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How big is Britain's *'Green Economy'*?

Ben Pile -- June 2013

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Introduction

Both the Labour Party and the coalition partners have emphasised their desire to champion the green economy while in government and in opposition. The current and previous governments have sought to make the UK a world leader in environmental policy-making by pushing for global and EU-wide agreements. To demonstrate this leadership ahead of negotiations under the United Nations Framework Convention on Climate Change, the UK was the first country to commit to legally-binding 'carbon budgets' under the 2008 Climate Change Act, the terms of which exceed any existing or planned international obligations. However, the strong political consensus on the climate and environment between the three political parties may have allowed policies to be drafted without the scrutiny that such far-reaching interventions deserve. Similarly, evidence concerning the need, effectiveness and consequences of such policies provided to policymakers may have escaped a proper evaluation by independent and disinterested parties.

Advocates of climate and energy policies have argued that, rather than being a cost, tackling climate change will create net benefits. Following the Climate Change Act, in early 2009 the then Labour government announced a new industrial strategy - a 'Green New Deal' -- that would create 400,000 jobs. Speaking about the 'inevitable' response to the 'environmental and economic imperative' to create a low carbon economy, Peter Mandelson announced at a Low Carbon Industrial Strategy Summit held that year that *'The huge industrial revolution that is unfolding in converting our economy to low carbon is going to present huge business and employment opportunities*'. The following year, the General election produced a Conservative-Liberal Democrat coalition, which promised to be the 'greenest government ever'. The previous government's 'Green New Deal' was replaced by the coalition's 'Green Deal', which similarly promised economic recovery through policies intended to drive investment, growth and jobs in the green sector.

However, the job of isolating and estimating the size any sector of the economy is not straightforward. There was no ready and robust definition of what might the green sector might consist of on which to base policy and strategy decisions. In 2007 the Department for Business, Enterprise and Regulatory Reform (BERR) commissioned market intelligence firm, Innovas, to provide it with data about the size of the global and UK 'Low Carbon and Environmental Goods and Services' (LCEGS) market and its prospects for growth. According to Innovas's research, the global LCEGS market was worth $3 trillion, and would grow by 45% over the following eight years. The UK's share of this market in 2007, at 3.5% was worth £107 billion. On the basis of this analysis, NGOs, quangos, and other advocacy and representative organisations argued that Britain should develop strategies for increasing its advantage in this growing global sector. This data, now produced annually in reports compiled by Innovas/K-Matrix, and commissioned by the Department for Business, Innovation and Skills (BIS), continues to show growth in the LCEGS sector, underpinning arguments for the continuing support for the LCEGS sector through a range of policy interventions.

The claim that the LCEGS sectors amounted to approximately 9% of global and 7% of domestic GDP is extraordinary. It seemed to suggest that industry had undergone a radical, spontaneous transformation on a world wide scale in response to concerns about changes in the environment. To put the size of the UK LCEGS market in perspective, the UK's total spend on healthcare is around 9% of GDP.

The fact that this global transformation had taken place spontaneously seemed to make a good argument that the remaining non-LCEGS parts of the economy might be easily transformed through policies. But it ought to have raised more questions about what the research had included in its definition of 'LCEGS'. Although BIS and Innovas claimed that the research was detailed and comprehensive, only the top lines of research were published, omitting any useful detail. When questions were put to Innovas and BIS about what the LCEGS sector consisted of, answers were not forthcoming and FOI requests were refused on the grounds that the data was the intellectual property of Innovas, and more recently, K-Matrix who produced the more recent LCEGS reports.

This decision was challenged after it was discovered that BERR had specified the taxonomy of sectors that Innovas/K-Matrix were to investigate, rather than, as had been claimed in FOI refusals, BIS bought the research 'off the shelf'. Consequently, after a request for BIS to undertake an internal review under FOI rules, the department released the full taxonomy, but continued to withhold the data relating to the size of each sector's market.

This report is a review of that taxonomy, and an attempt to establish whether or not the analyses produced by Innovas/K-Matrix for BERR/BIS have been fit for purpose. Until now, this data has been hidden from public view -- and much remains so. Thus, in spite of current and previous governments' stated commitment to transparent policy-making, the public is being denied the opportunity to see for itself the grounds on which far-reaching and potentially costly policies have been based. Furthermore, independent researchers have been prevented from producing their own analyses of the raw data.

This report provides that information to the public for the first time, and offers comments about the taxonomy used in the LCEGS reports and comparisons with other data in the public domain. Although a comprehensive analysis of the LCEGS reports remains impossible while the data on which they are based remains hidden, there is now sufficient data to suggest that the 'LCEGS' sector does not match any useful definition of 'green', and does not measure an 'emerging' economic sector and thus does not amount to a sound basis for policy-making.

The following analyses has been produced on behalf of Roger Helmer MEP by Ben Pile, an independent political researcher.

The Low Carbon Environmental goods and services reports can be found on the BIS websites:

Low carbon and environmental goods and services (LCEGS): report for 2010/11. (PDF)

Low carbon and environmental goods and services: report for for 2009/10. (PDF)

More information from BIS is available at

http://bis.ecgroup.net/Publications/BusinessSectors/LowCarbonBusinessOpportunities.aspx

Summary

- This report does not aim to estimate the actual size of the green economy, but to evaluate the LCEGS report produced for the Department for Business, Innovation and Skills (BIS) by Innovas/K-Matrix.
- This report is also not intended to offer definitive, accurate estimates of the sectors of the economy measured by the LCEGS report, but to offer evidence that the LCEGS report may be unreliable, and that the full scope of the LCEGS report's research should be published.

- LCEGS reports have been widely cited in arguments for policy, and have been used as the basis of strategic planning and other decisions.
- The limited release of data relating to the LCEGS sector has denied the public the opportunity to examine the basis for many far-reaching and costly policies.
- BIS should release the full database into the public domain to allow proper scrutiny of the LCEGS report and for other analyses of the LCEGS sector data to be formed, and to widen the discussion on environmental and other policies.

- The LCEGS taxonomy consists of categories of market sectors which are too broad, leading to a substantial over-estimate of the LCEGS sector, or 'green economy'.
- A number of LCEGS categories encompass markets that do not qualify as 'low carbon', 'renewables' or 'environmental', such as the markets for certain fossil fuels.
- A number of LCEGS categories include markets that have been established for decades or longer, giving a misleading picture of the size of the scale of the LCEGS sector, its growth, and its potential.
- In many cases the LCEGS report's estimate of certain markets cannot be sustained when compared to other data in the public domain.

- The LCEGS report estimates the green economy to be worth approximately £122 billion.
- By examining the LCEGS taxonomy and excluding some markets wrongly included in the LCEGS sector, and by comparing the LCEGS market data, a much lower estimate of the LCEGS sector was produced: £27.9 billion.
- When the costs of other green policies such as taxes and subsidies are taken into account, a further estimate of the LCEGS sector is produced, which is lower again: £16.76 billion.
- **The LCEGS report may have exaggerated the size of the green economy by between £93 billion and £104 billion.**

Impacts of the LCEGS report

The Low Carbon Environmental Goods and Services (LCEGS) report is produced annually by Innovas/K-Matrix for the Department of Business, Innovation and Skills (BIS) (and previously BERR). It is widely cited in arguments for climate, energy and industrial policies. The data in the report has informed government policy and analysis. For example:

> Joan Ruddock: *The definition of green jobs used in the Government's UK Low Carbon Industrial Strategy is based on an analysis of the Low Carbon and Environmental Goods and Services (LCEGS) sector*. (Hansard)

The LCEGS reports have implications for international, national, regional and local policy. Following the UK government's lead, the report's authors, Innovas/Kmatrix have been commissioned by other regional and local governments to produce reports on the LCEGS sector in Scotland, London, Manchester, and Sheffield. Outside of government, civil society organisations, such as the CBI and The Renewable Energy Association, and TUC have used the LCEGS research directly.

