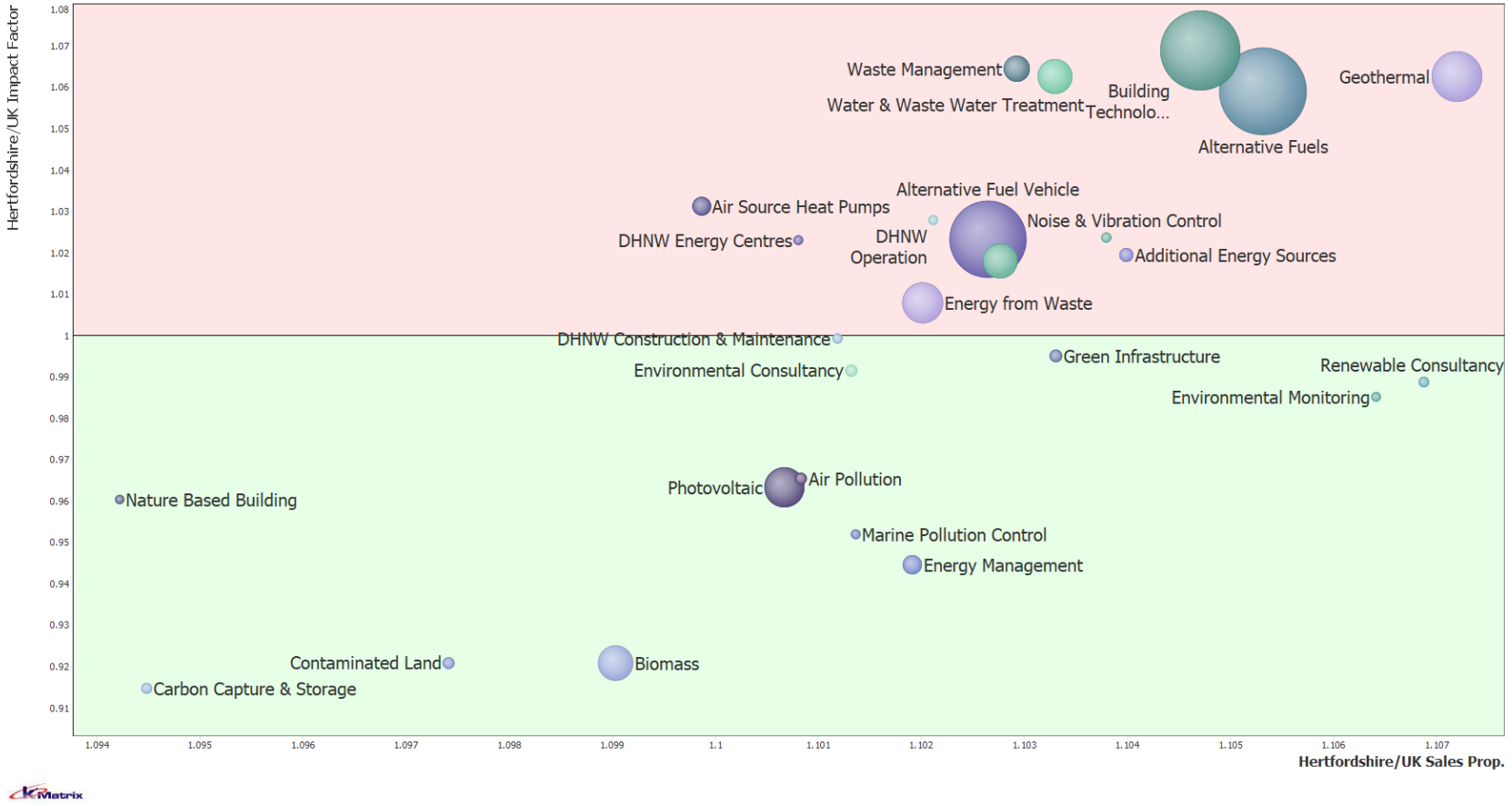



Figure 48 excludes the outlier sub-sectors from Figure 47 and illustrates the remaining 26 sub-sectors hold a larger proportion of the UK market than the sector average, predominantly because the Wind sub-sector is very large, but holds a relatively small proportion of the UK market compared with sector

average. The majority of the larger sub-sectors, including Alternative Fuels, Building Technologies, Alternative Fuel Vehicles and Geothermal saw greater contraction than the UK average. By comparison, Photovoltaic, Biomass and Energy Management saw less contraction than the UK average.

### Section 6.4.2: Growth in Sales of LCEGS2023 Market, by Level 2 Sub-sector, Between 2020/21 and 2021/22, Hertfordshire and the UK

Table 10 illustrates how Hertfordshire compares with the UK as a whole for the 36 Level 2 sub-sectors, in terms of size of market in 2021/22 and growth between 2020/21 and 2021/22.

Hertfordshire as a % of UK Sales has been converted to a Proportionality Factor, where:

- 1.0 equals the sector value (0.7% of the UK total)
- below 1.0 represents a smaller market than the sector total proportion
- above 1.0 represents a market which is larger than the sector total proportion (indicating a strength in Hertfordshire)

Likewise, the Hertfordshire/UK Growth Factor indicates where growth has been higher in Hertfordshire than the UK, where:

- 1.0 equals the same growth in Hertfordshire as the UK
- below 1.0 represents a smaller growth than the UK
- above 1.0 represents a larger growth than the UK

**Table 10: Comparison of Hertfordshire and UK LCEGS2023 Sales (£m) and Growth in Sales between 2020/21 and 2021/22**

| Level 1 | Level 2 | UK Sales £m 2021/22 | UK % Growth 2020/21 to 2021/22 | Hertfordshire Sales £m 2021/22 | Hertfordshire % Growth 2020/21 to 2021/22 | Hertfordshire as % of UK | Hertfordshire/ UK 2021/22 Sales Prop. | Hertfordshire/ UK Growth Factor |
|---|---|---|---|---|---|---|---|---|
| **Low Carbon** | Additional Energy Sources | 2,009.3 | 3.4% | 50.6 | 3.5% | 2.5% | 1.1 | 1.0 |
| | Alternative Fuel Vehicle | 26,448.1 | 5.4% | 665.0 | 5.6% | 2.5% | 1.1 | 1.0 |
| | Alternative Fuels | 31,961.7 | 4.6% | 810.3 | 5.6% | 2.5% | 1.1 | 1.2 |
| | Building Technologies | 28,414.8 | 2.5% | 716.8 | 3.1% | 2.5% | 1.1 | 1.2 |
| | Carbon Capture & Storage | 767.1 | 3.2% | 19.4 | 3.4% | 2.5% | 1.1 | 1.0 |
| | Carbon Finance | 23,366.9 | 12.2% | 147.6 | 13.2% | 0.6% | 0.3 | 1.1 |
| | Energy Management | 4,202.7 | 2.0% | 106.1 | 2.0% | 2.5% | 1.1 | 1.0 |
| | Nuclear Power | 4,625.4 | 2.5% | 77.7 | 2.2% | 1.7% | 0.7 | 0.9 |
| **Renewable Energy** | Air Source Heat Pumps | 3,842.0 | 1.7% | 96.7 | 2.2% | 2.5% | 1.1 | 1.3 |
| | Biomass | 10,963.9 | 7.1% | 275.8 | 6.5% | 2.5% | 1.1 | 0.9 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Geothermal | 16,796.1 | 6.0% | 423.7 | 6.4% | 2.5% | 1.1 | 1.1 |
| | Hydro | 658.8 | 2.9% | 13.8 | 2.8% | 2.1% | 0.9 | 1.0 |
| | Photovoltaic | 12,868.2 | 8.4% | 322.8 | 7.7% | 2.5% | 1.1 | 0.9 |
| | Renewable Consultancy | 669.6 | 2.4% | 16.9 | 2.0% | 2.5% | 1.1 | 0.8 |
| | Wave & Tidal | 165.6 | 6.0% | 3.5 | 6.2% | 2.1% | 0.9 | 1.0 |
| | Wind | 38,301.3 | 4.4% | 803.8 | 4.3% | 2.1% | 0.9 | 1.0 |
| **Environmental** | Air Pollution | 1,196.2 | 2.2% | 30.1 | 2.1% | 2.5% | 1.1 | 0.9 |
| | Contaminated Land | 1,187.2 | 2.9% | 30.0 | 2.8% | 2.5% | 1.1 | 0.9 |
| | Energy from Waste | 12,801.5 | 4.0% | 322.2 | 4.1% | 2.5% | 1.1 | 1.0 |
| | Environmental Consultancy | 1,194.9 | 3.5% | 30.1 | 3.4% | 2.5% | 1.1 | 1.0 |
| | Environmental Monitoring | 233.1 | 3.4% | 5.9 | 3.3% | 2.5% | 1.1 | 1.0 |
| | Marine Pollution Control | 195.6 | 4.0% | 4.9 | 3.6% | 2.5% | 1.1 | 0.9 |
| | Noise & Vibration Control | 372.5 | 3.8% | 9.4 | 3.9% | 2.5% | 1.1 | 1.0 |
| | Recovery and Recycling | 10,442.5 | 3.7% | 263.6 | 4.1% | 2.5% | 1.1 | 1.1 |
| | Waste Management | 6,914.0 | 2.7% | 174.4 | 3.5% | 2.5% | 1.1 | 1.3 |
| | Water & Waste Water Treatment | 10,110.8 | 1.7% | 254.7 | 2.3% | 2.5% | 1.1 | 1.4 |
| **District Heat Networks** | DHNW Construction & Maintenance | 527.8 | 0.6% | 13.3 | 0.8% | 2.5% | 1.1 | 1.3 |
| | DHNW Energy Centres | 231.2 | -3.3% | 5.8 | -3.2% | 2.5% | 1.1 | 1.0 |
| | DHNW Operation | 273.1 | -1.3% | 6.9 | -1.2% | 2.5% | 1.1 | 0.9 |
| **Green Infrastructure & Nature Based Solutions** | Green Infrastructure | 1,355.1 | 0.5% | 34.2 | 0.7% | 2.5% | 1.1 | 1.3 |
| | Nature Based Building | 98.6 | -0.1% | 2.5 | -0.4% | 2.5% | 1.1 | 1.3 |
| **Sustainable Food Production** | Biodegradable Food Packaging | 94.9 | 3.3% | 2.6 | 1.1% | 2.7% | 1.2 | 0.3 |
| | Food Waste Reduction Activities | 369.8 | 4.1% | 10.1 | 4.2% | 2.7% | 1.2 | 1.0 |
| | Low Carbon Agriculture | 1,650.5 | 3.8% | 45.1 | 4.1% | 2.7% | 1.2 | 1.1 |
| | Low Carbon Meat Alternatives | 846.2 | 3.7% | 23.0 | 3.1% | 2.7% | 1.2 | 0.8 |
| | Low Carbon Milk Alternatives | 800.4 | 3.8% | 21.8 | 3.7% | 2.7% | 1.2 | 1.0 |
| **Total** | | **255,761.3** | **5.0%** | **5,840.7** | **4.8%** | **2.3%** | | |

Figure 49 illustrates the data in Table 10 and shows how Hertfordshire compares with the UK for the 36 Level 2 sub-sectors, with regards to size of market and growth in sales between 2020/21 and 2021/22.

The x-axis represents the Hertfordshire/UK sales proportionality factor for 2021/22, which was calculated for each sub-sector by dividing the Hertfordshire sales as a percentage of UK, by 2.3%. This proportionality factor demonstrates where Hertfordshire holds a larger or smaller share of the UK market than the sector proportion as a whole, where:

- 1.0 = 2.3% of the UK market
- >1.0 = larger than 2.3% share
- <1.0 = smaller than 2.3% share

The y-axis represents the growth of Hertfordshire's Level 2 sub-sectors compared with the UK between 2020/21 and 2021/22. This was calculated for each sub-sector by dividing the growth within Hertfordshire by the growth for the UK. This growth rate factor demonstrates which sub-sectors have grown more strongly than the UK, where:

- 1.0 = the same growth in sub-sector sales as the UK
- >1.0 = stronger growth in sub-sector sales than the UK
- <1.0 = slower growth in sub-sector sales than the UK

The graph is split into four quadrants along 1 on each axis, with sub-sectors in each demonstrating:

- Top right = larger market share than expected and stronger growth in sub-sector sales than the UK ***(Ideal Position)***
- Bottom Right = larger market share than expected and slower growth in sub-sector sales than the UK
- Top left = smaller market share than expected and stronger growth in sub-sector sales than the UK
- Bottom left = smaller market share than expected and slower growth in sub-sector sales than the UK

The bubbles represent the 36 Level 2 sub-sectors and are sized by the 2021/22 sales £m, illustrating the relative sizes of each sub-sector.

**Figure 49: Hertfordshire/UK 2020/21 Sales Proportionality Factor vs. Hertfordshire/UK 2020/21 to 2021/22 Growth Factor of Level 2 Sub-sectors – Bubbles Sized by 2021/22 Sales £m**

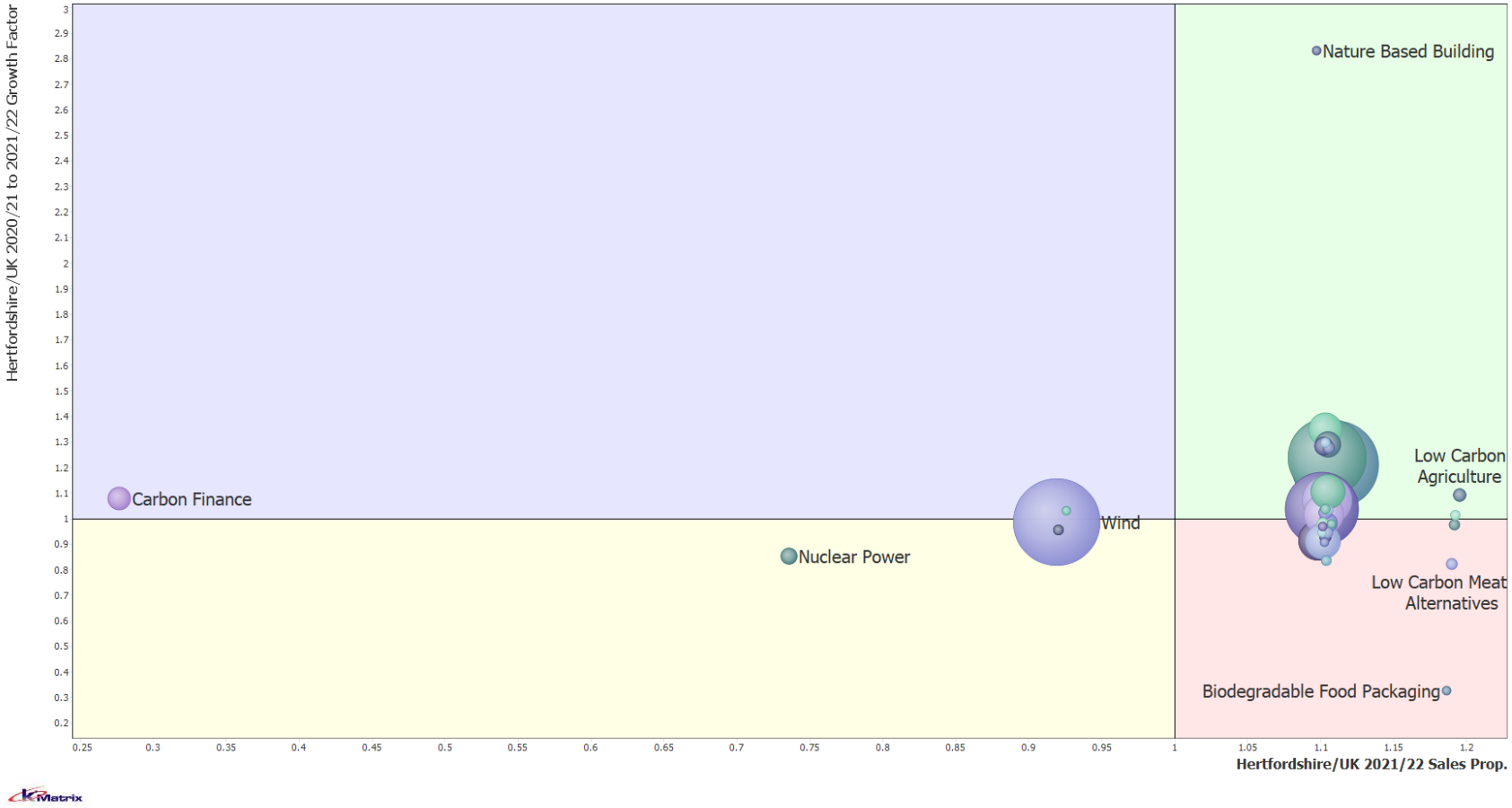



Figure 49 clearly illustrates similar outlier sub-sectors as Figure 48, with one addition: Nature Based Building. Carbon Finance, Nuclear Power and to a lesser extent Wind, Wave & Tidal and Hydro holding a below average proportion of the UK market, while Food Waste reduction Activities, Low Caron Milk Alternatives, Low Carbon Agriculture, Low Carbon Meat Alternatives, Biodegradable Food Packaging and Nature based Building are significantly larger than the sector average.

In terms of growth between 2020/21 and 2021/22, Carbon Finance grew slightly more strongly than the UK, Nuclear Power had slower growth and Wind, Wave & Tidal and Hydro saw similar growth. Low Carbon Agriculture grew more strongly than the UK average, Food Waste Reduction activities and Low Carbon Milk Alternatives saw similar growth to the UK, and Low Carbon Meat Alternatives and Biodegradable Food Packaging saw slower growth than the UK sub-sector averages. Nature Based Building is also an outlier, with significantly strong growth than the UK average for the sub-sector.

These 11 sub-sectors are excluded in Figure 50 to allow further analysis of the remaining 25 sub-sectors.

**Figure 50: Hertfordshire/UK 2020/21 Sales Proportionality Factor vs. Hertfordshire/UK 2020/21 to 2021/22 Growth Factor of Level 2 Sub-sectors – Bubbles Sized by 2021/22 Sales £m – Outlier Sub-sectors Excluded**

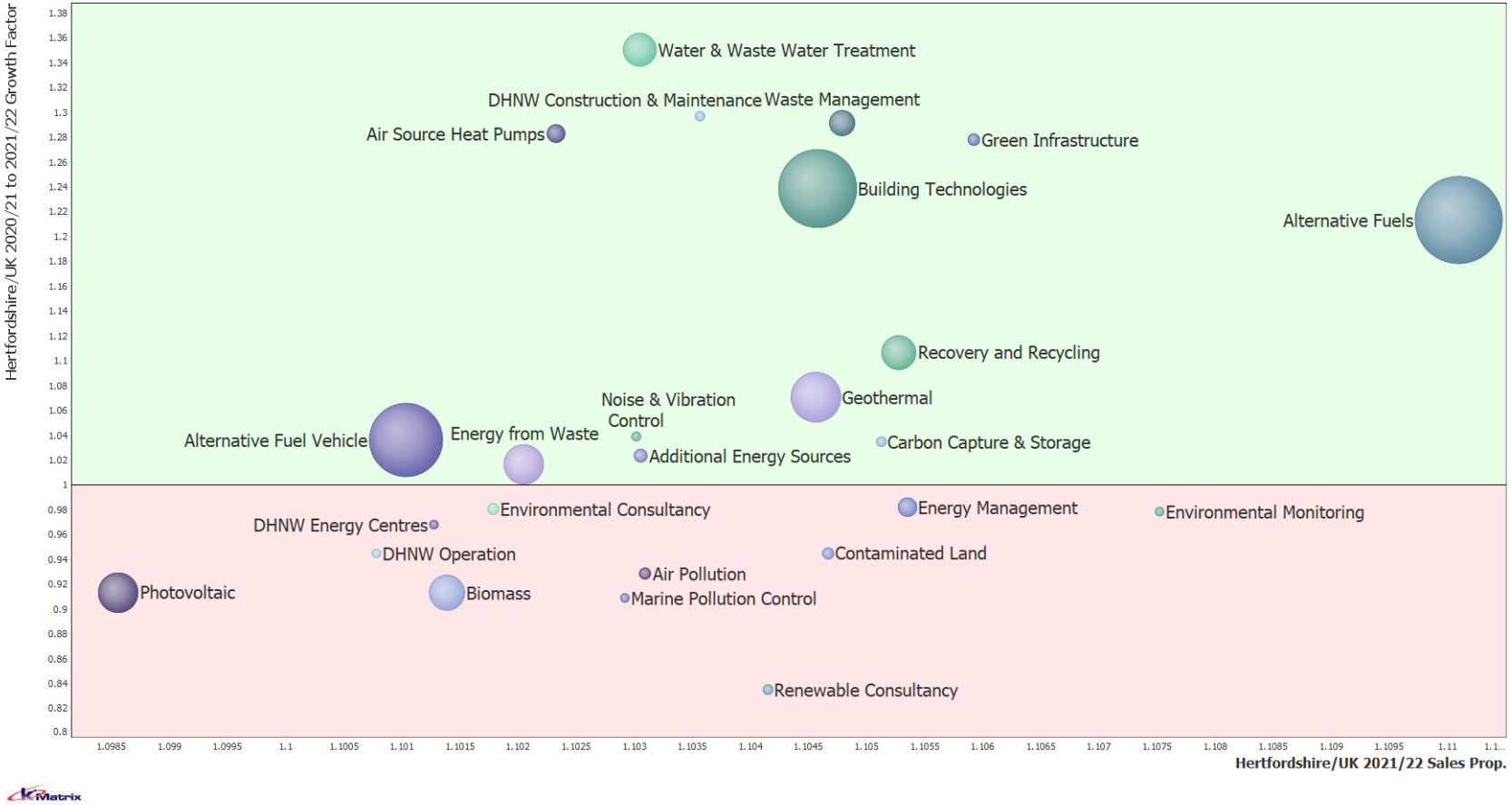


Figure 50 excludes the outlier sub-sectors from Figure 49 and illustrates large sub-sectors such as Building Technologies, Alternative Fuels and Water & Waste Water Treatment, Waste Management and Air Source Heat Pumps grew more strongly than the UK sub-sectors, while Photovoltaic and Biomass saw weaker growth than the UK sub-sector averages.

Figure 51 provides Figures 47 and 48, and 49 and 50 side by side for easy comparison of changes in growth and proportionality factors of sub-sectors in 2019/20 and 2021/22.

