

United Kingdom

Low Carbon Environmental Goods and Services

“Where we were, where we are, and where we’re going”

kMatrix Data Services Ltd

May 2021



Financial Years 2007/08 to 2020/21

Forecast Years 2021/22 to 2025/26

Disclaimer

kMatrix Data Services Limited

This information is provided as an indication of the progress of the UK's Low Carbon Environmental Goods and Services sector between 2007/08 and 2019/20, the impact of the Covid-19 pandemic in 2020/21 and forecast sales out to 2025/26.

It does not constitute advice to anyone as to what they should do, when, where or with whom.

Readers should exercise discretion or seek further professional guidance before committing themselves to any future actions or investments arising from this information.

Report Introduction

This report has been produced at the sole discretion of kMatrix Data Services Limited, as a response to the impact of the global Covid-19 pandemic.

kMatrix has reported the size of the Low Carbon Environmental Goods and Services (LCEGS) sector within the UK for regional governments and private clients for over a decade.

The information within this report is intended to illustrate the progress the LCEGS sector has made in the UK between 2007/08 through to 2019/20. The impact of the pandemic has been significant on the LCEGS sector, however forecasts are good with regards to recovery.

kMatrix have measured the full LCEGS sector to produce this report, with high-level findings being reported here. Further detail is available through:

kMatrix Data Services Limited

www.kmatrix.co

sarah@kmatrix.org

Table of Contents

Section	Contents	Page
	Executive Summary	4
	Introduction	7
1	UK's LCEGS Sector - 2018/19 to 2020/21	13
2	UK's LCEGS by Level 1 - 2018/19 to 2020/21	14
3	UK's LCEGS by Level 2 - 2018/19 to 2020/21	15
4	UK's LCEGS Sales Timeseries – 2007/08 to 2025/26	17
Appendix 1	The LCEGS Sector Definition	23
Appendix 2	The kMatrix Methodology	31
Appendix 3	LCEGS and Office of National Statistics Environmental Goods and Services Sector Comparison	35

Executive Summary

The UK's Low Carbon and Environmental Goods and Services (LCEGS) sector was worth £205.7bn to the UK's economy in 2020/21, as indicated by the value of sales in the sector. These sales were generated by over 75,700 businesses that employed over 1.2 million people in the sector in 2020/21.

Sales and growth

The Low Carbon and Environmental Goods and Services sector in the UK grew year on year from 2007/08 to 2019/20, before contracting during 2020/21. In 2018/19 total sales in the sector were worth £210.5bn, they grew to £226.1bn in 2019/20 and shrank to £205.7.3bn in 2020/21.

The sector in the UK grew by 7.4% during the financial year 2018/19 to 2019/20 and contracted by -9.0% during 2019/20 to 2020/21.

Employment

Employment in UK's Low Carbon and Environmental Goods and Services sector grew year on year from 2007/08 to 2019/20, before contracting during 2020/21. Employment in 2018/19 was 1.37 million, in 2019/20 was 1.48 million and 2020/21 had dropped to 1.28 million. Annual growth rate in employment was 7.3% between 2018/19 and 2019/20 and -13.1% between 2019/20 and 2020/21.

Companies

The number of companies in the UK's Low Carbon and Environmental Goods and Services sector grew year on year from 2007/08 to 2019/20, before contracting during 2020/21. The number of companies in 2018/19 was 79,232, in 2019/20 they grew to 87,339 and contracted to 75,715 in 2020/21. Annual growth rate in the number of companies was 10.2% between 2018/19 and 2019/20 and -13.3% between 2019/20 and 2020/21.

UK's sub-sectors

In 2020/21 the UK's Low Carbon and Environmental Goods and Services sector was made up by the following proportions: Low Carbon 49%, Renewable Energy 35% and Environmental 15%.

UK's sub-sector strengths

Of the 24 sub-sectors within the Low Carbon Environmental Goods and Services sector, 11 account for 92% of sales.

The five largest sub-sectors in the Low Carbon and Environmental Goods and Services sector by sales account for 60% of the UK's total sales and are made up of:

- Wind (£33.3bn) – this includes control systems development and manufacture, drive train development, manufacture and systems integration, consulting houses and companies providing power firming systems and services, maintenance services and grid integration services.
- Alternative Fuels (£29.7bn) – this includes R&D functions, alternative fuel providers, designers and consultancy, process implementation, sales and accounting and application development specialists.
- Building Technologies (£22.8bn) - this includes head office functions, building systems design and consultancy and building systems providers and installers.
- Carbon Finance (£20.8bn) - this includes Carbon finance trading houses and consultancies.
- Geothermal (£17.9bn) - this includes branch office functions, design, international consultancy, lateral geothermal systems providers and installers at the domestic and small commercial level and vertical control systems developers and suppliers.

The next six largest sub-sectors by sales account for a further 31% of the UK's total sales and are made up of:

- Alternative Fuel Vehicle (£17.6bn) - include selling agencies, alternative fuel development companies and consulting and applications development for vehicle conversion specialists.
- Biomass (£10.2bn) - this includes systems development, supply, implementation and R&D.
- Photovoltaic (£10.2bn) - this includes head office functions, systems developers, providers and installers.
- Recovery and Recycling (£10.1bn) – this includes waste collection, glass stock processing and paper feedstock processing.
- Water & Waste Water Treatment (£9.9bn) - development and implementation by utilities along with supply, consultancy and implementation by independent consulting engineers.
- Waste Management (£6.7bn) - this includes process development and new process implementation and consulting, public and private operations management and supply and installation of operational equipment.

UK's LCEGS Growth between 2018/19 and 2020/21

Between 2018/19 and 2019/20 the strongest growth was seen in:

- Wind (23.9%)
- Biomass (16.4%)
- Noise and Vibration Control (14.4%)
- Wave & Tidal (12.5%)
- Carbon Capture and Storage (11.7%)
- Photovoltaic (10.5%)

The slowest growth was seen in:

- Air Pollution Control (1.7%)
- Energy Management (-1.0%)
- Alternative Fuel Vehicle (-1.6%)
- Nuclear Power (-2.5%)
- Hydro (-3.6%)
- Contaminated Land (-4.3%)

The variations between 2018/19 and 2020/21 are usual market fluctuations within a healthy sector.

The strongest growth between 2019/20 and 2020/21 was seen in:

- Alternative Fuel (-8.3%)

The slowest growth was seen in:

- Alternative Fuel Vehicle (-9.9%)
- Renewable Energy General Consultancy (-9.5%)
- Wind (9.3%)
- Water & Waste Water Treatment (-9.2%)

All other sub-sectors saw growth of between -8.8% and -9.1% between 2019/20 and 2020/21. These growth rates are not usual market fluctuations and represent significant impact on the LCEGS sector.

UK's LCEGS Forecast growth

- Growth forecasts are performed by the triangulation of forecasts across the sector and within parallel sectors across the chains and networks of supply. As such, forecasts can be cautious in some areas of market and more optimistic in others and by providing forecasts at the sector-level, we can smooth the data.
- At the time of writing, the Bank of England are forecasting 7.3% growth across the UK economy during 2021. This growth includes the last 3 months of the 2020/21 financial year.
- kMatrix measured the LCEGS market on a monthly basis during 2020, which indicated a steady contraction of the market month-on-month between March and November, with a levelling off in December.
- The market began to recover between January-March 2021 despite further lock-downs as the industry began to recover partly due to changes in the way businesses operated such as the digitization of the sales process and B2B relations.
- The Bank of England forecast includes the whole economy and the predicted injection of money from households able to save during the pandemic. The LCEGS sector is unlikely to benefit from the proposed spending spree to same degree as sectors such as hospitality and as such the industry forecasts are less optimistic.
- Growth between 2020/21 and 2021/22 is expected to be 3.7%, which is the slowest since 2007/08.
- Growth is expected to increase year-on-year through the five-year period to 6.7% annual growth by 2025/26.