The impact this has had on UK policy is impossible to estimate. Nonetheless, the fact that the LCEGS reports -- which are not produced transparently, and are not subject to peer-review -- have had a significant impact on UK policy is indubitable. Shortly after the publication of the 2009 LCEGS report, senior members of the then Labour Government outlined their vision for a greener economy at a launch of their Low Carbon Industrial Strategy that drew heavily on the 2009 LCEGS report. They, and politicians since, have claimed that a green economy will not only transform productive activity UK, it would end the economic downturn, abolish unemployment, and even inject a sense of meaning, future and 'purpose' into public life.

Peter Mandelson: *This transition to low carbon is an environmental and an economic imperative and opportunity for us. It is also inevitable. There is no high carbon future for us. The huge industrial revolution that is unfolding in converting our economy to low carbon is going to present huge business and employment opportunities as well as enabling us to meet our climate change targets and reduce our energy consumption.*

Ed Miliband: *There's been a huge growth in the green sector and it's already a three-trillion dollar worldwide industry set to grow by 15 per cent. The question isn't is that industry going to happen -- it is going to happen. The question is can Britain take advantage of that. That's what our strategy is designed to do. It covers a whole range of areas from waste to recycling to renewables... to a whole range of sectors. Increasing numbers of people are going to be working in these areas and we want Britain to be a world leader.*

Gordon Brown: *So let us set a challenge to our scientists -- to lead the world in this great human endeavour to create a clean environment for future generations. Let us each set a challenge to business to compete, to lead the world in the new low carbon products. Let us set a challenge to our planners to build homes and buildings and businesses and then eco-towns and eco-cities around the vision of a low carbon environment. And let us set a challenge to our schools. Let us teach young people -- inspire them -- that a low carbon future is not only the best future we can have, but the best future they can have as young people too. And let me tell you our low carbon future, to create the low carbon economy we need, is now a national endeavour that gives us purpose for years to come.*

Cutting our carbon would help UK business - Lord Alan Sugar - Financial Times. June 2 2013.

> Back in 2010, when I first raised the importance of the renewable sector to the UK economy in the House of Lords, we were one of the biggest investors in this £3.3tn global market – so it is regrettable that Britain is falling behind in terms of technology, investment and attracting business. The industry, worth £122bn a year to the UK, was a growing sector in 2010-11, employing just under 1m people.

UK green economy grew £5.4bn in 2011 - Will Nichols - The Guardian. 25 May 2012

> Record growth over the last year pushed the UK green goods and services market past the £122bn mark, according to new government figures that reveal the low carbon economy now employs almost one million people.

Scotland Low Carbon and Environmental Goods and Services: Sector Study **-** March 16 2011

> The Low Carbon and Environmental Goods and Services: Sector Study for Scotland is an integral part of the Low Carbon Economic Strategy evidence base. The intention of this study is to provide an in depth analysis of the Low Carbon and Environmental Goods and Services (LCEGS) sector in Scotland and relate it to the global markets in which it operates.

Green Deal is a massive economic opportunity - Chris Huhne - November 2 2010

> From electric vehicles to energy management, the global low-carbon and environmental goods and services sector is a £3.2 trillion market. It is forecast to reach £4 trillion before this Parliament dissolves. Last year, our share of that market was worth £112 billion. 900,000 people are employed in the low-carbon sector and its supply chain; by 2015, there will be at least a million. That's a workforce – and a budget – to rival the NHS.

BERR broadens research on EGS to cover low-carbon sector -Environment Analyst - 10 March 2009

> A major market intelligence report produced for the Business Department by business consultancy Innovas shows how the Government now sees the environmental goods and services sector as part of the more important low-carbon economy. Reflecting the change, BERR has restructured its sector support services by creating a new low carbon business opportunities unit that also encompasses its policy areas on corporate responsibility, sustainable development and waste.

Building low carbon Britain - DECC Press Release - 6 March 2009

> Gordon Brown, Peter Mandelson and Ed Miliband were meeting business leaders at a Low Carbon Industrial Summit in London to map out the UK's industrial priorities for taking advantage of the new global low carbon economy - currently estimated to be worth £3 trillion globally and employing over 880,000 people in the UK.

Method

The LCEGS reports produced by Innovas/K-Matrix for BIS aims to estimate the size of the parts of the economy that involve 'Low Carbon and Environmental Goods and Services'. In 2010-11, this sector was estimated to have been worth £122 billion of sales.

This estimate has been hard to corroborate. The LCEGS reports do not contain sufficient data to reproduce the research. However, the taxonomy used to establish size of the LCEGS sector has now been released under Freedom of Information rules, allowing a deeper interrogation of the LCEGS reports than was previously possible.

The taxonomy is a hierarchical list of 3200 market activities that comprise the LCEGS sector. Within the list there are 5 levels of hierarchy. At the top level of the hierarchy there are three main categories: Renewables, Low Carbon and Environmental. Each of these categories divides into further categories over the subsequent levels.

This taxonomy provides the structure of a database, which contains market data for each sector: the value of sales, the number of companies and the number of employees. This data is then published in the annual LCEGS reports. For example The following table shows the data published in the LCEGS report, showing market sizes for Level 2 categories.

Level 1	Level 2	Sales £m 2008/09	Sales £m 2009/10	Sales £m 2010/11
Environmental	Air Pollution	978	997	1,018
	Contaminated Land	939	963	990
	Environmental Consultancy	770	794	821
	Environmental Monitoring	155	160	166
	Marine Pollution Control	124	129	133
	Noise & Vibration Control	212	220	229
	Recovery and Recycling	6,724	6,936	7,174
	Waste Management	4,946	5,071	5,210
	Water Supply and Waste Water Treatment	8,101	8,230	8,373
Low Carbon	Additional Energy Sources	1,251	1,297	1,347
	Alternative Fuel Vehicle	13,113	12,915	13,430
	Alternative Fuels	15,678	17,176	18,107
	Nuclear Power	3,727	3,798	3,873
	Building Technologies	13,526	14,129	14,794
	Carbon Capture & Storage	483	497	515
	Carbon Finance	5,640	5,925	6,319
	Energy Management	2,634	2,718	2,812
Renewables	Biomass	5,216	5,454	5,728
	Geothermal	9,722	10,186	10,701
	Hydro	516	529	544
	Photovoltaic	4,721	4,997	5,315
	Renew able consulting	492	505	520
	Wave & Tidal	78	82	86
	Wind	12,258	13,070	14,017
	Total	**112,004**	**116,780**	**122,222**

The LCEGS reports only publish complete data for the top two levels of the LCEGS taxonomy. This creates a problem for anyone trying to understand what the LCEGS sector consists of, or to understand what the basis for UK energy, climate and industrial policy is. With detail hidden from view in levels 3, 4 and 5, the LCEGS sector may not be as equivalent to the 'green economy', nor as representative of an emerging sector as many commentators have been led to believe. Moreover, by encompassing more of the productive economy within the definition of LCEGS than is warranted, the LCEGS reports may have provided misleading data to policy makers making decisions about the UK's economic future.