**Figure 51a: Figures 46 and 48 Compared**

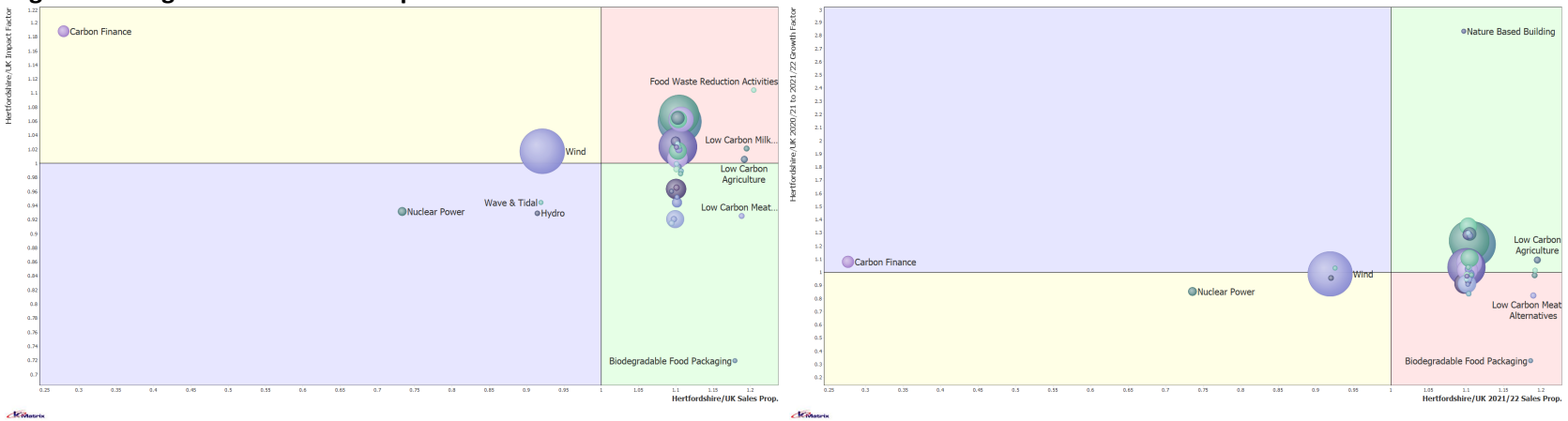
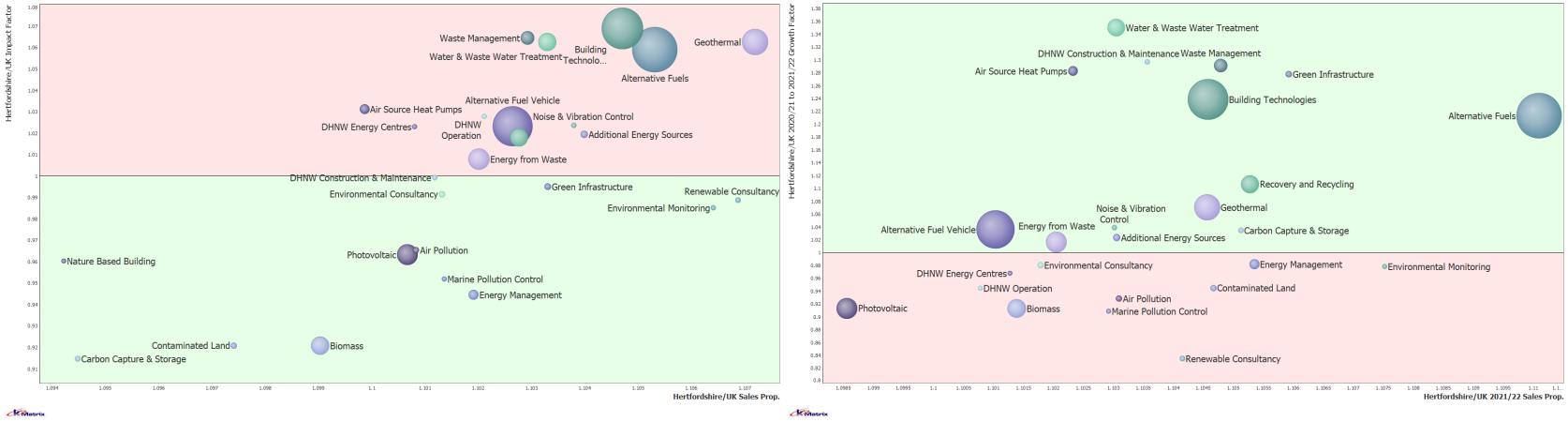



**Figure 51b: Figures 45 and 47 Compared**



Figures 51a and 51b illustrate despite the differences in market contraction between 2019/20 and 2020/21 and growth between 2020/21 and 2021/22, the proportion of the UK market held by Hertfordshire sub-sectors has not altered significantly. Note: the graphs in Figure 50b are expanded by the removal of 10 outlier sub-sectors, so although proportionality looks altered between the two years, the difference is less than 0.1% of UK market share.

In terms of contraction and growth, there is little pattern with regards to high contraction leading to either slow or strong growth, for example, Carbon Finance was saw strong contraction, but reasonable growth; Geothermal was impacted more than the UK average, but grew in line with the UK average; Water & Waste Water Treatment saw severe contraction, but strong growth; and Air Source Heat Pumps saw more contraction than the UK, and also slow growth.

### Section 6.4.3: Summary of Hertfordshire and UK 3-Year LCEGS2023 Market Contraction in Sales, by Level 2 Sub-sector, between 2019/20 and 2021/22

Table 11 shows the 3-year contraction in sales, by sub-sector for Hertfordshire and the UK as a percentage contraction of sales from 2019/20 to 2021/22.

**Table 11: Summary of Hertfordshire and UK 3-Year LCEGS2023 Market Contraction in Sales between 2019/20 and 2021/22**

| Category | Level 2 Sub-sector | Level 1 Sub-sector | Hertfordshire 2021/22 Sales £m | Hertfordshire % Growth in Sales 2019/20 to 2021/22 | UK % Growth in Sales 2019/20 to 2021/22 | Percentage Point Difference |
|---|---|---|---|---|---|---|
| **Hertfordshire Sub-sectors with Less Contraction than the UK 2019/20 to 2021/22** | Carbon Capture & Storage | Low Carbon | 19.4 | -5.1% | -6.0% | 0.9 |
| | Wave & Tidal | Renewable Energy | 3.5 | -2.7% | -3.4% | 0.7 |
| | Contaminated Land | Environmental | 30.0 | -5.9% | -6.5% | 0.6 |
| | Hydro | Renewable Energy | 13.8 | -5.8% | -6.4% | 0.5 |
| | Biodegradable Food Packaging | Sustainable Food Prod'n | 2.6 | -5.5% | -6.0% | 0.5 |
| | Alternative Fuels | Low Carbon | 810.3 | -3.7% | -4.0% | 0.4 |
| | Energy Management | Low Carbon | 106.1 | -3.3% | -3.6% | 0.3 |
| | Nuclear Power | Low Carbon | 77.7 | -6.2% | -6.5% | 0.3 |
| | Low Carbon Agriculture | Sustainable Food Prod'n | 45.1 | -5.9% | -6.2% | 0.3 |
| | Nature Based Building | GI&NBS | 2.5 | -11.3% | -11.6% | 0.2 |
| | Recovery and Recycling | Environmental | 263.6 | -5.5% | -5.7% | 0.2 |
| | Green Infrastructure | GI&NBS | 34.2 | -11.0% | -11.1% | 0.2 |
| | Air Source Heat Pumps | Renewable Energy | 96.7 | -6.4% | -6.5% | 0.2 |
| | Biomass | Renewable Energy | 275.8 | -2.2% | -2.4% | 0.2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | DHNW Construction & Maintenance | District Heat Networks | 13.3 | -6.4% | -6.6% | 0.2 |
| | Air Pollution | Environmental | 30.1 | -6.7% | -6.8% | 0.2 |
| | Waste Management | Environmental | 174.4 | -6.2% | -6.4% | 0.1 |
| | Marine Pollution Control | Environmental | 4.9 | -5.1% | -5.2% | 0.1 |
| | Low Carbon Meat Alternatives | Sustainable Food Prod'n | 23.0 | -5.6% | -5.7% | 0.1 |
| | Environmental Monitoring | Environmental | 5.9 | -5.8% | -5.9% | 0.1 |
| **Hertfordshire Sub-sectors with the same Contraction as the UK** | Environmental Consultancy | Environmental | 30.1 | -5.8% | -5.8% | 0.0 |
| | DHNW Energy Centres | District Heat Networks | 5.8 | -7.1% | -7.1% | 0.0 |
| | Energy from Waste | Environmental | 322.2 | -6.0% | -6.0% | 0.0 |
| | Building Technologies | Low Carbon | 716.8 | -5.9% | -5.9% | 0.0 |
| | Water & Waste Water Treatment | Environmental | 254.7 | -7.7% | -7.6% | 0.0 |
| **Hertfordshire Sub-sectors with Greater Contraction than the UK 2019/20 to 2021/22** | Noise & Vibration Control | Environmental | 9.4 | -5.7% | -5.6% | -0.1 |
| | Additional Energy Sources | Low Carbon | 50.6 | -5.8% | -5.7% | -0.1 |
| | DHNW Operation | District Heat Networks | 6.9 | -8.7% | -8.6% | -0.1 |
| | Alternative Fuel Vehicle | Low Carbon | 665.0 | -8.8% | -8.6% | -0.2 |
| | Photovoltaic | Renewable Energy | 322.8 | -3.8% | -3.6% | -0.2 |
| | Geothermal | Renewable Energy | 423.7 | -4.4% | -4.1% | -0.3 |
| | Renewable Consultancy | Renewable Energy | 16.9 | -7.5% | -7.3% | -0.3 |
| | Wind | Renewable Energy | 803.8 | -8.0% | -7.7% | -0.3 |
| | Low Carbon Milk Alternatives | Sustainable Food Prod'n | 21.8 | -6.1% | -5.9% | -0.3 |
| | Food Waste Reduction Activities | Sustainable Food Prod'n | 10.1 | -6.6% | -5.6% | -1.0 |
| | Carbon Finance | Low Carbon | 147.6 | 1.1% | 2.2% | -1.0 |

Table 11 illustrates the difference in contraction between geography and sub-sector between 2019/20 and 2021/22. Hertfordshire has performed better than the UK in 20 of the 36 sub-sectors, by between 0.1 percentage point for Environmental Monitoring, Low Carbon Meat Alternatives, Marine Pollution Control and Waste Management and 0.9 percentage points for Carbon Capture & Storage. Hertfordshire has performed less well than the UK in 11 of the 36 sub-sectors, by between -0.1 percentage point from Noise & Vibration Control, Additional energy Sources and DHNW Operation and -1.0 percentage points for Carbon Finance. Most sub-sectors are in-line with the UK average and although there is some deviation for some sub-sectors, they are not as significant as some areas of the country, where deviation has been 3 percentage points or more.

## Section 7: Hertfordshire's LCEGS2023 Forecast Sales Growth

Forecasts are triangulated from industry forecasts from within and around the sector, using the study methodology and provide a snapshot of industry 'best guess' as of March 2023.

Figure 52 Shows the forecast growth rates for the LCEGS2023 sector between 2021/22 and 2025/26. The growth rates would be applied to the previous year to calculate the sales for the year indicated, so for example, the 2022/23 growth rate indicates the expected growth in sales between 2021/22 and 2022/23.

**Figure 52: Hertfordshire and UK's LCEGS2023 Sector Forecast Growth (%) 2022/23 to 2025/26**

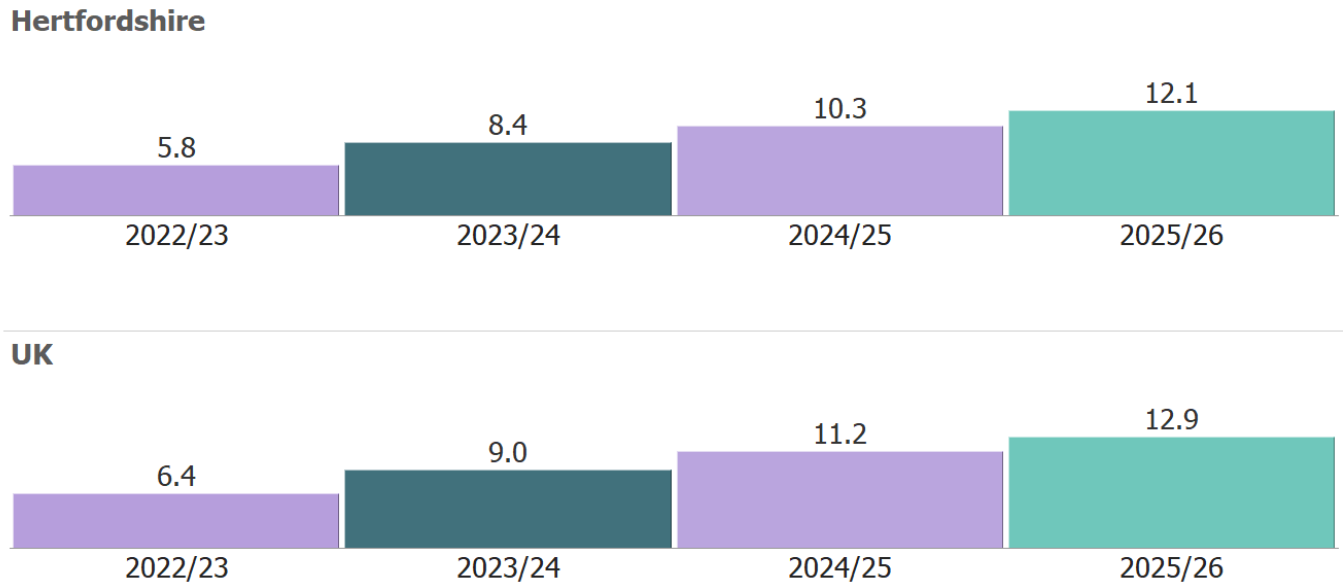



Figure 52 Shows the LCEGS2023 sector in Hertfordshire is forecast to see consistent growth through the forecast period, of 5.8% growth between 2021/22 and 2022/23, growing year-on-year to reach 12.1% growth between 2024/25 and 2025/26.

The UK is expected to see stronger growth than Hertfordshire, with 6.4% growth between 2021/22 and 2022/23, growing year-on-year to reach 12.9% growth between 2024/25 and 2025/26.

Table 12 shows the sales value for Level 1 sub-sectors for 2021/22, the forecast sales values for 2022/23 through to 2025/26 and the annual percentage growth from the previous year. The growth rates refer to the growth expected during the financial year listed. Forecast growth for the majority of sub-sectors is generally consistent with levels of historical growth, but in the current economic climate, forecasts beyond 2023/24 will be less robust.

**Table 12: Hertfordshire's LCEGS2023 Level 1 Forecast Sales (£m) and Growth (%) 2021/22 to 2025/26**

| Level 1 | 2021/22 Sales £m | 2022/23 Forecast Growth % | 2022/23 Forecast Sales £m | 2023/24 Forecast Growth % | 2023/24 Forecast Sales £m | 2024/25 Forecast Growth % | 2024/25 Forecast Sales £m | 2025/26 Forecast Growth % | 2025/26 Forecast Sales £m |
|---|---|---|---|---|---|---|---|---|---|
| Low Carbon | 2,593.3 | 5.5% | 2,737.3 | 7.5% | 2,941.9 | 9.5% | 3,220.4 | 11.2% | 3,581.9 |
| Renewable Energy | 1,957.0 | 7.3% | 2,099.3 | 11.9% | 2,348.7 | 13.9% | 2,675.4 | 16.0% | 3,103.9 |
| Environmental | 1,125.2 | 3.9% | 1,168.6 | 4.7% | 1,223.7 | 5.8% | 1,295.2 | 6.4% | 1,378.6 |
| District Heat Networks | 26.0 | 3.0% | 26.8 | 7.6% | 28.8 | 10.3% | 31.8 | 12.1% | 35.6 |
| Green Infrastructure & Nature Based Solutions | 36.7 | 5.0% | 38.5 | 10.2% | 42.5 | 11.6% | 47.4 | 13.6% | 53.9 |
| Sustainable Food Production | 102.5 | 4.6% | 107.2 | 5.5% | 113.1 | 6.7% | 120.6 | 8.1% | 130.3 |
| **Total** | **5,840.7** | **5.8%** | **6,177.6** | **8.4%** | **6,698.6** | **10.3%** | **7,390.8** | **12.1%** | **8,284.2** |

Table 12 illustrates that LCEGS2023 Total Sales are forecast to increase from £5.8bn in 2021/22 to £8.3bn in 2025/26.

Forecast growth rates vary between sub-sectors, with Environmental and Sustainable food Production forecast to see single-digit growth across the forecast period, while Low Carbon, Renewable Energy, District Heat Networks and Sustainable Food Production is forecast to see double-digit growth by 2025/26.

Growth is within one percentage point of the UK forecasts for all sub-sectors except for Low Carbon, which is between 1.2% and 1.8% slower than the UK.

Table 13 shows the sales value for Level 2 sub-sectors for 2021/22, the forecast sales values for 2022/23 through to 2025/26 and the annual percentage growth from the previous year. The growth rates refer to the growth expected during the financial year listed. Forecast growth for the majority of sub-sectors is generally consistent with levels of historical growth, but in the current economic climate, forecasts beyond 2023/24 will be less robust.

**Table 13: Hertfordshire's LCEGS2023 Level 2 Forecast Sales (£m) and Growth (%) 2021/22 to 2025/26**

| Level 1 | Level 2 | 2021/22 Sales £m | 2022/23 Forecast Growth % | 2022/23 Forecast Sales £m | 2023/24 Forecast Growth % | 2023/24 Forecast Sales £m | 2024/25 Forecast Growth % | 2024/25 Forecast Sales £m | 2025/26 Forecast Growth % | 2025/26 Forecast Sales £m |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Carbon | Additional Energy Sources | 50.6 | 4.6% | 52.9 | 5.4% | 55.8 | 6.7% | 59.5 | 7.2% | 63.8 |
| | Alternative Fuel Vehicle | 665.0 | 4.9% | 697.9 | 7.4% | 749.5 | 9.5% | 820.8 | 12.1% | 920.1 |
| | Alternative Fuels | 810.3 | 5.5% | 855.1 | 6.8% | 913.0 | 8.4% | 989.4 | 8.9% | 1,077.7 |
| | Building Technologies | 716.8 | 5.0% | 752.7 | 7.3% | 807.7 | 9.1% | 881.6 | 11.7% | 985.1 |
| | Carbon Capture & Storage | 19.4 | 3.9% | 20.1 | 4.8% | 21.1 | 6.0% | 22.3 | 6.1% | 23.7 |
| | Carbon Finance | 147.6 | 13.9% | 168.1 | 16.2% | 195.3 | 20.6% | 235.5 | 21.6% | 286.4 |
| | Energy Management | 106.1 | 3.8% | 110.2 | 5.5% | 116.2 | 6.7% | 124.0 | 7.6% | 133.4 |
| | Nuclear Power | 77.7 | 3.2% | 80.1 | 3.9% | 83.3 | 4.9% | 87.4 | 5.1% | 91.8 |
| Renewable Energy | Air Source Heat Pumps | 96.7 | 7.1% | 103.6 | 15.2% | 119.3 | 17.1% | 139.8 | 20.5% | 168.5 |
| | Biomass | 275.8 | 8.6% | 299.5 | 11.2% | 333.0 | 14.2% | 380.2 | 16.1% | 441.5 |
| | Geothermal | 423.7 | 8.0% | 457.6 | 15.9% | 530.4 | 18.6% | 629.1 | 21.8% | 766.0 |
| | Hydro | 13.8 | 3.5% | 14.3 | 4.3% | 14.9 | 5.5% | 15.8 | 5.7% | 16.7 |
| | Photovoltaic | 322.8 | 7.1% | 345.9 | 9.2% | 377.8 | 11.0% | 419.5 | 13.1% | 474.3 |
| | Renewable Consultancy | 16.9 | 3.2% | 17.4 | 3.7% | 18.1 | 4.2% | 18.8 | 4.9% | 19.7 |
| | Wave & Tidal | 3.5 | 7.3% | 3.8 | 9.1% | 4.1 | 10.9% | 4.5 | 11.6% | 5.1 |
| | Wind | 803.8 | 6.6% | 857.1 | 11.0% | 951.1 | 12.3% | 1,067.7 | 13.5% | 1,212.1 |
| Environmental | Air Pollution | 30.1 | 2.8% | 31.0 | 3.3% | 32.0 | 4.0% | 33.3 | 4.3% | 34.7 |
| | Contaminated Land | 30.0 | 3.7% | 31.0 | 4.5% | 32.5 | 5.5% | 34.2 | 5.8% | 36.2 |
| | Energy from Waste | 322.2 | 4.9% | 337.9 | 5.9% | 357.9 | 7.1% | 383.5 | 8.6% | 416.5 |
| | Environmental Consultancy | 30.1 | 4.6% | 31.4 | 5.6% | 33.2 | 7.0% | 35.5 | 7.2% | 38.1 |
| | Environmental Monitoring | 5.9 | 4.2% | 6.1 | 5.2% | 6.5 | 6.5% | 6.9 | 7.1% | 7.4 |
| | Marine Pollution Control | 4.9 | 5.0% | 5.2 | 6.2% | 5.5 | 7.9% | 5.9 | 7.6% | 6.4 |
| | Noise & Vibration Control | 9.4 | 4.7% | 9.8 | 5.8% | 10.4 | 6.9% | 11.1 | 7.7% | 12.0 |
| | Recovery and Recycling | 263.6 | 4.6% | 275.7 | 5.8% | 291.5 | 7.2% | 312.6 | 7.4% | 335.9 |
| | Waste Management | 174.4 | 3.4% | 180.3 | 4.0% | 187.5 | 5.0% | 196.9 | 5.2% | 207.3 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Water & Waste Water Treatment | 254.7 | 2.1% | 260.1 | 2.5% | 266.8 | 3.2% | 275.2 | 3.3% | 284.2 |
| DHNW | DHNW Construction & Maintenance | 13.3 | 3.0% | 13.7 | 7.4% | 14.7 | 10.0% | 16.2 | 11.9% | 18.1 |
| | DHNW Energy Centres | 5.8 | 3.1% | 6.0 | 7.6% | 6.4 | 10.4% | 7.1 | 12.1% | 8.0 |
| | DHNW Operation | 6.9 | 3.0% | 7.1 | 7.9% | 7.6 | 10.6% | 8.4 | 12.5% | 9.5 |
| GI&NBS | Green Infrastructure | 34.2 | 5.0% | 35.9 | 10.2% | 39.6 | 11.5% | 44.2 | 13.6% | 50.2 |
| | Nature Based Building | 2.5 | 4.7% | 2.6 | 10.4% | 2.9 | 12.2% | 3.2 | 14.1% | 3.7 |
| Sustainable Food Production | Biodegradable Food Packaging | 2.6 | 4.0% | 2.7 | 4.7% | 2.8 | 5.9% | 3.0 | 6.9% | 3.2 |
| | Food Waste Reduction Activities | 10.1 | 4.9% | 10.6 | 5.9% | 11.2 | 7.3% | 12.0 | 8.9% | 13.1 |
| | Low Carbon Agriculture | 45.1 | 4.6% | 47.1 | 5.5% | 49.7 | 6.7% | 53.0 | 8.1% | 57.3 |
| | Low Carbon Meat Alternatives | 23.0 | 4.5% | 24.0 | 5.5% | 25.4 | 6.7% | 27.1 | 8.1% | 29.3 |
| | Low Carbon Milk Alternatives | 21.8 | 4.5% | 22.8 | 5.4% | 24.0 | 6.5% | 25.6 | 7.8% | 27.6 |
| **Total** | | **5,840.7** | **5.8%** | **6,177.6** | **8.4%** | **6,698.6** | **10.3%** | **7,390.8** | **12.1%** | **8,284.2** |

Table 13 illustrates that forecast growth rates vary between sub-sectors, with Geothermal, Carbon Finance, Air Source Heat Pumps, Biomass, Green Infrastructure, Nature Based Building, Wind, Photovoltaic, DHNW Operation, Alternative Fuel vehicle, DHNW Energy Centres, DHNW Construction & Maintenance, Building Technologies and Wave & Tidal all forecast to see double-digit growth by 2025/26.

Growth is within one percentage point of the UK forecasts for all sub-sectors.

## Section 8: Hertfordshire's LCEGS2023 Potential Employment Growth

In this section we look at forecasts for employment to reach Net Zero in 2050, for the sector and Level 1 sub-sectors, reporting a 'No Policy' baseline forecast and a 'Current Policy' forecast, which includes the Heat & Buildings Strategy (2021), Net Zero Strategy (2021), the Prime Minister's Ten Point Plan (2020), Industrial and Clean Growth Strategies (2016), Energy White Paper (2020), Energy Security Policy (2021) and Industrial Decarbonisation Strategy (2022).

Employment forecasts estimate the ***total employment required for Hertfordshire to meet Net Zero in 2050***; in the core sector and the chains and networks of supply, which might be outside of Hertfordshire.

How Hertfordshire's sector responds to the opportunity presented by Net Zero, will determine the ***proportion of this expected employment to be based in Hertfordshire itself***.

For more information see page 37.

Forecasts are triangulated from industry forecasts from within and around the sector, using the study methodology and provide a snapshot of industry 'best guess' as of March 2023.

Figure 53 shows 2021/22 baseline employment for the sector, with the forecasts to Net Zero in 2050, under 'No Policy' and 'Current Policy' net zero scenarios. A key point of the analysis is even without policy, the sector is forecast to see strong, double-digit growth throughout the forecast period and current policy has the potential to front-load that growth, resulting in a significantly larger market.