UK's LCEGS Sales Timeseries

- Sales increased from £102.6bn in 2007/08 to £226.1bn in 2019/20, with annual growth rates generally between 4.6% and 5.6% for the first six years and between 5.9% and 7.4% from 2013/14 to 2019/20.
- 2019/20 to 2020/21 saw a -9.0% contraction of the LCEGS sector in the UK, with sales falling from £226.1bn to £205.7bn. This is similar to the ONS UK GDP contraction of 9.9% for 2020.
- Growth from 2020/21 through to 2025/26 is expected to see the LCEGS sector grow to £266.5bn over the next five years, with annual growth for the first year of 3.7%, rising to 6.7%.

UK's LCEGS Level 1 Growth 2020/21-2021/22 to 2024/25-2025/26

- Environmental sub-sector is expected to see annual growth of 2.7% rising to 5.1%.
- Low Carbon sub-sector is expected to see annual growth of 4.1% rising to 7.5%.
- Renewable Energy sub-sector is expected to see annual growth of 5.1% rising to 9.2%.

UK's LCEGS Top Level 2 Sub-sectors Growth 2020/21-2021/22 to 2024/25-2025/26

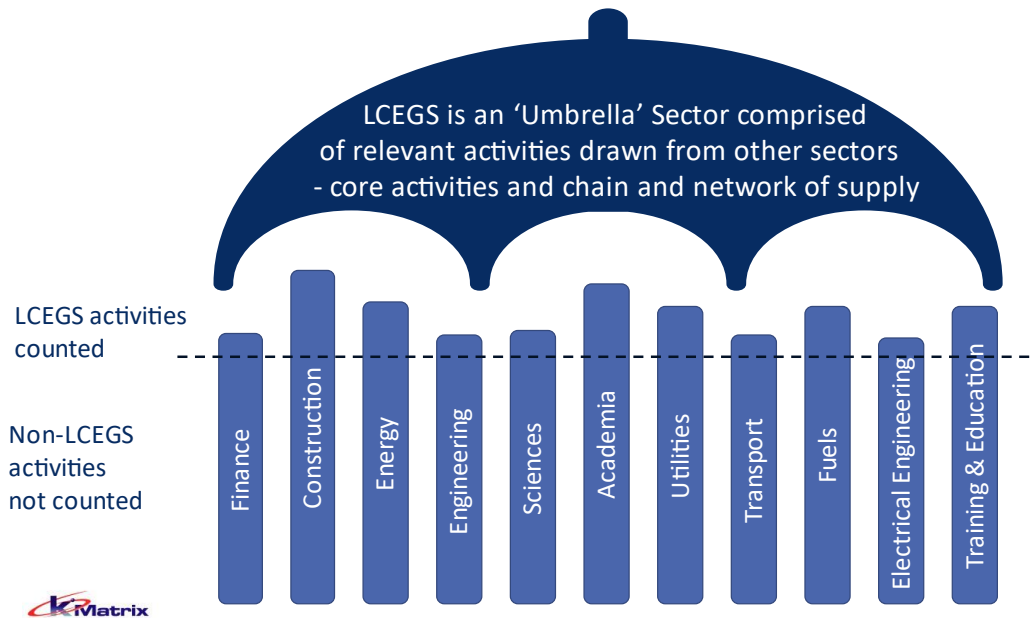
- Wind sub-sector is expected to see annual growth of 6.9% rising to 12.5% over 5 years.
- Alternative Fuels sub-sector is expected to see annual growth of 5.1% rising to 9.4%.
- Building Technologies sub-sector is expected to see annual growth of 5.6% rising to 10.4%.
- Carbon Finance sub-sector is expected to see annual growth of 7.8% rising to 14.4%.
- Geothermal sub-sector is expected to see annual growth of 5.1% rising to 9.2%.
- Alternative Fuel Vehicle sub-sector is expected to see annual growth of 7.8% rising to 14.4%.
- Biomass sub-sector is expected to see annual growth of 4.7% rising to 8.7%.
- Photovoltaic sub-sector is expected to see annual growth of 6.2% rising to 10.8%.
- Recovery and recycling sub-sector is expected to see annual growth of 3.2% rising to 5.8%.
- Water & Waste Water Treatment sub-sector is expected to see annual growth of 1.6% rising to 2.9%.
- Waste Management sub-sector is expected to see annual growth of 2.6% rising to 4.8%.

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.

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:



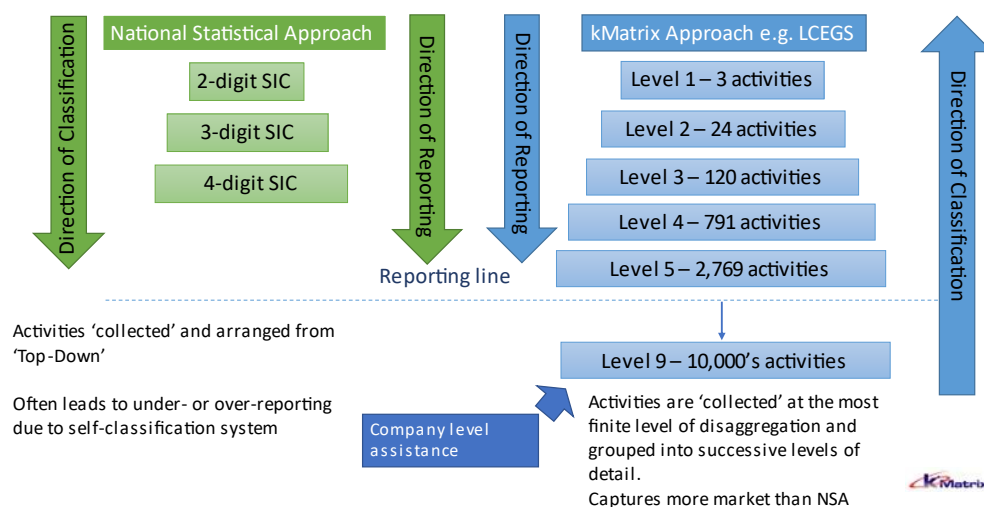
The sector is comprised of both core elements and those in the chain and network of supply, without whom the sector could not function.

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.