The release of the taxonomy allows interrogation of the claims made in the LCEGS reports in three important ways:

- It is now possible to see what is included in the 'LCEGS' sector, to see if it is equivalent to the everyday understanding of the 'green economy'.
- The taxonomy allows us to see which part of the LCEGS are emergent, and which are established.
- Market data from other sources can be used to compare with estimates in the LCEGS report.

In the following analysis, a search through the taxonomy at levels 2 and 3 reveals a number of categories or market activities which should not included as belonging to LCEGS sector, given a sensible definition of that sector. In each case that a category is excluded from the LCEGS sector, an argument is offered as to why it does not agree with reasonable understanding of 'LCEGS' or 'emerging' .

Next, a comparison is made between market data in the LCEGS reports with data gathered from other data sources. The LCEGS reports contain limited information about 29 level 3 categories and their market, each representing over £1 billion worth of sales. These 29 categories amount to nearly 83 per cent of the LCEGS sector. However, when an attempt is made to corroborate this market data with other official reports, it can be shown that the LCEGS report overestimates the size of these sectors.

Using a more sensible definition of the LCEGS sector and with other available data, a more realistic estimate of the size of the LCEGS sector is then made. This estimate is then considered against the arguments made by policymakers and advocacy organisations in favour of policies to support the LCEGS sector.

Finally, some argument is offered to suggest that much of the volume of trade counted as LCEGS is neither spontaneous, nor representative of economic growth or development, but may in fact be a transfer from other parts of the economy, or worse, represent a net cost to the economy.

Level 1 of the LCEGS taxonomy

The top level of the LCEGS taxonomy consists of three sectors: Environmental, Low Carbon, and Renewables. In this section, each of these three sectors is considered in turn.

Level 1	Level 1 2010-11 total £m
Environmental	24,114
Low Carbon	61,197
Renewables	36,911
TOTAL	122,222

Renewables

The following table expands on the 'Renewables' sector -- worth £36.9 billion in 2010-11.

Level 1	Level 2	Sales £m 2010/11
Renewables	Biomass	5,728
	Geothermal	10,701
	Hydro	544
	Photovoltaic	5,315
	Renewable consulting	520
	Wave & Tidal	86
	Wind	14,017
	Total	**36,911**

This figure is extremely large. By contrast, and to put this figure into perspective, the UK Digest of Energy Statistics (DUKES) produced by DECC advises that the entire UK electricity market in 2010 was worth £29.8 billion[1]. Yet the contribution of renewable energy sources to this market was just 6.8%[2]. This considerable disparity needs explaining. Although sales of electricity cannot be compared to investment in productive capacity, such investment cannot exceed the value of the end product's retail market indefinitely.

A further question mark over this definition of the Renewables sector emerges when the data from the LCEGS report is considered next to data provided in a report published by the Renewable Energy Association, the data from which was also provided by Innovas/K-Matrix.

[1] DUKES 2012: Annual Tables - Sales of electricity and gas by sector (DUKES 1.7) - https://www.gov.uk/government/statistical-data-sets/dukes-2012-annual-tables

[2] DUKES 2012 - Chapter 5 - Electricity - Page 21. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65818/5955-dukes-2012-chapter-5-electricity.pdf

Data from the Renewable Energy Association's *Renewable Energy: Made in Britain Report 2010-11* is tabled below:

Sector	Employment across supply chain	companies across supply chain	Sector turnover (£m)	Total value global market (£m)	export value (£)	Notes
Onshore wind	15,200	730	2,000	130,000	500	
Offshore wind	16,200	790	2,100			
Solar PV	15,650	2,200	1,800	28,000	315	
Hydro	4,970	260	544	13,700	57	(power)
Wave & tidal	800	33	86	2,100	8	
Anaerobic digestion – biogas	2,650	140	320	8,800	28	(power, renewable fuel for transport, green gas (biomethane) injection, combined heat and power)
Mixed waste-to-energy technologies	6,020	330	786	23,000	99	(combustion, pyrolysis, gasification, landfill gas for CHP, heat and power)
Heat pumps	7,320	380	935	23,400	69	(air, water and ground source heat)
Biomass CHP	21,090	140	331	9,300	45	(heat and power)
Solar Thermal	7,550	340	830	28,000	215	(heat)
Deep geothermal	200	25	10	3,000	1	(heat and power)
Biomass power	3,300	170	450	18,100	86	
Solid biomass fuels	8,940	520	1,200	34,000	90	
Liquid biofuels	3,500	200	485	15,400	25	(transport)
Wood-fuel boilers and stoves	4,350	210	540	11,900	57	(heat)
TOTAL	117,740	6,468	12,417	348,700	1,095	

The Renewable Energy Association, from the same data, appeared to estimate that the entire renewable sector to be worth just £12.4 billion -- some £25.5 billion less. Putting the sectors from the LCEGS and REA reports next to each other reveals an even greater difference:

LCEGS REPORT 2010-11			REA report 2010-11	
Level 1	**Level 2**	**Sales £m 2010/11**	**Sector**	**"UK sector turnover" £m**
Renewables	Biomass	5,728	Biomass CHP	331
			Biomass power	450
			Solid biomass fuels	1,200
	Geothermal	10,701	Heat Pumps	935
			Deep Geothermal	10
	Hydro	544	Hydro	544
	Photovoltaic	5,315	Solar PV	1,800
	Renewable consulting	520	>>>>>	520
	Wave & Tidal	86	Wave & Tital	86
	Wind	14,017	Onshore Wind	2,000
			Offshore Wind	2,100
	Total	**36,911**		**9,976**

It may have been Innovas/K-Matrix's intention to capture a greater part of the Renewables supply chain for the LCEGS report than is covered in the REA report. However, this cannot account for such a huge difference.

More could be done here to evaluate the claims made in the REA report. However, the intention here is simply to demonstrate that the figures claimed in the LCEGS report, and the basis on which they are made should be in the public domain if they are to inform a debate with consequences for public policy. A near four-fold exaggeration of this sector's value between the two reports -- which are based on the same data -- are sufficient to make this argument.

Environmental

The following table expands on the 'Environmental' sector -- worth £36.9 billion in 2010-11.

Level 1	Level 2	Sales £m 2010/11
Environmental	Air Pollution	1,018
	Contaminated Land	990
	Environmental Consultancy	821
	Environmental Monitoring	166
	Marine Pollution Control	133
	Noise & Vibration Control	229
	Recovery and Recycling	7,174
	Waste Management	5,210
	Water Supply & Waste Water Treatment	8,373
	Total	**24,114**

Of the level 2 categories in this sector, three are problematic: 'Water Supply & Waste Water Treatment', 'Waste Management' and 'Recovery and Recycling'. These figures are also implausibly large.

