cambium

IT FOR SUSTAINABILITY SERIES:

Reducing Enterprise Greenhouse Gas Emissions
The UK Market Opportunity for IT Vendors
2013-2020





Cambium LLP Eco innovation Centre, City Road, Peterborough, PE1 1SA

IT for Sustainability Series:

Reducing Enterprise Greenhouse Gas Emissions

The UK Market Opportunity for IT Vendors

(2013-2020)

CONTENTS

List of Figures

Part 1:

Overview of Methodology and Summary of Market Forecasts

Part 2:

Detailed Methodology and Analysis

Acknowledgements

Authors

Iain Burns – Director of Research – Cambium Research Limited

Tony O'Donnell - Cambium Research Limited

Cambium also wishes to thank and recognise the following persons for their support and encouragement in the development of this work.

Professor Michael Bonaventura , Chief Executive, Crichton Carbon Centre

Dr. Rachel Dunk, Academic Director, Crichton Carbon Centre

Executive Summary

This research report estimates the size of the UK IT market that will be created as a result of the UK Government's objective to reduce the emissions of Greenhouse Gases in the UK to 34% of the 1990 baseline by 2020. The report has been created to provide insight to providers of IT Goods and Services regarding the evolution and size of this emerging IT market opportunity in the UK.

The report comprises two parts. Part 1 of the report provides taxonomy for this market, the IT for Emissions Reduction (IT4ER) market. It places this new market in the context of other related and adjacent markets specifically the IT for Sustainable Business (IT4SB) market and the IT for Business Adaptation (IT4BA) market. This part of the report also provides estimates for the size of this market and a preliminary assessment of the implications for IT vendors.

Part 2 describes the proprietary methodology that has been used to create these market estimates.

Our market forecast shows that the IT for Emissions Reduction (IT4ER) market will grow to be worth $ 9.74 Bn. by 2020, representing an 11% compound growth rate from current levels, which is greater than the growth rate of any other sector by a factor of nearly 3.5.

The IT4ER market estimates for IT are broken down in the constituent elements for Hardware, Software and Services. This data is shown in the following table:

	UK IT Emissions Reduction (IT4ER) Market Forecasts 2013-2020 ($Bn)							
Sub-Sector	2013	2014	2015	2016	2017	2018	2019	2020
Hardware	0.24	0.29	0.39	0.57	0.83	1.16	1.57	2.12
Software	0.15	0.18	0.24	0.34	0.5	0.7	0.94	1.27
Services	0.73	0.88	1.18	1.72	2.49	3.48	4.7	6.35
Total	**1.12**	**1.34**	**1.82**	**2.63**	**3.82**	**5.34**	**7.21**	**9.74**

The composition of spend across different sub sectors within the UK is examined and similar forecasts for each of them is provided. The sub-sectors analysed include:

- Buildings
- Dematerialisation
- Energy Supply
- Industry
- Remote Work
- Transport

Within these sectors the largest IT opportunities will be seen in Transport, Energy Supply and Buildings, which represent 24%, 23% and 19% of this market respectively. The analysis of each sector describes the IT applications that typically will be deployed in each market.

IT vendors wishing to capitalise on this growing market will:

- require an understanding of the Policy and relevant UK Legislation underpinning the UK's goal of reducing Greenhouse Gas Emissions.
- need to appreciate that the energy efficiency priorities of prospective clients in different industries will not be uniform.
- need to recognise that IT procurement decisions in the IT for Emissions Reduction (IT4ER) market will not always be driven by the IT function.
- be most effective if they develop a sales and marketing strategy that recognises that the IT4ER market is a part of a wider and bigger IT for Sustainability (IT4S) market opportunity.
- need to review their channel strategies to execute effectively in the IT4ER market.

Introduction

How big is the UK market for IT in 2020 that will support achievement of the UK Government's targets for reducing Greenhouse Gas emissions?

For the first time this study provides a range of estimates for the size of the UK market for IT (Hardware, Software and Services) that will be required if the UK is to meet the Government target of reducing UK emissions by 34% by 2020 against the 1990 baseline.

Achievement of these ambitious goals will certainly require better resource management and energy efficiency across the entire UK economy. Simply put the UK needs to achieve more using less energy. But knowing how much more and how much less is all about data collection and information management at high speed and in huge volumes. Today organisations and the public are collecting far less than a 1 millionth of the data that will be needed at device level to be able to monitor all UK resource usage in near real time and hold that information for many years.

The delivery of the UK's share of Global emissions reductions will not happen without detailed and timely information to measure, monitor and manage all the complex systems that will be involved from individual organisations up to and including National infrastructure.

In turn, that information will be used to strategise, plan, design, develop, run, manage and control so much of what is needed to become more sustainable. In a fast changing and complex world full of masses of data, this can only be enabled by using Information Technology (IT) at all levels.

These market estimates incorporate a deployment profile created by Cambium that recognises the current economic challenges facing the UK. As a result it assumes that IT investments will accelerate in the middle and latter parts of the assessment period to the level of investment predicted by our model and required by the Policy objectives.

These market estimates provide a valuable guide to the size and scope of the potential IT markets that will be created for the UK Government to achieve its policy objectives set out in the Climate Change Act (2008) by 2020

Our analysis predicts that this market, the IT for Emissions Reduction (IT4ER) market, will become an important component of the UK's overall IT marketplace and will grow significantly faster than the wider UK IT market in the period 2013 to 2020. The analysis also provides insight as to the market potential in different sub markets of the IT4ER market, including:

- Buildings
- Dematerialisation
- Energy Supply
- Industry
- Remote Work
- Transport

IT vendors with relevant technologies and/or services will therefore find these estimates a useful input in developing their sales and marketing strategies to capitalise on this market growth.

Structure of Report

In order to make the findings of this study more accessible and transparent to readers with varying interests the report has been structured into two distinct parts.

Part I - Summary of Market Forecasts

This section of the report provides:

- An overview of relevant UK climate change legislation and policy
- The transition to sustainable business models in the UK
- A definition and sub-segment structure for the UK IT for Sustainability (IT4S) market, including the IT for Emissions Reductions (IT4ER) market
- A high level overview of the methodology used to create the market estimates
- Details of our market sizing estimates for hardware, software and services for the UK as a whole and for key sectors within the IT4ER market
- A summary of conclusions of the report and implications for vendors.
- Recommended next steps that vendors should consider in order to position themselves effectively in this market.

Part II – Detailed Methodology and Analysis

This section of the report provides transparency into the methods and assumptions used in the study. In addition to a listing of our sources this section provides further details on the results of our literature review and the approach taken to the development of our forecasting model.

This section will be of particular interest to experts in information technology as well as climate policy and legislation.

Appendices

The appendices provide other relevant information that describes:

- A review and comparison of taxonomies used by our primary sources and an explanation of how a unified categorisation was synthesised.
- The scaling factors for each of our sources used to develop the estimates
- Details of the methodologies used to calculate the IT4ER estimates for the UK
- An introduction to the authors, Cambium and the services that they provide to IT vendors

PART I - Summary of Market Forecasts

Introduction to Part 1

To place the estimates provided later in this report into context, it is important to understand the key drivers that are shaping investment in IT that support Emissions Reductions in the UK, by both the Private and Public Sector. These market drivers come from two perspectives:

- The impact of UK Government Legislation and Policy
- The adoption of sustainable business strategies by the public and private sector

Consider each of these drivers in turn.