Example of bottom-up approach to classification – LCEGS Taxonomy



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 as 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 clients publishing reports or published peer-reviewed academic journals include:

- Cyber Security: https://www.eunity-project.eu/m/filer_public/4b/62/4b6262dc-3bca-4145-a84b-b514049156ce/1_lsec_japan_eunity_ecso_wg2_cima_seldeslachts_ulrich_20190124881.pdf
- Low carbon environmental goods and services sector: https://www.london.gov.uk/sites/default/files/london_low_carbon_market_snapshot_-_2019.pdf and https://www.enterprisem3.org.uk/sites/default/files/2020-02/Hampshire-LCEGS-Market-Report-2015-16-to-2017-18-2nd-Draft_0.pdf
- The green Economy: <https://rgs-ibg.onlinelibrary.wiley.com/doi/pdf/10.1002/geo2.36> and <https://www.nature.com/articles/s41599-019-0329-3>
- Adaptation economy: <https://www.nature.com/articles/nclimate2944>
- Carbon Finance: <https://www.nature.com/articles/nclimate1492?draft=marketing>
- Weather and Climate: <https://advances.sciencemag.org/content/3/5/e1602632.full>
- Climate Services: <https://www.sciencedirect.com/science/article/pii/S2405880719300494?via%3Dihub>

The LCEGS Dataset

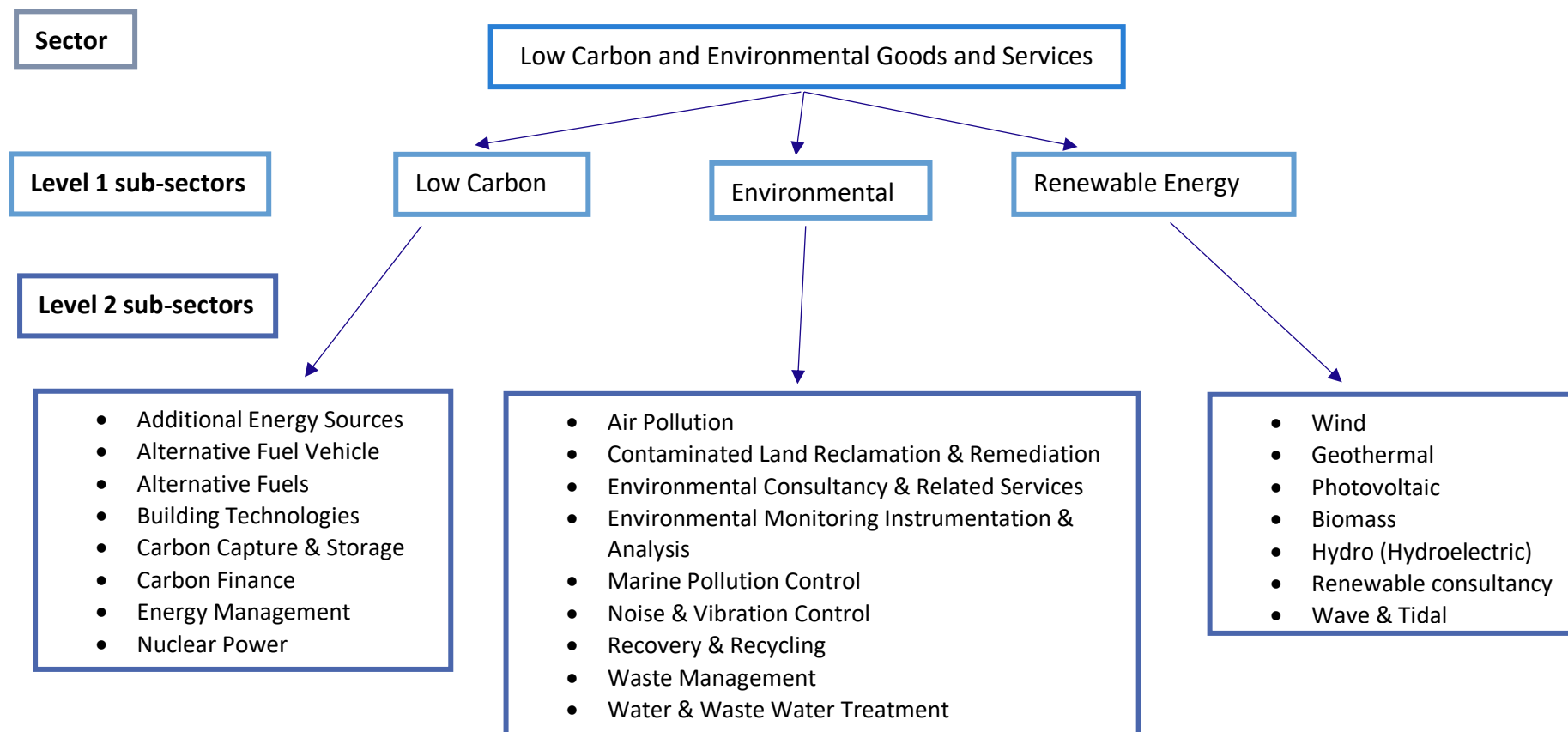
The data used in this report is based upon the work and methodology used by kMatrix to provide datasets on the UK's Low Carbon Environmental Goods and Services (LCEGS) sector for UK Government reported annually by the Department for Business, Innovation and Skills (BIS) from 2008/09 to 2011/12 and further reported every 3 years for the UK and London by the Greater London Authority to 2017/18, representing a continuous annual timeseries of the LCEGS sector for over a decade.

The LCEGS sector has been defined using 24 sub-sectors (or Level 2 markets) grouped into three broad categories (or Level 1 markets) - Environmental, Renewable Energy and Low Carbon. The addition of the Renewable Energy and Low Carbon groupings illustrates the evolution of the current LCEGS sector definition from its original Environmental roots and reflects developments in the market as sectors across the economy evolve to address the environmental challenges that they and the world is facing.

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.

The time series provides 11 years of sales, companies and employment data and 10 years of growth rates for the LCEGS sector as a whole. The data is then broken down into three Level 1 sub-sectors (Low Carbon, Environmental and Renewable Energy) and then those three sub-sectors are split into further Level 2 sub-sectors to provide greater resolution and insights for analysing the data.

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. As an illustration (provided below), the LCEGS sector is broken down into three Level 1 sub-sectors, one of which is Renewable Energy, which is in turn broken down into seven Level 2 sub-sectors, one of which is Wind that is then broken down into a further three Level 3 sub-sectors and so on:



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 LCEGS sector definition, used in this report, includes 2,800 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 LCEGS is included as Appendix 1, a brief explanation of the LCEGS methodology at 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.

What is actually measured?

The dataset measures the core activities of the sector along with enabling activities 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.