Water Supply & Waste Water Treatment

The supply, treatment and disposal of water is not by any measure a 'green' activity, even if utilities companies are obliged to adhere to environmental standards. The supply of water to domestic and industrial consumers is no more an 'environmental' product than is the sale of petrol on a petrol station forecourt. The disposal of waste water has more obvious consequences for the environment, but the processing of sewage before its disposal is a practice that was observed long before the contemporary understandings of the 'environment' has been turned into policy. This category is irredeemably broad -- too broad to be useful. For instance, under the 'Water Supply & Waste Water Treatment' sector are further sectors such as 'Engineering > Fabrication and Welding Services for the Water Industry> General Fabrication and welding Services in the Field' and ' Engineering > Field Engineering Maintenance Pipes & Valves > Refurbishment of Main Valves', which cannot be included in the LCEGS sector without expanding it beyond meaning. Why is welding in the water sector 'green', but not welding in, say, the oil industry?

Evidence that the LCEGS report has over-stated the LCEGS part of the 'Water Supply & Waste Water Treatment' sector can be found by comparing these figures to data relating to the UK water market. According to water regulator, OFWAT, water company turnover in England and Wales in 2010 was £10 billion[3].

Even if we were to give the benefit of the doubt to the claim that this sector was sufficiently 'green' to be included in the LCEGS sector, the supply and treatment of water in the UK is not an emerging market, as is implied by the LCEGS report. It is therefore excluded from the analysis.

[3] OFWAT - Water companies in England and Wales: financial summary 2010-11 - Turnover by company - http://www.ofwat.gov.uk/regulating/reporting/rpt_fsum2010-11

Waste Management

'Waste Management' is another level 2 category under the 'Environmental' sector which implies a special, green sector within a broader waste management sector. However, this is not the case. Investigation of the subsequent hierarchy reveals that the sector includes such activities as the construction and operation of landfill sites and the construction of incinerators.

In what respects are these activities 'environmental'? On any reasonable perspective, burning waste or burying it in landfill is no more 'green' or an environmental service than is pumping pollution into a river. For these reasons, and because this is not an emerging sector and this sector has too broad a definition to be useful, it too has been excluded from the final estimate.

Recovery and Recycling

The reclamation of waste materials with economic value existed long before it was ever justified on the basis of it being good for the environment. Moreover, questions about the actual good done by recycling of materials -- especially post-consumer recycling -- have not been resolved. Creating policy imperatives to recycle more materials may end up having other negative effects on the environment, such as increasing energy use in collection, for example. Similarly, the growth in this sector may well have been driven by policies such as the EU Landfill Directive, rather than by technological change or consumer demand.

It is not enough to say that the Recovery and Recycling sectors belong in the LCEGS sector simply because the concepts seem at face-value to be 'green', or otherwise have consequences for the environment. More work is needed to justify the inclusion of this sector than has been done in the LCEGS report. Therefore this sector has also been excluded from the final estimate.

The Remaining 'Environmental' Categories

The remaining sectors in the Environment Sector -- Air Pollution, Contaminated Land, Environmental Consultancy, Environmental Monitoring, Marine Pollution Control, Noise & Vibration Control -- are far more specific than the three excluded categories. Moreover, they more closely resemble an everyday understanding of what the LCEGS sector would consists of. Therefore, they remain included in the analysis, though no market data could be found to establish the size of these markets.

Low Carbon

The 'Low Carbon' category is the largest of the three level 1 LCEGS categories. It is worth £61.2 billion according to the report.

Level 1	Level 2	Sales £m 2010/11
Low Carbon	Alternative Fuels	18,107
	Building Technologies	14,794
	Alternative Fuel Vehicle	13,430
	Carbon Finance	6,319
	Nuclear Power	3,873
	Energy Management	2,812
	Additional Energy Sources	1,347
	Carbon Capture & Storage	515
	Total	**61,197**

As well as being the largest sector, 'Low Carbon' is also the most encompassing, ranging from fuels, through finance and construction sectors. It also suffers from being the most opaque of the three level 1 categories, with much detail being revealed by an inspection of the level 3 categories.

This inspection of the level 3 categories under the 'Low Carbon' sector is helped by the limited level 3 market data of sectors worth more than £1bn published in the LCEGS report.

Rank	Level 1	Level 2	Level 3	Sales £m	% Total
1	Low Carbon	Alternative Fuels	Other Bio Fuels	12,889	10.5
2	Low Carbon	Alternative Fuel Vehicle	Alternative Fuels (main Stream) for Vehicles Only	11,697	9.6
3	Environmental	Water Supply and Waste Water	Water Treatment and Distribution	5,957	4.9
4	Renewables	Wind	Wind Farm Systems	5,681	4.6
5	Low Carbon	Building Technologies	Windows	5,428	4.4
6	Low Carbon	Carbon Finance	Carbon Credits Trading	4,925	4
7	Low Carbon	Building Technologies	Insulation and Heat Retention Materials	4,445	3.6
8	Renewables	Wind	Large Wind Turbine	4,403	3.6
9	Renewables	Geothermal	Whole Systems Manufacture	4,280	3.5
10	Renewables	Wind	Small Wind Turbine	3,933	3.2
11	Low Carbon	Building Technologies	Doors	3,345	2.7
12	Environmental	Recovery and Recycling	Waste Collection	2,782	2.3
13	Renewables	Biomass	Biomass Energy Systems	2,370	1.9
14	Renewables	Geothermal	Suppliers of Systems	2,368	1.9
15	Renewables	Geothermal	Manuf acture and Supply of Specialist Equipment	2,270	1.9
16	Renewables	Photovoltaic	Systems & Equipment	2,361	1.9
17	Low Carbon	Alternative Fuels	Other Fuels	2,179	1.8
18	Environmental	Waste Management	Construction & Operation of Waste Treatment Facilities	2,141	1.8
19	Environmental	Water Supply and Waste Water	Engineering	2,172	1.8
20	Low Carbon	Alternative Fuels	Main Stream Bio Fuels	1,998	1.6
21	Renewables	Biomass	Boilers and related Systems	1,843	1.5
22	Low Carbon	Alternative Fuel Vehicle	Other Fuels and Vehicles	1,734	1.4
23	Environmental	Waste Management	Equipment For Waste Treatment	1,748	1.4
24	Low Carbon	Building Technologies	Monitoring and Control Systems	1,576	1.3
25	Renewables	Geothermal	Consulting & Related Services	1,646	1.3
26	Low Carbon	Nuclear Power	Nuclear Power Plant Operations	1,523	1.2
27	Renewables	Photovoltaic	Photovoltaic Cells	1,390	1.1
28	Renewables	Photovoltaic	Other Related Equipment and Chemicals	1,252	1
29	Environmental	Recovery and Recycling	Glass Stock Processing	1,070	0.9
			TOTAL:	101,406	82.6

Of 141 level 3 sectors in the LCEGS database, just 29 comprise 82.6%, or £101.4 billion of the £121 billion total. However, the problem of opacity in level 2 categories persists in level 3. A closer examination of each level 2 category in the 'Low Carbon' sector now follows.

Alternative Fuels

The 'Alternative Fuels' sector is the largest level 2 sector in the LCEGS report. At £18.2 billion It consists of the following level 3 sectors.

Level 1	Level 2	Level 3	Sales (£m)
Low Carbon	Alternative Fuels	Bio Fuels Alternative for Vehicles Only	--
		Main Stream Bio Fuels	1,998
		Other Bio Fuels	12,889
		Other Fuels	2,179
		Batteries	--
		TOTAL	17066

Market data for the level 3 categories for the 'Batteries' and 'Bio Fuels Alternative for Vehicles Only' sectors are not published in the LCEGS report, because these sectors achieve sales of less than £1 billion. These level 3 categories are explored in more depth in the following sections.