UK Climate Change Legislation & Policy

In late November 2008 the UK Government introduced the world's first long-term legally binding framework to tackle the dangers of climate change – the Climate Change Act 2008. The Climate Change Act aims to manage and respond to climate change in the UK, by setting legally binding targets for CO_2 emissions by the UK and establishing clear and regular accountability for achievement of these targets to the UK Parliament and to the devolved legislatures. The Act has a number of primary objectives:

1. To promote a transition towards a low carbon society in the UK
2. to demonstrate the UK's international leadership on the reduction of greenhouse gas emissions
3. to support the setting of a predictable price for carbon

These objectives were underpinned by a number of key provisions of the Act, which included:

a. A legally binding target of at least an 80 per cent cut in greenhouse gas emissions by 2050, to be achieved through action in the UK and abroad. Also a reduction in emissions of at least 34 per cent by 2020. Both these targets are against the greenhouse gas emissions produced by the UK in 1990, which is the 'baseline' year against which future emissions targets are compared.
b. A carbon budgeting system which caps emissions over five-year time periods, with three budgets set at a time, to ensure that the UK remained on track for the 2050 target. These Carbon budgets run from 2008-12, 2013-17 and 2018-22, and were set in May 2009. The UK Government is obliged to report to Parliament on its policies and a proposal to meet these budgets, and this requirement was fulfilled by the UK Low Carbon Transition Plan. published in July 2009.
c. The creation of the Committee on Climate Change (CCC) - an independent, expert body to advise the Government on the level of carbon budgets and on where cost-effective savings can be made. The Committee submits annual reports to Parliament on the UK's progress towards targets and budgets.
d. The setting up of an emissions trading scheme
e. A review of the impact of and adaptation to climate change

In support of these objectives the UK Government has a number of legislative instruments designed to support the achievement of these national goals. Over time the impact of this legislation and policy will be widespread as the UK seeks to develop a low Carbon economy.

IT will have a pivotal role in enabling this transition by providing the means to measure monitor and ultimately manage the energy consumed and emissions produced across the economy. As a result, this legislative pressure will underpin the demand for IT goods and services to support emissions reduction.

The Transition to Sustainable Business Models in the UK

In addition to legislation some of the large producers of greenhouse gas emissions within the UK economy are also seeking to voluntarily reduce their emission of Greenhouse Gases as they seek to become more sustainable businesses.

Sustainability and the Triple Bottom Line

The notion of sustainable development was defined by the Brundtland Commission set up by the United Nations in their Report, Our Common Future, published in 1987

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

This has been extended by business in the development of sustainable business strategies using the Triple Bottom Line model. These strategies are being adopted to ensure the long-term viability and success of the business.

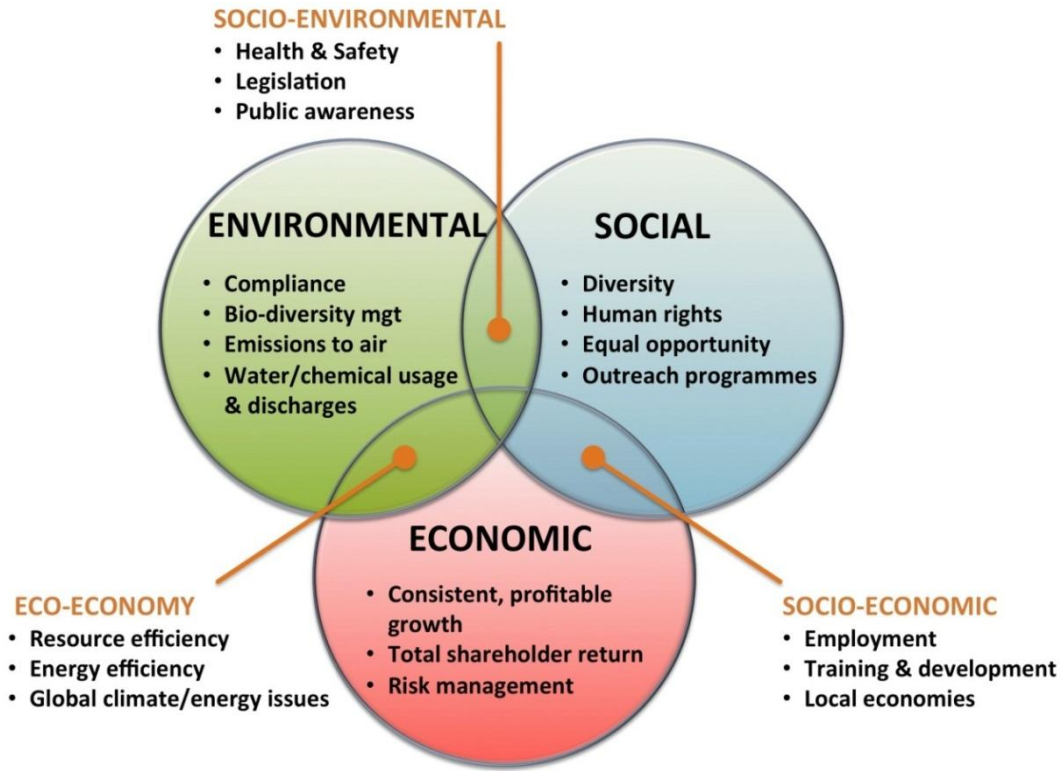


Figure 1 Sustainability in Practice

This trend towards sustainable business practice depicted in the diagram above is catalysing large organisations to adopt one or more of the following responses:

- become more efficient in their use of key resources e.g. energy, raw materials and water to reduce waste and associated operational costs as well as to ensure security of supply of key resources
- ensure that they meet the expectations of key stakeholders e.g. customers, employees and investors in relation to their environmental and social stewardship
- become compliant with new legislation that in turn is creating reputational and financial risks that require management and mitigation
- capitalise on the significant new market opportunities being created by the transition to a sustainable economy

To ensure adoption of these strategies, the executive management teams are setting ambitious goals in these areas. One of the most visible target areas for action is in the setting of organisation wide targets for the reduction of greenhouse gas emissions both to reduce environmental impact and reduce energy costs.

UK Market Structure and Definitions

Both UK Government Legislation and the adoption of voluntary Sustainability strategies combine to drive investment in IT that enables the achievement of relevant objectives. In order to understand the interplay between these respective drivers, Cambium has developed a segmentation model that demonstrates the interaction and overlap between these activities.

The UK IT for Sustainability Market (IT4S)

Cambium's model for the segmentation of the IT market for Sustainability (IT4S) is shown in Fig 1. The market has four main markets.

1. IT Efficiency – This is where a lot of the focus on "Green IT" has been over the last 6-8 years. It is focused on swapping old technology for updated efficient equipment. There has been a lot of attention within IT circles on Data Centres and how efficient they are (or not). This segment therefore includes the services and software associated with understanding and improving the Data Centre.

2. Sustainable IT – Like (1) above, this market is "Inside IT" and is still concerned with the sustainability of IT itself. However in this market, the clients are more focused on looking at complete sub-systems and making them sustainable. For example, building and running a sustainable SAP Platform, making HR systems more sustainable by concentrating on the upstream activity of the system, running on an efficient platform, maintaining in a more efficient way and considering the outputs of the system and minimising any adverse aspects on environmental, social and economic dimensions, moving applications to a cloud platform.

3. IT For Sustainable Business (IT4SB) – This market looks outside of IT at where in the enterprise IT can be used to enable sustainability. This market breaks down into four sub-segments.

    a. National Sustainable Resource Use – this sub-market supports National infrastructure enterprises such as the Utilities, the networks such as The National

GRID, The Rail Network. This is where IT enabled national systems will improve efficient running, energy reductions on a large scale and emissions reductions.