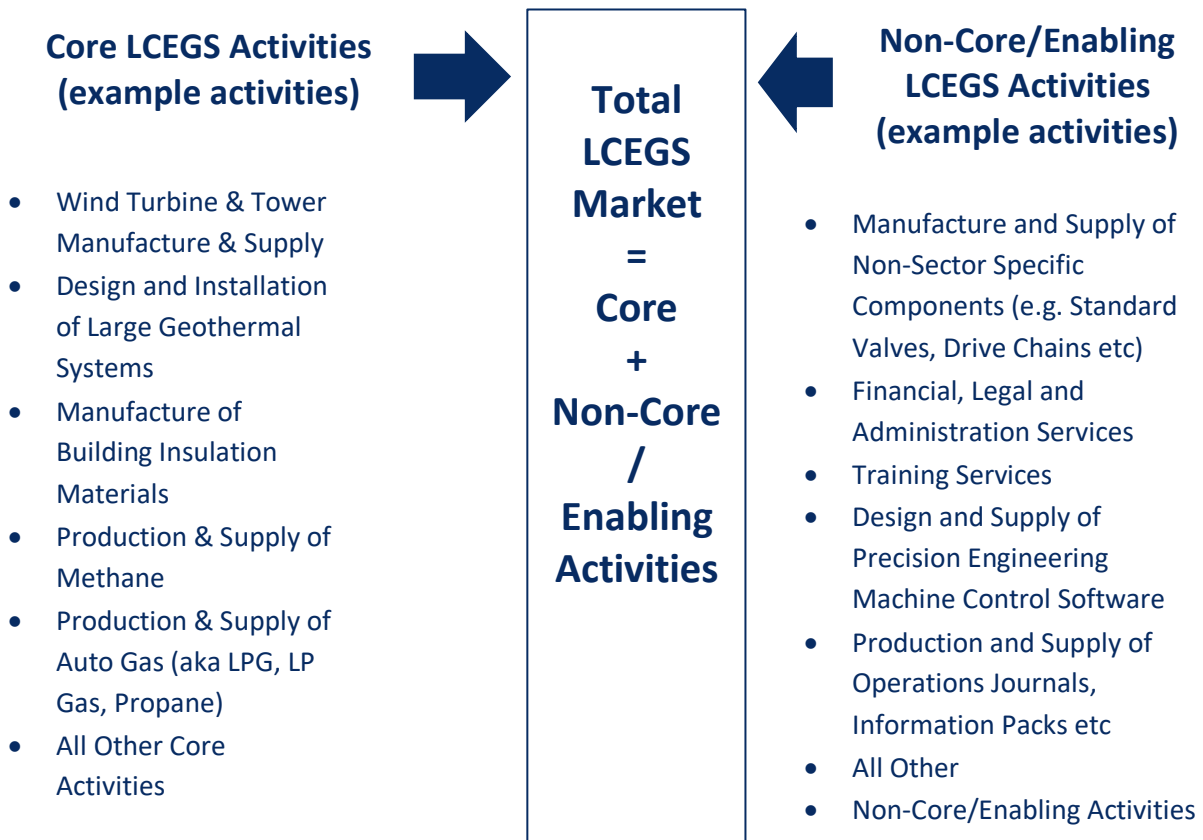
The purpose of the LCEGS dataset in its original form, is to provide a standardized measure of the complete LCEGS sector. The whole dataset includes those 'core' activities, which would immediately come to mind such as the manufacture of a wind turbine blade, but also the less obvious 'non-core' activities, 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 can realistically be considered part of the LCEGS sector. The taxonomy is built and interrogated by assembling activities and services which are then grouped together under different headings. From the example taxonomy in figure 1, seven level 2 activities are grouped together to form the Renewable Energy Level 1 heading. There are five levels in total, comprising approximately 2,800 activities.

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.



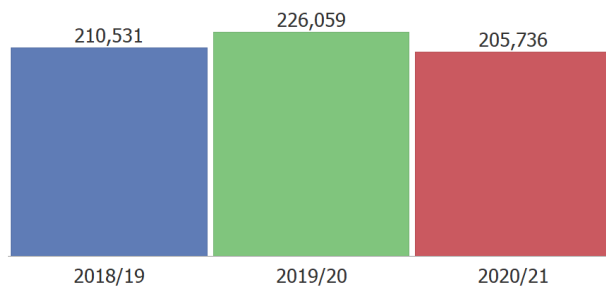
The economic values provided are Sales values, which are transactions made within the sector, which have an economic footprint that can be measured. For companies which service multiple sectors, for example in finance, the sales value is the value of sales that company has in the LCEGS market, it does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

UK's Low Carbon and Environmental Goods and Services (LCEGS) Analysis

1 UK's LCEGS by Sector – 2018/19 to 2020/21

In this section of the report, the UK's LCEGS performance is compared for the last three years for the three key measures of Sales, Employment and Growth.

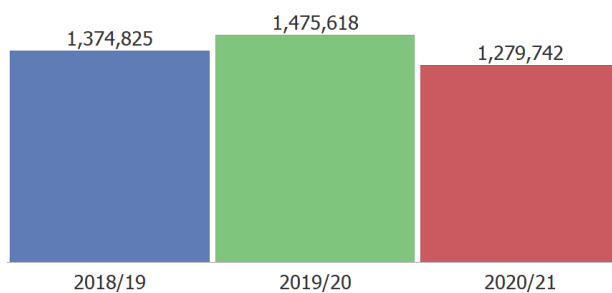
Figure 1: Sales 2018/19 to 2020/21 in £m



The UK's LCEGS sales in 2020/21 were £206bn, down from £211bn in 2018/19.

Annual sales growth in the UK's LCEGS sector was 14.0% from 2017/18 to 2018/19 (2017/18 value in section 4), 7.4% from 2018/19 to 2019/20 and -9.0% from 2019/20 to 2020/21.

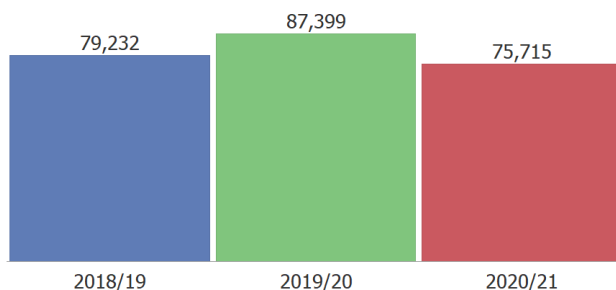
Figure 2: Employment 2018/19 to 2020/21



The UK's LCEGS employment dropped from 1.4 million jobs in 2018/19 to 1.3 million jobs in 2020/21.

Annual employment growth in the UK's LCEGS was 9.4% from 2017/18 to 2018/19, 7.3% from 2018/19 to 2019/20 and -13.1% from 2019/20 to 2020/21.

Figure 3: Companies 2018/19 to 2020/21



The UK's LCEGS company count in 2020/21 was 75,715, down from 79,232 in 2018/19.

Annual company growth in the UK's LCEGS was 9.3% from 2017/18 to 2018/19, 10.2% from 2018/19 to 2019/20 and -13.3% from 2019/20 to 2020/21.

2 UK's LCEGS at Level 1 – 2018/19 to 2020/21

The analysis in this section of the report focuses on the Level 1 split of LCEGS sector in the UK for each of the last three years.

Figure 4: Sales 2018/19 to 2020/21 in £m (Level 1)

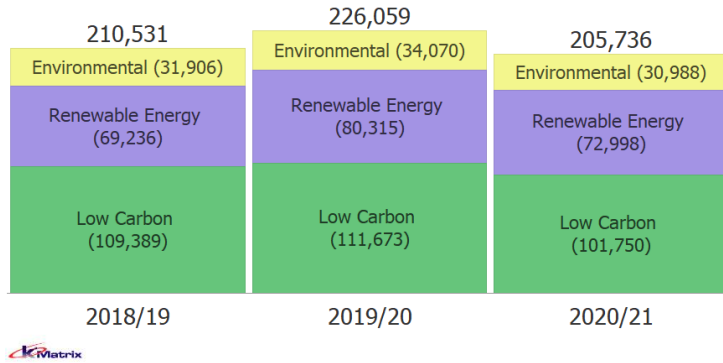


Figure 4 shows the three-year LCEGS sales split by Level 1.

In 2018/19 the split was 52% Low Carbon, 33% Renewable Energy and 15% Environmental. This altered in 2019/20 to 49% Low Carbon, 36% Renewable Energy and 15% Environmental and did not significantly change in 2020/21.