Low Carbon -> Alternative Fuels -> Other Bio Fuels

The 'Other Bio Fuels' sector is the largest level 3 sector. At £12.9 billion it represents more than 10% of the entire LCEGS sector. The following table shows the contents of this sector to level 5, with market data obtained from DUKES[4].

Level 1	Level 2	Level 3	Level 4	Level 5	Volume 2010 (toe)
Low Carbon	Alternative Fuels	Other Bio Fuels	Methane	Production of Methane For Fuel Distribution of Methane for Fuel Supply of Methane for Fuel	1,945,000
			Wood	Production of Wood For Fuel Distribution of Wood for Fuel Supply of Wood for Fuel	682,000
			Wood Gas	Production of Wood Gas For Fuel Distribution of Wood Gas for Fuel Supply of Wood Gas for Fuel	NO DATA
			Vegetable Oil	Production of Vegetable Oil For Fuel Distribution of Vegetable Oil for Fuel Supply of Vegetable Oil for Fuel	NO DATA
			Biomass	Production of Biomass For Fuel Distribution of Biomass for Fuel Supply of Biomass for Fuel	1,772,000
			Peanut Oil	Production of Peanut Oil For Fuel Distribution of Peanut Oil for Fuel Supply of Peanut Oil for Fuel	NO DATA

If the sales of methane, wood, wood gas, vegetable oil, biomass and peanut oil are as substantial as the LCEGS report claims, this would be remarkable. In energy terms, it is equivalent to nearly half of the UK's energy consumption. Thus further investigation is required.

No data were found for 3 of the 6 level 4 categories under Low Cabon > Alternative Fuels > Other Bio Fuels. However, wood gas, vegatable oil and peanut oil for fuel are assumed here to be very small markets, and so their omission will not be significant. DECC/DUKES report on production and consumption of methane, wood and Biomass in Tonnes of Oil Equivalent (ToE), though does not produce sales data. An estimate of the value of the sales in these sectors has been produced by assuming a price for each fuel equivalent to oil. This gives the following result.

[4] DECC - Digest of UK Energy Statistics 2012. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65850/5956-dukes-2012-chapter-6-renewable.pdf

Level 4	Volume 2010 (toe)		Production	Imports	Exports	Total	Production (Boe)	$	£
Methane	1,945,000	**Landfill gas**	1,658,000	0	0	1,658,000	11,606,000	1,160,600,000	754,390,000
		Sewage gas	287,000	0	0	287,000	2,009,000	200,900,000	130,585,000
Wood	682,000	**Wood waste**	253,000	48,000	45,000	301,000	1,771,000	177,100,000	115,115,000
		Wood	429	1,000	38,000	1,429	3,003	300,300	195,195
Biomass	1,772,000	**Farm waste etc**	304,000	0	0	304,000	2,128,000	212,800,000	138,320,000
		Straw/SRC/Other	585,000	883,000	24,000	1,468,000	4,095,000	409,500,000	266,175,000
								TOTAL:	**1,404,780,195**

The table above makes the following assumptions:

- Production (Boe) is toe multiplied by 7 -- 1 metric tonne of oil = 7 barrels.
- $ value is determined to be $100/barrel
- £ is calculated at approximately today's exchange rate of GB£0.65 to US$1

The result of this estimate is that this sector is worth just £1.4 billion -- £11.5 billion less than the LCEGS report claims. The LCEGS claim of £12.9 billion sales of these fuels seems highly implausible.

Low Carbon -> Alternative Fuels -> Other Fuels

The 'Low Carbon -> Alternative Fuels -> Other Fuels' sector consists of the production, distribution and supply of just one commodity: hydrogen. DUKES does not report on the volumes of trade in hydrogen, and, notwithstanding some venture projects it is not a widely used transport fuel.

The LCEGS report's claim that the hydrogen for fuel market is worth nearly £2.2 billion seems implausible in the context of market data concerning other sources of energy. Moreover, hydrogen is produced either by fossil fuel extraction processes, or by electrolysis, requiring electricity, which in turn requires fossil fuel or renewable generation sources. The renewable energy infrastructure required to produce sufficient hydrogen to be worth £2.2 billion would be substantial. Therefore, this sector has been excluded from the final estimate.

Low Carbon -> Alternative Fuels -> Mainstream Bio Fuels

The 'Low Carbon -> Alternative Fuels -> Mainstream Bio Fuels' sector is worth slightly under £2 billion, according to the LCEGS report.

Level 1	Level 2	Level 3	Level 4	Level 5
Low Carbon	Alternative Fuels	Main Stream Bio Fuels	Bio Diesel	Production of Bio Diesel
				Supply of Bio Diesel
				Distribution of Bio Diesel
			Ethanol	Production of Ethanol
				Supply of Ethanol
				Distribution of Ethanol
			Butanol	Production of Butanol
				Supply of Butanol
				Distribution of Butanol

HMRC report that 962 million litres of biodiesel and 612 litres of bioethanol were sold in 2010 [5]. Neither the HMRC nor DUKES report on sales volumes of butanol. It assumed therefore that the volume is very low, and therefore not considered by this report. Assuming an equivalence of after-tax prices bioethanol with petrol (approx 124.3p/litre), and biodiesel with diesel (approx 127.9p/litre), this amounts to £1,978 million -- which is very close to the LCEG report's figure of £1,998 million. However, a substantial part of this is tax. The figure of £1.98 billion is used by the final estimate.

Low Carbon -> Alternative Fuels -> Bio Fuels Alternative for Vehicles Only

No market data is given for the ' Low Carbon -> Alternative Fuels -> Bio Fuels Alternative for Vehicles Only' sector. However, it contains the following categories:

Level 1	Level 2	Level 3	Level 4	Level 5
Low Carbon	Alternative Fuels	Bio Fuels Alternative for Vehicles Only	Butanol - as a direct replacement for Gasoline	Production of Butanol - as a direct replacement for Gasoline Supply of Butanol - as a direct replacement for Gasoline Distribution of Butanol - as a direct replacement for Gasoline
			E85 - 15% Gasoline, 85% Ethanol blend	Production of E85 - 15% Gasoline, 85% Ethanol blend Supply of E85 - 15% Gasoline, 85% Ethanol blend Distribution of E85 - 15% Gasoline, 85% Ethanol blend
			P-series Fuels (can be used in any E85 compatible car)	Production of P-series Fuels (can be used in any E85 compatible car) Supply of P-series Fuels (can be used in any E85 compatible car) Distribution of P-series Fuels (can be used in any E85 compatible car
			Hempseed Oil Fuel or other Straight Vegetable Oils	Production of Hempseed oil Fuel or other Straight Vegetable oils Supply of Hempseed oil Fuel or other Straight Vegetable oils Distribution of Hempseed oil Fuel or other Straight Vegetable oils
			Bio Diesel	Production of Bio Diesel Supply of Bio Diesel Distribution of Bio Diesel

There is clearly some overlap with the 'Low Carbon -> Alternative Fuels -> Mainstream Bio Fuels' sector, and any remaining differences will be small. This sector has therefore been excluded from the final estimate.

Low Carbon -> Alternative Fuels -> Batteries

This category concerns the research and development, manufacture, supply and distribution of batteries, battery cables, connectors, chargers, charge controllers, chemicals and testing equipment.