**Figure 53: Hertfordshire LCEGS2030 Employment Forecast to Net Zero, No Policy and with Current Policy**

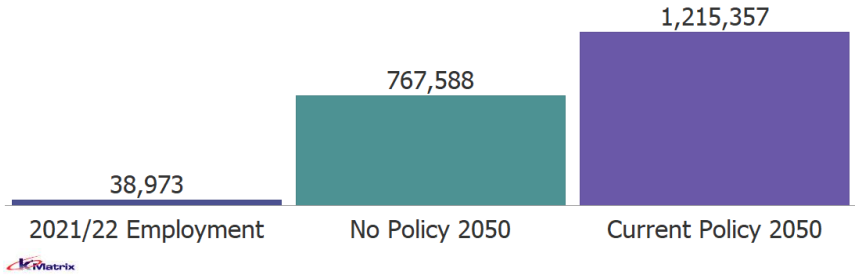



Figure 53 shows employment forecasts to reach net zero in 2050, no policy and with current policy. Under a no policy scenario, net zero 2050 would require a 19.7x increase in employment, and this increases with current policy to 31.2x in employment.
Figure 54 shows the same data as Figure 52, split by Level 1 sub-sector.

**Figure 54: Hertfordshire LCEGS2030 Employment Forecast to Net Zero, No Policy and with Current Policy, Split by Level 1**

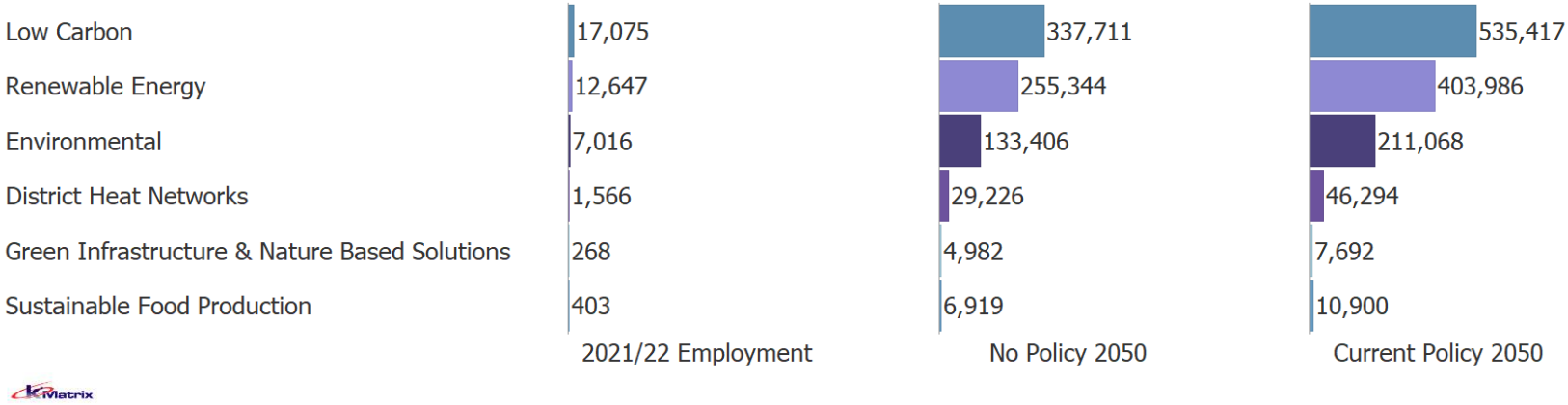



Figure 54 shows the same data as Figure 53, split by Level 1, which illustrates the whole market is forecast to require similar increases in order to fulfil the Net Zero 2050 target.

Net Zero 2050 'No Policy' baseline employment forecast:

- Low Carbon – 19.8x increase in employment
- Renewable Energy – 20.2x increase in employment
- Environmental – 19.0x increase in employment
- DHNW – 18.7x increase in employment
- GI&NBS – 18.6x increase in employment
- Sustainable Food Production – 17.2x increase in employment

Net Zero 2050 'Current Policy' employment forecast:

- Low Carbon – 31.4x in employment
- Renewable Energy – 31.9x in employment
- Environmental – 30.1x in employment
- DHNW – 29.6x in employment
- GI&NBS – 29.7x in employment
- Sustainable Food Production – 27.0x in employment

Table 14 provides the 36 Level 2 sub-sector employment forecasts to reach net zero by 2050. For each Level 2 sub-sector, the 2021/22 employment numbers are provided, followed by the employment growth factor to reach Net Zero in 2050 with No Policy, the 2050 Employment Forecast Numbers with No Policy; followed by the growth factor for Net Zero in 2050 wit Current Policy and their associated employment forecast numbers for Current Policy.

The Employment growth factor is determined by dividing the forecast employment by employment in 2021/22, and represents the required increase, e.g., for Additional Energy Source, employment in 2021/22 is 354 and is forecast to require 19.8x the number of employees for Net Zero 2050 with No Policy, so 354 x 19.8 = 7,015 employees forecast for Net Zero 2050 No Policy.

**Table 14: Hertfordshire LCEGS2030 Employment Forecast to Net Zero, No Policy and with Current Policy, Split by Level 2**

| Level 1 | Level 2 | 2021/22 Employment | No Policy Employment Growth Factor | No Policy 2050 Employment | Current Policy Employment Growth Factor | Current Policy 2050 Employment |
|---|---|---|---|---|---|---|
| Low Carbon | Additional Energy Sources | 354 | 19.8 | 7,015 | 31.0 | 10,990 |
| | Alternative Fuel Vehicle | 4,089 | 19.8 | 80,893 | 31.8 | 129,852 |
| | Alternative Fuels | 5,132 | 19.5 | 100,176 | 30.8 | 158,230 |
| | Building Technologies | 5,593 | 19.9 | 111,213 | 31.4 | 175,614 |
| | Carbon Capture & Storage | 145 | 19.6 | 2,845 | 31.1 | 4,505 |
| | Carbon Finance | 351 | 21.9 | 7,674 | 34.9 | 12,232 |
| | Energy Management | 836 | 20.2 | 16,873 | 31.6 | 26,415 |
| | Nuclear Power | 575 | 19.2 | 11,022 | 30.6 | 17,578 |
| Renewable Energy | Air Source Heat Pumps | 724 | 19.7 | 14,294 | 31.1 | 22,547 |
| | Biomass | 1,835 | 20.6 | 37,834 | 32.5 | 59,578 |
| | Geothermal | 3,341 | 19.9 | 66,639 | 31.4 | 104,827 |
| | Hydro | 110 | 19.6 | 2,150 | 30.8 | 3,374 |
| | Photovoltaic | 2,304 | 20.8 | 48,003 | 33.1 | 76,150 |
| | Renewable Consultancy | 133 | 19.5 | 2,598 | 30.6 | 4,067 |
| | Wave & Tidal | 18 | 20.3 | 368 | 32.3 | 587 |
| | Wind | 4,182 | 20.0 | 83,458 | 31.8 | 132,856 |
| Environmental | Air Pollution | 243 | 19.4 | 4,710 | 30.7 | 7,461 |
| | Contaminated Land | 215 | 19.7 | 4,229 | 30.9 | 6,635 |
| | Energy from Waste | 1,209 | 17.1 | 20,725 | 27.1 | 32,807 |
| | Environmental Consultancy | 220 | 19.7 | 4,335 | 31.1 | 6,845 |
| | Environmental Monitoring | 44 | 19.7 | 872 | 31.2 | 1,379 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Marine Pollution Control | 32 | 19.7 | 636 | 31.2 | 1,008 |
| | Noise & Vibration Control | 66 | 19.6 | 1,298 | 30.8 | 2,046 |
| | Recovery and Recycling | 1,735 | 19.7 | 34,113 | 30.9 | 53,669 |
| | Waste Management | 1,285 | 19.5 | 24,989 | 31.0 | 39,829 |
| | Water & Waste Water Treatment | 1,966 | 19.1 | 37,499 | 30.2 | 59,390 |
| **DHNW** | DHNW Construction & Maintenance | 801 | 18.6 | 14,888 | 29.3 | 23,480 |
| | DHNW Energy Centres | 351 | 18.8 | 6,605 | 30.0 | 10,540 |
| | DHNW Operation | 413 | 18.7 | 7,734 | 29.7 | 12,274 |
| **GI&NBS** | Green Infrastructure | 250 | 18.6 | 4,652 | 28.7 | 7,182 |
| | Nature Based Building | 18 | 18.8 | 330 | 29.1 | 510 |
| **SFP** | Biodegradable Food Packaging | 9 | 17.0 | 161 | 27.2 | 258 |
| | Food Waste Reduction Activities | 43 | 16.9 | 727 | 27.0 | 1,159 |
| | Low Carbon Agriculture | 182 | 17.1 | 3,103 | 27.1 | 4,914 |
| | Low Carbon Meat Alternatives | 87 | 17.4 | 1,515 | 26.8 | 2,337 |
| | Low Carbon Milk Alternatives | 82 | 17.3 | 1,413 | 27.3 | 2,232 |
| **Total** | | **38,973** | **19.7** | **19.7** | **31.2** | **31.2** |

Table 14 shows that the employment forecasts and the factor increase in employment show more variation than for Level 1 sub-sectors, with the highest employment requirements for Carbon Finance (21.9 for No Policy and 34.9 with Current Policy); Photovoltaic (20.8 and 33.1); Biomass (20.6 and 32.5); Wave & Tidal (20.3 and 32.3) and Energy Management (20.2 and 31.6).

# Section 9: Hertfordshire's LCEGS2023 Available Sales and Sector Scalability

## Section 9.1: Hertfordshire's Sales and Available Sales 2019/20 to 2021/22

The Available Sales metric is a sub-set of the Sales value and refers to the non-dominated portion of the market, i.e., the portion of the Sales market which is not 'locked' through long term contracts or aggressive sales tactics and is realistically available to new market entrants under usual cost of sales. It is important because if the market is heavily dominated, and the Available Sales market is small, this can represent a significant barrier to market. Table 15 shows the Sales, Available Sales and Available Sales as a Percentage of Sales for Hertfordshire, by Level 2 sub-sector for all three reporting years.

**Table 15: Hertfordshire's LCEGS2023 Level 2 Sales (£m), Available Sales (£m) and Available Sales as a Percentage of Sales (%) 2019/20 to 2021/22**

| Level 1 | Level 2 | 2019/20 Sales £m | 2019/20 Available Sales £m | 2019/20 Available Sales as a % of Sales | 2020/21 Sales £m | 2020/21 Available Sales £m | 2020/21 Available Sales as a % of Sales | 2021/22 Sales £m | 2021/22 Available Sales £m | 2021/22 Available Sales as a % of Sales |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Carbon | Additional Energy Sources | 53.7 | 24.2 | 45.1% | 48.9 | 22.3 | 45.6% | 50.6 | 23.0 | 45.3% |
| | Alternative Fuel Vehicle | 728.9 | 332.8 | 45.7% | 629.5 | 289.2 | 45.9% | 665.0 | 302.4 | 45.5% |
| | Alternative Fuels | 841.0 | 384.2 | 45.7% | 767.0 | 331.3 | 43.2% | 810.3 | 360.1 | 44.4% |
| | Building Technologies | 761.9 | 344.3 | 45.2% | 695.2 | 311.1 | 44.8% | 716.8 | 322.6 | 45.0% |
| | Carbon Capture & Storage | 20.4 | 9.2 | 45.3% | 18.7 | 8.3 | 44.4% | 19.4 | 8.7 | 45.1% |
| | Carbon Finance | 145.9 | 65.6 | 44.9% | 130.4 | 58.4 | 44.8% | 147.6 | 60.8 | 41.2% |
| | Energy Management | 109.7 | 49.0 | 44.7% | 104.0 | 47.0 | 45.2% | 106.1 | 47.8 | 45.1% |
| | Nuclear Power | 82.8 | 38.4 | 46.3% | 76.0 | 34.4 | 45.2% | 77.7 | 35.4 | 45.6% |
| Renewable Energy | Air Source Heat Pumps | 103.3 | 46.4 | 44.9% | 94.6 | 42.9 | 45.4% | 96.7 | 42.5 | 43.9% |
| | Biomass | 282.0 | 125.8 | 44.6% | 258.9 | 115.4 | 44.6% | 275.8 | 124.0 | 45.0% |
| | Hydro | 443.0 | 201.1 | 45.4% | 398.1 | 178.3 | 44.8% | 423.7 | 190.3 | 44.9% |
| | Photovoltaic | 14.7 | 6.6 | 45.1% | 13.5 | 6.0 | 44.8% | 13.8 | 6.3 | 45.5% |
| | Renewable Consultancy | 335.7 | 151.2 | 45.0% | 299.8 | 133.9 | 44.7% | 322.8 | 144.3 | 44.7% |
| | Wave & Tidal | 18.3 | 8.1 | 44.5% | 16.5 | 7.5 | 45.1% | 16.9 | 7.6 | 44.9% |
| | Wind | 3.6 | 1.6 | 43.7% | 3.3 | 1.5 | 45.3% | 3.5 | 1.6 | 45.6% |
| | Geothermal | 873.7 | 397.8 | 45.5% | 770.4 | 347.8 | 45.1% | 803.8 | 369.6 | 46.0% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Environmental | Air Pollution | 32.3 | 14.6 | 45.2% | 29.5 | 13.3 | 45.0% | 30.1 | 13.5 | 44.9% |
| | Contaminated Land | 31.8 | 14.2 | 44.5% | 29.1 | 12.9 | 44.3% | 30.0 | 13.5 | 45.2% |
| | Energy from Waste | 342.8 | 153.3 | 44.7% | 309.5 | 137.9 | 44.6% | 322.2 | 145.2 | 45.1% |
| | Environmental Consultancy | 31.9 | 14.5 | 45.6% | 29.1 | 13.1 | 45.2% | 30.1 | 13.5 | 44.9% |
| | Environmental Monitoring | 6.3 | 2.8 | 45.4% | 5.7 | 2.6 | 44.9% | 5.9 | 2.7 | 45.0% |
| | Marine Pollution Control | 5.2 | 2.4 | 45.4% | 4.8 | 2.2 | 45.8% | 4.9 | 2.2 | 44.8% |
| | Noise & Vibration Control | 10.0 | 4.5 | 45.3% | 9.0 | 4.0 | 44.8% | 9.4 | 4.2 | 45.1% |
| | Recovery and Recycling | 278.9 | 125.0 | 44.8% | 253.1 | 115.1 | 45.5% | 263.6 | 117.8 | 44.7% |
| | Waste Management | 186.0 | 84.7 | 45.5% | 168.5 | 75.5 | 44.8% | 174.4 | 77.3 | 44.3% |
| | Water & Waste Water Treatment | 275.8 | 124.7 | 45.2% | 249.0 | 111.3 | 44.7% | 254.7 | 114.2 | 44.8% |
| DHNW | DHNW Construction & Maintenance | 14.2 | 6.4 | 45.1% | 13.2 | 5.9 | 45.0% | 13.3 | 6.0 | 45.1% |
| | DHNW Energy Centres | 6.3 | 2.8 | 45.2% | 6.0 | 2.7 | 44.8% | 5.8 | 2.6 | 45.2% |
| | DHNW Operation | 7.5 | 3.4 | 45.1% | 7.0 | 3.1 | 45.0% | 6.9 | 3.1 | 45.3% |
| GI&NBS | Green Infrastructure | 38.4 | 17.7 | 46.0% | 34.0 | 15.5 | 45.5% | 34.2 | 15.2 | 44.4% |
| | Nature Based Building | 2.8 | 1.2 | 44.8% | 2.5 | 1.1 | 45.3% | 2.5 | 1.1 | 44.7% |
| Sustainable Food Production | Biodegradable Food Packaging | 2.7 | 1.2 | 45.5% | 2.5 | 1.2 | 46.3% | 2.6 | 1.2 | 45.6% |
| | Food Waste Reduction Activities | 10.8 | 4.9 | 45.9% | 9.7 | 4.4 | 45.8% | 10.1 | 4.5 | 44.6% |
| | Low Carbon Agriculture | 47.9 | 21.3 | 44.6% | 43.3 | 19.5 | 45.1% | 45.1 | 20.4 | 45.4% |
| | Low Carbon Meat Alternatives | 24.4 | 11.1 | 45.7% | 22.3 | 10.2 | 45.6% | 23.0 | 10.3 | 44.9% |
| | Low Carbon Milk Alternatives | 23.2 | 10.6 | 45.5% | 21.0 | 9.6 | 45.7% | 21.8 | 9.9 | 45.5% |
| **Total** | | **6,197.7** | **2,807.8** | **45.3%** | **5,573.7** | **2,496.6** | **44.8%** | **5,840.7** | **2,625.6** | **45.0%** |

Table 15 illustrates that the proportion of the Sales market which is considered 'Available', is not 'locked' by long term contracts and is realistically available to new market entrants has remained steady, with an average of 45%. The proportion of Available market can vary depending on the sector or sub-sector and from country to country. Within Hertfordshire, Available Sales as a percentage of Sales was between 43.7% for Wave & Tidal and 46.3% for Nuclear Power in 2019/20 and between 41.2% for Carbon Finance and 46.0% for Wind in 2021/22. Within sub-sectors, the proportion of Available market has increased by 2.0 percentage points for Wave & Tidal; 0.8 percentage point for Low Carbon Agriculture; 0.6 percentage points in Contaminated Land 0.5 percentage points for Wind. Conversely, the proportion of Available market has contracted by -3.7 percentage points for Carbon Finance; -1.7 percentage points for Green Infrastructure; -1.3 for Food waste Reduction Activities and -1.2 percentage points for Alternative Fuels.

## Section 9.2: Hertfordshire's Sector Scalability 2021/22

In this section, we explain the concept of scalability of sub-sectors, what influences it, how it can be combined with Sales to explore opportunities.

The concept of sector scalability explicitly refers to the scalability of the sector, it does not necessarily refer to the ability of ***individual companies*** to scale, as each individual company will experience their own limiting factors and factors promoting growth. All of the metrics in this section (and the report as a whole) refer to and provide detail on the sector as a collective.

Scalability refers to the combination of:

- Existence of appropriate available market – the non-dominated portion of the market, not 'locked' by long-term contracts and realistically available to new market entrants
- The ability of existing, operational technology to increase capacity
- Affordability of new technology – the cost/benefit of increasing capacity through adoption of new technology
- Availability of appropriate skill sets in the locality
- Historic growth
- Accessibility of networks and chains of supply

All of these factors are taken into consideration when grading scalability.

The scalability of the sector has been calculated by attributing a scalability factor of 'Low', 'Medium' or 'High' per product or service, which has been given the corresponding value of 1 = Low; 2 = Medium and 3 = High. We have then taken the average of those values for the products and services grouped together for the Levels to produce an index of scalability.

For example, there are 54 products and services within the Level 3 sub-sector of Windows, within the Building technologies (Low Carbon) sub-sector. Each product and service was allocated a scalability factor:
21 products and services listed as 'High' with a score of 3
12 products and services listed as 'Medium' with a score of 2
21 products and services listed a 'Low' with a score of 1

Calculation:

$$\frac{(21x3) + (12x2) + (21x1)}{54} = 2.56$$

The scalability index has been calculated for the 5,133 products and services at Level 5 of the dataset, with the average being used to plot the potential for scalability against the Sales of the sector at Level 2.

Figure 55 shows the Sales plotted against the scalability index of the 36 Level 2 sub-sectors for Hertfordshire, with each bubble sized by the Sales of that sub-sector. The most desirable position would be the top right-hand corner of the graph, with high Sales and high Scalability.

**Figure 55: Hertfordshire's Scalability vs. GVA of Level 2 Sub-sectors – Bubbles Sized by Sales**

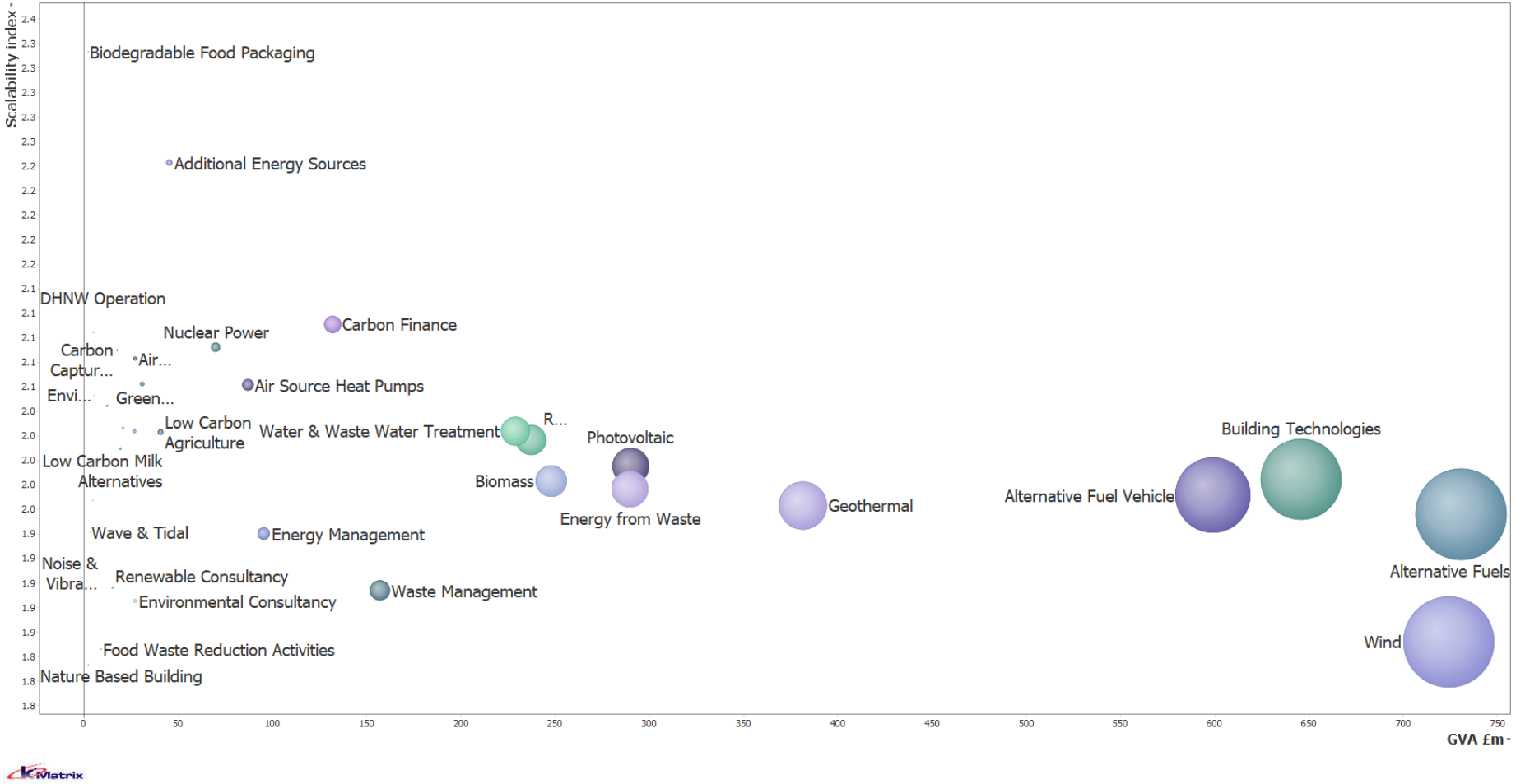



Figure 55 shows that although they are small in terms of GVA (and Sales), Biodegradable Food Packaging and Additional Energy Sources are highly scalable compared with the other sub-sectors. They are removed from Figure 56 to allow analysis of the remaining 34 sub-sectors.