Figure 5: Employment 2018/19 to 2020/21 (Level 1)

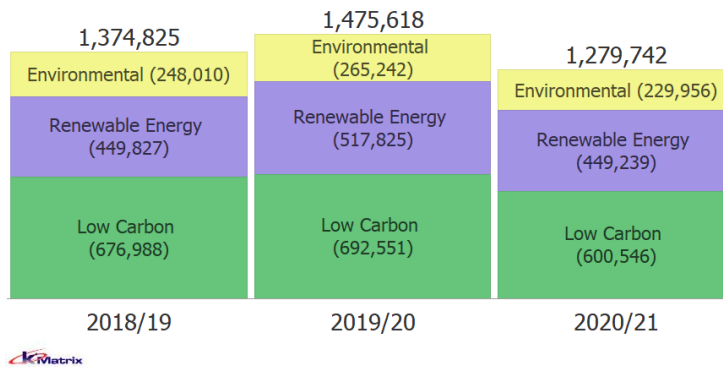


Figure 5 shows the three-year employment split by Level 1.

In 2018/19 the split was 49% Low Carbon, 33% Renewable Energy, and 18% Environmental. This altered in 2019/20 to 47% Low Carbon, 35% Renewable Energy and 15% Environmental and did not significantly change in 2020/21.

Figure 6: Companies 2018/19 to 2020/21 (Level 1)

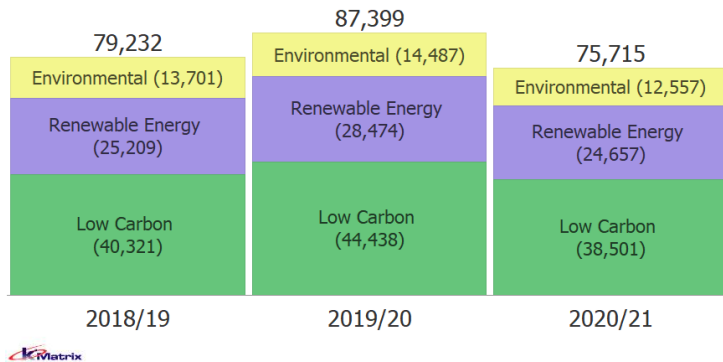


Figure 6 shows the three-year company split by Level 1.

In 2018/19 the split was 51% Low Carbon, 32% Renewable Energy, and 17% Environmental. This altered in 2019/20 to 51% Low Carbon, 33% Renewable Energy and 17% Environmental and did not significantly change in 2020/21.

3 UK's LCEGS at Level 2 – 2018/19 to 2020/21

Table 1 compares all 24 sub-sectors of LCEGS and shows that the five leading sub-sectors: Wind (16%), Alternative Fuels (12%), Building Technologies (11%), Carbon Finance (10%) and Geothermal (9%), and have the largest share in terms of sales, company numbers and employment and accounted for 61% of the UK's LCEGS sector activity in 2020/21.

There is then a second grouping of six sub-sectors that are: Alternative Fuel Vehicles 9%, Biomass 5%, Photovoltaic 5%, Recovery and Recycling 5%, Water and Waste Water Treatment 5% and Waste Management 3%; that make up a further 31% of the LCEGS sector sales in 2020/21.

These 11 sub-sectors dominate the LCEGS sector sales and together made up 92% of its overall sales in 2020/21.

Table 1 also provides growth between 2018/19 and 2019/21 and 2019/20 and 2020/21. Between 2018/19 and 2019/20 the strongest growth was seen in:

- Wind (23.9%)
- Biomass (16.4%)
- Noise and Vibration Control (14.4%)
- Wave & Tidal (12.5%)
- Carbon Capture and Storage (11.7%)
- Photovoltaic (10.5%)

The slowest growth was seen in:

- Air Pollution Control (1.7%)
- Energy Management (-1.0%)
- Alternative Fuel Vehicle (-1.6%)
- Nuclear Power (-2.5%)
- Hydro (-3.6%)
- Contaminated Land (-4.3%)

The variations between 2018/19 and 2020/21 are usual market fluctuations within a healthy sector.

The strongest growth between 2019/20 and 2020/21 was seen in:

- Alternative Fuel (-8.3%)

The slowest growth was seen in:

- Alternative Fuel Vehicle (-9.9%)
- Renewable Energy General Consultancy (-9.5%)
- Wind (9.3%)
- Water & Waste Water Treatment (-9.2%)

All other sub-sectors saw growth of between -8.8% and -9.1% between 2019/20 and 2020/21. These growth rates are not usual market fluctuations and represent significant impact on the LCEGS sector.

Table 1: Sales (£m) 2018/19 to 2020/21 (Level 2)

	Level 1	Level 2	2018/19 Sales £m	Growth	2019/20 Sales £m	Growth	2020/21 Sales £m
<i>Environmental</i>		Air Pollution	1,262.5	1.7%	1,283.9	-8.9%	1,170.1
		Contaminated Land Reclamation & Remediation	1,325.7	-4.3%	1,269.2	-9.1%	1,153.6
		Environmental Consultancy and Related Services	1,157.9	9.5%	1,268.4	-9.0%	1,154.7
		Environmental Monitoring, Instrumentation and Analysis	235.2	5.3%	247.6	-9.0%	225.4
		Marine Pollution Control	196.7	4.9%	206.3	-8.9%	188.0
		Noise & Vibration Control	345.1	14.4%	394.7	-9.1%	359.0
		Recovery and Recycling	10,430.5	6.1%	11,071.7	-9.1%	10,066.4
		Waste Management	6,915.1	6.8%	7,384.8	-8.9%	6,729.6
		Water & Waste Water Treatment	10,037.5	9.0%	10,943.9	-9.2%	9,941.4
<i>Low Carbon</i>		Additional Energy Sources	1,965.9	8.3%	2,129.7	-8.8%	1,942.7
		Alternative Fuel Vehicle	19,893.9	-1.6%	19,578.8	-9.9%	17,645.5
		Alternative Fuels	31,376.1	3.3%	32,416.4	-8.3%	29,720.3
		Building Technologies	24,030.2	3.9%	24,963.7	-8.8%	22,764.4
		Carbon Capture & Storage	730.4	11.7%	816.0	-8.9%	743.0
		Carbon Finance	22,330.0	2.4%	22,871.0	-8.9%	20,824.3
		Energy Management	3,991.0	-1.0%	3,950.9	-8.9%	3,598.1
		Nuclear Power	5,071.0	-2.5%	4,946.3	-8.8%	4,511.5
<i>Renewable Energy</i>		Biomass	9,653.9	16.4%	11,234.4	-8.9%	10,235.1
		Geothermal	18,354.3	7.3%	19,687.0	-9.1%	17,894.1
		Hydro	729.4	-3.6%	703.5	-9.0%	640.0
		Photovoltaic	10,071.7	10.5%	11,132.4	-8.8%	10,155.6
		Renewable Energy General Consultancy	684.5	5.5%	722.1	-9.5%	653.8
		Wave & Tidal	152.4	12.5%	171.5	-8.9%	156.3
		Wind	29,590.2	23.9%	36,664.3	-9.3%	33,263.6
		Total	210,531.3	7.4%	226,058.5	-9.0%	205,736.4

4 UK's LCEGS Sales Timeseries – 2007/08 to 2025/26

In this section we provide growth forecasts for the next five years, followed by the timeseries from 2007/08 through to 2025/26.