A search through the LCEGS database also reveals the somewhat spurious categories of "Low Carbon -> Alternative Fuels -> Batteries -> Battery Suppliers -> Manufacture of Battery Suppliers", "Low Carbon -> Alternative Fuels ->Batteries -> Battery Suppliers -> Supply of Battery Suppliers" and "Low Carbon -> Alternative Fuels ->Batteries -> Battery Suppliers -> Distribution of Battery Suppliers". It is assumed that this is a error in the database design.

The 'Alternative Fuels -> Batteries' sector has been left out of the final estimate on the basis that the battery sector is not new, is too broad for a reasonable definition of 'green', and even where a case may be made that batteries are a truly 'low carbon' fuel, it is not clear what this case would be.

[5] HMRC Hydrocarbon Oils Bulletin - April 2013 - https://www.uktradeinfo.com/Statistics/Tax%20and%20Duty%20Bulletins/Oils0413.xls

Building Technologies

The 'Building Technologies' level 2 sector -- worth £14.8 billion -- includes the following level 3 sectors:

Level 1	Level 2	Level 3	Sales (£m)
Low Carbon	Building Technologies	Windows	5,428
		Doors	3,345
		Insulation and Heat Retention Materials	4,445
		Monitoring and Control Systems	1,576

Inspection of the levels 4 and 5 sectors within each of the 'Low Carbon -> Building Technologies' level 3 sectors reveals that the LCEGS report has taken a far too broad definition to be useful.

Level 1	Level 2	Level 3	Level 4
Low Carbon	Building Technologies	Windows	Electro Chromatic Window Glass
			Double Glazed Units
			Triple Glazed Units
			Advanced Plastic Thermally Insulated Frames (Windows)
			Honeycomb Systems (Windows)
			Insulated Alloy Frames (Windows)
		Doors	Insulated Plastic Doors
			Insulated Plastic Doors
			Insulated Plastic Doors
			Insulated Plastic Doors
			Insulated Plastic Doors
			Insulated Alloy Doors
			Insulated Alloy Doors
			Insulated Alloy Doors
			Insulated Alloy Doors
			Insulated Alloy Doors
		Insulation and Heat Retention Materials	Insulation Materials (Walls)
			Controlled Venting and Ducting
			Heat Retention Ceramics
			Heat Retention Surfaces
			Fibre Insulation Materials (Roofing)
			Granular Insulation Materials
			Electronic Control Systems
		Monitoring and Control Systems	Motorized Valves and Actuators
			Sensing Devices
			Inter Building Electronic Control Systems
			Balanced Inter Building Heating Systems
			Energy Management Software
			Energy Analysis Software
			Energy Monitoring Systems
			Distributed Energy Management Software

Moreover, these technologies -- double gazing, for example -- existed prior to environmental imperatives and policies. Houses have always had doors, windows, walls and roofs, and it has always made sense for these things to offer insulation from the elements, and for homes to be fitted with thermostatically-controlled heating. Meanwhile, although policies that have mandated, supported or promoted the use of insulation and other low carbon or low-emission technologies have created apparent growth in these markets, their net benefit -- i.e. the extent to which they reduce the use of carbon, or reduce energy demands economically -- is questionable[6]. Efficiency for the sake of efficiency may not survive cost-benefit analyses. Therefore this category has been excluded from the final estimate.

[6] European Court of Auditors - Cost-effectiveness of Cohesion Policy Investments in Energy Efficiency - http://eca.europa.eu/portal/pls/portal/docs/1/19610748.PDF

Low Carbon -> Alternative Fuel Vehicle

This level 2 sector amounts to £13.4 Million of sales -- or 11% of the entire LCEGS sector. There are two further level 3 sectors.

Level 1	Level 2	Level 3	Sales (£m)
Low Carbon	Alternative Fuel Vehicle	Alternative Fuels (main Stream) for Vehicles Only	11,697
		Other Fuels and Vehicles	1,734

Low Carbon -> Alternative Fuel Vehicle -> Alternative Fuels (main stream) for Vehicles Only

The 'Low Carbon -> Alternative Fuel Vehicle -> Other Fuels and Vehicles' sector contains the following level 3 sectors.

Level 1	Level 2	Level 3	Level 4	Level 5	Volume 2010 £
Low Carbon	Alternative Fuels	Alternative Fuels (main Stream) for Vehicles Only	Hydrogen Internal-Combustion Car	Production of Hydrogen Internal-Combustion Car Supply of Hydrogen Internal-Combustion Car Distribution of Hydrogen Internal-Combustion Car	NO DATA
			Natural Gas - Compressed or Liquefied	Production of Natural Gas - Compressed or Liquefied Supply of Natural Gas - Compressed or Liquefied Distribution of Natural Gas - Compressed or Liquefied	4,165,264
			Auto Gas (aka LPG, LP Gas, Propane)	Production of Auto Gas (aka LPG, LP Gas, Propane) Supply of Auto Gas (aka LPG, LP Gas, Propane) Distribution of Auto Gas (aka LPG, LP Gas, Propane)	136,766,500
			SynFuel - Synthetic Fuels	Production of SynFuel - Synthetic Fuels Supply of SynFuel - Synthetic Fuels Distribution of SynFuel - Synthetic Fuels	NO DATA

No data was found for the use of hydrogen and SynFuel as transport fuels. It is assumed that these markets are very small, and so these two sectors are excluded from the final estimate.

The volume data for the 'Natural Gas' and 'Auto Gas' sectors was estimated using DECC/DUKES[7] and HMRC[8] reports, per the following table.

Level 4	Volume 2010 £		Production	Other Sources	Imports	Exports	Transport	Transport (litres)	Duty/KG £	Price/ litre £	Duty paid £	£
Natural Gas - Compressed or Liquefied	4,165,264	LNG					3,000		0.2460		738,000	4,165,264
Auto Gas (aka LPG, LP Gas, Propane)	136,766,500	Butane	640,000	336,000	199,000	203,000	0					
		Propane	1,607,000	716,000	162,000	529,000	106,000	210,410,000	0.3151	0.65	33,403,250.00	136,766,500
										TOTAL:		140,931,764

- 1 Kg propane = 1.985 litres
- HMRC data do not list volumes of trade or receipts from LNG and LPG separately, and DUKES does not list LNG as a transport fuel. Table data has been calculated from other data
- Duty on LPG and LNG changed 3 times in the year 2010-11. The rate of VAT also changed. Duty of 0.246 is assumed for LNG, and 0.3151 for LPG
- The price of LNG has been estimated using LPG, multiplied by the ratio of their energy values per KG

[7] DECC - Digest of UK Energy Statistics 2012. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65850/5956-dukes-2012-chapter-6-renewable.pdf

[8] HMRC Hydrocarbon Oils Bulletin - April 2013 - https://www.uktradeinfo.com/Statistics/Tax%20and%20Duty%20Bulletins/Oils0413.xls

This estimates the size of the LPG and LNG markets based on DECC and HMRC data to be just £140,931,764 -- far less than the £11.7 billion claimed in the LCEGS report.

However, even if these sectors were as large as the LCEGS report claimed, they should be excluded from it because LPG and LNG are, on any reasonable definition, fossil fuels. This sector is therefore excluded from the final estimate.

Low Carbon -> Alternative Fuel Vehicle -> Other Fuels and Vehicles

The ' Low Carbon -> Alternative Fuel Vehicle -> Other Fuels and Vehicles' level 3 sector has the following level 4 sectors.