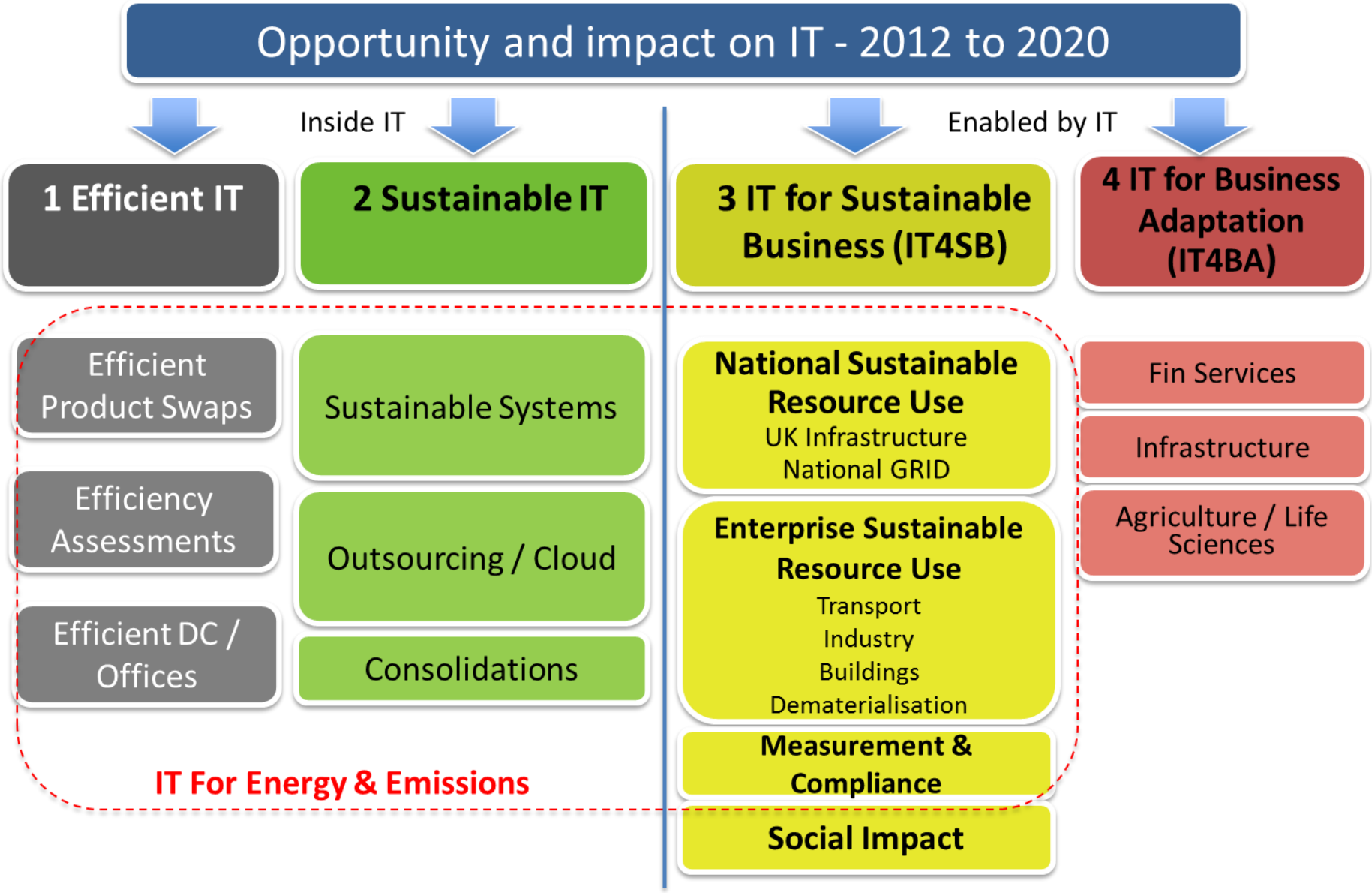
b. Enterprise Sustainable Resource Use – Very similar to (a) above but this sub-market looks within and all across each Enterprise. Some of the focus areas for it are in Transport optimisation, running better Buildings, specific Industry-based efficiency opportunities and Dematerialisation, where physical processes are replaced by virtual substitutes. For example, video conferencing instead of travel; online invoices instead of paper; e-learning instead of attending classrooms; music downloads instead of buying a CD in a shop.

c. Measurement and Compliance - Organisations will face on-going pressures to be compliant with new environmental legislation. In turn this will provide an on-going driver to gather new data and to produce new reports and information. This area also addresses the need for IT in managing the emerging area of Carbon accounting that Local and National Government will require on an ever expanding basis.

d. Social Impact – This sub-market focuses mostly on the need to relate to and enable the social needs of all the people related to any Enterprise and its approach to sustainability.

4. IT For Business Adaptation – Regardless of what steps are taken to improve the environmental and resource outlook for a business or enterprise, it is also important and strategic to plan for the expected or even worse outcomes. In this sub-market enterprises need to focus efforts on understanding, avoiding and adapting to the risks of Climate Change, resources scarcity and other outcomes. Examples can be found in many Enterprises such as the need to plan for long-term water availability for decades ahead, access to rare materials, the movement of diseases North and South from the Equator and planning for more extreme weather with its disruptive impact on industry sectors such as agriculture, insurance, travel, and construction.

Figure 2 IT for Sustainability (IT4S) – Market Segmentation



The UK IT for Emissions Reduction Market (IT4ER)

This study is primarily focused on two opportunities for IT to reduce emissions within the wider sustainability context.

1) Those areas of sustainability associated with energy and emissions reductions
2) The part of that above which is enabled by IT

For clarity this Study is focused upon the quantification of IT investments required to reduce greenhouse gas emissions. Consequently it does not include an assessment of the additional significant IT market opportunities in the areas of:

- Measurement and Compliance unrelated to greenhouse gas emissions
- Social Impacts
- Adaptation to climate change

This includes most of, but not all, of the IT for Sustainability market as shown in Fig 1 page 13.

In that figure, the red dotted area indicates those sub-markets that are covered by this study.

High Level Overview of Methodology

The Study presents an approach to the conversion of GHG emission reduction targets into a sizing estimate for the value of IT goods and services required to deliver a given reduction target. This is a problem yet to be addressed by jurisdictions setting the emissions reductions levels. There does not appear to be an articulation by such legislators of the IT needs driven by their reduction targets. It provides an important framework that helps IT users and vendors to estimate and budget for the investment required in new IT infrastructure in order to enable a specific emissions target to be achieved.

How has the approach been developed?

While a large number of studies have provided evidence of the need for emissions reductions and the industry sectors where these should occur, relatively few have looked at the role that IT can play. Those that do suggest that IT has the potential to deliver some 30% of global emissions reductions: a huge contribution which is in danger of going untapped.

However, very little has been done that connects the need for IT and the size of the market at a national level, starting from the energy and emissions targets.

This report combines a thorough analysis of key primary research (see reference list on page 45) with clear assumptions and insight to enable the development of a model, which quantifies the IT investments required to reduce the emissions of the greenhouse gases targeted by UK Government climate policy and legislation.

Our method includes the derivation of a common taxonomy for six IT solution areas, which is named the Cambium Unified Taxonomy (see Appendix A page 47). This identifies those sectors that can benefit most from IT-enabled interventions, quantifies the emissions reduction potential in each of those areas and derives an estimate of the corresponding market size. .