Growth forecasts are performed by the triangulation of forecasts across the sector and within parallel sectors across the chains and networks of supply. As such, forecasts can be cautious in some areas of market and more optimistic in others and by providing forecasts at the sector-level, we can smooth the data.

At the time of writing, the Bank of England are forecasting 7.3% growth across the UK economy during 2021. This growth includes the last 3 months of the 2020/21 financial year. kMatrix measured the LCEGS market on a monthly basis during 2020, which indicated a steady contraction of the market month-on-month between March and November, with a levelling off in December. The market began to recover between January-March 2021 despite further lock-downs as the industry began to recover partly due to changes in the way businesses operated, such as the digitization of the sales process and B2B relations. The Bank of England forecast includes the whole economy and the predicted injection of money from households able to save during the pandemic. The LCEGS sector is unlikely to benefit from the proposed spending spree to same degree as sectors such as hospitality and as such the industry forecasts are less optimistic.

Figure 7 shows the growth forecasts for the LCEGS sector as a whole for the UK. Growth during the financial year 2021/22 is expected to be 3.7%, which is the slowest since 2007/08, which saw growth of 4.6%. Growth is expected to increase year-on-year through the five-year period to 6.7% annual growth.

Figure 7: UK LCEGS Forecast Growth Rates 2021/22 to 2025/26

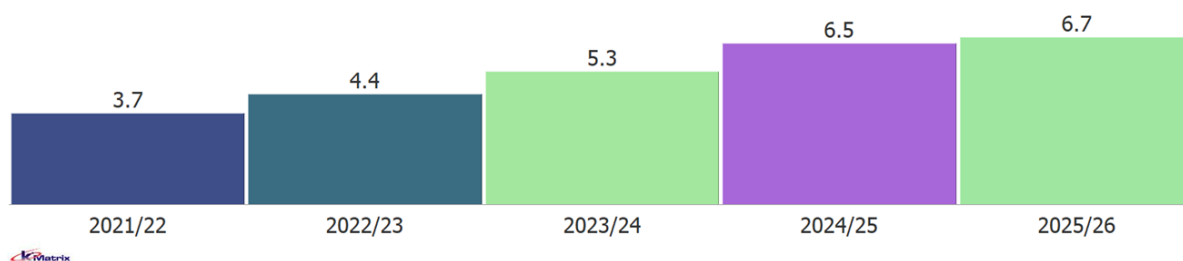


Figure 8 shows the previous annual measurements in £bn between 2007/08 to 2019/20 plotted alongside the current 2020/21 measurement and forecast sales figures through to 2025/26.

Sales increased from £102.6bn in 2007/08 to £226.1bn in 2019/20, with annual growth rates generally between 4.6% and 5.6% for the first six years and between 5.9% and 7.4% from 2013/14 to 2019/20.

2019/20 to 2020/21 saw a -9.0% contraction of the LCEGS sector in the UK, with sales falling from £226.1bn to £205.7bn. This is similar to the ONS UK GDP contraction of 9.9% for 2020.

Growth from 2020/21 through to 2025/26 is expected to see the LCEGS sector grow to £266.5bn over the next five years. Sales are not expected to reach pre-pandemic levels for two years.

Figure 8: UK LCEGS Sector Timeseries 2007/08 to 2025/26 (Sales £bn)

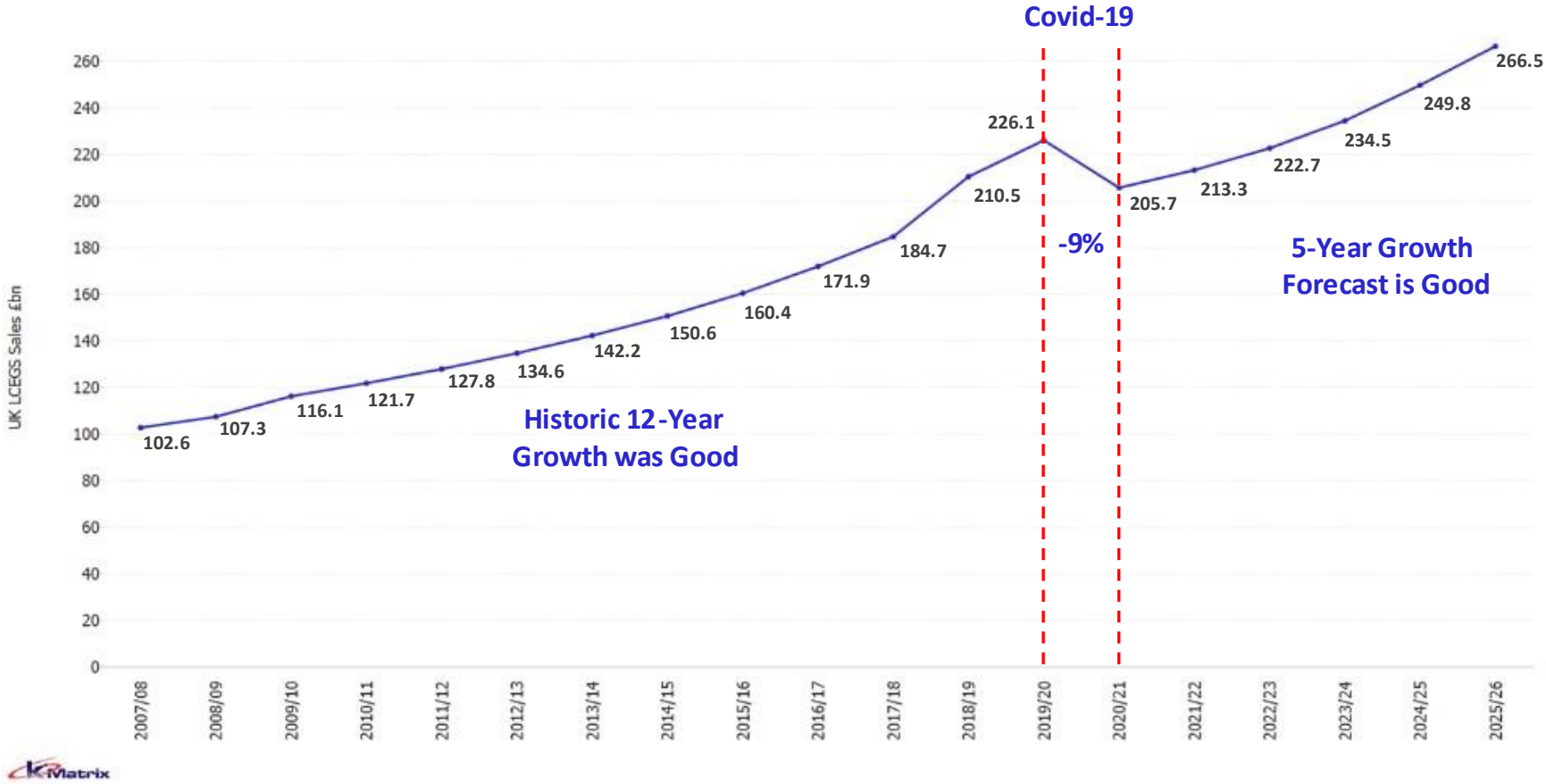


Figure 9: UK LCEGS Forecast Growth Rates 2021/22 to 2025/26 – Level 1

Environmental

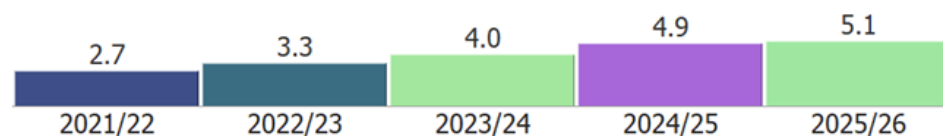
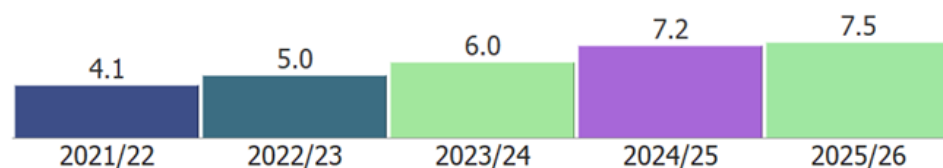


Figure 8 shows the growth forecasts during the financial years 2021/22 to 2025/26 for each Level 1 sub-sector of the LCEGS sector.