**Figure 56: Hertfordshire's Scalability vs. GVA of Level 2 Sub-sectors – Bubbles Sized by Sales, Outliers Removed**

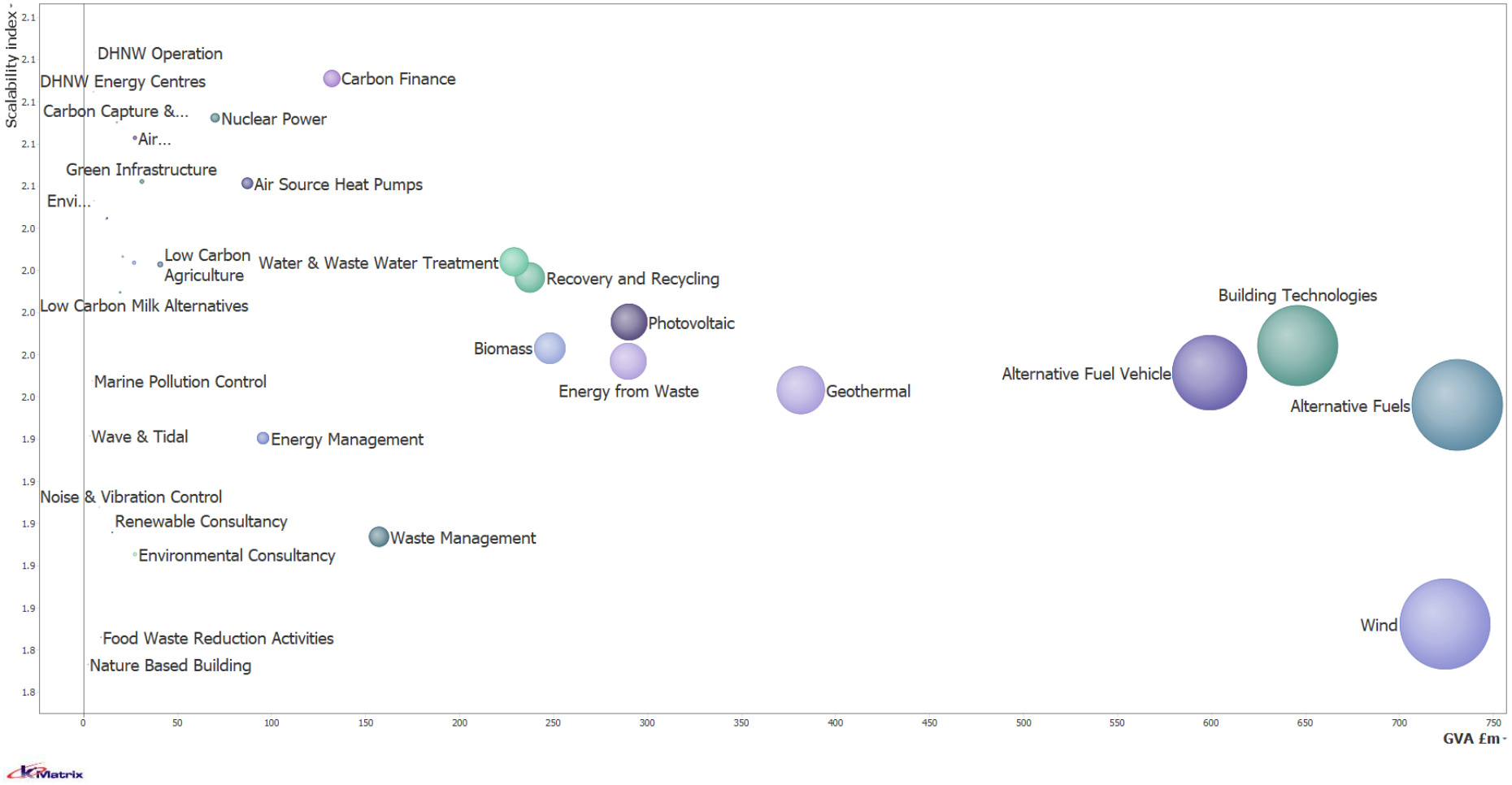


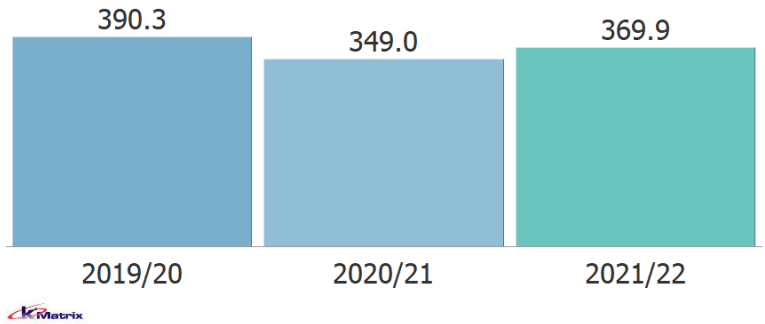

Figure 56 shows that of the large sub-sectors, Carbon finance, Nuclear Power, Air Source Heat Pumps, Water & Waste Water Treatment and Recovery & Recycling are the most easily scalable. There is a group of large sub-sectors which are moderately scalable and include Alternative Fuels, Building Technologies, Alternative Fuel Vehicles, Geothermal, Photovoltaic, Energy from Waste and Biomass. Wind is the largest sub-sector, but one of the least easily scalable, with Waste management and Energy Management also below average for scalability.

## Section 10: Hertfordshire's LCEGS2023 International Trade

In this section, we look at the exports and imports of the LCEGS2023 sector and Level 2 sub-sectors.

This section of the report addresses Hertfordshire's LCEGS2023 Exports over the past two years when compared with totals for the UK.

**Figure 57: Hertfordshire's Exports (£m) 2019/20 to 2021/22**




The value of Hertfordshire's LCEGS2023 Exports were £370m 2021/22, up from £349m in 2020/21, after falling from £390m in 2019/20.

This represents 94.8% recovery of exports after the economic shock.

Growth was -10.6% between 2019/20 and 2020/21 and 6.0% between 2020/21 and 2021/22.

In comparison, UK Export growth in LCEGS2023 was -15.0% and 8.2% with a 92.0% recovery.

**Figure 58: Hertfordshire's Exports (%) by Sub-Sector 2021/22**

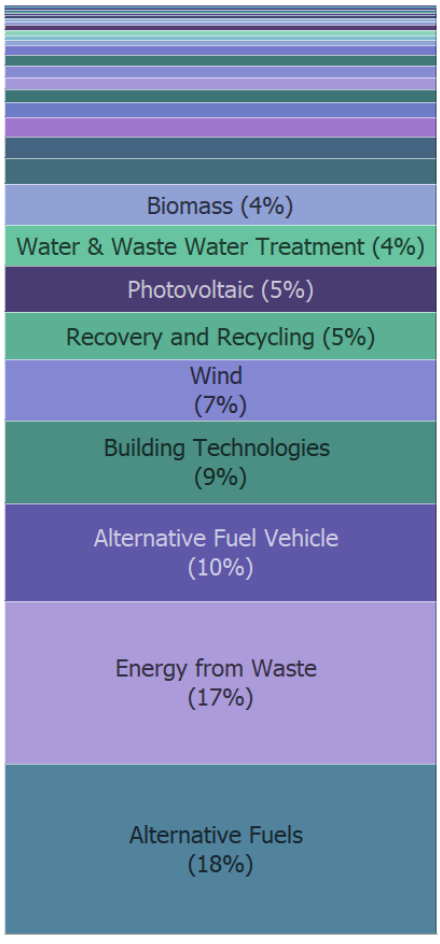


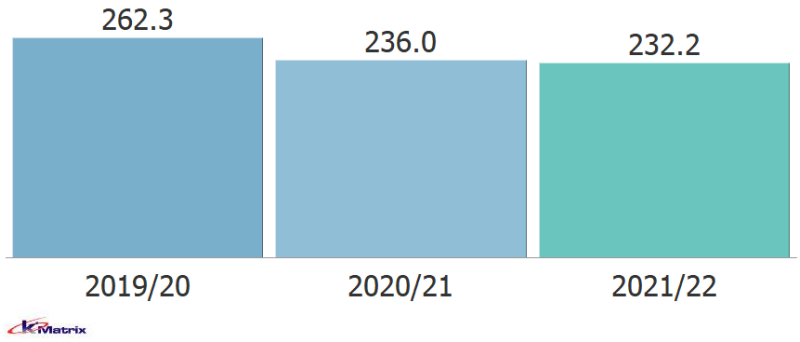

Figure 58 shows Hertfordshire's Exports by the 36 Level 2 sub-sectors.

Hertfordshire represented 2.3% of all UK LCEGS2023 exports in 2020/21, in line with Hertfordshire's 2.3% of overall UK Sales for that year.

Figure 58 shows the proportion of Hertfordshire's LCEGS2023 exports by Level 2 sub-sector for 2021/22, with Alternative Fuels 18%, Energy from Waste 17%, Alternative Fuel Vehicle 10%, Building Technologies 9%, Wind 7%, Recovery & Recycling 5%, Photovoltaic 5%, Water & Waste Water Treatment 4% and Biomass 4% being the leading sub-sectors and accounting for 79% of all Hertfordshire LCEGS2023 exports.

This split is quite different to Hertfordshire's 2019/20 exports, with Energy from Waste 18%, Alternative Fuel Vehicle 12%, Alternative Fuels 11%, Building Technologies 10%, Wind 6%, Photovoltaic 5%, Recovery & Recycling 5% Water & Waste Water Treatment 4%, Biomass 3%, Carbon Finance 3% and waste Management 3% being the leading sub-sectors and accounting for 81% of all Hertfordshire LCEGS2023 exports.

**Figure 59: Hertfordshire's Imports (£m) 2019/20 to 2021/22**




The value of Hertfordshire's LCEGS2023 Imports were £232m 2021/22, down from £236m in 2020/21, and £262m in 2019/20.

This represents 88.5% reduction in imports and no recovery after the economic shock.

Growth was -10.0% between 2019/20 and 2020/21 and -1.6% between 2020/21 and 2021/22.

In comparison, UK Import growth in LCEGS2023 was -10.6% and -1.0% with a 92.0% reduction.

**Figure 60: Hertfordshire's Imports (%) by Sub-Sector 2021/22**

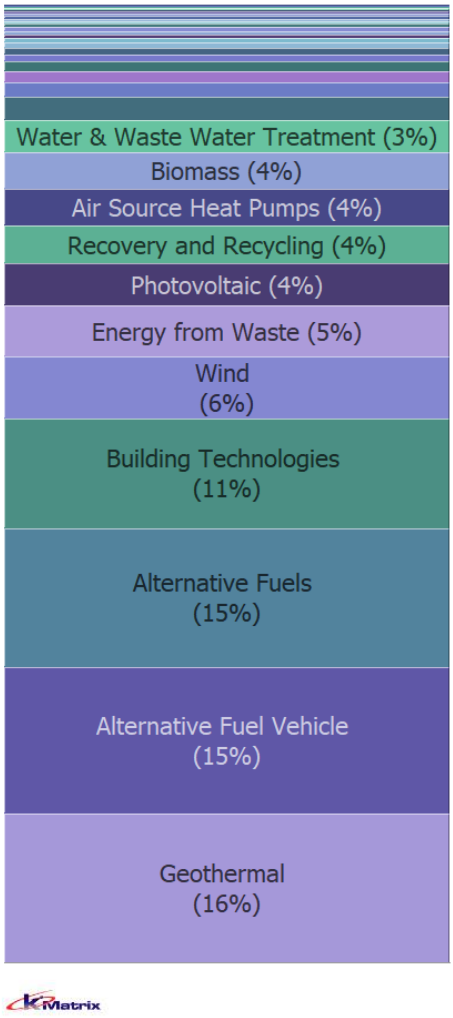



Figure 60 shows Hertfordshire's Imports by the 36 Level 2 sub-sectors.

Hertfordshire represented 1.8% of all UK LCEGS2023 imports in 2020/21, slightly below Hertfordshire's 2.3% of overall UK Sales for that year.

Figure 60 shows the proportion of Hertfordshire's LCEGS2023 imports by Level 2 sub-sector for 2021/22, with Geothermal 16% (17% in 2019/20), Alternative Fuel Vehicle 15%, Alternative Fuels 15% (13% in 2019/20), Building Technologies 11%, Wind 6% (7% in 2019/20), Energy from Waste 5%, Photovoltaic 4%, Recovery & Recycling 4%, Air Source Heat Pumps 4%, Biomass 4%, and Water & Waste Water Treatment 3% being the leading sub-sectors and accounting for 87% of all Hertfordshire LCEGS2023 exports in both 2021/22 and 2019/20.

In Tables 15, 16 and 17 Hertfordshire's LCEGS2023 Exports are shown by sub-sector for each of the three years of the report and are expressed as a percentage of Sales, Available Exports are expressed as a percentage of Exports and Imports are expressed as a percentage of Sales.

| | | 2019/20 | | | 2020/21 | | | 2021/22 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Level 1 | Level 2 | Sales £m | Exports £m | Exports as a % of Sales | Sales £m | Exports £m | Exports as a % of Sales | Sales £m | Exports £m | Exports as a % of Sales |
| Low Carbon | Additional Energy Sources | 53.7 | 3.4 | 6.4% | 48.9 | 3.0 | 6.2% | 50.6 | 3.7 | 7.3% |
| Low Carbon | Alternative Fuel Vehicle | 728.9 | 47.6 | 6.5% | 629.5 | 39.3 | 6.2% | 665.0 | 38.8 | 5.8% |
| Low Carbon | Alternative Fuels | 841.0 | 42.1 | 5.0% | 767.0 | 57.6 | 7.5% | 810.3 | 67.9 | 8.4% |
| Low Carbon | Building Technologies | 761.9 | 37.2 | 4.9% | 695.2 | 31.8 | 4.6% | 716.8 | 33.3 | 4.6% |
| Low Carbon | Carbon Capture & Storage | 20.4 | 1.5 | 7.2% | 18.7 | 1.3 | 6.8% | 19.4 | 1.3 | 6.8% |
| Low Carbon | Carbon Finance | 145.9 | 12.4 | 8.5% | 130.4 | 4.5 | 3.4% | 147.6 | 7.5 | 5.1% |
| Low Carbon | Energy Management | 109.7 | 7.1 | 6.5% | 104.0 | 5.9 | 5.7% | 106.1 | 6.1 | 5.7% |
| Low Carbon | Nuclear Power | 82.8 | 5.9 | 7.2% | 76.0 | 4.8 | 6.4% | 77.7 | 5.1 | 6.6% |
| Renewable Energy | Air Source Heat Pumps | 103.3 | 1.1 | 1.1% | 94.6 | 1.0 | 1.0% | 96.7 | 1.0 | 1.1% |
| Renewable Energy | Biomass | 282.0 | 16.4 | 5.8% | 258.9 | 19.1 | 7.4% | 275.8 | 16.3 | 5.9% |
| Renewable Energy | Geothermal | 443.0 | 4.8 | 1.1% | 398.1 | 4.5 | 1.1% | 423.7 | 4.8 | 1.1% |
| Renewable Energy | Hydro | 14.7 | 1.0 | 6.8% | 13.5 | 1.0 | 7.5% | 13.8 | 1.1 | 8.2% |
| Renewable Energy | Photovoltaic | 335.7 | 21.2 | 6.3% | 299.8 | 17.5 | 5.8% | 322.8 | 18.2 | 5.6% |
| Renewable Energy | Renewable Energy Consultancy | 18.3 | 1.1 | 6.2% | 16.5 | 0.9 | 5.7% | 16.9 | 1.4 | 8.4% |
| Renewable Energy | Wave & Tidal | 3.6 | 0.2 | 6.4% | 3.3 | 0.2 | 7.3% | 3.5 | 0.2 | 6.7% |
| Renewable Energy | Wind | 873.7 | 25.1 | 2.9% | 770.4 | 22.8 | 3.0% | 803.8 | 24.2 | 3.0% |
| Environmental | Air Pollution | 32.3 | 2.2 | 6.8% | 29.5 | 1.9 | 6.5% | 30.1 | 1.9 | 6.4% |
| Environmental | Contaminated Land | 31.8 | 2.2 | 7.0% | 29.1 | 2.0 | 7.0% | 30.0 | 2.1 | 6.9% |
| Environmental | Energy from Waste | 342.8 | 70.3 | 20.5% | 309.5 | 63.4 | 20.5% | 322.2 | 64.6 | 20.1% |
| Environmental | Environmental Consultancy | 31.9 | 2.2 | 6.9% | 29.1 | 1.9 | 6.5% | 30.1 | 2.2 | 7.2% |
| Environmental | Environmental Monitoring | 6.3 | 0.4 | 6.1% | 5.7 | 0.4 | 7.2% | 5.9 | 0.4 | 7.0% |
| Environmental | Marine Pollution Control | 5.2 | 0.3 | 6.7% | 4.8 | 0.3 | 6.7% | 4.9 | 0.4 | 7.7% |
| Environmental | Noise & Vibration Control | 10.0 | 0.6 | 6.4% | 9.0 | 0.6 | 6.1% | 9.4 | 0.6 | 6.8% |
| Environmental | Recovery and Recycling | 278.9 | 19.0 | 6.8% | 253.1 | 16.4 | 6.5% | 263.6 | 19.1 | 7.2% |
| Environmental | Waste Management | 186.0 | 11.9 | 6.4% | 168.5 | 10.4 | 6.2% | 174.4 | 10.1 | 5.8% |
| Environmental | Water & Waste Water Treatment | 275.8 | 17.2 | 6.2% | 249.0 | 16.6 | 6.7% | 254.7 | 16.5 | 6.5% |
| DHNW | DHNW Construction & Maintenance | 14.2 | 4.1 | 28.9% | 13.2 | 0.2 | 1.3% | 13.3 | 0.2 | 1.2% |
| DHNW | DHNW Energy Centres | 6.3 | 1.9 | 31.0% | 6.0 | 0.1 | 1.2% | 5.8 | 0.1 | 1.2% |
| DHNW | DHNW Operation | 7.5 | 3.6 | 48.3% | 7.0 | 0.1 | 1.2% | 6.9 | 0.1 | 1.2% |
| GI&NBS | Green Infrastructure | 38.4 | 3.3 | 8.5% | 34.0 | 0.3 | 1.0% | 34.2 | 0.4 | 1.0% |
| GI&NBS | Nature Based Building | 2.8 | 0.8 | 28.8% | 2.5 | 0.1 | 3.5% | 2.5 | 0.1 | 3.5% |
| Sust. Food Prod'n | Biodegradable Food Packaging | 2.7 | 0.6 | 21.7% | 2.5 | 0.5 | 19.8% | 2.6 | 0.6 | 22.2% |
| Sust. Food Prod'n | Food Waste Reduction Activities | 10.8 | 2.2 | 20.3% | 9.7 | 2.1 | 21.9% | 10.1 | 1.9 | 19.3% |
| Sust. Food Prod'n | Low Carbon Agriculture | 47.9 | 10.1 | 21.1% | 43.3 | 8.2 | 19.0% | 45.1 | 8.8 | 19.6% |
| Sust. Food Prod'n | Low Carbon Meat Alternatives | 24.4 | 4.6 | 18.9% | 22.3 | 4.3 | 19.2% | 23.0 | 4.7 | 20.6% |
| Sust. Food Prod'n | Low Carbon Milk Alternatives | 23.2 | 4.4 | 18.8% | 21.0 | 3.9 | 18.6% | 21.8 | 4.1 | 19.0% |
| **Total** | | **6,197.7** | **390.3** | **6.3%** | **5,573.7** | **349.0** | **6.3%** | **5,840.7** | **369.9** | **6.3%** |

**Table 15: Hertfordshire's LCEGS2023 Exports as a % of Sales 2019/20 to 2021/22**

Table 15 shows the Exports by sub-sector for each of the three years of the report and have been expressed as a percentage of that sub-sector's overall sales.

The overall average for 2021/22 is 6.3%, with variation across the sub-sectors from 1.0% for Green Infrastructure to 22.2% for Biodegradable Food Packaging.

Some sub-sectors, such as DHNW Construction & Maintenance and Green Infrastructure experienced significant reduction in exports between 2019/20 and 2020/21, which was maintained in 2021/22. This is consistent with the UK market, and it is unclear when this will recover.

| | | 2019/20 | | | 2020/21 | | | 2021/22 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Level 1 | Level 2 | Exports £m | Avail. Exports £m | Avail as a % of Exports | Exports £m | Avail. Exports £m | Avail as a % of Exports | Exports £m | Avail. Exports £m | Avail as a % of Exports |
| Low Carbon | Additional Energy Sources | 3.4 | 1.0 | 29.4% | 3.0 | 0.9 | 29.8% | 3.7 | 1.1 | 29.5% |
| Low Carbon | Alternative Fuel Vehicle | 47.6 | 14.0 | 29.5% | 39.3 | 11.8 | 30.0% | 38.8 | 11.8 | 30.5% |
| Low Carbon | Alternative Fuels | 42.1 | 13.0 | 30.9% | 57.6 | 17.4 | 30.2% | 67.9 | 20.4 | 30.1% |
| Low Carbon | Building Technologies | 37.2 | 11.1 | 29.8% | 31.8 | 9.5 | 29.9% | 33.3 | 10.0 | 30.1% |
| Low Carbon | Carbon Capture & Storage | 1.5 | 0.4 | 30.2% | 1.3 | 0.4 | 30.1% | 1.3 | 0.4 | 29.9% |
| Low Carbon | Carbon Finance | 12.4 | 3.7 | 29.5% | 4.5 | 1.3 | 29.8% | 7.5 | 2.2 | 29.6% |
| Low Carbon | Energy Management | 7.1 | 2.1 | 29.5% | 5.9 | 1.8 | 30.3% | 6.1 | 1.8 | 30.0% |
| Low Carbon | Nuclear Power | 5.9 | 1.8 | 29.6% | 4.8 | 1.4 | 29.9% | 5.1 | 1.5 | 30.1% |
| Renewable Energy | Air Source Heat Pumps | 1.1 | 0.3 | 30.4% | 1.0 | 0.3 | 30.3% | 1.0 | 0.3 | 30.2% |
| Renewable Energy | Biomass | 16.4 | 5.0 | 30.4% | 19.1 | 5.8 | 30.2% | 16.3 | 4.9 | 29.9% |
| Renewable Energy | Geothermal | 4.8 | 1.4 | 29.6% | 4.5 | 1.3 | 29.9% | 4.8 | 1.4 | 29.6% |
| Renewable Energy | Hydro | 1.0 | 0.3 | 29.8% | 1.0 | 0.3 | 29.5% | 1.1 | 0.3 | 30.6% |
| Renewable Energy | Photovoltaic | 21.2 | 6.3 | 29.9% | 17.5 | 5.2 | 29.5% | 18.2 | 5.4 | 29.7% |
| Renewable Energy | Renewable Energy Consultancy | 1.1 | 0.3 | 28.8% | 0.9 | 0.3 | 30.2% | 1.4 | 0.4 | 29.5% |
| Renewable Energy | Wave & Tidal | 0.2 | 0.1 | 30.5% | 0.2 | 0.1 | 29.9% | 0.2 | 0.1 | 30.3% |
| Renewable Energy | Wind | 25.1 | 7.3 | 29.1% | 22.8 | 7.0 | 30.8% | 24.2 | 7.1 | 29.5% |
| Environmental | Air Pollution | 2.2 | 0.7 | 29.8% | 1.9 | 0.6 | 29.9% | 1.9 | 0.6 | 29.7% |
| Environmental | Contaminated Land | 2.2 | 0.7 | 29.9% | 2.0 | 0.6 | 29.9% | 2.1 | 0.6 | 30.3% |
| Environmental | Energy from Waste | 70.3 | 21.2 | 30.1% | 63.4 | 19.1 | 30.1% | 64.6 | 19.4 | 30.1% |
| Environmental | Environmental Consultancy | 2.2 | 0.7 | 29.5% | 1.9 | 0.6 | 29.6% | 2.2 | 0.6 | 29.8% |
| Environmental | Environmental Monitoring | 0.4 | 0.1 | 30.0% | 0.4 | 0.1 | 30.3% | 0.4 | 0.1 | 30.2% |
| Environmental | Marine Pollution Control | 0.3 | 0.1 | 30.2% | 0.3 | 0.1 | 30.1% | 0.4 | 0.1 | 29.6% |
| Environmental | Noise & Vibration Control | 0.6 | 0.2 | 30.2% | 0.6 | 0.2 | 30.0% | 0.6 | 0.2 | 29.7% |
| Environmental | Recovery and Recycling | 19.0 | 5.7 | 29.8% | 16.4 | 4.9 | 29.8% | 19.1 | 5.7 | 30.0% |
| Environmental | Waste Management | 11.9 | 3.6 | 29.8% | 10.4 | 3.1 | 29.8% | 10.1 | 3.0 | 29.7% |
| Environmental | Water & Waste Water Treatment | 17.2 | 5.1 | 29.6% | 16.6 | 4.9 | 29.5% | 16.5 | 5.0 | 30.1% |
| DHNW | DHNW Construction & Maintenance | 4.1 | 1.2 | 29.9% | 0.2 | 0.1 | 29.8% | 0.2 | 0.0 | 29.7% |
| DHNW | DHNW Energy Centres | 1.9 | 0.6 | 30.5% | 0.1 | 0.0 | 30.4% | 0.1 | 0.0 | 29.9% |
| DHNW | DHNW Operation | 3.6 | 1.1 | 29.9% | 0.1 | 0.0 | 29.9% | 0.1 | 0.0 | 29.6% |
| GI&NBS | Green Infrastructure | 3.3 | 1.0 | 29.8% | 0.3 | 0.1 | 30.3% | 0.4 | 0.1 | 29.9% |
| GI&NBS | Nature Based Building | 0.8 | 0.2 | 30.7% | 0.1 | 0.0 | 30.1% | 0.1 | 0.0 | 29.6% |
| Sust. Food Prod'n | Biodegradable Food Packaging | 0.6 | 0.2 | 27.7% | 0.5 | 0.1 | 29.5% | 0.6 | 0.2 | 27.7% |
| Sust. Food Prod'n | Food Waste Reduction Activities | 2.2 | 0.6 | 29.3% | 2.1 | 0.7 | 31.0% | 1.9 | 0.6 | 30.8% |
| Sust. Food Prod'n | Low Carbon Agriculture | 10.1 | 3.0 | 30.1% | 8.2 | 2.4 | 29.5% | 8.8 | 2.6 | 29.7% |
| Sust. Food Prod'n | Low Carbon Meat Alternatives | 4.6 | 1.4 | 30.0% | 4.3 | 1.3 | 30.6% | 4.7 | 1.4 | 29.7% |
| Sust. Food Prod'n | Low Carbon Milk Alternatives | 4.4 | 1.3 | 30.0% | 3.9 | 1.2 | 30.4% | 4.1 | 1.2 | 29.8% |
| **Total** | | **390.3** | **116.7** | **29.9%** | **349.0** | **104.9** | **30.0%** | **369.9** | **111.0** | **30.0%** |

**Table 16: Hertfordshire's LCEGS2023 Exports and Available Exports as a % of Sales 2019/20 to 2021/22**

Table 16 shows detail for Available Exports, which represent the non-dominated portion of the export market and represents the value of the export market realistically available to new market entrants under usual cost of export.