In 2008, in a breakthrough paper – "Information and Communication Technologies: The Power of Productivity" - for the American Council for an Energy-Efficient Economy (ACEEE), John A. Laitner and Karen Ehrhardt-Martinez discovered the link between the use of Information Technology and reduced energy consumption, a proxy for emissions reductions. Their analysis showed that in 2008 a Kilo-Watt-Hour (kWh) of Information Technology was needed in 2008 to reduce USA emissions by 6.7 to 13.5 Kwh of energy assuming it was created with CO2e generated at an average of 500gm per KWh.

Here the Laitner & Martinez equations are used as the basis for the model of market size. First the amount of energy that would need to be consumed by IT is estimated – in its broadest sense - to produce a corresponding saving of energy, through the application of that IT, to achieve the level of emissions reductions required by legislation by 2020. The IT estimate is then broken down into its component parts: hardware, software and services. Three different methods have been used to sense check the results and provide a high, medium and low threshold of the size of the UK market for IT for Emissions Reductions (IT4ER).

> With an equation that can turn energy and emissions reductions into actual amounts of Information Technology required, three methods have been used to estimate the UK IT for Energy and Emission Reduction Market (IT4ER) for 2020.

An outline of the four-step method is provided in Figure 3 below.

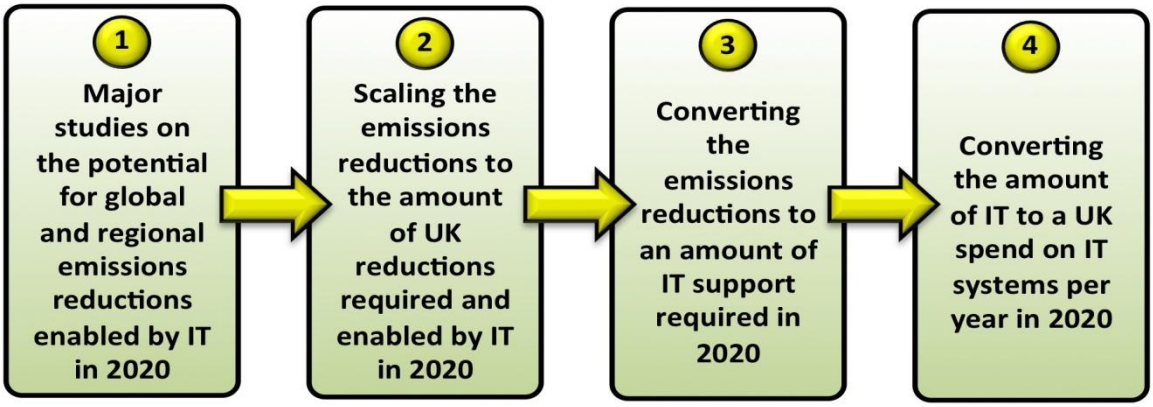


Figure 3 High Level Method

UK IT for Emissions Reduction (IT4ER) Market Forecasts 2013-2020

Introduction

If the UK is to achieve its publicly stated emissions reductions target of 34% by 2020, the IT market opportunity in 2020 for Emissions Reduction (IT4ER) will be worth almost $10Bn. This would be approximately 11% in value compared with today's UK ICT market and is therefore a significant opportunity for many IT vendors to aim at over the next 8 years. These vendors have relevant technologies or services today that enable the reduction of energy consumption and resulting CO2 production or alternatively mitigating the emission of other greenhouse gases.

It represents a brand new market with low barriers to entry and no market dominating players. As a result it is an attractive growth market underpinned by the compelling twin drivers of legislative pressure and the potential for significant cost savings due to a close alignment with reduced energy consumption.

These will remain strong drivers of investment, even in a challenged economic environment.

With these powerful tailwinds the market is set to grow at a compound average growth rate (CAGR) of 11% between now and 2020. This represents a growth rate of 3.5 times the average growth in the UK IT market. The table below summarises our overall market prediction for the growth of this market over the period.

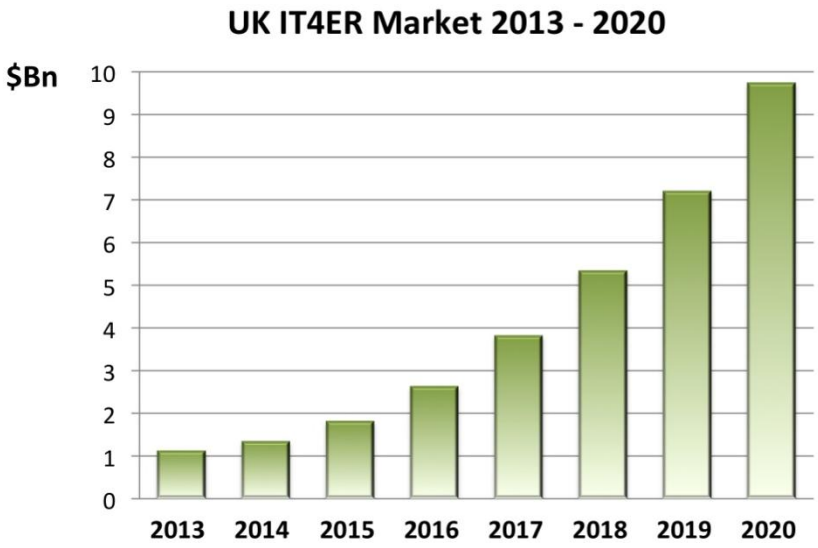


Figure 4. UK IT4ER Market Forecasts 2013 - 2020

Cambium's estimate of growth in this market has taken account of the economic headwinds affecting all investment in the current UK recession. These macroeconomic effects will reduce relative growth of this market in the early years of the assessment period. Nonetheless growth in this market driven by the significant commitment of large corporates to achieve their global sustainability goals, including emissions reduction targets, will ensure that this market will continue to grow faster than the wider IT market.

Assuming there is no political consensus to change the emissions reductions targets defined in the Climate Change Act (2008), it can be expected that growth in this market will accelerate later in the assessment period in order to realise the UK Government's policy goals.

Key Subsectors Within the UK IT for Emissions Reduction (IT4ER)

	UK IT Emissions Reduction (IT4ER) Market Forecasts 2013-2020 ($Bn)							
Sub-Sector	2013	2014	2015	2016	2017	2018	2019	2020
Hardware	0.24	0.29	0.39	0.57	0.83	1.16	1.57	2.12
Software	0.15	0.18	0.24	0.34	0.5	0.7	0.94	1.27
Services	0.73	0.88	1.18	1.72	2.49	3.48	4.7	6.35
Total	**1.12**	**1.34**	**1.82**	**2.63**	**3.82**	**5.34**	**7.21**	**9.74**

Figure 5 IT4ER - Hardware, Software and Services Market 2013 to 2020

The following sections consider the sub sectors of this market in more detail. The table below shows Cambium's market estimate for Hardware, Software and Services during the assessment period 2013 – 2020.

UK IT for Emissions Reduction (IT4ER) – Hardware Market

By 2020 our study indicates that the UK hardware sector of this market will exceed $2.12bn in value. Our estimate has taken into consideration the continuing improvement in price / performance of hardware.

The analysis presented in Part II of this report considers how much energy would be required to support the IT infrastructure necessary to remove the equivalent of a kWh's worth of emissions. Over the period 2013 to 2020 a KW of new IT purchased will do more work each year and the price of a KW of IT will reduce year on year.