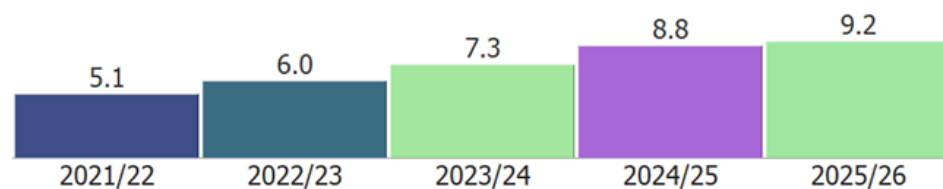
The Environmental sub-sector is expected to see the slowest annual growth of 2.7% rising to 5.1% throughout the forecast period.

Low Carbon



The Low Carbon sub-sector is expected to see stronger growth than the Environmental sub-sector of 4.1% rising to 7.5% throughout the forecast period.

Renewable Energy



The Renewable Energy sub-sector is expected to see the strongest growth, of 5.1% rising to 9.2% throughout the forecast period.

Figure 10: UK LCEGS Forecast Growth Rates 2021/22 to 2025/26 – Environmental Top Level 2 sub-sectors.

Recovery and Recycling

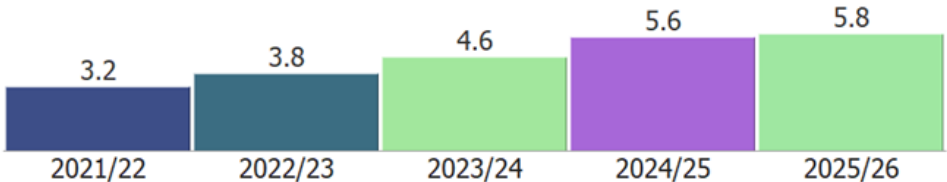
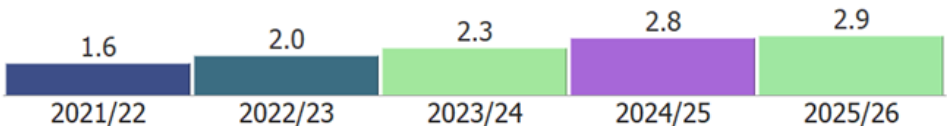


Figure 10 shows the growth forecasts during the financial years 2021/22 to 2025/26 for the top 3 Level 2 sub-sectors of the Environmental Level 1 sub-sector.

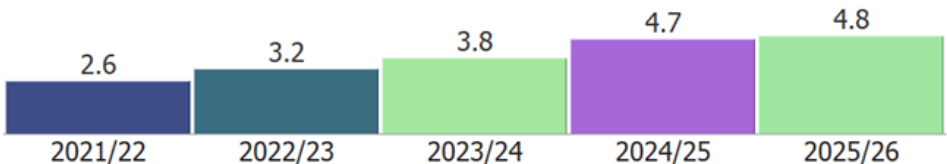
Recovery and Recycling is expected to see the strongest annual growth of 3.2% rising to 5.8% throughout the forecast period.

Water & Waste Water Treatment



Water & Waste Water Treatment is expected to see the slowest annual growth of 1.6% rising to 2.9% throughout the forecast period.

Waste Management



Waste Management is expected to see annual growth of 2.6% rising to 4.8% throughout the forecast period.

Figure 11: UK LCEGS Forecast Growth Rates 2021/22 to 2025/26 – Low Carbon Top Level 2 sub-sectors.

Alternative Fuels

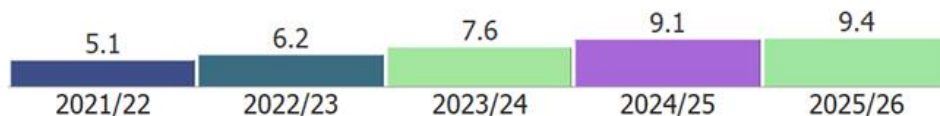
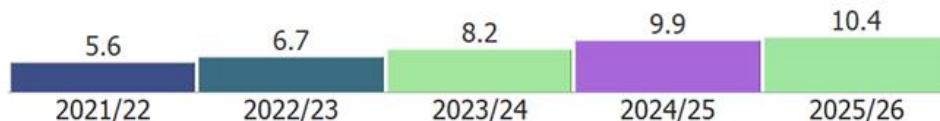


Figure 11 shows the growth forecasts during the financial years 2021/22 to 2025/26 for the top four Level 2 sub-sectors of the Low Carbon Level 1 sub-sector.

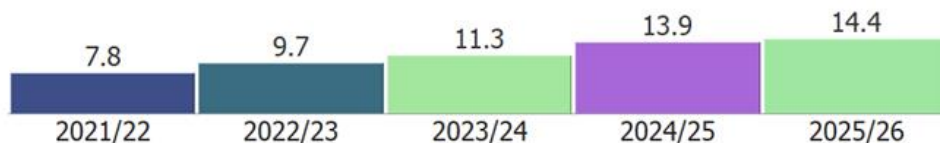
Alternative Fuels is expected to see growth of 5.1% rising to 9.4% throughout the forecast period.

Building Technologies



Building technologies is expected to see annual growth of 5.6% rising to 10.4% throughout the forecast period.

Carbon Finance



Carbon Finance is expected to see the strongest annual growth within the Low Carbon sub-sector of 7.8% rising to 14.4% throughout the forecast period.

Alternative Fuel Vehicle



Alternative Fuel Vehicle is expected to see the slowest annual growth of the top Low Carbon sub-sectors of 4.8% rising to 8.9% throughout the forecast period.

Figure 12: UK LCEGS Forecast Growth Rates 2021/22 to 2025/26 – Renewable Energy Top Level 2 sub-sectors.

Wind

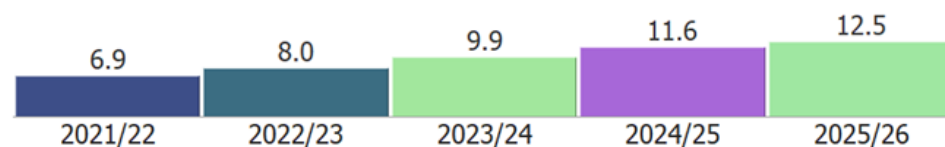
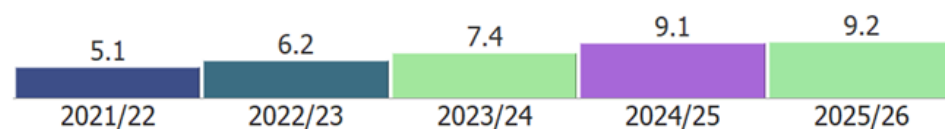


Figure 12 shows the growth forecasts during the financial years 2021/22 to 2025/26 for the top four Level 2 sub-sectors of the Renewable Energy Level 1 sub-sector.