The overall average for Available Sales as a Percentage of Sales has remained similar for 2019/20 (29.9%) and 2021/22 (30.0%).

There is variation across the sub-sectors from 27.7% for Biodegradable food Packaging to 30.8% for Food Waste Reduction Activities.

| | | 2019/20 | | | 2020/21 | | | 2021/22 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Level 1 | Level 2 | Sales £m | Imports £m | Imports as a % of Sales | Sales £m | Imports £m | Imports as a % of Sales | Sales £m | Imports £m | Imports as a % of Sales |
| Low Carbon | Additional Energy Sources | 53.7 | 1.8 | 3.4% | 48.9 | 1.5 | 3.1% | 50.6 | 1.6 | 3.2% |
| Low Carbon | Alternative Fuel Vehicle | 728.9 | 40.3 | 5.5% | 629.5 | 37.6 | 6.0% | 665.0 | 35.3 | 5.3% |
| Low Carbon | Alternative Fuels | 841.0 | 34.2 | 4.1% | 767.0 | 34.7 | 4.5% | 810.3 | 33.8 | 4.2% |
| Low Carbon | Building Technologies | 761.9 | 29.8 | 3.9% | 695.2 | 25.9 | 3.7% | 716.8 | 26.6 | 3.7% |
| Low Carbon | Carbon Capture & Storage | 20.4 | 0.7 | 3.4% | 18.7 | 0.6 | 3.1% | 19.4 | 0.6 | 3.2% |
| Low Carbon | Carbon Finance | 145.9 | 2.8 | 1.9% | 130.4 | 2.3 | 1.8% | 147.6 | 2.6 | 1.7% |
| Low Carbon | Energy Management | 109.7 | 4.2 | 3.8% | 104.0 | 3.5 | 3.3% | 106.1 | 3.6 | 3.4% |
| Low Carbon | Nuclear Power | 82.8 | 2.8 | 3.3% | 76.0 | 2.4 | 3.2% | 77.7 | 2.5 | 3.2% |
| Renewable Energy | Air Source Heat Pumps | 103.3 | 11.0 | 10.6% | 94.6 | 9.7 | 10.3% | 96.7 | 8.9 | 9.2% |
| Renewable Energy | Biomass | 282.0 | 9.5 | 3.4% | 258.9 | 8.1 | 3.1% | 275.8 | 8.8 | 3.2% |
| Renewable Energy | Geothermal | 443.0 | 45.3 | 10.2% | 398.1 | 40.6 | 10.2% | 423.7 | 36.2 | 8.5% |
| Renewable Energy | Hydro | 14.7 | 0.5 | 3.3% | 13.5 | 0.4 | 3.2% | 13.8 | 0.4 | 3.1% |
| Renewable Energy | Photovoltaic | 335.7 | 11.6 | 3.4% | 299.8 | 9.9 | 3.3% | 322.8 | 10.4 | 3.2% |
| Renewable Energy | Renewable Energy Consultancy | 18.3 | 0.6 | 3.4% | 16.5 | 0.6 | 3.5% | 16.9 | 0.6 | 3.4% |
| Renewable Energy | Wave & Tidal | 3.6 | 0.1 | 3.3% | 3.3 | 0.1 | 3.1% | 3.5 | 0.1 | 3.1% |
| Renewable Energy | Wind | 873.7 | 17.7 | 2.0% | 770.4 | 14.5 | 1.9% | 803.8 | 14.9 | 1.9% |
| Environmental | Air Pollution | 32.3 | 1.0 | 3.2% | 29.5 | 0.9 | 3.0% | 30.1 | 0.9 | 3.1% |
| Environmental | Contaminated Land | 31.8 | 1.2 | 3.7% | 29.1 | 1.0 | 3.4% | 30.0 | 1.0 | 3.4% |
| Environmental | Energy from Waste | 342.8 | 12.7 | 3.7% | 309.5 | 11.6 | 3.8% | 322.2 | 12.4 | 3.8% |
| Environmental | Environmental Consultancy | 31.9 | 1.0 | 3.2% | 29.1 | 0.8 | 2.9% | 30.1 | 0.9 | 3.0% |
| Environmental | Environmental Monitoring | 6.3 | 0.2 | 3.3% | 5.7 | 0.2 | 3.1% | 5.9 | 0.2 | 3.0% |
| Environmental | Marine Pollution Control | 5.2 | 0.2 | 3.4% | 4.8 | 0.1 | 3.0% | 4.9 | 0.2 | 3.1% |
| Environmental | Noise & Vibration Control | 10.0 | 0.3 | 3.2% | 9.0 | 0.3 | 3.1% | 9.4 | 0.3 | 3.0% |
| Environmental | Recovery and Recycling | 278.9 | 10.2 | 3.7% | 253.1 | 8.2 | 3.2% | 263.6 | 9.0 | 3.4% |
| Environmental | Waste Management | 186.0 | 6.2 | 3.4% | 168.5 | 5.4 | 3.2% | 174.4 | 5.7 | 3.3% |
| Environmental | Water & Waste Water Treatment | 275.8 | 8.8 | 3.2% | 249.0 | 7.6 | 3.1% | 254.7 | 7.8 | 3.1% |
| DHNW | DHNW Construction & Maintenance | 14.2 | 1.6 | 11.0% | 13.2 | 1.5 | 11.2% | 13.3 | 1.3 | 10.0% |
| DHNW | DHNW Energy Centres | 6.3 | 0.7 | 10.7% | 6.0 | 0.6 | 10.2% | 5.8 | 0.6 | 9.5% |
| DHNW | DHNW Operation | 7.5 | 0.8 | 10.7% | 7.0 | 0.8 | 10.8% | 6.9 | 0.7 | 10.0% |
| GI&NBS | Green Infrastructure | 38.4 | 0.7 | 1.9% | 34.0 | 0.6 | 1.9% | 34.2 | 0.6 | 1.8% |
| GI&NBS | Nature Based Building | 2.8 | 0.0 | 1.5% | 2.5 | 0.0 | 1.5% | 2.5 | 0.0 | 1.3% |
| Sust. Food Prod'n | Biodegradable Food Packaging | 2.7 | 0.1 | 3.9% | 2.5 | 0.1 | 2.7% | 2.6 | 0.1 | 2.8% |
| Sust. Food Prod'n | Food Waste Reduction Activities | 10.8 | 0.4 | 3.6% | 9.7 | 0.4 | 4.0% | 10.1 | 0.4 | 4.1% |
| Sust. Food Prod'n | Low Carbon Agriculture | 47.9 | 1.6 | 3.4% | 43.3 | 1.7 | 3.9% | 45.1 | 1.6 | 3.5% |
| Sust. Food Prod'n | Low Carbon Meat Alternatives | 24.4 | 0.8 | 3.4% | 22.3 | 0.8 | 3.6% | 23.0 | 0.8 | 3.7% |
| Sust. Food Prod'n | Low Carbon Milk Alternatives | 23.2 | 0.8 | 3.3% | 21.0 | 0.9 | 4.2% | 21.8 | 0.8 | 3.6% |
| **Total** | | **6,197.7** | **262.3** | **4.2%** | **5,573.7** | **236.0** | **4.2%** | **5,840.7** | **232.2** | **4.0%** |

**Table 17: Hertfordshire's LCEGS2023 Imports as a % of Sales 2019/20 to 2021/22**

Table 17 shows the Imports by sub-sector for each of the three years of the report and have been expressed as a percentage of that sub-sector's overall sales.

The overall average for 2021/22 is 4.0%, with variation across the sub-sector from 1.3% for Nature Based Building to 10.0% for DHNW Construction & Maintenance and DHNW Operation.

Figure 61 shows the 2021/21 Exports (£m), plotted against Hertfordshire's 2019/20 Export Growth for all Level 2 sub-sectors, with the bubbles sized according to the size of the Exports.

**Figure 61: Hertfordshire's LCEGS2023 Exports vs Level 2 Export Growth between 2020/21 and 2021/22**

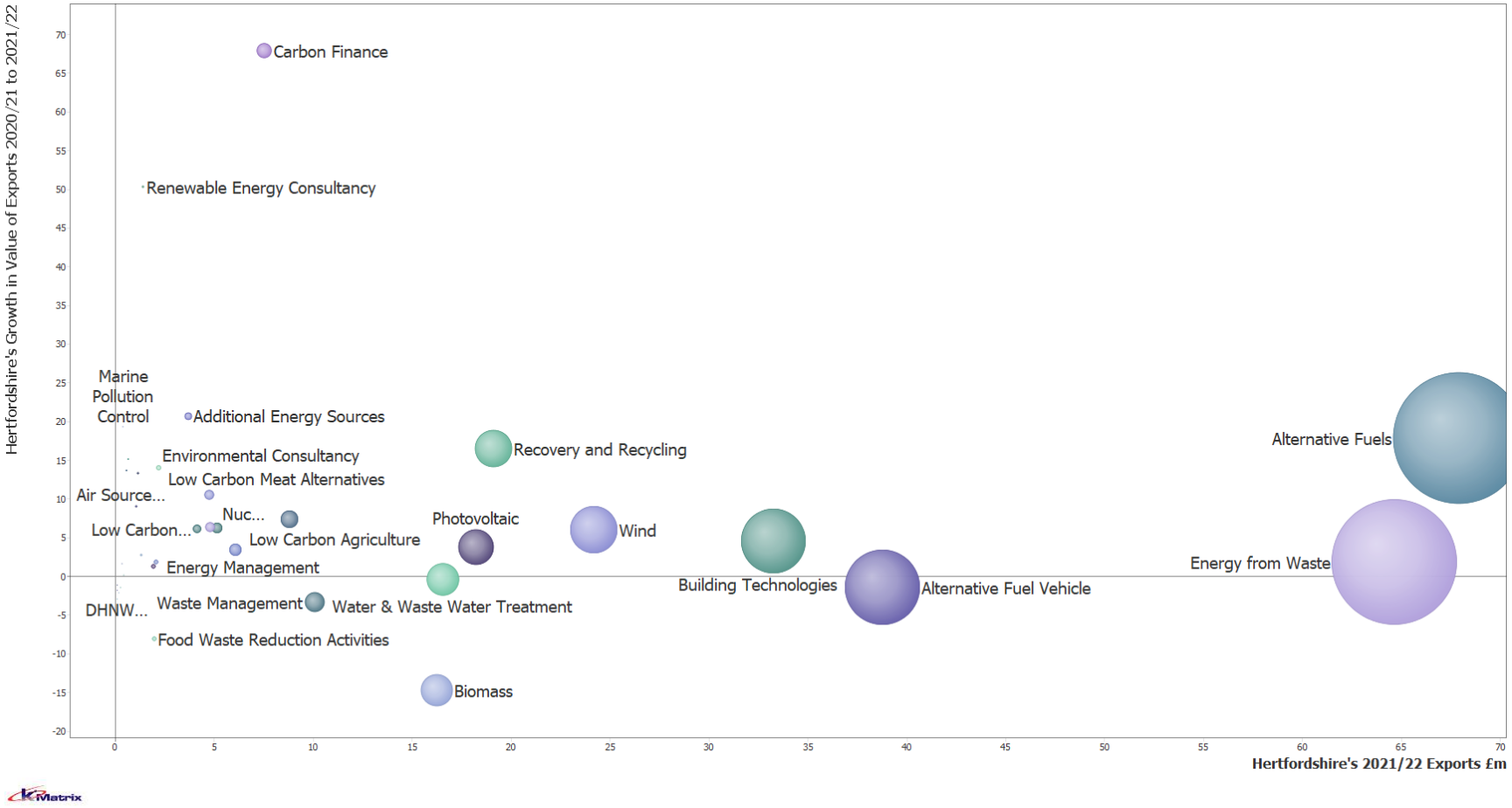



Figure 61 illustrates that some sub-sectors including Carbon Finance and Renewable Energy Consultancy saw strong growth between 2002/21 and 2021/22, while others such as Biomass and Food Waste Reduction Activities saw further contraction in exports. Alternative Fuels is the largest exporter and the second largest sub-sector in terms of sales and saw good growth of 17.9% between 2020/21 and 2021/22.

## Study Conclusion

Hertfordshire has a healthy Low Carbon Environmental Goods and Services Sector, which was worth £5.8bn in Sales to Hertfordshire's economy in 2021/22 and employed over 40,000 people in over 2,000 businesses.

Comparisons with the latest GDP data released by the ONS for Local Authority GDP, which is for 2020, are with LCEGS2023 Sales for the fiscal year 2020/21 (not 2021/22 as per the rest of the report), for comparative purposes.

When the 2020 ONS GDP figures are compared with LCEGS2023 Sales, the LCEGS2023 sector Sales of £5.6bn in 2020/21 account for 12.4% of Hertfordshire's £44.8bn (2020) GDP. This is higher than the UK LCEGS2023 Sales contribution in 2020/21 of £244.8bn, which was 11.4% of the UK £2,144.7bn (2020) GDP. This indicates the strength of the LCEGS2023 sector in Hertfordshire, which accounts for a larger proportion of GDP than the UK average.

Additionally, four of the five largest Level 2 sub-sectors in Hertfordshire contribute a larger proportion of GDP than the UK average, and the largest three of these are in the Low Carbon Level 1 sub-sector. These are contributing a larger proportion than the national average, with none demonstrating significant scalability barriers, and so should be considered strengths:

| **Level 2 Sub-sector (Ordered by 2020/21 Sales)** | **Hertfordshire 2020/21 Sales as % of Hertfordshire GDP** | **UK 2020/21 Sales as % of UK GDP** |
|---|---|---|
| Alternative Fuels (£767m) | 1.7% | 1.4% |
| Building technologies (£695m) | 1.6% | 1.3% |
| Alternative Fuel Vehicle (£630m) | 1.4% | 1.2% |
| Geothermal (£398m) | 0.9% | 0.7% |

Level 2 sub-sectors with a combination of strengths such as large Sales (above £75m), contributing a larger proportion of GDP than the UK average, large Export market and Scalability and which are therefore strategically important to Hertfordshire include:

**Alternative Fuels** (Low Carbon, with £810m in Sales in 2021/22)

***Large Size in terms of Sales***, Higher proportion of GDP than UK average, ***Moderately Scalable*** and ***largest Export Market*** (£68m) with the strongest growth in Exports (17.9%) between 2020/2021 and 2021/22

**Building Technologies** (Low Carbon, with £717m in Sales in 2021/22)

***Large Size in terms of Sales***, Higher proportion of GDP than UK average, ***Moderately Scalable*** and ***large Export Market*** (£39m) with growth in exports (4.6%) between 2020/21 and 2021/22

**Alternative Fuel Vehicle** (Low Carbon, with £665m in Sales in 2021/22)

***Large Size in terms of Sales***, Higher proportion of GDP than UK average, ***Moderately Scalable*** and ***large Export Market*** (£39m) in 2021/22

**Geothermal** (Renewable Energy, with £424m in Sales in 2021/22)

***Large Size in terms of Sales***, Higher proportion of GDP than UK average and ***Moderately Scalable***

**Wind** (Renewable Energy, with £804m in Sales in 2021/22)

***Large Size in terms of Sales***, ***large Export Market*** (£24m) with growth in exports (6.0%) between 2020/21 and 2021/22 but low Scalability

**Recovery & Recycling** (Environmental, with £364m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Highly Scalable***, with ***large Export Market*** (£19m) with very strong growth in Exports (16.6%) between 2020/21 and 2021/22

**Carbon Finance** (Low Carbon, with £148m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Highly Scalable***, with ***good Export Market*** (£8m) with very strong growth in Exports (67.9%) between 2020/21 and 2021/22

**Photovoltaic** (Renewable Energy, with £323m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Moderately Scalable*** and ***large Export Market*** (£18m) with growth in exports (3.8%) between 2020/21 and 2021/22

**Energy from Waste** (Environmental, with £322m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Moderately Scalable*** and ***large Export Market*** (£65m) in 2021/22

**Water & Waste Water Treatment** (Environmental, with £255m in Sales in 2021/22)

***Large Size in terms of Sales***, ***Highly Scalable***, with ***large Export Market*** (£17m) in 2021/22

**Air Source Heat Pumps** (Renewable Energy, with £97m in Sales in 2021/22)

***Large Size in terms of Sales*** and ***Highly Scalable***

**Nuclear Power** (Low Carbon, with £78m in Sales in 2021/22)

***Large Size in terms of Sales*** and ***Highly Scalable***

The LCEGS2023 sector definition is forecast to be high-growth, with the LCEGS2023 sector in Hertfordshire forecast to see consistent growth in Sales of 5.8% growth between 2021/22 and 2022/23, growing year-on-year to reach 12.1% growth between 2024/25 and 2025/26.

This compares with UK sector growth of 6.4% growth between 2021/22 and 2022/23, growing year-on-year to reach 12.9% growth between 2024/25 and 2025/26. The stronger growth forecasts for the UK are due to the size and nature of the sector in London.

Sales in Hertfordshire's LCEGS2023 sector are forecast to grow from £5.8m in 2021/22 to £8.3m in 2025/26.

The LCEGS2023 sector is also expected to see significant potential growth in Employees under Net Zero 2050 targets. Net Zero 2050 forecasts for employment include:

- No policy employment is forecast to increase from 38,973 in 2021/22 to 767,588 (19.7x) employment in 2050 under a net zero scenario

- Current Policy employment is forecast to increase from 38,973 in 2021/22 to 1,215,357 (31.2x) employment in 2050 under a net zero scenario

**Note:** Employment forecasts include 'No policy' and 'Current Policy' scenarios. The purpose of providing this distinction is to provide detail to policy makers of the likely impact of current policy, but also to provide the likely baseline minimal growth of the sector if those policies were not in place. The 'No Policy' forecast essentially provides a baseline growth, which represents an average of the forecasts from within the sector, while 'Current Policy' forecast are based on national government net zero policies. These have been overlaid on the baseline 'No Policy' forecasts, to provide insight into the impacts of those policies. Forecasts. Further description is provided on page 37.

# Appendix 1: LCEGS2023 Sector Definition

This appendix describes an overview of the Level 1 sub-sectors within the LCEGS2023 taxonomy, followed by a high-level description of the Level 2 sub-sectors, then more detailed descriptions of Level 2 sub-sectors within their Level 1 Groupings.

LCEGS2023 taxonomy extends the LCEGS dataset from 2,769 to 5,133 activities, through the addition of District Heat Networks, Green Infrastructure & Nature Based Building and Sustainable Food Production at Level 1. Existing Level 1 sub-sectors Low Carbon, Renewable Energy and Environmental have been extended to include:

**Low Carbon** – further detail (beyond that within the original LCEGS taxonomy) for Electric Vehicles, Hydrogen Vehicles, EV Batteries, Production of Hydrogen, Insulation and Heat retention Materials (domestic and non-domestic applications), alterations in Levels 3-5 and addition of mature-market activities e.g., maintenance

**Renewable Energy** – Air Source Heat Pumps moved from Level 4 to Level 2, Geothermal re-structured at Level 3 to increase usability and Wind split into offshore and onshore at Level 3, alterations in Levels 3-5 and addition of mature-market activities e.g., maintenance

**Environmental** – Addition of Energy from Waste as a Level 2 sub-sector
Some of the alterations are drawn from standalone taxonomies held by kMatrix and reported to other cities and LEPs (e.g., Wind and Geothermal), other areas were extended by kMatrix as a response to stakeholder engagement (e.g., splitting building insulation materials into domestic and non-domestic applications).