The IT hardware is assumed to be a mix of Servers, Storage and Network elements. Starting from the analysis for 2020 and working backwards, the method has evaluated how much IT is needed to grow towards the 2020 value from a low base and then how much that IT equipment will cost. This enables us to value the market in each year up to 2020. It is also assumed that IT hardware will run for 4 years and therefore the market size quoted in any one year is replacing 25% of the installed base and growing that base.

Cambium expects IT vendors to continue to face increasing interest in the energy efficiency of their products due to the growing size of the emissions that will accompany the overall growth of the wider IT market.

Notwithstanding on-going improvements in the energy efficiency of the hardware, the growth in the IT market will lead to a growth in absolute emissions. That said, the application of IT [IT4SB] will be essential if the economy wide emissions reduction targets are to be realised. As a result IT vendors (and others) will need to clearly articulate the case for allowing an increase in emissions from the ICT sector in order to achieve:

- higher levels of energy efficiency in other asset classes such as buildings and transport
- reduction in overall energy consumption via dematerialisation and remote working
- the integration of low carbon energy generation from intermittent sources into the National Grid by the creation of a smart grid infrastructure

Additionally, due to a growing focus on reducing individual organisations' emissions in combination with the wider acceptability of cloud computing models, it can be expected that many organisations will seek to outsource the ICT element of their operations to third party Managed Service Providers (MSPs). It is anticipated that a significant amount of hardware investment will be made by MSPs, which will become a fast growing sector of the economy.

MSPs will therefore need to develop advanced strategies for improving their own sustainability as businesses if they wish to mitigate brand damage as well as the cost burdens of environmental taxes and rising energy prices. Our scenario does not include any consideration of the potential 'leakage' of hardware investment to non UK geographies as MSPs seek to mitigate against any UK specific tax on their operations.

Given the importance of low carbon IT skills and expertise to both the achievement of UK emissions targets and associated economic growth, it is assumed that these anomalies will be resolved within the period. Should these market distortions remain then this element of our forecast will need to be revised accordingly.

UK IT for Emissions Reduction (IT4ER) – Software Market

The Software element of the IT4ER market is set for strong growth for the same underlying reasons.

Recent Cambium Research (**2**) indicates that there are already a large number of Software Vendors active in the UK market. Of these over 50 are defined in this study as being targeted at the needs of large enterprises.

Of these over 60% have their headquarters outside the UK. This insight shows the global recognition of the UK's leading global position through its national commitment to emissions reduction.

Whilst this market will undergo a consolidation over time this study provides evidence that at present the barriers to entry are low and that there is a race in progress to develop and broaden application functionality.

Paragraph 85 of Part 5 of the Climate Change Act required the Government to introduce regulations on emissions reporting or explain why that was not necessary. For this reason on June 20th, 2012 the Government announced the introduction of mandatory greenhouse gas emissions reporting for all companies listed on the main market of the London Stock Exchange by April 2013. This announcement will only accelerate the development of this market sector.

One trend in many of the software solutions that are emerging is the capability they provide to be delivered via cloud or using a software-as-a-service model. It is likely that this market will become a useful catalyst for the adoption of cloud solutions by larger organisations keen to measure, manage and monitor their emissions footprint.

As a result this ecosystem of Sustainability Software Vendors (SSVs) will be of particular interest to leading MSPs wishing to access this growth market opportunity.

As many of the investments made by organisations will be motivated by their desire to reduce their emissions, then the 'end to end' Sustainability of any jointly provided solutions will grow in importance as a selection criterion. It will no longer be good enough to look at the discrete efficiency of components of hardware, software and services. A full end-to-end analysis will need to be in place to look at the full life-cycle cost of complete systems so that their total effect is supporting the improvement of an organisation's overall sustainability.

The growth in Software deployment in this market can be expected to accelerate as more references for the category emerge during the period. One of the key benefits of the adoption of this Software will be the delivery of ever increasing transparency into energy use and emissions production. In turn this availability of new information will be used by organisations to further optimise energy consumption.

This optimisation will involve the adoption of more energy efficiency innovations and with that use will be an increasing use of analytical functionality within the software category. This will invariably also drive more integration of these new emissions reduction applications with other operational systems. In turn this will drive growth of middleware infrastructure to enable correlation of energy

consumption and emissions with related operational systems e.g. supply chain management and procurement.

Over time the growth in this software market will be fuelled by the wider deployment of sensor networks used to enable real-time monitoring of energy consumption by key operational assets, such as plant, machinery, buildings and transfer systems.

This growth in data will power more investment in software to enable the analysis of the resulting large data sets

UK IT for Emissions Reduction (IT4ER) – Services Market

Driven by UK legislation, such as the EU Emissions Trading Scheme (EUETS) and Climate Change Agreements, the market for consulting services relating to emissions reduction and energy efficiency is already well established.

As organisations adopt more software solutions to become compliant with this legislation it can be expected that the services economy around the deployment of these applications will grow significantly to form the largest component by value of the overall IT4ER market. Cambium estimates that for every $ of software, there will be an additional $5 of services revenues.

Many of these services may be supplied by the same managed services providers that supply the applications used to measure, manage and monitor emissions. Success in these markets will require specialist expertise and understanding of the methodologies and standards for measurement and management of emissions. The recent announcement by Defra (**6**) of the introduction of mandatory GHG emissions will require measurement based on a protocol that is defined in a complimentary manual downloadable from the Defra Website (www.defra.gov.uk/environment/economy/business-efficiency/reporting)

In addition to these specialist technical skills, service providers will also require knowledge of the energy dynamics of specific asset types such as buildings or transportation systems. The early phase of this market is likely to be characterised by service 'solutions' based upon a portfolio of boutique consultancies, either integrated by a larger 'Prime' service provider or self-integrated by an enterprise's IT department.

Service providers that are able to facilitate comprehensive service offerings and to capture early references will enjoy the benefits of a rapidly growing market opportunity. Indeed the new business deals that result are likely to enable further substantial cross-selling opportunities. These opportunities will result as clients turn their attention to aspects of their Sustainability strategy, such as water consumption or reduction of waste. It is this longer term opportunity that is drawing the attention of the world's largest consultancies to this market.

Successful service providers will also need to closely manage their own emissions and energy impact as clients will wish to see tangible evidence of their providers 'walking the walk' as well as 'talking the talk'. For those that can meet these challenges the IT4ER market will be a significant and predictable source of services revenue for the rest of the decade.

UK Sub Sector Analysis

Having analysed the composition of the IT for Emissions Reduction (IT4ER) market from the perspective of component goods and services, this section of the study considers emissions reductions opportunities across the UK economy.

In this part of the study the IT markets associated with the following opportunity areas will be considered, where investment in IT can enable significant emission reductions by organisations wishing to reduce emissions and to achieve operational cost savings via reduced energy consumption.

- Buildings
- Dematerialisation
- Energy Supply
- Industry
- Remote Work
- Transport

Market estimates are provided in each of the following sections showing the hardware, software and services element for each opportunity area.

The following chart in Fig 6 can be created using the data from Fig 22 in the Appendices.