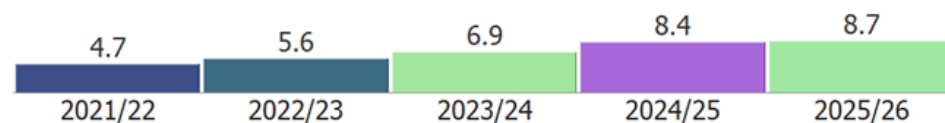
Wind is expected to see the strongest growth of the Renewable Energy Level 1 sub-sector of 6.9% rising to 12.5% throughout the forecast period.

Geothermal



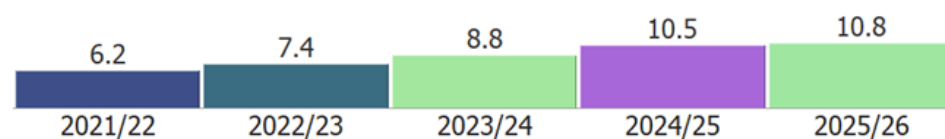
Geothermal is expected to see annual growth of 5.1% rising to 9.2% throughout the forecast period.

Biomass



Biomass is expected to see the slowest annual growth within the Renewable Energy sub-sector of 4.7% rising to 8.7% throughout the forecast period.

Photovoltaic



Photovoltaic is expected to see annual growth of 6.2% rising to 10.8% throughout the forecast period.

Appendix 1

LCEGS Sector Definition

The **Low Carbon and Environmental Goods and Services** (LCEGS) is divided into three Level 1 sub-sectors - Environmental, Renewable Energy and Low Carbon. These are in turn divided into 24 Level 2 sub-sectors:

- The Environmental sub-sector is made up of the following: Air Pollution Control, Contaminated Land Reclamation & Remediation, Environmental Consultancy, Environmental Monitoring, Marine Pollution Control, Noise & Vibration Control, Recovery & Recycling, Waste Management and Water Supply & Waste Water Treatment.
- The Renewable Energy sub-sector is made up of the following: Biomass, Geothermal, Hydro, Photovoltaic, Renewable Energy Consultancy, Wave & Tidal and Wind.
- The Low Carbon sub-sector is made up of the following: Additional Energy Sources, Alternative Fuels & Vehicles, Alternative Fuels, Building Technologies, Carbon Capture & Storage, Carbon Finance, Energy Management and Nuclear Power.

Environmental activities include 9 Level 2 sub-sectors, divided into 47 Level 3 activity groupings:

- Air Pollution includes indoor and industrial air quality and emissions control.
- Contaminated Land Reclamation/Remediation includes Decommissioning of Nuclear Sites.
- 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.

Low Carbon includes 8 Level 2 sub-sectors, divided into 49 Level 3 activity groupings:

- 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.
- Alternative Fuels & Vehicles includes main stream and other vehicle fuels.
- Alternative Fuels includes Main Stream and other Bio Fuels, Batteries and Other Fuels.
- Building Technologies includes Doors, Windows, Monitoring & Control Systems, and Insulation/Heat Retention Materials.

Renewable Energy includes 7 Level 2 sub-sectors, divided into 30 Level 3 activity groupings:

- Wind includes Large Turbines, Small Turbines and Wind Farm Systems.
- Wave & Tidal includes Ebb & Flood, Pumps & Equipment, Turbine & Generation etc.
- Photovoltaic includes Systems & Equipment, Cells and Chemicals.
- Hydro includes Turbines, Pumps, Electricity Supply and Dams.
- Geothermal includes Whole Systems, Specialist Equipment, Consulting and R&D.
- Biomass includes Energy, Furnace, Boilers and Related Systems.
- Renewable Energy consulting includes specialist consulting and legal advice.

Further detail on the Level 2 sub-sectors are provided below in their Level 1 groupings:

Environmental

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.

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.

Renewable Energy

Biomass Energy sub-sector includes all activities that convert biomass into energy but excludes biomass materials (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:

- Manufacture and supply of specialist thermally enhanced equipment - grout, heat pumps, pipes, flow control valves, drilling equipment, installation rigs and ancillary equipment.
- Whole systems manufacture and supply for industrial, residential and community geothermal energy applications.
- Component design and research - design services, component research and component recycling.
- Consulting & related services - architectural, construction, systems design, consulting, engineering, installation and project development services.

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.

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.

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 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 and maintenance of photovoltaic modules, mounting systems, ancillary components, cells and cell materials.
- Other equipment & chemicals - manufacture, supply, installation 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 wind farm systems, large and small wind turbines. The sub-sector is divided by size of turbine rather than location (onshore and offshore) because it is easier to differentiate and map supply chain activities in this way. It includes:

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

Low Carbon

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 includes the production, supply and distribution of Natural Gas (Compressed or Liquefied), Synthetic Fuel and Auto Gas (LPG, LP Gas or Propane).
- Other Fuels and Vehicles includes vehicle technologies and fuel sources that are still at an early stage.
- Research, Design, Development and Prototyping activities are included for: Hydrogen fuel cells and hydrogen internal combustion, Electric, Hybrid Electric, Steam powered, Organic waste fuel, Wood gas, Solar powered and Air, Spring & Wind powered vehicles.

Alternative Fuels sub-sector includes a wide range of Low(er) carbon fuel sources that are not included under Renewable Energy. It includes the manufacture, production, supply and distribution of:

- Batteries - chemicals, chargers, controllers, cables, connectors, containers, suppliers and testing equipment.
- Bio fuels for Vehicles - bio diesel, butanol, ethanol and vegetable oils.
- Mainstream Bio fuel applications (non-transport) - bio diesel, butanol and ethanol.
- Other Bio fuels - biomass, methane, peanut oil, vegetable oil, wood and woodgas.
- Other fuels - Hydrogen.

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 manufacture, supply, distribution, installation and development of double glazed, electro chromatic, insulated alloy, honeycomb and triple glazed units.
- Doors - the manufacture, supply, distribution, installation and development of insulated alloy and plastic doors.
- Insulation and heat retention materials - the manufacture, supply, distribution, installation and development of insulation materials, heat retention surfaces & ceramics, electronic control systems and controlled venting and ducting systems.

- 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:

- 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, supply, distribution and installation of energy saving light bulbs & tubes, lighting and control systems.
- Heating & Ventilation - manufacture, supply, distribution and installation of energy saving equipment and 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.

Appendix 2

The kMatrix Methodology

2.1 Introduction

This sector (until 2015) has not been well documented by government statistics, so 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 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.

2.2 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.

- **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.
- **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.

2.3 kMatrix's Methodology

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.

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 (FAME, Companies House etc), international sources, industry/trade sources, the advertising industry (YELL etc.) 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 a company, for counting purposes, to the activity that accounts 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.

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 Whole Time Equivalents (WTE).

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.

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. Growth is an exception because rates cannot meaningfully be differentiated at a local level, therefore we apply regional growth rates throughout.

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: https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/ukenvironmentalaccounts/2010to2015		