## A1.1 Level 1 Sub-sector Descriptions

The **Low Carbon and Environmental Goods and Services 2023** (LCEGS2023) taxonomy is divided into six Level 1 sub-sectors - Low Carbon, Renewable Energy, Environmental, District Heat Networks, Green Infrastructure & Nature Based Solutions and Sustainable Food Production. These are in turn divided into 36 Level 2 sub-sectors:

- **Low Carbon** sub-sector is made up of the following: Additional Energy Sources, Alternative Fuel Vehicles, Alternative Fuels, Building Technologies, Carbon Capture & Storage, Carbon Finance, Energy Management and Nuclear Power
- **Renewable Energy** sub-sector is made up of the following: Air Source Heat Pumps, Biomass, Geothermal, Hydro, Photovoltaic, Renewable Energy Consultancy, Wave & Tidal and Wind
- **Environmental** sub-sector is made up of the following: Air Pollution Control, Contaminated Land Reclamation & Remediation, Energy from Waste, Environmental Consultancy, Environmental Monitoring, Marine Pollution Control, Noise & Vibration Control, Recovery & Recycling, Waste Management and Water Supply & Waste Water Treatment
- **District Heat Networks (DHNW)** sub-sector is made up of the following: DHNW Construction & Maintenance, DHNW Energy Centres and DHNW Operation
- **Green Infrastructure & Nature Based Solutions** sub-sector is made up of the following: Green Infrastructure, and Nature Based Building
- **Sustainable Food Production** sub-sector is made up of the following: Low Carbon Agriculture, Low Carbon Meat Alternatives, Low Carbon Milk Alternatives, Food Waste Reduction Activities and Biodegradable Food Packaging

## A1.2 High-level Descriptions of Level 2 Sub-sectors in Level 1 Sub-sectors

**Low Carbon** Level 2 sub-sectors are:

- Carbon Finance includes Credits Finance, Fund Management, Trading and Research

- Carbon Capture & Storage includes Capture, Pipeline, Storage and Engineering
- Energy Management includes Lighting, Heating & Ventilation and Engineering
- Nuclear Power includes Construction, Commissioning, Operations, Engineering and Testing Services
- Additional Energy Sources include Energy Storage Research, Fuel Cells & Hydrogen (excludes hydrogen as vehicle fuel)
- Alternative Fuel Vehicle includes main stream alternative Fuels and other fuels and vehicles.
- Alternative Fuels includes Main Stream and other Bio Fuels, EV Batteries, Non-EV Batteries, Hydrogen Fuel for Vehicles, and other fuels
- Building Technologies includes Doors, Windows, Monitoring & Control Systems and Insulation/Heat Retention Materials

**Renewable Energy** Level 2 sub-sectors are:

- Air Source Heat Pumps include Commercial/Large Scale, Community Based and Domestic/Small Scale
- Biomass includes Energy, Furnace, Boilers and Related Systems
- Geothermal includes Ground Source Heat Pumps, Specialist Equipment and Water Source Heat Pumps
- Hydro includes Turbines, Pumps, Electricity Supply and Dams
- Photovoltaic includes Systems & Equipment, Cells and Chemicals
- Renewable Energy consulting includes specialist consulting and legal advice
- Wave & Tidal includes Ebb & Flood, Pumps & Equipment, Turbine & Generation etc.
- Wind includes Offshore Large Turbines, Offshore Wind Farm Systems, Offshore Wind Farm Systems, Onshore Wind Farm Systems, Onshore Wind Farm Systems and Small Turbines

**Environmental** Level 2 sub-sectors are:

- Air Pollution includes indoor and industrial air quality and emissions control
- Contaminated Land Reclamation/Remediation includes Decommissioning of Nuclear Sites
- Energy from Waste includes the equipment manufacture, sales and maintenance for systems using waste from the Automotive Sector, Chemical Industry, Domestic Sector, Farming, Food Processing & Preparation, Land Fill, Logistics and Transport Sector, Manufacturing, Other Processing Industry, Secondary Sewage and Other sectors NEC
- Environmental Consulting includes consulting, training & other services
- Environmental Monitoring includes analysis, monitoring and instrumentation
- Marine Pollution and Noise & Vibration Control both include abatement, consulting and R&D
- Recovery & Recycling includes Waste Collection and various recycling processes
- Waste Management includes Waste Treatment Facilities & Equipment, consulting and R&D
- Water Supply and Waste Water Treatment includes treatment, distribution, consulting and R&D

**District Heat Networks** Level 2 sub-sectors are:

- DHNW Construction and Maintenance includes consumer side heat network connections, grid connection, ground works, project consulting services and Underground assets
- DHNW Energy Centres include energy centre and sub-station buildings and energy centre equipment
- DHNW Operation includes ownership and operational management, systems energy measurement and monitoring, DHNW-supplied energy sales, energy storage for the DHNW, fuel supply and storage at DHNW energy centres and Heat supply (specifically the supply of waste heat from industrial and commercial premises)

**Green Infrastructure & Nature Based Solutions** Level 2 sub-sectors are:

- Green Infrastructure includes activities aimed at the installation and/or management of green infrastructure for purposes such as flood reduction etc and are split by Agricultural Land, Coastal Habitats, Forest and woodland, Freshwater Systems (Fish ladders etc) and Green Linkages (Golf Courses, Hedges etc)
- Nature Based Building includes the installation and maintenance of both hard infrastructure and planting material for green roofs and walls

**Sustainable Food Production** Level 2 sub-sectors are:

- Low Carbon Agriculture includes Low Carbon Agricultural Vehicles, Farming Equipment and Consultancy
- Low Carbon Meat Alternatives includes production equipment and products
- Low Carbon Milk Alternatives includes production equipment and products
- Food Waste Reduction Activities includes zero waste catering and food retail
- Biodegradable Food Packaging includes R&D, manufacture and supply

### A1.3 Further Detail: Level 2 Sub-sectors in Low Carbon

**Low Carbon** includes 8 Level 2 sub-sectors, divided into 50 Level 3 activity groupings, the Level 2 sub-sectors are:

**Additional Energy Sources** sub-sector groups together R&D, Design and Prototyping activities relating to a range of new Low Carbon energy sources.

These energy sources include: Fuel Cells, Hydraulic Accumulators, Hydrogen, Molten Salt, Thermal Mass, Compressed Air, Superconducting Magnets and more general energy storage research.

This is a small sub-sector (in value and impact) because only energy sources that have a current economic footprint (i.e. trading) are included. This excludes a number of promising energy sources that are still in development and for which economic evidence is not yet available.

**Alternative Fuel and Vehicles** sub-sector includes Low Carbon Fuel and technology activities that relate to (predominantly) automotive transport. It is divided into Alternative Fuels (main stream) and Other Fuels and Vehicles. This sub-sector does not include bio diesel (see Alternative Fuels). It includes:

- Alternative Fuels (main stream) for Vehicles Only includes the production, supply and distribution of Natural Gas (Compressed or Liquefied), Synthetic Fuel, Auto Gas (LPG, LP Gas or Propane) and Hydrogen for vehicles
- Other Fuels and Vehicles includes Research, Design, Engineering, Maintenance, Manufacture, Services, Supply and Training activities are included for: Hydrogen fuel cells and hydrogen internal combustion cars and non-cars; Electric; Hybrid Electric, Plug-in Hybrid Electric, Organic waste fuel, MAGLEV, Solar powered and Air powered vehicles and Prototyping fuel and vehicle technologies

**Alternative Fuels** sub-sector includes a wide range of Low(er) carbon fuel sources that are not included under Renewable Energy, it excludes fuel sources specifically for District Heat Networks, which are counted in the DHNW sub-sector. It includes the manufacture, production, supply and distribution of:

- EV Batteries, including manufacture, supply, distribution and installation of cables, charge controllers, charge points, chargers, chemicals, connectors, containers, suppliers and testing equipment
- Non-EV Batteries - including manufacture, supply and distribution of chemicals, chargers, controllers, cables, connectors, containers, suppliers and testing equipment
- Hydrogen – manufacture, supply and distribution of hydrogen (non-vehicle)
- Bio fuels for Alternative Vehicles only – the production, supply and distribution of bio diesel, butanol, ethanol and vegetable oils
- Mainstream Bio fuel applications (non-transport) – production, supply and distribution of bio diesel, butanol and ethanol
- Other Bio fuels - – production, supply and distribution of biomass feedstock, methane, peanut oil, vegetable oil, wood and wood gas

**Building Technologies** sub-sector includes main stream building materials and systems that contribute to reduced energy use and to lowering the carbon footprint of buildings. It includes:

- Windows - the R&D, engineering services, manufacture, supply, distribution, installation, maintenance, training and services of double glazed, electro chromatic, insulated alloy, honeycomb and triple glazed units.

- Doors - the R&D, engineering services, manufacture, supply, distribution, installation, maintenance, training and services of insulated alloy and plastic doors.
- Insulation and heat retention materials - the R&D, engineering services, manufacture, supply, distribution, installation, maintenance, training and services of Fibre insulation materials for roofing (domestic and non-domestic), granular insulation materials (domestic and non-domestic), heat retention surfaces & ceramics, Insulation materials for walls (domestic and non-domestic), electronic control systems, and controlled venting and ducting systems (non-domestic)
- Monitoring and control systems - the manufacture, supply, distribution, installation and development of energy and distributed energy control, monitoring, management and analysis systems.

**Carbon Capture & Storage** sub-sector includes activities that store carbon emissions - from locations like power plants and prevent them entering the atmosphere. It includes manufacturing, supply, distribution, installation, maintenance, development and design of:

- Pre combustion capture systems
- Post combustion capture systems
- Oxy-Fuel combustion systems
- Pipeline systems and services
- Ship storage and discharge systems
- Ocean storage equipment and services
- Mineral storage equipment and services
- Geological storage equipment and services
- Engineering, project management and consulting services.

**Carbon Finance** sub-sector includes investment activities and financial instruments for emission reduction projects and carbon trading. This includes:

- Carbon credits finance and fund management - land, project or general trading services from finance houses and investment funds.
- Carbon credits trading - development and supply of trading systems, land/project/general trading houses and transactions.
- Carbon market intelligence - carbon markets analysis & reporting and carbon trading by forecasting and reporting from journals, online, data providers or other publishing sources.
- Projects and verification - data collection, verification, legal, project development, capacity development and carbon declaration services.
- Press and journalism - financial press and periodicals, other journals, data providers and online services.

**Energy Management** sub-sector includes energy saving and power management activities for industrial and domestic use. It includes:

- Technologies R&D into high efficiency lighting, heating & ventilation, power, lighting, equipment & pumps and advance management systems
- Gas Supply - monitoring, meterage, leak detection & maintenance, gas supply control and manufacture of high efficiency consumer equipment and devices
- Lighting - manufacture, engineering services, supply, distribution, installation, services, training and maintenance of energy saving light bulbs & tubes, lighting and control systems for domestic and industrial systems
- Heating & Ventilation - manufacture, supply, distribution installation and maintenance of energy saving equipment and systems, for domestic and industrial systems
- Electrical - manufacture, supply and installation of energy saving power control, building control, power consumption control & monitoring systems
- Consulting and other services - advice & consultancy, publication, training and design of management systems

**Nuclear Power** sub-sector includes all activities that relate to the generation of nuclear power, excluding decommissioning of nuclear sites. It includes:

- Nuclear safety engineering services, regulatory compliance, reactor management, fail-to-safety engineering
- Nuclear power plant operations management, engineering and PR
- Nuclear cooling equipment - manufacture, installation and maintenance
- Construction of plant and equipment - site development, reactor and buildings and power plant/equipment construction
- Commissioning engineering services - cooling & thermal control, engineering maintenance, instrumentation, power distribution, reactor & plant commissioning
- Sampling & testing services - thermal control testing, remote monitoring, back-up plant monitoring and effluent discharge testing
- Nuclear scientific services - research, laboratory testing and fuel management

### A1.4 Further Detail: Level 2 Sub-sectors in Renewable Energy

**Renewable Energy** includes 8 Level 2 sub-sectors, divided into 33 Level 3 activity groupings, Level 2 sub-sectors are:

**Air Source Heat Pumps** sub-sector includes all activities relating to all sizes of Air Source Heat Pumps, it does not include photovoltaic or battery systems used as power sources, these are included in Photovoltaic (Renewable Energy) and Non-EV Batteries (Low Carbon) respectively. It includes:

- Commercial Large Scale - R&D, Manufacture, Supply, Engineering Services, Consulting and Installation of Ancillary Equipment, Architectural Services, Components, Project Development Services and Whole Systems
- Community - R&D, Manufacture, Supply, Engineering Services, Consulting and Installation of Ancillary Equipment, Architectural Services, Components, Project Development Services and Whole Systems
- Domestic/Small Scale - R&D, Manufacture, Supply, Engineering Services, Consulting and Installation of Ancillary Equipment, Architectural Services, Components, Project Development Services and Whole Systems

**Biomass Energy** sub-sector includes all activities that convert biomass into energy but excludes biomass feedstock (see Alternative Fuels). It includes:

- Biomass furnace systems - manufacture, supply, consulting, design, installation, engineering and other services for domestic, industrial and community applications
- Biomass energy systems - manufacture, supply, consulting, design, installation, engineering and other services for domestic, industrial and community applications.
- Manufacture of biomass boilers and systems including boilers, cogeneration, heat exchange and packaged power systems for domestic, industrial and community applications
- Biomass boilers and related systems including supply, consulting, design, engineering, installation and other services for boilers, cogeneration, heat exchange and packaged power systems for domestic, industrial and community applications
- Technical and operational consulting

**Geothermal Energy** sub-sector includes all activities relating to the extraction and use of heat generated from the earth. It includes:

- Ground Source Heat Pumps – split by Commercial/Large Scale, Community Based, Domestic/Small Scale – R&D, Manufacture, engineering services, consulting, training, supply, installation and maintenance of ancillary equipment, architectural services, components, whole systems and project development services
- Water Source Heat Pumps – split by Commercial/Large Scale, Community Based, Domestic/Small Scale – R&D, Manufacture, engineering services, consulting, training, supply, installation and maintenance of ancillary equipment, architectural services, components, whole systems and project development services
- Specialist Systems and Equipment – split by Commercial Applications, Domestic Applications and Whole System R&D, includes R&D, engineering services, manufacture and supply of ancillary equipment, drilling equipment, flow control valves, geothermal plastic pipes, grouting equipment, installation rigs, pump sets, thermally enhanced grout

**Hydroelectric Energy** sub-sector includes activities that help to extract energy from river and other water sources held in dams (as opposed to wave or tidal energy) that is used to drive turbines and generators. Large scale civil engineering/construction activities associated with dam building have not been included in this analysis. It includes:

- Turbines - manufacture, supply, installation and maintenance of turbine generators, control systems, spares and structural supports and fittings
- Dams & structures - manufacture, supply, installation and maintenance of dam operational systems, control systems, maintenance services and sluice gates and actuators
- Pumping & lubrication - manufacture, supply, installation and maintenance of pumps, spares, storage and lubrication systems and spares
- Electricity supply - manufacture, supply, installation and maintenance of power factor, power distribution and grid connections and supporting structures

**Photovoltaic Energy** sub-sector includes all activities that help to convert solar radiation into useable energy. It includes:

- Chemicals - production and supply of solar chemicals and solar pond salt
- Systems & equipment - manufacture, supply, installation, engineering services, training, services and maintenance of active and batch systems, clerestory windows, light shelves and tubes, solar box cookers, solar combi-systems and solar lighting design
- R&D - solar power and solar car research
- Photovoltaic cells - manufacture, supply, installation, engineering services, training, services and maintenance of photovoltaic modules, mounting systems, ancillary components, cells and cell materials
- Other equipment & chemicals - manufacture, supply, installation, engineering services, training and maintenance of glass houses, convection towers, heliostats, parabolic collectors, turbines, trough collectors, towers and solar trackers

**Renewable Energy Consulting** sub-sector includes consulting and legal services specific to Renewables i.e., not included in general or specific environmental consulting. It includes:

- Legal services - wind farm location and other renewable energies
- Consulting - turbines, solar and photovoltaic applications, public sector and corporate Renewables policies, nuclear energy, insulation technologies and alternative fuel technologies

**Wave & Tidal Energy** sub-sector includes all activities that help to convert the energy from waves and tides into usable power (also known as marine renewable energy). It includes:

- Turbines & generators - the manufacture, supply, installation and maintenance of tidal turbines, structural supports and fittings, spares and turbine control systems

- Pumps & equipment - the manufacture, supply, installation and maintenance of pumps and pump spares
- Two basin schemes - provision of structural engineering and field maintenance services
- Ebb & flow systems - manufacture, supply, installation and maintenance of ebb and flood generation systems
- Assessment & Measurement - waves, water levels, turbidity, tidal energy, sediment, salinity pollutants, fish stocks monitoring and local/ global environmental impact assessment
- Other general services - financial planning, operational and maintenance services

**Wind Energy** sub-sector includes all activities that convert wind power into usable energy. This includes onshore and offshore wind farm systems, large and small wind turbines. It includes:

- Offshore Large Wind Turbines - manufacture, supply, installation, and maintenance of large turbine systems (blades, towers, fixing structures, cowlings, enclosures, gear boxes and drive trains), componentry and research
- Offshore Wind farm systems - manufacture, supply, installation, engineering services, consulting, operation and maintenance of integration, power plant, power control, grid entry equipment and systems and electrical and mechanical componentry
- Onshore Large Wind Turbines - manufacture, supply, installation, and maintenance of large turbine systems (blades, towers, fixing structures, cowlings, enclosures, gear boxes and drive trains), componentry and research
- Onshore Wind farm systems - manufacture, supply, installation, engineering services, consulting, operation and maintenance of integration, power plant, power control, grid entry equipment and systems and electrical and mechanical componentry
- Small wind turbines – R&D, manufacture, supply, installation and maintenance of small turbine systems (blades, towers, fixing structures, cowlings, enclosures, gear boxes and drive trains), componentry and research

### A1.5 Further Detail: Level 2 Sub-sectors in Environmental

**Environmental** activities include 10 Level 2 sub-sectors, divided into 58 Level 3 activity groupings, Level 2 sub-sectors are:

**Air Pollution Control** sub-sector includes a wide range of manufacturing, operations, consulting and engineering functions that relate to improving and maintaining air quality. It includes:

- Emission Control sensing and monitoring systems and technologies.
- Indoor Air Quality Control (domestic and industrial) through ventilation, cooling and purification systems.
- Dust & Particulate control through installed technologies like filters, towers, scrubbers, cyclones and eliminators.
- Process Engineering for odour control and other cleaner technologies.
- Industrial Emission Control technologies and equipment (manufacture, installation, operations and maintenance).
- Emission Control through manufacture, installation and operation of sampling, control and evaluation systems.

**Contaminated Land Reclamation and Remediation** sub-sector includes all activities that bring land back into agricultural, industrial, community or commercial use. This includes longer term activities like the decommissioning of nuclear sites.

Remediation and land reclamation include land forming, bunds, geotextiles, storage & containment, oil interceptors, drainage systems, monitoring systems, proprietary treatment processes, sampling & analysis, site investigation, specialist cleaning services, cleaner technology R&D, surface & ground water services, organic waste composting and other services.

Decommissioning includes equipment, consulting, project management, safety critical assessment, pollution control, enviro risk analysis & impact assessment, recycling & compaction, waste collection & containment, waste water treatment, site assessment, excavation, sampling & analysis and monitoring.

**Energy from Waste** sub-sector includes all activities that convert energy from waste but excludes the feedstock. It includes R&D, consultancy, manufacture, supply, installation, maintenance, training and services for Autoclave, Conversion treatment, Gasification, Incineration, MBT, Pre-treatment, Pyrolysis, WID compliant biomass and other energy extraction processes NED for:

- Automotive Sector
- Chemical Industry
- Domestic Sector Not Elsewhere determined (NED)
- Farming
- Food Processing & Preparation
- Land Fill
- Logistics & Transport Sector
- Manufacturing
- Other Processing Industry
- Other Sectors Not Elsewhere determined (NED)
- Secondary Sewage

**Environmental Consulting and Services** sub-sector includes consulting, training and management services that are specific to the environmental sector. It includes:

- Specialist consulting - habitat assessment, regulations, compliance and management systems, audits and impact assessment, eco design, eco-investment, climate change modelling, insurance and bio-diversity advice & assessment
- Manpower and executive recruitment, temporary and permanent recruitment, contracted and interim management services.
- Management services - general consulting, financial, IT, software and marketing services.
- Training and education - publications, online publications, teaching aids, newsletters and courses for waste management, waste water treatment etc.

**Environmental Monitoring, Instrumentation and Analysis** sub-sector includes activities that measure water, soil and air quality and that support wider pollution control activities in other land, water, marine or air- based environmental sub-sectors. It includes:

- Environmental monitoring- development of cleaner monitoring processes and technologies, vehicle testing, oil spill detection, food testing, nitrate levels, meteorological, water/soil/air quality testing and monitoring.
- Instrumentation equipment & control manufacture, supply, maintenance and development of instrumentation, laboratory equipment and software for environmental/ air/ water/ land/ marine analysis.
- Environmental analysis - laboratory testing, data logging & recording, quality reporting, collection & collation of samples, auto sampling systems, in-field measurement and reporting and R&D in water, soil and emissions analysis.

**Marine Pollution Control** sub-sector includes responses to pollution hazards at sea and also discharged from land-based sources. It includes the following products and services for deep sea, coastal waters and inland waterways. It includes:

- Marine pollution abatement - manufacture, supply and maintenance of booms, chemical discharge treatment equipment, solid & liquid waste/radioactive containment and treatment equipment and monitoring services, spillage clean-up services, shoreline & shallow water remediation and maintenance services and collection & containment services.
- R&D - cleaner processes and technologies, monitoring systems, oil absorbents, boom and containment systems, water containment and treatment technologies.
- Specialist consulting and training - chemical discharge prevention, education, policy & planning, training, publications, sewerage discharge management, radioactive waste management and solid and liquid waste management.

**Noise & Vibration Control** sub-sector includes all activities that prevent or control noise and vibration pollution. It includes:

- Noise abatement - manufacture, supply, installation and maintenance of barriers, acoustic management equipment, noise insulation, noise & vibration control and monitoring equipment, acoustic management equipment, noise insulation materials, monitoring services, large plant services and surface modifications.
- R&D - noise attenuation, noise sensing, vibration sensing, vibration control and noise & vibration abatement equipment and cleaner technologies and process by development.
- Consulting and training - consulting, publications, training and noise monitoring services.

**Recovery & Recycling** sub-sector includes all activities relating to the collection and processing of domestic and industrial waste products. It includes:

- Waste collection - manufacture, supply, installation and operation of equipment and services for collection of household, industrial and hazardous waste, treatment of waste prior to landfill and supply of pre-treated recyclates.
- Engineering & equipment - engineering services and process control for the complete range of recycling stock
- Consulting & training - collection and processing consultancy and training, publishing, legal & insurance advice.
- R&D - metals recovery, pyrolysis, bio-based systems, new recyclable materials, new collection & processing technologies.
- Recycling stock - recovery, recycling, processing, sorting, supply and packaging of rubber, plastics, paper, oil, electrical, electronics, glass, composting, construction & demolition, automotive, wood and textiles stocks.

**Waste Management** sub-sector includes the treatment/management of domestic and industrial waste that cannot otherwise be recycled. It includes:

- Construction & operation of waste treatment facilities for anaerobic digestion, composting, incineration, landfill, waste to energy conversion and the supporting engineering services.
- Equipment for Waste treatment, manufacture, supply, installation and maintenance of bio filters, bio reactors, collection equipment, grease traps, oil interceptors, materials processing equipment, monitoring & control equipment and nightsoil & landfill leachate treatment.
- R&D - incineration technologies, energy from waste systems, cleaner processing & treatment technologies, disposal of hazardous waste and other materials processing technologies.
- Consultancy and training - books, periodicals & publications, specialist consulting and training for asbestos, hazardous materials and other waste management systems.

**Water Supply and Waste Water Treatment** sub-sector includes activities relating to the treatment of pollutants in the water supply. It includes:

- Water treatment and distribution, manufacture, supply, installation and maintenance of systems for activated sludge, aerobic & anaerobic treatment, biological odour & corrosion control, demand management & leakage reduction, effluent treatment, filters, microbial treatment, screens, sequencing batch reactors, water disinfection and storm/grey water treatment.
- Engineering - field engineering, pipe & valve maintenance, fitting & construction, fabrication & welding and engineering design.
- R&D - water purification, water management, black/grey water treatment, biocides, bio reactors and aerobic/anaerobic treatment technologies.
- Consulting and training - engineering and water management training, publishing and specialist consulting for water systems treatment, management and engineering.