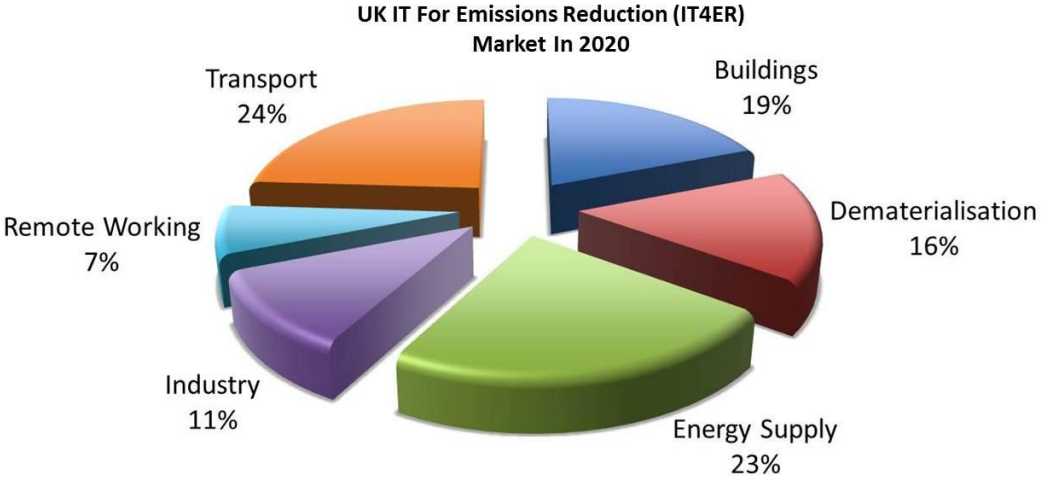


Figure 6 IT4ER Market – Overview of Sub-Segments

The biggest potential can be seen in the transport and energy supply infrastructure, whilst significant markets also exist to make Buildings more efficient in terms of energy consumption with an associated reduction in emissions. Dematerialisation of traditional physical processes such as online retail also account for a significant proportion of the emerging market opportunity.

Industry also offers the potential for further emission reductions, whilst the emissions reductions enabled by IT invested in remote working is the smallest opportunity of those considered.

Impact of IT investment on Emissions Reductions vs. Systemic impacts

The estimates provided in the following section consider the direct or indirect effects of investing in IT to improve the emissions reductions in each of the following sectors. These effects include ***first order effects***, which are those direct improvements in energy efficiency that may result from the replacement of one infrastructure with a more energy efficient technology, for example.

Also included are the indirect ***second order effects***, where emissions are reduced as the IT investment creates a change in production processes, transport usage or consumption, where energy use is optimised.

By contrast, over time an increased use of IT may lead to fundamental changes in consumption patterns and behaviour, the growing use of on-line movies in the home may be an example. The increased consumption of online entertainment can over time lead to unpredictable increases in IT utilisation that then result in a net increase in energy consumption at a national level. The current study does not include an assessment of any potential increases in emissions within the assessment period that may arise from these ***systemic effects***.

Comparison of Opportunity Areas for IT Investment to Reduce Emissions

Looking at each of the opportunity areas in turn and in alphabetical order as opposed to the size of the market opportunity that each represents, the following review below includes:

- **Types of IT investment** in each sector
- Size of the potential **market opportunity**

Buildings

Buildings - Types of IT investment

A 2004 estimate concluded that about 40% of the UK's CO_2 emissions were generated from the energy used to heat, cool and light buildings in the UK. 14% of these emissions were accounted for by residential use **(1)** as opposed to commercial operations.

IT has a massive potential scope to reduce these emissions via innovations that improve energy efficiency in building and make them 'smart'. These include:

- Building and energy management systems
- Energy analysis and optimisation software
- Environmental sensors
- Lighting control systems
- Metering technologies

Recent evidence from North America indicates that better building design and the use of building management systems to optimise energy use could save 15% of building's emissions. In a recent report by the Climate Group (**7**) on behalf of the Global eSustainability Initiative (GeSI), it was found that globally, smart buildings technologies could enable around 1.68 $GtCO_2e$ of emissions savings, worth $340.8 billion

New buildings will be architected and constructed to optimise energy efficiency and to minimise emissions. IT will be integral to the achievement of these efficiencies commencing with the use of IT to model and optimise different building designs. IT in the form of sensors and systems will also be embedded within the fabric of the building to optimise energy consumption from heating, lighting or air conditioning with ambient external conditions e.g. air temperature with room occupancy throughout the day. Older buildings on the other hand will require retrofitting of smart, IT enabled infrastructure.

IT also offers the potential to support the intelligent management of estates of buildings within an enterprise, enabling the development of management strategies that look to optimise occupancy and energy consumption.

Buildings – the market (UK IT4ER) opportunity in 2013-2020

The table below summarises the market estimates for IT investments in this segment during the assessment period.

By 2020 this market sector is expected to be worth $ 1.85bn.

One of the biggest drivers for the growth of IT in this market sector will be legislation, as part of the UK Government's strategy to achieve its carbon emissions objectives and to accelerate the growth of a low carbon economy.

	2013	2014	2015	2016	2017	2018	2019	2020
Hardware	$0.046	$0.056	$0.075	$0.109	$0.158	$0.221	$0.298	$0.402
Software	$0.028	$0.033	$0.045	$0.065	$0.095	$0.132	$0.179	$0.241
Services	$0.139	$0.167	$0.225	$0.326	$0.473	$0.662	$0.894	$1.207
Total	**$0.213**	**$0.255**	**$0.345**	**$0.500**	**$0.725**	**$1.015**	**$1.371**	**$1.850**

Figure 7 The Building Market Segment Forecasts

These initiatives include the objective to move to zero carbon homes from 2016 and zero carbon non-domestic buildings from 2019 (**1**). This is legislation focused on new build which is supported by other initiatives such as the ***Green Deal*** aimed at the retrofit of energy efficiency innovations. The Green Deal for example is a new financing framework to enable the provision of fixed improvements to the energy efficiency of households and non-domestic properties, funded by a charge on energy bills that avoids the need for consumers to pay upfront costs. More details can be found at www.decc.gov.uk

IT vendors with relevant technology will only be able to penetrate these markets via the development of collaborative partnerships with the existing consultants, engineers and architects that advise on the design of new buildings and the retrofit of energy efficiency innovations.

Many of these new value networks of suppliers are already starting to emerge, especially where buildings management is outsourced to a services vendor or propriety management company. The convergence of the building services industry with the IT sector is likely to accelerate as this market develops.

Dematerialisation

Dematerialisation - Types of IT investment

Dematerialisation is the term given to processes where a physical product is substituted by a service or virtual 'product'. Examples of this within our analysis would be typified by physical goods purchased being replaced by the acquisition of a substitute product

The replacement of a physical process e.g. visiting a shop to buy a physical book by a virtual process e.g. buying and downloading an e-book uses less energy, sometimes as much as an order of magnitude less than the physical process. In general, the IT enabled virtual process enables a reduction in real emissions from the physical process it is replacing.

There are many application areas emerging that may fall into this category, which include:

- In silicon testing and modelling

- Paperless office and document management technologies
- E-media and entertainment e.g. books, magazines, video, E-commerce, including online retail, banking and insurance

This substitution is not limited to consumption of goods and services but also enables individuals to socialise virtually with corresponding emissions reduction through less use of transport for physical travel. For the purposes of our analysis similar travel substitution associated with the work environment or work related process will be considered separately. The market estimates for IT investments in support of these new IT-enabled work processes are considered in the section called Remote Working on page 30.

Dematerialisation – the market (UK IT4ER) opportunity in 2013-2020

The table below provides our estimates of the size of the IT market available to technology innovations that can dematerialise existing consumption processes.