Level 1	Level 2	Level 3	Level 4
Low Carbon	Alternative Fuel Vehicle	Other Fuels and Vehicles	Plug-in Hybrid Electric Vehicle
			Steam Engine Cars (like the Stanley Steamer)
			Coal-Oven Steam Cars
			Organic Waste Fuel
			Wood Gas on-board Gasification
			Solar Cell-Powered or Charged Cars
			Tesla's Electric Car (with Antenna)
			Hydrogen Fuel Cell, Liquefied or Compressed Hydrogen
			MAGLEV - with Induction Drive
			Air Car - working on Compressed Air
			Nuclear Powered
			Rubber Band (stored Energy)
			Spring Power or "wind-up" car (stored elastic Energy)
			Wind-Powered Sail Cars

Although this sector is entirely related to research and development, a number of these technology sectors are somewhat fanciful. Moreover, the benefits of R&D aside, there is no real market for some of these sectors, and there is no way of corroborating the LCEGS report's claims that this sector is worth £1.7 billion. It has therefore been excluded from the final estimate.

Low Carbon -> Carbon Finance

The 'Low Carbon -> Carbon Finance' level 2 sector is worth £6.3 billion according to the LCEGS report. It breaks down into levels 3 and 4 as follows.

Level 1	Level 2	Level 3	Level 4
Low Carbon	Carbon Finance	Carbon Credits Finance & Fund Management	Carbon Credits Finance Houses
			Carbon Credit Funds & Funds Management
		Carbon Credits Trading	Carbon Credits Trading Systems
			Carbon Credits Trading Houses
			Carbon Trading Transactions
		Carbon Market Intelligence & Forecasting	Carbon Markets Analysis and Reporting
			Carbon Trading Forecasting and Reporting
		Carbon Credits Journals and Press Periodicals	Carbon Credits Journals
			Carbon Credits Press and Journalism
		Projects and Verification	Project Verification Services
			Project Development Services

Corroborating data on these sectors was not found. However, it is assumed that data on volumes of carbon credit trading are reliable. However, there is a discussion later in this report about how this sector should be included in the LCEGS report, since carbon credits are not a tangible commodity.

Low Carbon -> Nuclear Power

The 'Low-Carbon -> Nuclear Power' sector is worth £3.9 billion according to the LCEGS report.

This is a surprisingly low figure when considered next to other LCEGS sectors, which are, in terms of energy output, far less productive on a *£-for-£* basis. The wind sector, for example, is valued at £14 Billion. Yet according to DUKES, only produced 2.7% of the UK's electricity in 2010, versus the 16% provided for nuclear at less than a third of the cost. Although the figures given for nuclear and wind LCEGS sectors do not necessarily capture like-for-like markets, this disparity nonetheless suggests that not releasing the full database into the public domain has denied the public the opportunity of such like-for-like analyses that would be possible given the release of the full taxonomy and market data. For instance, a £14 billion annual investment in nuclear would do much more to decarbonise energy production than the same investment in wind.

The level 2 nuclear sector breaks down into level 3 and 4 categories as follows.

Level 1	Level 2	Level 3	Level 4
Low Carbon	Nuclear Power	Nuclear Science Services	Nuclear Science Laboratory Testing Services Nuclear Science Fuel Management Services Nuclear Science Research Services
		Commissioning Engineering Services	Plant Commissioning Engineering Services Reactor Commissioning Engineering Services Engineering Maintenance Services Power Distribution Engineering Services Cooling and Thermal Control Engineering Services Instrumentation Engineering Services
		Construction of Plant & Equipment	Construction of Nuclear Reactors Construction of Power Plants and Equipment Buildings Construction Site Development Services
		Nuclear Safety Engineering Services	Reactor Engineering Management Services Fail to Safety Engineering Services Regulatory Compliance Engineering Services
		Sampling & Testing Services	Remote Monitoring Services Back up Plant Monitoring Services Effluent Discharge Sampling and Testing Services Thermal Control Testing Services
		Nuclear Power Plant Operations	Nuclear Power Plant Management Operations Nuclear Power Plant PR Operations Nuclear Power Plant Engineering Management Operations
		Manufacture of Cooling Equipment for the Nuclear Power Industry	Manufacture of Cooling Equipment Installation of Cooling Equipment Maintenance of Cooling Equipment

However, the LCEGS 'Low Carbon -> Nuclear Power' sector does not agree with an everyday definition of 'green'. UK political parties have either been unwilling or unable to commit to nuclear energy in recent years. Prior to the 2010 UK General Election, the Liberal Democrats promised the abolition of nuclear power in their environmental and energy policies. Similarly, in Germany -- a world leader in green energy -- plans for the phasing out of nuclear power were drawn up in the wake of the Fukushima accident. Moreover, green campaigners and NGOs have campaigned and lobbied vigorously against the UK's nuclear power sector since its beginnings. Therefore, this sector is excluded from the final estimate.

Low Carbon -> Energy Management

The 'Low Carbon -> Energy Management' sector contains the following levels 3 and 4 sectors.

Level	Level	Level 3	Level 4
Low Carbon	Energy Management	Energy Saving Lighting Equipment	Production Of Energy Saving Industrial Lighting Bulbs & Tubes Production of Energy Saving Industrial Lighting Systems Industrial Lighting Control Systems Production Of Energy Saving Domestic Lighting Bulbs & Tubes Production of Energy Saving Domestic Lighting Systems Domestic Lighting Control Systems
		Energy Saving Heating & Ventilation Equipment	Production of Energy Saving Industrial Heating Control Systems Production Of Industrial Energy Saving Heating Equipment Production of Energy Saving Industrial Ventilation Systems Production Of Industrial Energy Saving Ventilation Equipment Production of Energy Saving Domestic Heating Control Systems Production Of Domestic Energy Saving Heating Equipment Production of Energy Saving Domestic Ventilation Control Systems Production Of Domestic Energy Saving Ventilation Equipment
		Energy Saving Electrical Equipment	Industrial Power Factor Control Equipment Building Control Systems Industrial Power Consumption Control & Monitoring Equipment Domestic Buildings Control Equipment Domestic Power Consumption Monitoring Equipment
		Gas Supply	Leak Detection & Maintenance Services Supply Systems Maintenance Services Consumer Equipment Maintenance Gas Monitoring Services Manufacture of High Efficiency Consumer Equipment Enhancement Devices Supply System Upgrade Equipment Gas Monitoring Equipment Gas Supply Optimisation & Control Systems Gas Meterage Equipment
		Consulting, Education & Training	Design Of Energy Management Systems New Build Design Of Energy Management Systems Retro Fit Energy Management Advice and Consultancy Energy Management Training Services Energy Management Publication of Books and Periodicals Energy Management of Leaflets and Brochures
		Technologies, Research & Development	New Lighting Technologies Heat Pumps & Equipment Power Management Software Infra Red Detection Systems Development of Energy Management Software Development of Advanced Energy Management Systems Development of High Efficiency Lighting Development of High Efficiency Power Systems Development of High Efficiency Heating & Ventilation Systems

Although this is the broadest level 2 category, none of the level 3 sectors within this sector have sales worth more than £1 billion. These facts make a comparison with other data very difficult. The inclusion of gas supply equipment suggests that this sector is too broad and is capturing more than what might reasonably be considered as belonging to the LCEGS sector. However, other level 3 sectors seem to be consistent with the LCEGS sector. Therefore, this sector is included in the final estimate.