### A1.6 Further Detail: Level 2 Sub-sectors in District Heat Networks

**District Heat Networks** includes 3 Level 2 sub-sectors, divided into 30 Level 13 activity groupings, Level 2 sub-sectors are:

**DHNW Construction and Maintenance** sub-sector measures the infrastructure for Heat Networks but excludes the heat source. It includes all activities involved in connecting properties to a DHNW and maintaining the infrastructure, both underground and aboveground assets. It includes:

- Consumer side heat network connections – manufacture, supply, services, installation and maintenance of consumer connections and consumer heat equipment such as heat distribution systems, interface units, heating controls, energy monitoring and consumer interfaces
- Grid connections – manufacture, supply, services, installation and maintenance for communications network connection, electricity connection and gas connection, includes network design services and sub-station equipment
- Ground Works – manufacture, consulting, supply, services, installation and maintenance involved in groundwork main and specialist contracting, groundworks equipment, tools, supplies and consumables, groundworks site management and underground asset installation and testing
- Project consulting services – consulting services involved in commercial legal and land services, opportunity identification and appraisal, project feasibility consulting services, financial, services, project management services, marketing and publicity and project planning and approvals
- Underground DHNW assets – manufacture, supply, installation and maintenance of heat pipework and associated insulation, private communications network cabling and private electrical network cabling

**DHNW Energy Centres** sub-sector measures the infrastructure and maintenance of Energy Centres and includes all activities involved in the construction or re-modelling of energy centres and sub-station buildings and energy centre equipment. It includes:

- Energy Centre and sub-statin buildings – manufacture, supply, services, installation and maintenance for the construction or re-modelling including building equipment and consumables, external envelope building materials, other trades material; and building site management involved in health and safety, access and traffic management, security etc.
- Energy Centre Equipment – manufacture, supply, installation and maintenance of equipment including water pumping equipment, backup and top-up boilers, black-start generation sets, cooling systems, electrical switchgear and controls and heat generation equipment (for biomass, energy from waste, Gas CHP or heat only systems)

**DHNW Operation** sub-sector measures the operation of Heat Networks includes all activities involved in the operation of DHNWs. It includes:

- DHNW ownership and operational management – R&D, services, supply and training for DHNW customer sales and services operations, includes HR, recruitment etc, DHNW energy centre operations including data analytics and real-time decision making, DHNW financial management operations, education and training, marketing & PR, asset portfolio management and R&D into total systems
- DHNW System energy measurement and monitoring – manufacture, supply, installation and maintenance of asset condition monitoring and safety sensors, including electricity cable sensor, fuel sensors, heat sensors etc.; energy and fuel meters, including gas sub-meters, electricity sub-meters, heat sub-meters, fuel meters, main electricity meters, main gas meters and main heat meters; and non-domestic energy monitoring and control systems, including automated energy meter reading services, data loggers, real-time energy monitors etc.
- DHNW-supplied energy sales – supply of electricity or heat to the commercial, public sector or residential customers
- Energy storage for the DHNW – manufacture, supply, installation and maintenance of equipment for electricity storage via batteries and thermal storage via thermal stores
- Fuel supply and storage at DHNW Energy Centres – manufacture, supply, installation and maintenance of equipment for fuel storage, including biomass stores, compressed hydrogen storage systems, LPG and Diesel storage tanks and safety and security control systems; and Fuel supply (of fuels used to general heat for DHNWs in dedicated energy centres only), these are separate to fuel supply of biomass etc. within Alternative Fuels
- Heat Supply (sales of waste heat from industrial and commercial processes) – supply of waste heat from private sector sources (Waste commercial heat (e.g. Cooling operations related to life sciences, food and IT sectors, or Waste light industrial heat e.g. Waste heat from light industrial processes such as paper production); and public sector sources (Waste Operators / Energy from Waste Plants and Water Utilities/Anaerobic Digestion)

### A1.7 Further Detail: Level 2 Sub-sectors in Green Infrastructure & Nature Based Solutions

**Green Infrastructure & Nature Based Solutions** includes 2 Level 2 sub-sectors, divided into 30 Level 3 activity groupings, Level 2 sub-sectors are:

**Green Infrastructure** sub-sector includes the R&D, consulting, supply, installation, engineering services, training, services and maintenance of different classifications of Green Infrastructure, where work is intended to improve biodiversity, mitigate flooding, improve habitat use, reduce bank erosion, re-wiggle rivers etc. Classifications of Green Infrastructure form Level 3 sub-sectors and include:

- Agricultural Land including cropland and grassland
- Coastal habitats including lagoons and sand-dunes
- Forest and Woodland including ancient woodland and timber plantations
- Freshwater systems (fish ladders etc) including lakes/reservoirs, ponds, stream and wetland/peatlands
- Green linkages including country parks, golf courses, hedgerows, local wildlife sites, nature reserves, regionally important geological sites and Sites of special scientific interest (SSSI)

**Nature Based Building** sub-sector includes the R&D, consulting, manufacture, supply, installation, engineering services, training, services and maintenance of green roofing and green walls, which can

form an important part of floodwater management (reducing/slowing rainwater runoff) and increasing biodiversity. It includes:

- Green Roofing including hard infrastructure and planting material
- Green Walls including hard infrastructure and planting material

### A1.7 Further Detail: Level 2 Sub-sectors in the Sustainable Food Production

**Sustainable Food Production** includes 5 Level 2 sub-sectors, divided into 10 Level 3 activity groupings, Level 2 sub-sectors are:

**Low Carbon Agriculture** sub-sector includes R&D, manufacture, consulting, supply, installation, engineering services, training, services and maintenance of low carbon vehicles and agricultural machinery. It includes:

- Low Carbon Agricultural Vehicles split by Biogas Agricultural Vehicles (Biogas Large Farm Vehicles, Biogas Off-road Utility Vehicles and Biogas Tractors); Electric Agricultural Vehicles (Electric Large Farm Vehicles, Electric Off-road Utility Vehicles, Electric Tractors, Hybrid Large Farm Vehicles, Hybrid Off-road Utility Vehicles and Hybrid Tractors) and Hydrogen Agricultural Vehicles (Hydrogen Large Farm Vehicles, Hydrogen Off-road Utility Vehicles and Hydrogen Tractors)
- Low Carbon Farming Equipment split by Low Carbon Grain Dryers (Biomass, LPG and others); specialist low carbon farming equipment such as Agri-robots, bulk hoppers, cultivation and seeding, milking machinery, mixers and trolleys, potting and filling machines, remote imaging for farming, specialist horticultural machinery and vertical farming systems
- Low Carbon Farming Consultancy and Related Services including specialist consultancy to the farming sector and training and education

**Low Carbon Meat Alternatives** sub-sector includes R&D, manufacture, consulting, supply, installation, engineering services, training, services and maintenance of meat alternative production equipment and meat alternative products, including meat replacements, protein powders and plant-based protein source, and is segmented by protein source. It includes:

- Low Carbon Meat Alternatives Production Equipment for the following protein sources: Mycoprotein, Pea-based, Soy-based, Wheat-based and other low carbon meat alternative production equipment
- Low Carbon Meat Alternatives Products for the following protein sources: Mycoprotein, Pea-based, Soy-based, Wheat-based and other low carbon meat alternative products

**Low Carbon Milk Alternatives** sub-sector includes R&D, manufacture, consulting, supply, installation, engineering services, training, services and maintenance of milk alternative production equipment and milk alternative products, it does not include protein powders and plant-based protein sources and is segmented by protein source. It includes:

- Low Carbon Milk Alternatives Production Equipment for the following protein sources: Mycoprotein, Pea-based, Soy-based, Wheat-based and other low carbon milk alternative production equipment
- Low Carbon Milk Alternatives Products for the following protein sources: Mycoprotein, Pea-based, Soy-based, Wheat-based and other low carbon milk alternative products

**Food Waste Reduction Activities** sub-sector includes R&D, manufacture, consulting, supply, installation, engineering services, training, services and maintenance of equipment for reducing food waste, alongside the sale of close to shelf-life food in designated premises, food waste reduction apps, food recycling etc. It includes:

- Zero Waste Catering such as food recycling of unsold food produced in restaurants, recycling into other meal (e.g. soup kitchens), or recycling into non-food products (e.g. coffee grounds to brickettes); unsold food apps from cafes and restaurants where clients purchase unsold meals at the end of opening hours at significantly reduced prices to divert unsold food to landfill; zero waste cafes and restaurants, often associated with larger charitable endeavors, these cafes either operate under usual trading terms, with a set price for food produced, or can operate on a 'pay what you can' basis, often using food donated from supermarkets etc.
- Zero Waste Food Retail including end of shelf life food and drink sales from designated clearance online, retail or wholesales stores, for products close to either the use-by date or best before date (but not past either); Past best before date online, retail and wholesale stores, for products past their best before (but no past use by dates); Unsold food apps associated with supermarkets and other retailers, these apps provide detail of unsold food which can be purchased at a discount, some include detail of which meals are available, others provide a mystery bag of mixed goods, listing the full price vs discount; extended shelf life R&D includes research into packaging, storage, ingredients etc. to extend shelf life of products

**Biodegradable food Packaging** sub-sector includes R&D, manufacture, consulting, services, supply and training for the development and production of biodegradable products. It is not split into further levels of segmentation

# Appendix 2: The kMatrix Methodology

## A2.1 Introduction

The methodology works beyond standard industrial and market classifications and looks for multiple sources of industrial-based evidence to quantify market values. kMatrix is unique in how it identifies, assembles, evaluates, monitors and develops rules for the use of those sources to quantify 'difficult-to-measure' markets.

Market activities are only included when there are multiple data sources. These sources are screened to remove duplicate references to any single source and then shortlisted by removing outliers (e.g., a good which is usually £10, but someone is selling for £90 on Amazon, this would be considered an outlier and removed from the dataset) and unreliable sources. This shortlist is then screened again until some consistency in value is achieved.

Market values created in this way are then "reality tested" by comparing these values within and across sectors, against known national/regional industrial specialism, across nations, against known trade flows and recognised industry benchmarks.

This methodology is quantitative and data intensive. Its uniqueness resides in the ability to manage and select reliable sources that are specific to each market activity. The data sources are global in nature and derive from government, private sector, institutional, industrial, trade, advertising, HR, financial, investor, academic and other (unpublished) sources. Up to 900 sources are used to compile the national LCEGS data set.

Sources are carefully managed. kMatrix measure and rate their sources' accuracy and reliability over time and exclude sources that are outdated or without a measurable track record. They use no less than seven qualified sources showing some consistency in results for deriving any values that they print. They create a mean value from these selected values and then assign a confidence level (generally of about 85%) based upon the spread of selected values around the mean

In contrast to most research or consulting reports kMatrix do not identify, copy and then acknowledge single data sources for specific tables or analytical comments. This is impossible for them to do because they multi-source every aspect of their data and then "transform" it into a new value. This makes single source attribution meaningless.

## A2.2 Data Triangulation – The Cornerstone of kMatrix

kMatrix uses a propriety data triangulation methodology to calculate over 100 metrics for many sectors including Domestic Retrofit, Space, Climate Services, Green Economy, Marine, Security, Cybersecurity, Adaptation & Resilience, Water, Design and others.

The methodology for sector analysis is definition and source-driven. The definition determines WHAT gets measured and the source model determines HOW it gets measured.

All of the data measures are multi-sourced, and the process starts by defining the financial value of the sector (based upon our inclusive definition) from a wide variety of sources.

When kMatrix create a sector definition they always check that multiple sources of economic data exist for each included activity. This financial value is checked against existing sector values and also against the value of other economic sectors.

This is an iterative process that continues until they arrive at robust values and comparisons for all activities within the sector (comparative values of Wind vs. Photovoltaic vs. Biomass) that can then be meaningfully compared across global economies (UK vs. US vs. China etc.) and

across different sectors (environmental consultancy vs. other specialist consulting activities). It is important that the methodology triangulates economic values in this way so that they:

a) Can exclude the research bias that often occurs from focusing on a single sector in a single country and

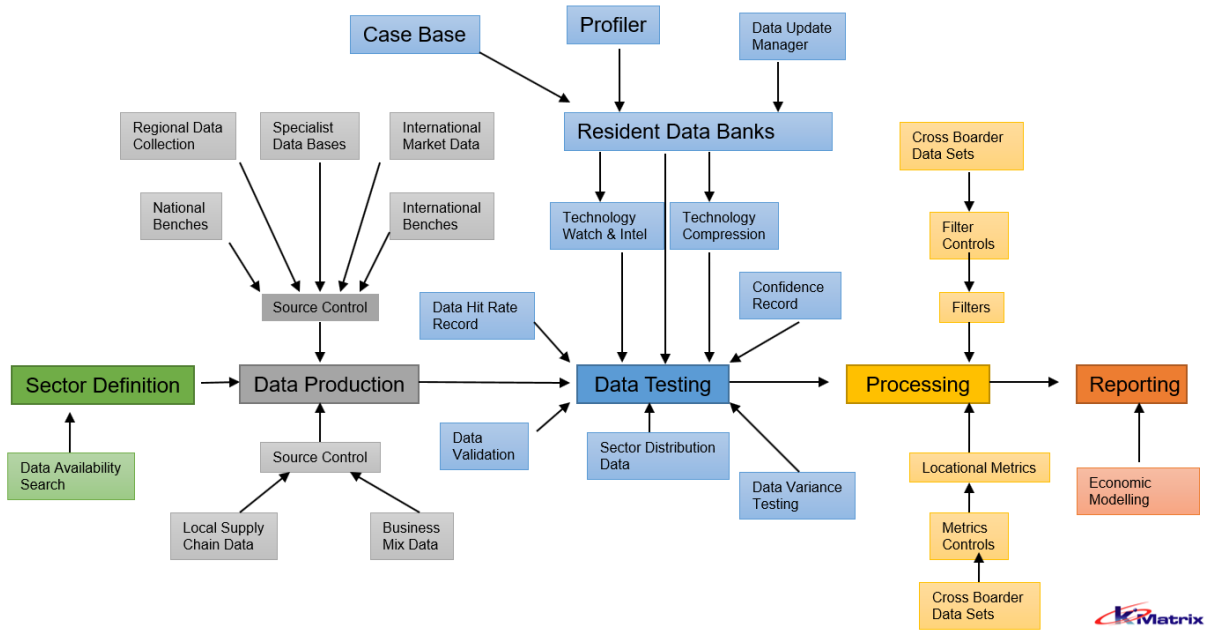
b) Ensure that they are effectively monitoring a sector that is still evolving by absorbing activities often included in other sectors.

The same general research methodology is used across all sectors and metrics, while the requirements for each industrial sector research project vary, the methodology and process always follow the same five key stages:

1. Define – Identify, select and group the target market activities, whilst conducting an initial check for the right volume and quality of data sources
2. Assemble – Populate the data measures for each market activity, carefully filtering the core data sources to ensure that confidence levels are within bounds
3. Check – Apply quality assurance checks to ensure data accuracy/consistency across market activities and different countries and, in some cases, cross-check with different sector values
4. Validate – Sense-check and spot-check market data values against specific projects/authoritative sources/expert knowledge/customers or clients
5. Publish – Recalculate, update confidence levels and publish research data set

This process is illustrated in more detail by the Sector Research Model (Figure 1), where the numbers correspond to the process stages above.

**Sector Research Model**




The research model used by kMatrix comprises distinct but iterative phases. This is because kMatrix needs to "create" its own data before it can analyse it. This is fundamentally different from any SIC-based sector analysis that takes its data as a "given."

Within the above model a range of different research methods are employed. Some aspects of the research system are semi-automated (necessary when dealing with large volumes of data),

but the rulesets and software algorithms are based upon 35+ years' experience in compiling and reporting complex markets and all final decisions about reported outputs are subject to intense analyst scrutiny.

The research methods employed include:

- Desk research to define sector content and determine sector boundaries
- Industrial templates that identify core and supply chain activities in detail for inclusion in sector definition
- Data discovery tools to identify new data and sources relating to the defined sector activities
- Data coding systems to ensure that sector, company-level data and other classification systems are aligned for analysis and reporting purposes
- Data management techniques and systems to maintain existing source libraries and integrate them with new source materials
- Software systems with defined (but flexible) rulesets to filter source content
- Semi-automated processes for modelling and calculating data values from selected source lists
- Knowledge base of case study materials that can be accessed to help fill data gaps and provide industrial performance benchmarks
- Quality assurance processes and tools that check all values against a range of international, national and industrial comparators
- Data management and visualisation tools for presenting and reporting data

### A2.3 Measures

Throughout this dataset the focus is on a small number of key measures. To summarise, these are:

- **Sales** – This is the estimate (in £m) of economic activity by identified companies in a defined region within the supply/value chain for market products and services. The estimate is based upon where sales activity takes place rather than where it is reported.
- **Companies** – This is a measure of the total number of companies in a defined region that match, or fit within, the market activity headings. This represents a Company Equivalent, similar to the concept of Employment FTE measurements, the proportion of a company relevant to activities in LCEGS are measured, discounting the proportion of a company active in other sectors; this removes the potential for double-counting companies which are active in multiple sub-sectors, where logging each company would distort the company figures.
- **Employment** – This is a measure of the estimated employment numbers across all aspects of the supply/value chain. National, regional and other economic data sources have been used to estimate current employment levels for each area of market activity, as a Full Time Equivalent (FTE).
- **Growth** – This is a multi-year measure that includes historical AND forecast growth. The growth measure is derived from live, rapidly changing and multi-sourced data links and is specifically based upon growth in Sales. Growth is generally a measure of increased

market opportunity and can be used for trend analysis, comparison across different markets or as a moving indicator of market confidence (growth time series).

- **Exports** – This is a measure of products and services sold overseas and is calculated using in-country/out-of-country data and additional data from the logistics and freight forwarding industry.

**Sales**

The key measure that is used for financial value is Sales i.e., the value of sector products and services sold either to other businesses or directly to consumers from the geographically located company base, whether it be national, regional, sub-regional or Local Authority. This means that the analysis only includes activities where there is a measurable economic footprint. It does not include publicly-funded research or pre-commercial consumption of funds, except where those activities result in the purchase of product and services from third parties.

As they derive the financial value for the sector they also assemble and assess the UK company base that is contributing to this value. In the first case they identify all "significant" or "specialist" companies, these are companies where LCEGS account for over 80% of company sales, and then the supply/value chain companies where LCEGS sales is an important and measurable component of their overall sales - (over 20%). These percentages are indicative and vary for different LCEGS activities.

**Companies**

The company count acts as a further reality check on the financial value of the sector by comparing company turnover values in this and other sectors and also assists in the geographical analysis of where LCEGS value is created. For company counts and company listings we use standard data sources, international sources, industry/trade sources, the advertising industry and, with caution, company-published information.

One important fact about the methodology is that in a typical SIC approach to sector analysis, a company is counted once and the value of its activities are very often assigned to a single category (which may or may not reflect what a company actually sells now), within a single sector and from a single geographical location.

This approach is to identify and assign value to different activities within a company that may fall within the same sector and to exclude values associated with different sectors. Where possible, they also break the reported activity down within larger multi-site companies so that only the value created within a region/LA is reported for that region/LA.

By analysing a sector in this way, they are able to capture the economic value generated by all "specialist" and supply/value chain companies, without any double counting of value. However, the methodology does mean that a single company may contribute value to multiple activities, and we have to be careful not to double-count companies. To avoid this we assign portions of a company, for counting purposes, to the activities that account for most of its sector sales. This does mean that on some occasions some of the smaller activities in our analysis may have a financial value in the sales column but a zero in the company column.

Some activities have a company count of 0, despite having employment figures, because these are services from various companies, delivered by the equivalent number of employees from various organisations, however counting all of those organisations as companies would give a false impression of the sub-sector being larger than it is.

**Employment**

When financial values and company numbers have been calculated the methodology then looks at the employment base for the sector. The analysis of employment includes HR/Recruitment industry data, trade/industry data, government statistics, company reported employment levels and a variety of industry benchmarks that show employee input ratios into different products and processes. They do not survey companies directly for this information.

From these different sources we calculate employment numbers for LCEGS sector activities, taking into account how staff can operate processes that produce products for different markets. We, therefore, measure our employment numbers in Full Time Equivalents (FTE), equivalent to a standard 40-hour week.

**Growth**

Sales Growth is both an historical and a forecast measure and the methodology applies the same multi-source rigour to assessing growth that has already occurred as to growth that may occur. Growth forecasting shows the importance of both multi sourcing AND tracking the historical reliability/accuracy of sources used. It is based upon continuous monitoring of forecast "opinions" that are constantly being updated and re-evaluated, as a result "in-year" measurements of predicted growth can vary depending on when the sample is taken and change as sources respond to events like recession.

For this reason, we measure annual growth as a) a value frozen at a point in time and b) a time series (monthly or quarterly) measured throughout the year. In this file we include only the single (frozen) forecast. Separate files with detailed time series forecasts and trend analysis for the LCEGS sector are available.

Annual growth figures are useful in calculating and comparing the future contribution of sector activities beyond the current baseline. The percentage growth shows the RATE of change, the application of growth rates to the current sales baseline shows the IMPACT of change. Measuring the impact of change in financial terms shows how the ranking and importance of existing activities to the region/local authority may change over time and suggests when and where action may need to be taken to accommodate changes in the employment and company base.

The quoted growth rates in this dataset apply specifically to sales value. A growth in sales is indicative of changes in company numbers/employment but 5% sales growth does not necessarily equate to 5% employment growth. Companies can achieve growth in different ways and the recession has shown that companies will consume any "slack" before creating new jobs.

**Geography**

The methodology is designed to locate and measure economic activity at various geographical levels. The smallest unit of measurement is the Local Authority, but it can analyse data at county, sub-regional, LEP, regional and UK level. In the case of this study, data analyse covered the Hertfordshire LEP, which is the same geographical area as Hertfordshire.

When the methodology calculates and measures economic activity at the local authority level it takes into account existing local government boundaries, local GDP calculations and demographics, the postcode location of companies in the sector and any other local data that is available and relevant to the sector. When we measure sales and employment, therefore, our numbers are based upon where the business is located, rather than where people live.

There are some limits to what economic measures can be meaningfully or accurately applied at the local level. This is due to the range and specificity of data sources. Most of the economic development measures within this dataset can be accurately represented at a local level.

### A2.4 Calculating Skills - Employment

The foundation of the workforce data within this study is not derived from surveying the industry but from the in-house kMatrix Data Triangulation of multiple sources from within and around the industry.

The kMatrix methodology has the ability to measure economic activity at the product, service and skill-level of detail, without the use of either the Standard Industrial Classification (SIC) or Standard Occupational Classification (SOC) systems. This allows the development of a detailed market segmentation model, with in-depth skills measurement and analysis, which is specific to Energy Efficiency, without undue burden on the industry.

The data itself comes partly from trade bodies and companies, so although companies do not contribute directly to the quantitative data within the study, they are indirectly involved through the big data triangulation process.

Employment is a measure of the estimated employment numbers. National, regional, and other economic data sources have been used to estimate current employment levels for each sector activity. Where employment information is scarce, or where employment is estimated as a proportion of a company's sales, a comprehensive range of case study materials are assessed to provide sensible industry-specific ratios and benchmarks.

Terminology for jobs within industry is often varied, e.g., 'technician' and 'engineer', particularly within LCEGS and are used interchangeably and where culture within a company can determine terminology used for non-protected jobs. Additionally, there is also variation in terminology by both region and country, e.g., 'engineer' is a protected title in Canada, while in the UK, 'engineer' is not protected and can refer to everything from cleaning (domestic engineer) through to a 'civil engineer'. As such, kMatrix converts the data into common definitions.

Data has been collected from multiple sources including:

- Industry specific personnel associations
- Industry specific training associations
- Academic Data sources (sector specific)
- Sub-sector specific training providers
- Trans-sector training data (via academia and sector associations)
- Over 7,500 datasets in total

Total Employment at the job role level, is a measure of who has been employed in which role, it does not track their qualifications or whether the hire was successful, i.e., whether they had to undergo extensive training or upskilling to perform the role, or for how long. It doesn't measure quality, only quantity.

The measurement is a Full Time Equivalent (FTE), which is a calculation of the number of hours worked within a Job Role, performing the tasks within the service being undertaken. It is an indication of how many people working full-time would be required to fulfil the work being measured. If two people worked part-time, they would be counted as one FTE.

The benefit of this form of measurement is it provides a clear indication of how many hours of work are undertaken and how this varies between skill-sets, between sub-sectors and between

the same skills in different sub-sectors. It also gives an indication of how many people are working within the sector, without double-counting people who are multi-skilled.

The limitation of the FTE measurement is that it does not give an indication of how many people in total are providing the service. Because it measures the hours worked, it does not count a person working 2 hours as an individual within the sector, i.e., it does not count how many people work part-time within the sector. Conversely, it has the benefit of not over-reporting or under-reporting workers depending on a set criteria. For example, if only those working more than 60% of the time in the sector were included and the sector is defined by high numbers of part-time workers, the employment figures have the potential to be vastly under-reported and visa-versa.

By using the FTE system of measurement, with the advantages and limitations clearly stated, the absolute time worked can be used for skills analysis.

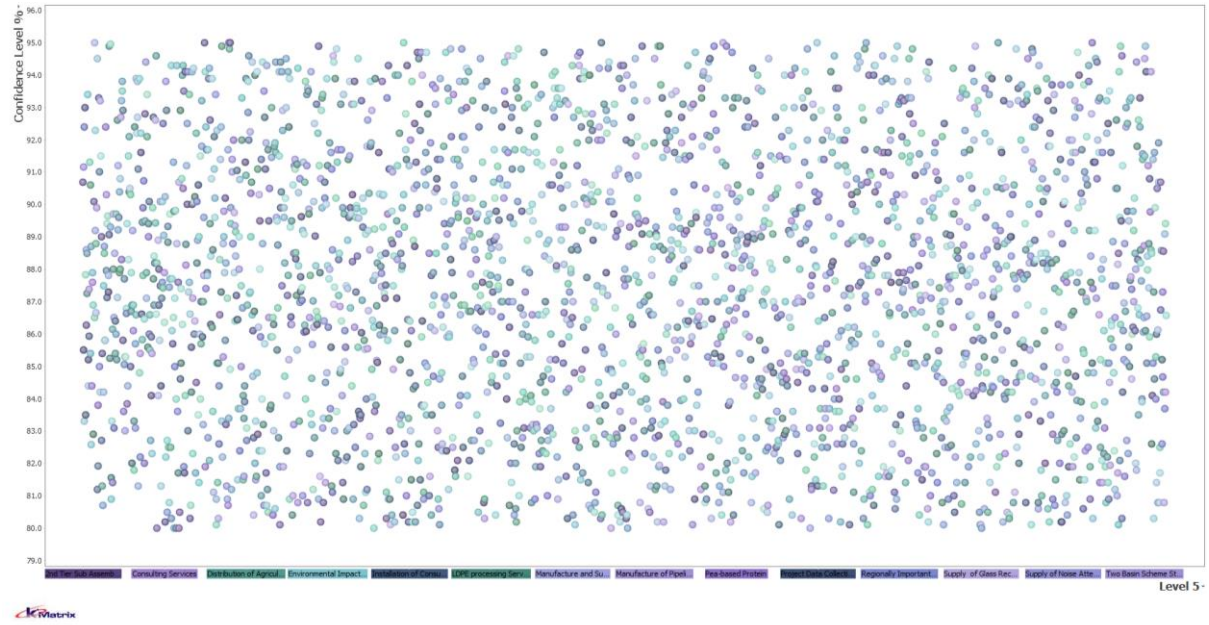
The data is calculated from the employment side, grouping employees into activities within markets, as opposed to selecting the market and then looking at the employees within it. By using this distinction, we can view how many people are doing what, where and why.