	2013	2014	2015	2016	2017	2018	2019	2020
Hardware	$0.039	$0.047	$0.063	$0.092	$0.133	$0.186	$0.251	$0.339
Software	$0.023	$0.028	$0.038	$0.055	$0.080	$0.111	$0.151	$0.203
Services	$0.117	$0.140	$0.189	$0.275	$0.398	$0.558	$0.753	$1.016
Total	**$0.179**	**$0.215**	**$0.290**	**$0.421**	**$0.611**	**$0.855**	**$1.154**	**$1.558**

Figure 8 The Dematerialisation Segment Forecasts

If the UK is to achieve its emission goals for 2020, the market estimate for IT spend associated with Dematerialisation will have a value of almost $1.6Bn. As the market is only expected to be worth $ 180m in 2013, this represents a very significant growth potential. A lot of innovation is being applied to this market as existing and new organisations find new ways to do existing activities and new things to do that are all going to substitute data flows for physical actions. This market could well grow faster than predicted here.

Energy Supply

Energy Supply - Types of IT investment

Low Carbon power generation will include a substantial contribution from variable renewable sources e.g. wind and solar into the National Grid. At the same time it is seen as desirable to discover new opportunities for technology to enable new pricing tariffs that will incentivise more electricity consumption in off-peak periods.

To intermediate between these variable supplies and demands will need more intelligence across the Grid. The resulting Smart Grid will be essential to the delivery of this low carbon vision and a variety of IT technologies will be required to enable this infrastructure, including IT applications in a number of key areas of the implementation, such as:

- The integration of distributed, small-scale electricity generation.
- Transmission and distribution grid management.
- Increase in electricity storage capacities.
- Dynamic and real-time pricing for electricity consumption and distributed generation.

- Electricity conservation and energy-efficiency.
- Demand management.
- Integration of electric vehicles and renewable energy sources.

In addition to the delivery of the smart gird infrastructure itself, IT demand will also increase from applications that can be used to optimise energy consumption as a consequence of the Smart Grid infrastructure being present. The applications will be built to achieve the following benefits:

- buying energy into the grid at the best price and place.
- optimising the generating plants usage and uptime.
- running the distribution GRID more efficiently.
- predictive maintenance.
- demand management.
- virtual metering, enabling large users to manage energy consumption in real-time.
- enabling home users to use less energy.

As a result the IT opportunity presented both within and related to the supply of energy will accelerate rapidly in the coming decade.

Energy Supply – the market (UK IT4ER) opportunity in 2013-2020

The largest market opportunity amongst the sectors being analysed is in the area of energy supply. This is not surprising since the supply of energy generated by burning fossil fuels accounts for 35% of the UK's greenhouse gas emissions **(1).**

The UK government sees the introduction of low carbon energy generation as a pivotal part of its strategy to create secure low carbon supplies of energy. As about a quarter of the UK power generation plants are to close in the next decade, the Government is pursuing a policy of decarbonising the UK electricity power generation infrastructure.

This includes a mix of generation sources including renewable energy, notably off shore wind and in some regions nuclear. The Government estimates that this investment in new power generation will be £110bn over the coming decade. The associated IT market will be an important beneficiary of this investment.

It is no surprise that our estimate of the IT market for energy supply is the largest over the period, rising to a total of $2.24 bn in 2020.

	2013	2014	2015	2016	2017	2018	2019	2020
Hardware	$0.056	$0.067	$0.091	$0.132	$0.191	$0.267	$0.361	$0.487
Software	$0.034	$0.040	$0.054	$0.079	$0.114	$0.160	$0.216	$0.292
Services	$0.168	$0.202	$0.272	$0.395	$0.572	$0.801	$1.082	$1.461
Total	**$0.258**	**$0.309**	**$0.418**	**$0.605**	**$0.878**	**$1.229**	**$1.659**	**$2.240**

Figure 9 The Energy Supply Segment Forecasts

The Government is also underpinning this investment by a number of legislative incentives to ensure that low carbon power is preferred to fossil-fuel based power generation, these include:

- Reform of the Electricity Supply Market
- Carbon Floor pricing
- Feed in Tariffs for renewable energy
- Capacity payments and emissions performance standards

Industry

Industry - Types of IT investment

Most energy intensive processes involved in the manufacturing of a Product have been the subject of considerable management attention over time due to the relatively high costs associated with energy consumption. As a result, a lot of the low hanging fruit that may exist in other less energy intensive industries may have already been 'picked'.

That being said, there are opportunities for reducing the emissions from manufacturing processes. Historically the source of energy was less important, whereas today the issue is not merely energy efficiency, but also emissions reduction, which offers further scope for investment in on-site renewable energy sources such as wind and solar or waste to energy converters. Investment in many of these renewable energy sources benefit from Government incentives such as Feed In Tariffs (FITs), Renewable Energy Obligation Certificates (ROCs) etc. However, these renewable energy sources need to be integrated operationally into the management infrastructure of the production processes, creating new IT deployment opportunities to optimise energy generation from these sources.

In addition to managing better optimisation of energy consumption with production processes and integrating new low carbon energy generation, there is also a role for new IT systems to support the design and modelling of products at the research stage. Increasingly, design criteria include the improved resource efficiencies in the construction and use of new products.

Finally there are a class of essential components that are common to many industrial applications, especially in the arena of manufacturing, which can benefit significantly from the application of more intelligence. This is the category of electric motors, where IT can be used to optimise their operation so that production downtime is reduced, performance is improved and energy use is minimised along with the associated emissions.

Industry– the market (UK IT4ER) opportunity in 2013-2020

Industrial organisations have traditionally been used to optimise the energy efficiency of their operations in order to bear down on operational energy costs. Despite this there is potential for significant growth in the amount of IT deployed to support further optimisation of emissions reductions.

The opportunity for further IT investment to reduce emissions in the Industrial sector is set to grow to be worth over $1 billion by 2020. The expected market forecasts in terms of Hardware Software and services are shown below.

	2013	2014	2015	2016	2017	2018	2019	2020
Hardware	$0.027	$0.032	$0.043	$0.063	$0.091	$0.128	$0.172	$0.233
Software	$0.016	$0.019	$0.026	$0.038	$0.055	$0.077	$0.103	$0.140
Services	$0.080	$0.096	$0.130	$0.189	$0.274	$0.383	$0.517	$0.699
Total	**$0.123**	**$0.148**	**$0.200**	**$0.290**	**$0.420**	**$0.588**	**$0.793**	**$1.071**

Figure 10 The Industry Segment Forecasts

In part, this market growth will be driven by legislation that will seek to provide incentives and drivers for further investment in energy efficiency. This greater scrutiny will result in a need for finer grain reporting of emissions across all energy uses, including companies' supply chains.

Due to the increased focus on environmental impact and input costs such as energy, more attention will be paid to the design and production of more sustainable products, which in turn will see greater investment in IT supported design and simulation technologies.

These pressures for more sustainable products are likely to be felt first by those industrial businesses whose customers include either individual consumers or retail businesses, whose clients are primarily individual consumers. This pressure will arise from the aspirations of consumers to acquire sustainable products, which will be passed back to industry by the retailers, who will want to source products which support this aspiration. These market pressures will be underpinned by the greater public transparency that will result from more public reporting e.g. mandatory Greenhouse Gas Emissions (**6**) of the direct impact of businesses and their supply chains on the environment.

Remote Work

Remote Work - Types of IT investment

This section covers IT applications that support work processes, but where the actual work takes place away from the traditional workplace and is usually supported by some form of virtual collaboration.

Emissions reductions are realised as there is no need for work colleagues to travel to meet each other physically, which affords secondary benefits in that the building that contains the normal workplaces should be able to use less energy to support those physically working there, in terms of heating, ventilation, power and light and so in turn reduce emissions.