Low Carbon -> Additional Energy Sources

The 'Low Carbon -> Additional Energy Sources' level 2 sector contains the following levels 3 and 4 sectors.

Level 1	Level 2	Level 3	Level 4
Low Carbon	Additional Energy Sources	Flywheel Energy Storage	Production of Prototype of Flywheel Energy Storage Design and Development of Concept of Flywheel Energy Storage Research & Experimentation of Flywheel Energy Storage
		Hydrogen Produced by Electrolysis	Production of Prototype of Hydrogen Produced by Electrolysis Design and Development of Concept of Hydrogen Produced by Electrolysis Research & Experimentation of Hydrogen Produced by Electrolysis
		Hydraulic Accumulator	Production of Prototype of Hydraulic Accumulator Design and Development of Concept of Hydraulic Accumulator Research & Experimentation of Hydraulic Accumulator
		Superconducting Magnetic Energy Storages	Production of Prototype of Superconducting Magnetic Energy Storages Design and Development of Concept of Superconducting Magnetic Energy Storages Research & Experimentation of Superconducting Magnetic Energy Storages
		Compressed Air in Cylinders and in Caverns	Production of Prototype of Compressed air in Cylinders and in Caverns Design and Development of Concept of Compressed air in Cylinders and in Caverns Research & Experimentation of Compressed air in Cylinders and in Caverns
		Energy Storage Research	Production of Prototype of Energy Storage Research Design and Development of Concept of Energy Storage Research Research & Experimentation of Energy Storage Research
		Fuel Cells	Production of Prototype of Fuel Cells Design and Development of Concept of Fuel Cells Research & Experimentation of Fuel Cells
		Molten Salt	Production of Prototype of Molten Salt Design and Development of Concept of Molten Salt Research & Experimentation of Molten Salt
		Thermal Mass	Production of Prototype of Thermal Mass Design and Development of Concept of Thermal Mass Research & Experimentation of Thermal Mass

Again, none of these level 3 sectors had markets worth more than £1 billion. It is therefore assumed that the LCEGS report's estimate of this sector's £2.8 billion is reliable, and it is included in the final estimate.

Low Carbon -> Carbon Capture and Storage

The 'Low Carbon -> Carbon Capture and Storage' level 2 Sector is worth £515 million, according to the LCEGS report. It consists of the following sectors.

Level 1	Level 2	Level 3	Level 4
Low Carbon	Carbon Capture & Storage	Post-Combustion Capture	Fuel Management
			Fuel Reactor & Equipment
			Co2 Storage
			Fixtures & Fittings
		Pre-combustion Capture	Flue Gas Handling
			Flue Gas Co2 Extraction
			Co2 Storage
			Fixtures & Fittings
			Maintenance Services
		OxyFuel Combustion	Oxy Fuel Mixture Control Gear
			Gas Recycling Gear
			Furnace Structure
			Fixtures & Fittings
			Maintenance Services
		Pipeline	Pipeline Systems Entry Exit Equipment
			Pipeline Maintenance Services
			Pipeline Structure & Componentry
		Ship	Onboard Gas Storage Systems
			Loading & Discharge Equipment
			Maintenance Services
		Ocean Storage	Deep Sea Discharge Equipment
			Mooring and Anchorage Pontoons and Platforms
			Deep Sea Maintenance Services
		Mineral Storage	Location Search Services
			Minerals Storage Pumping and Discharge Equipment
			Reaction Monitoring Equipment
			Maintenance Services
		Geological Storage	Drilling Services
			Drilling Equipment and Systems
			Pumping and Discharge Equipment
			Site Maintenance Services
			Monitoring & Control Equipment
		Engineering	Site Engineering & Commissioning
			Deep Sea Engineering & Commissioning
			Engineering Design Services
			Consulting Engineers
		Project Management	Land Based Project Management Services
			Deep Sea Project Management Services
		Consultancy	Pre Combustion Consulting Services
			Post Combustion Consulting Services
			Oxy Combustion Consulting Services
			Co2 Storage Consultancy
			Deep Sea Operations Consultancy

The CCS sector is included in the final estimate, though there may be good reasons to question this inclusion. First, it has not been possible to confirm the LCEGS' estimate of the sector. Second, there are no commercial CCS plant in operation. Third, it is not yet a true market sector. Fourth, it would appear that growth within this sector occurs only as a result of incentives offered by government.

Final Estimate

The preceding analysis of levels 2, 3 and 4 LCEGS sectors are combined in the following table.

Level 1	Level 2	Level 3	LCEGS Sales (£m)	Re-Estmate (£m)
Renewables	Biomass		5,728	1,981
	Geothermal		10,701	945
	Hydro		544	544
	Photovoltaic		5,315	1,800
	Renewable consulting		520	520
	Wave & Tidal		86	86
	Wind		14,017	4,100
		Renewables Total	**36,911**	**9,976**
Environmental	Air Pollution		1,018	1,018
	Contaminated Land		990	990
	Environmental Consultancy		821	821
	Environmental Monitoring		166	166
	Marine Pollution Control		133	133
	Noise & Vibration Control		229	229
	Recovery and Recycling		7,174	0
	Waste Management		5,210	0
	Water Supply & Waste Water Treatment		8,373	0
		Environmental Total	**24,114**	**3,357**
Low Carbon	Alternative Fuels	Other Bio Fuels	12,900	1,405
		Other Fuels	2,179	0
		Mainstream Bio Fuels	1,998	1,998
	Building Technologies	Windows	5,428	0
		Doors	3,345	0
		Insulation and Heat Retention Materials	4,445	0
		Monitoring and Control Systems	1,576	0
	Alternative Fuel Vehicle	Alt. Fuels (mainstream) for vehcles only	11,697	141
		Other Fuels and Vehicles	1,734	0
	Carbon Finance		6,319	6,319
	Nuclear Power		3,873	0
	Energy Management		2,812	2,812
	Additional Energy Sources		1,347	1,347
	Carbon Capture and Storage		515	515
		Low Carbon Total	**60,168**	**14,537**
		TOTAL	**121,193**	**27,870**

This re-estimate of £27.9 billion is £93.3 billion less than the £121.2 billion claimed in the LCEGS report.

Further Revision of the Estimate

The final estimate gives us a more realistic picture of the LCEGS sector than was offered by the LCEGS report. However, in order to form a more complete picture of the 'green economy', a broader and more critical approach is needed.

For instance, although Carbon finance was included in the final estimate, this sector creates no net value -- it simply takes money from elsewhere in the economy by adding a cost to the consumption of energy.

Some economic perspectives argue that this sends a 'signal' to the market to encourage investment. But this view remains controversial.

Removing the Climate Finance sector from the LCEGS estimate gives a new figure of **£21.6 billion.**

Accounting for Climate Taxes and subsidies

Critics of energy and climate policies have observed that much of the apparent growth in the green economy occurs because some taxes and subsidies directly benefit renewable energy operators.

The value of the LCEGS sector has therefore been inflated if money has been taken from elsewhere in the economy. Subtracting the total paid by consumers in environmental taxes will provide yet more perspective on the value of the green economy.

Tax/Subsidy	£m 2010
Climate Change Levy	674
Landfill Tax	1,143
Rnewables Obligation	1,600
CERT	1,375
TOTAL	**4,792**

The Real size of Britain's Green Economy

£16.76 billion

(£104.44 billion less than claimed in the LCEGS report)