### A2.5 Data Confidence Levels

All kMatrix datasets incorporate a measure of data Confidence Level. This is partly a mathematical function of the historic hit-rate of sources in terms of their previous forecasting accuracy for each metric and activity being measured. Confidence levels vary by activity, measure, geography and forecast year. Typically a confidence level of above 90% is achievable, meaning corroborative sources may vary from the mean value by +/-10%. The focus in the research process is to obtain an across-the board level of data confidence rather than attempt to achieve 100% confidence in any one set of numbers. As each data point has its own set of sources, so each data point has its own level of data confidence. Data confidence levels can vary according to how mature or emergent a product or service is, and how mature the reporting systems may be or for any given country. Developed nations typically have a wider range of robust sources to choose from.

kMatrix tracks the accuracy of sources over a period of time, with Confidence Levels being built up from the history of the accuracy of a source for a specific metric. The history or 'hit-rate' of a source is held for each metric, with some sources accepted for some metrics and rejected for other metrics, dependent on how accurate they have been in the past. Hit-rates are 'live' and the hit-rate of a source can change over time, as their performance changes over time, with some sources hit-rates being tracked over the last 35 years. The ability to select, reject and assess the validity of the extensive source list, for different markets, metrics and geographies is a fundamental aspect of the kMatrix process.

The bubble graph below plots the confidence values for 5,133 data points for Hertfordshire. The bubbles are not sized, they are only markers representing the percentage data confidence for each datapoint. Here we can see than confidence varies between 80-95% confidence, with most data points concentrated between 84-92%.




### A2.6 Difference Between Data Confidence Levels and Data Confidence Intervals

Data Confidence Intervals are often used within survey data, where they give an indication of the degree of uncertainty of an estimate within a sample, specifying the range of values likely to contain the unknown population value, by defining upper and lower limits within a data sample.

The difference between this and the Confidence Level above, is it provides the variance, but it weights all data as being equally valid and does not factor in the likely validity of each data source.

In summary, Data Confidence Levels are different to Data Confidence Intervals:

- ***Data Confidence Levels*** estimate the accuracy of a triangulated data point, based on the likely accuracy of each of the multiple sources of data that are used in the triangulation process, through tracking historical accuracy
- ***Data Confidence Intervals*** provide a range of values where the true number could lie, but do not provide detail on the validity of the values used within the production of the range

Confidence Intervals are not provided within the dataset because the data sources within the triangulation process for each datapoint are varied, created for many different reasons and will each have an individual hit-rate.

### A2.7 "Deep Dive" Example – Employment for Private Sector Contracts of Insulation

This example provides an illustration of how the multi-source approach has been used to calculate labour values. This worked example would give a figure for total number of insulation installers in England (separate study).

The multi-source approach includes six stages:

1. Select the data point
2. Identify the source data
3. Select sources for further analysis
4. Triage the sources to achieve a more consistent range of values

5. Calculate the mean value from the sources
6. Calculate the confidence level

Stage 1 involves selecting the data point. In this example, the data point is England employment for "Insulation".

Stage 2 involves identifying the data sources that are relevant to the calculation of the data point and is the source list that is used to calculate the value, for this datapoint, it would run to over 4,000 sources.

Stage 3 involves an initial sort and selection from the full list of sources to identify those of the most direct relevance to the data point. They are rejected if they are duplicates, i.e., using 3rd party data, if their hit rate is too low or if the value is excessively high or low with no evidence for deviation.

Stage 4 of the process involves "smoothing" the results by excluding the outlier values from the final calculation. In this case, 75 sources were ultimately selected and these are shown at Table A.1 and are labelled Source 1 through to Source 75. Their selection depends upon several factors stored within our source management system (columns 4-8 of Table A.1). These are:

- Value reported (Employees) – only sources showing value that are proximate to other values are included
- Year of data – ideally sources should be current, in this case all are 2021
- Hit rate over the past 5 years – level of assessed accuracy for this source over 5 years
- Number of times accessed – number of times this source has been used previously for this purpose i.e., same data point different years, identical data point different country etc.
- Triangulated – is the data extracted from a larger data set for the purposes of comparison?

Table A.1 shows that the 75 sources were all current, with employment values between 68,584 and 102,534, hit rates of between 72.3% and 94.8% and had been accessed previously between 34 and 155 times each. The source list is split (52/23) between sources used for triangulation and those that are not.

All the values in the data set are unique, which means that multiple sources that may quote the same value (possibly from an identical source) are eliminated from the final selection.

**Table A.1: Short List of Sources**

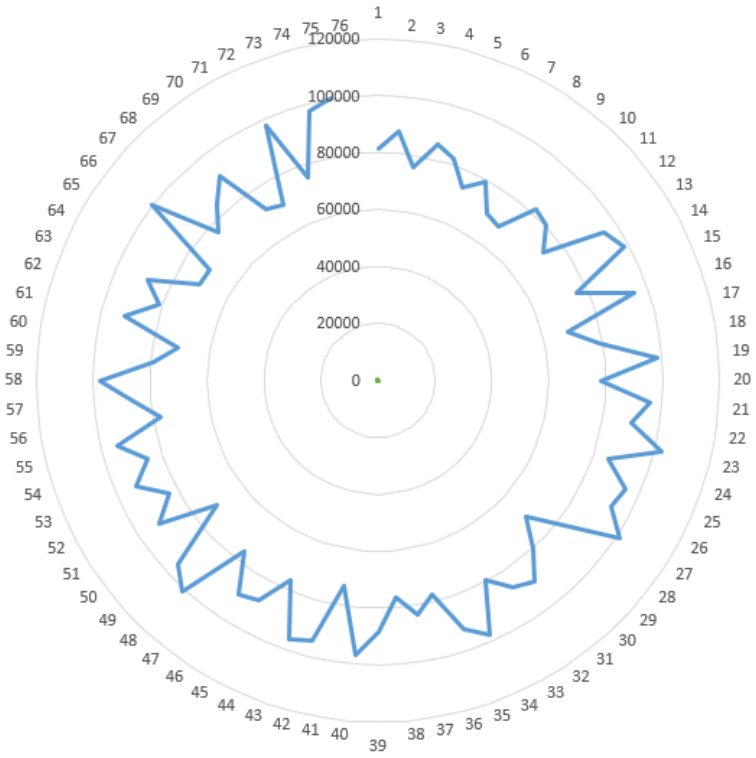
| No | DATA Source | Employees | Country | Year of Data | Hit Rate History % | Times Accessed | Triangulated | Accept Reject |
|---|---|---|---|---|---|---|---|---|
| 1 | Advanced Portfolio Technologies | 81,325.7 | England | 2021 | 92.2 | 119 | YES | accept |
| 2 | Advanced Technologies Inc | 87,653.9 | England | 2021 | 94.7 | 130 | YES | accept |
| 3 | Advantage Capital Limited | 75,767.2 | England | 2021 | 85.7 | 76 | YES | accept |
| 4 | Advantage Early Growth Limited | 85,430.5 | England | 2021 | 73.4 | 88 | NO | accept |
| 5 | Advent Venture Partners LLP | 82,437.4 | England | 2021 | 82.4 | 57 | YES | accept |
| 6 | Alliance for Climate Protection | 73,971.3 | England | 2021 | 89.5 | 88 | YES | accept |
| 7 | Alliance to Save Energy | 79,444.4 | England | 2021 | 76.9 | 34 | NO | accept |
| 8 | Alternative Investment Solutions | 69,952.1 | England | 2021 | 86.4 | 96 | YES | accept |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9 | Aluminium Federation | 68,583.8 | England | 2021 | 91.8 | 77 | NO | accept |
| 10 | Applied Environmental Research Foundation - AERF | 81,753.3 | England | 2021 | 84.6 | 46 | YES | accept |
| 11 | Architectural & Specialist Door Manufacturers Association | 80,385.0 | England | 2021 | 82.3 | 58 | YES | accept |
| 12 | Architectural Association (AA) School of Architecture | 73,458.2 | England | 2021 | 72.3 | 64 | YES | accept |
| 13 | Architectural Cladding Association | 95,008.3 | England | 2021 | 76.1 | 94 | YES | accept |
| 14 | Architectural Engineering Institute | 98,257.9 | England | 2021 | 86.3 | 123 | NO | accept |
| 15 | Architecture and Design Scotland | 76,280.3 | England | 2021 | 76.8 | 126 | YES | accept |
| 16 | Association for Environment Conscious Building | 95,093.8 | England | 2021 | 92.7 | 49 | NO | accept |
| 17 | Association for Project Management | 68,669.3 | England | 2021 | 79.6 | 83 | YES | accept |
| 18 | Association for Specialist Fire Protection | 78,760.2 | England | 2021 | 83.4 | 121 | YES | accept |
| 19 | Association for the Conservation of Energy | 98,514.4 | England | 2021 | 90.6 | 57 | YES | accept |
| 20 | Association for solar thermal industry | 78,503.7 | England | 2021 | 77.9 | 123 | NO | accept |
| 21 | Association of Average Adjusters | 95,863.4 | England | 2021 | 75.6 | 56 | NO | accept |
| 22 | Association of Builders' Hardware Manufacturers | 89,962.8 | England | 2021 | 89.7 | 53 | NO | accept |
| 23 | Association of Building Component Manufacturers Ltd | 102,533.7 | England | 2021 | 92.0 | 133 | NO | accept |
| 24 | Association of Building Engineers | 85,516.0 | England | 2021 | 74.6 | 50 | YES | accept |
| 25 | Association of Consulting Engineers | 94,922.8 | England | 2021 | 76.1 | 108 | YES | accept |
| 26 | Association of Environmental and Resource Economists (AERE) | 93,126.9 | England | 2021 | 94.7 | 61 | YES | accept |
| 27 | Association of Facilities Engineers | 101,165.4 | England | 2021 | 78.6 | 50 | YES | accept |
| 28 | Association of Rooflight Manufacturers | 82,779.5 | England | 2021 | 81.0 | 124 | YES | accept |
| 29 | Association of Tank & Cistern Manufacturers | 70,379.7 | England | 2021 | 77.7 | 73 | YES | accept |
| 30 | Biomass - Biomass Thermal Energy Council (BTEC) | 80,299.5 | England | 2021 | 83.2 | 93 | YES | accept |
| 31 | Biomass - Pellet Fuels Institute | 89,791.8 | England | 2021 | 74.2 | 55 | NO | accept |
| 32 | Biomass Energy Research Association (BERA) | 86,713.2 | England | 2021 | 74.1 | 54 | YES | accept |
| 33 | Blomberg | 79,615.4 | England | 2021 | 79.1 | 85 | YES | accept |
| 34 | BLT Financial Group | 97,830.3 | England | 2021 | 76.9 | 92 | YES | accept |
| 35 | BNP | 92,357.3 | England | 2021 | 93.2 | 114 | NO | accept |
| 36 | British Architectural Library | 77,392.0 | England | 2021 | 85.0 | 102 | YES | accept |
| 37 | British BioGen | 83,292.6 | England | 2021 | 77.3 | 148 | YES | accept |
| 38 | British Blind & Shutter Association | 76,536.8 | England | 2021 | 89.4 | 67 | NO | accept |
| 39 | British Board of Agreement | 88,338.0 | England | 2021 | 91.9 | 127 | YES | accept |
| 40 | British Cement Association | 97,060.7 | England | 2021 | 87.5 | 69 | NO | accept |
| 41 | British Computer Society | 73,201.7 | England | 2021 | 79.4 | 155 | YES | accept |
| 42 | British Concrete Masonry Association | 94,153.1 | England | 2021 | 73.3 | 62 | NO | accept |
| 43 | British Constructional Steelwork Association | 96,120.0 | England | 2021 | 77.2 | 132 | NO | accept |
| 44 | British Fire Protection Systems Association | 76,622.3 | England | 2021 | 84.4 | 62 | YES | accept |
| 45 | British Floor Covering Manufacturers Association | 88,081.5 | England | 2021 | 85.3 | 138 | YES | accept |
| 46 | British Foundry Association | 89,535.3 | England | 2021 | 78.5 | 137 | YES | accept |
| 47 | British Glass Manufacturers Association | 76,023.7 | England | 2021 | 75.9 | 79 | YES | accept |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 48 | British Hard Metals Association | 101,079.9 | England | 2021 | 81.8 | 36 | YES | accept |
| 49 | British Hydropower Association - UK | 95,435.9 | England | 2021 | 79.1 | 38 | NO | accept |
| 50 | British Institute of Architectural Technologists | 71,662.4 | England | 2021 | 81.9 | 97 | NO | accept |
| 51 | British Institute of Non-Destructive Testing | 91,844.2 | England | 2021 | 88.7 | 105 | NO | accept |
| 52 | British Laminate Fabricators Association Ltd. | 83,207.1 | England | 2021 | 94.8 | 116 | YES | accept |
| 53 | British Marine Equipment Association (BMEA), | 92,613.8 | England | 2021 | 81.3 | 71 | YES | accept |
| 54 | British Metals Castings Association | 85,601.5 | England | 2021 | 86.3 | 112 | YES | accept |
| 55 | British Metals Federation | 94,153.1 | England | 2021 | 81.8 | 69 | YES | accept |
| 56 | British Non-Ferrous Metals Federation | 77,563.0 | England | 2021 | 86.3 | 136 | YES | accept |
| 57 | British Photovoltaic Association | 86,200.1 | England | 2021 | 93.1 | 87 | YES | accept |
| 58 | British Plastics Federation | 97,659.3 | England | 2021 | 82.2 | 91 | NO | accept |
| 59 | British Precast Concrete Federation | 78,931.3 | England | 2021 | 94.2 | 154 | YES | accept |
| 60 | British Pump Manufacturers Association | 71,149.3 | England | 2021 | 77.0 | 60 | YES | accept |
| 61 | British Quality foundation | 91,758.7 | England | 2021 | 90.8 | 44 | YES | accept |
| 62 | British Resilient Flooring Manufacturers Association | 81,411.2 | England | 2021 | 84.0 | 35 | NO | accept |
| 63 | British Stainless Steel Association | 88,338.0 | England | 2021 | 79.7 | 151 | YES | accept |
| 64 | British Steel Corporation | 70,978.3 | England | 2021 | 73.0 | 97 | YES | accept |
| 65 | British Steel Strip Products | 70,807.2 | England | 2021 | 84.0 | 136 | YES | accept |
| 66 | British Urethane Foam Contractors Association | 100,310.3 | England | 2021 | 89.5 | 49 | YES | accept |
| 67 | British Wind Energy Association | 76,451.3 | England | 2021 | 76.1 | 150 | NO | accept |
| 68 | British Wood Preserving & Damp Proofing Association | 83,805.7 | England | 2021 | 79.7 | 124 | YES | accept |
| 69 | British Institute of Employment Studies | 90,732.5 | England | 2021 | 90.6 | 130 | YES | accept |
| 70 | Polo Tweed | 71,747.9 | England | 2021 | 87.6 | 132 | YES | accept |
| 71 | The Recruitment and Employment Confederation | 70,123.1 | England | 2021 | 88.3 | 139 | NO | accept |
| 72 | Ranstad Education | 97,573.8 | England | 2021 | 93.7 | 105 | YES | accept |
| 73 | Robert Half | 75,339.6 | England | 2021 | 79.3 | 106 | YES | accept |
| 74 | Blue Care | 97,573.8 | England | 2021 | 77.2 | 56 | NO | accept |
| 75 | A O C Jobs | 100,395.8 | England | 2021 | 92.5 | 78 | YES | accept |

Typically, the process for deciding which sources to include/exclude as part of the final calculation is visualised using radar charts. These charts are a key feature of the QA system and provide a rapid insight into the variation in source values. A radar showing sharp and frequent spikes is due for radical surgery, while a radar with a more consistent pattern (representing a degree of consensus in the sources) is subject to judicious pruning. An example of an outlier would be a good which is usually £10, but someone is selling for £90 on Amazon, this would be considered an outlier and removed from the dataset. These are removed from the dataset because an overpriced good can distort a dataset. This process is undertaken by an analyst (not an algorithm) and can take several iterations before a satisfactory final selection of sources is achieved. The final radar chart based upon the final selection of sources is shown at Figure A.1.

**Figure A.1 Radar Chart for Final 75 Sources**




Stage 5 involves the calculation of the mean value from the final list of 75 sources, now ranging between 68,584 and 102,534 employees. The adjusted mean value from this range is 85,106.

Stage 6 calculates the confidence level for the data point, which is an indication of the validity, based on the historic hit-rate of the sources used to triangulate the data point, in this case the confidence level is 83%.

Each data point that progresses through this process is then subject to further checks that ensure that the data point value is consistent with:

- Values in previous year's data
- Comparative values of UK employment compared with employment levels of same service in other countries
- Comparative analysis of UK employment values when related to other Installation services in the same category or family of services
- Consistency in employment trends over time
- Consistency in confidence levels over time

Where any uncertainty about the final data point remains, this may be due to either market uncertainty or data uncertainty. In the case of market uncertainty, the value remains unchanged, but in the case of data uncertainty, then Stages 1-6 are repeated, but this time with additional or alternative data sources.

## Appendix 3: LCEGS and Office of National Statistics Environmental Goods and Services Sector Comparison

The purpose of this appendix is to provide a brief description of some of the differences between the Office of National Statistics (ONS) Environmental Goods and Services Sector (EGSS) data and the LCEGS data provided by kMatrix. The two methodologies differ in the way data is collected, their methodologies, and in terms of their sector definitions.

kMatrix is a data house that specialises in providing evidential data for business modelling and analysis on a multi-sectoral basis. We provide back-room services to the likes of Deloitte and PWC amongst others in the UK, New Zealand, Australia, US and the EU for sectoral analysis and due diligence for sectoral development and investment. We also provide our business and technology profiling services through these channels to market, as well as direct to universities for technology spinouts and individual businesses for development purposes. Further customers include government departments such as BEIS, Home Office and various local and regional government departments.

The ONS EGSS data is produced primarily for the purpose of national accounting. It is sector-specific, using narrow sector definitions and takes no account of the value or supply chains in a sector. In contrast, the kMatrix methodology was originally designed to help companies by measuring technologies or activities using small taxonomies, to assist with investment and developmental planning. This capability was expanded to provide market data for a number of economic sectors, by creating larger taxonomies to capture as much of the market as possible, including the supply and value chains. Each taxonomy for a sector will draw relevant activities from many other sectors, to fully capture all activity. In this way, the LCEGS taxonomy captures activities across multiple sectors and down the value and supply chains. This difference in *what* is being measured is the fundamental reason why the definitions used by ONS and LCEGS do not align.

The kMatrix methodology uses a unique process of 'triangulation' to measure metrics such as employment and other characteristics of a sector at varying levels of detail. This process has been developed over 30 years and has been adopted by various governments, universities and major corporates to provide economic industry data for hard to measure sectors. It is similar in concept to the triangulation of satellites to work GPS satellite navigation systems. The methodology uses multiple data points which can be economic or non-economic in origin, from a number of different sources to 'triangulate' the value of a product or service in question.

This process is different to the methodology used by the ONS to produce the EGSS data, predominantly because the ONS data relies on self-certification of companies into SIC codes, whereas the kMatrix methodology calculates values based on multiple sources of data. The ONS data is based on where companies choose to classify themselves. kMatrix data looks at the activities of companies and attributes those activities to different sub-sectors. In effect, the ONS system is limited to the ability or willingness of companies to list which sectors their products or services are used in, this method is likely to produce both over and underestimates of market size as companies will attribute more or less of their activities to relevant SIC codes. The kMatrix methodology does not rely on company cooperation but looks at their activities and breaks them down into the levels or sub-sectors they are relevant to.

The kMatrix process operates on a 'bottom up' basis, meaning we look at products and services delivered, rather than company classifications and turnover, which is classed as 'top down' (SIC system). The bottom up process was developed to assist individual companies based on sectoral analysis findings and provide evidential data and advice. By looking at the sector from the bottom up (by each activity, product or service), the sector can be determined in accordance with the relevant sector definition, whilst allowing the flexibility to 'add in' or 'opt out' of various activities depending on the purpose of the reporting. ONS data itself is not used to produce kMatrix figures, but the kMatrix values can be reported out through the ONS classification system if required.

Table 1 shows a comparison between employment analysis for the London region using the SIC classification methodology and the kMatrix methodology for the Manufacturing sector and the

Construction sector.

**Table 1: Comparison of 2011 - 2016 Employment Data for SIC and kMatrix in London**

| Methodology | Sector | 2011 Jobs | 2012 Jobs | 2013 Jobs | 2014 Jobs | 2015 Jobs | 2016 Jobs |
|---|---|---|---|---|---|---|---|
| SIC based | Manufacturing | 106,750 | 108,250 | 106,750 | 112,000 | 108,000 | 105,250 |
| SIC based | Construction | 133,250 | 150,500 | 146,500 | 146,250 | 145,250 | 155,750 |
| kMatrix | Manufacturing | 137,351 | 135,943 | 138,951 | 141,873 | 140,308 | 131,230 |
| kMatrix | Construction | 166,629 | 195,334 | 177,915 | 184,022 | 184,317 | 199,038 |
| | | | | | | | |
| ***Indexed numbers for the rows above show that growth in the manufacturing and construction sectors is similar for both the SIC and kMatrix definitions*** | | 100 | 101.4 | 100.0 | 104.9 | 101.2 | 98.6 |
| | | 100 | 112.9 | 109.9 | 109.8 | 109.0 | 116.9 |
| | | 100 | 99.0 | 101.2 | 103.3 | 102.2 | 95.5 |
| | | 100 | 117.2 | 106.8 | 110.4 | 110.6 | 119.4 |

**Sector** - LCEGS is made up of elements from many different traditional sectors (including manufacturing, finance, construction, consulting and energy) therefore as a grouping it includes products and services from those sectors that together amount to the total value of the LCEGS grouping.
**Scale** - The ONS system only produces estimates of the sector size at the country level, whereas the LCEGS data can be provided by Country, Region, City, Local Authority etc.

Table 2 shows a summary of the main differences between the kMatrix data and the ONS EGSS data.

**Table 2: kMatrix and ONS – EGSS Comparison Summary Table**

| | kMatrix - LCEGS | ONS - EGSS |
|---|---|---|
| **Sector definition** | The LCEGS sector includes the EGSS definition but expands it to include all activities that contribute and enable growth in the sector. Those elements which are excluded from EGSS which are produced for purposes that, while beneficial to the environment, primarily satisfy technical, human and economic needs or that are requirements for health and safety are included in LCEGS if they contribute to the sector. For more information, please see Appendix 3 and Appendix 4 of this report. | The environmental goods and services sector is made up of areas of the economy engaged in producing goods and services for environmental protection purposes, as well as those engaged in conserving and maintaining natural resources. Excluded from the scope of EGSS are goods and services produced for purposes that, while beneficial to the environment, primarily satisfy technical, human and economic needs or that are requirements for health and safety. |
| **Sector size measurement** | Triangulation of data from multiple sources | Company surveys via company self-certification |
| **Sector sales coverage** | Full value of sales for the sector, including supply and value chain | Only sector sales, not including supply or value chains |

| | | |
|---|---|---|
| **Geographic range of coverage** | Global, Country, Regional, City & Local Authority | Country |
| **Available data includes** | Sales, number of employees, number of companies, exports, growth rates (historical and forecast) & 60+ more metrics | Output, GVA, employee count and exports |
| For further information and detail on the ONS – EGSS definition:<br><br>https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/ukenvironmentalaccounts/2010to2015 | | |