These benefits are off-set by the need to provide those energy services for the individual in their remote place of work, usually their home. Other rebound effects may include increased opportunistic use of personal cars or alternatively individuals (because of teleworking) may choose to live further away and use more energy where they have to travel to the employer's office.

The types of IT technologies that comprise this market include:

Virtual conferencing

This category of use includes not only the high quality tele-presence often used in organisations as an alternative to a face-to-face global meeting in another country but also to webinars and smaller scale personal video conference or calls provided by technologies such as Skype.

As faster broadband becomes more ubiquitous the potential for higher quality and more cost effective personal videoconferencing will increase and move to a more realistic format which will drive compute power needs even higher.

Tele-medicine

This is a specialised yet important form of teleworking, where expensive and highly skilled consultants can be shared between locations and where expert consultations can be provided to patients that are unable to travel. This also enables specialists to perform more work per day since they can work from an office environment and move from one patient to another in minutes.

Home-shoring

Unlike off shoring where call centres are often located in centralised facilities with large numbers of service operators overseas, home shoring enables local in country operators to provide a similar service via a home office. This affords organisations the opportunity to utilise local agents, who benefit from flexible working hours at home via a virtual call centre.

Remote Work– the market (UK IT4ER) opportunity in 2013-2020

In order to achieve the UK's emission reduction targets it is estimated that this market opportunity may eventually rise to be worth $680m in the UK. However with the availability of faster broadband more widely across the UK and the rapid rise in cost effective collaboration and videoconferencing technology, market growth in this sector could grow appreciably faster.

In line with many other aspects of data-based work, the size and volume of data that is shared remotely will also increase significantly leading to yet more storage and network growth. The increased use of including partners, supply chain and demand chain shared remote team activity is also an upward pressure on this market.

	2013	2014	2015	2016	2017	2018	2019	2020
Hardware	$0.017	$0.020	$0.028	$0.040	$0.058	$0.081	$0.110	$0.148
Software	$0.010	$0.012	$0.017	$0.024	$0.035	$0.049	$0.066	$0.089
Services	$0.051	$0.061	$0.083	$0.120	$0.174	$0.244	$0.329	$0.445
Total	**$0.078**	**$0.094**	**$0.127**	**$0.184**	**$0.267**	**$0.374**	**$0.505**	**$0.682**

Figure 11 Remote Work Segment Forecasts

Transport

Transport - Types of IT investment

The transport sector accounted for 22% of the UK's domestic Greenhouse Gas emissions (**5**). The vast majority of these emissions came from road transport which accounted for 19% of emissions. For this reason UK government policy is focused upon the development of improved vehicle technologies that will enable the introduction of new vehicle and fuel technologies e.g. electric and Ultra-Low Emission Vehicles (ULEVs).

Additionally, Government policy will also promote on-going efficiency in all modes of transport **(1)**. Electricity is set to provide the primary fuel source in the rail network as the government announced major expansion in the electrification of major rail lines enabling diesel rolling stock to be replaced by electric trains. Given the importance of the Transport sector to the UK's overall emissions, it will be a fertile market opportunity for IT innovation.

The IT applications that could be adopted here include:

- In vehicle applications

  These IT applications reduce emissions at the level of the individual vehicle and include vehicle telematics, navigation support tools to reduce journey times e.g. Satnavs and advanced driver assistance systems e.g. adaptive cruise control.

- Intelligent Transport Systems (ITS)

  These real-time systems combine a variety of IT assets e.g. maps, databases and sensor networks to identify transport infrastructure issues such as accidents, road works or congestion. These systems are not restricted to road users, but a similar approach can be applied to other forms of transport. The intelligent systems offer significant potential to streamline all forms of transport congestion to enable time, money and energy all to be saved with a parallel benefit in terms of emissions reductions.

- Road charging

  As road users increase with growth in the UK population one of the strategies being considered to reduce congestion is the concept of road charging or pricing. Debate is currently active in relation to awarding private sector companies the opportunity to invest in new roads and to fund by the ability to leverage a toll on users of the road, once built. Growth in road charging initiatives like this would also drive more investment in the IT infrastructure needed to enable it.

Transport – the market (UK IT4ER) opportunity in 2013-2020

The IT opportunity that will result from this is forecast to be $2.34bn by 2020. This represents an almost 10 x increase in IT investment in this sub-sector over the period of the analysis.

	2013	2014	2015	2016	2017	2018	2019	2020
Hardware	$0.058	$0.070	$0.095	$0.137	$0.199	$0.279	$0.376	$0.508
Software	$0.035	$0.042	$0.057	$0.082	$0.119	$0.167	$0.226	$0.305
Services	$0.175	$0.210	$0.284	$0.412	$0.597	$0.836	$1.129	$1.524
TOTALS	**$0.269**	**$0.323**	**$0.436**	**$0.632**	**$0.916**	**$1.282**	**$1.731**	**$2.337**

Figure 12 Transport Segment Forecasts

This market growth will be underpinned by legislation designed to support the achievement of the overall policy objectives outlined above (**1**). Growth will also be supported by the need for IT to drive the design, simulation, operation and monitoring of individual transport elements and vehicles as well as entire transport networks. The new supporting physical infrastructure such as charging points for Electric Vehicles and other future fuel connection points will drive more IT installations and data growth.

A Summary of Conclusions and Implications for IT Vendors

The IT For Emissions Reduction (IT4ER) Market

1. The IT4ER market, underpinned by powerful policy and economic drivers, is set to grow at a compound average growth rate (CAGR) of 11% between now and 2020. This is 3.5 times the average growth in the UK IT market.
2. The IT4ER hardware market in the UK will exceed $2.12bn by 2020.
3. The Software element of the IT4ER market is set for strong growth for the same underlying reasons as the wider market and is estimated to be worth $ 1.27bn in 2020.
4. There are over 50 Enterprise scale software vendors (**2**) operating in the UK attracted by the UK's leading position globally in its national commitment to emissions reduction.
5. The wider deployment of sensor networks will be used to enable real-time monitoring of energy consumption by key operational assets, such as plant, machinery, buildings and transfer systems. This will drive investment in additional hardware and software.
6. This growth in data will drive more investment in software to enable the analysis of Big Data. Successful software solutions will need to support the integration of real-time data and provide strong analytics capabilities.
7. The new management information created through the deployment of these new software solutions will be used by organisations to underpin their investment cases for other technologies, which further optimise energy consumption.
8. The services economy around the deployment of IT4ER software applications is expected to grow significantly to form the largest component by value of the overall IT4ER market to $6.35bn by 2020. It has been estimated that for every $1 of software, there will be an additional $5 of services revenues purchased.
9. The biggest potential for emissions reductions in the UK through IT investment will be seen in energy efficiency improvements in transport and energy supply infrastructure, with important secondary markets in building and industry. The dematerialisation of high energy processes will also be an important driver of IT investment in this market.

Implications for IT Vendors

1. Vendors will need to clearly articulate the role of IT as an enabler of improving resource efficiencies with corresponding reductions in economy-wide emissions.
2. Many organisations will seek to outsource ICT operations to third party managed service providers (MSPs) as a relatively easy and cost effective way of reducing their emissions in line with government targets. As a result, hardware investments will likely be significant in the infrastructure of these MSPs.
3. Leading MSPs wishing to capitalise fully on this growth opportunity will need awareness of a new class of software vendor - the Sustainability Software Vendors [SSVs] - and their capabilities in order to broaden out their service provision. (See Market conclusion 4)
4. Service providers such as MSPs will also need to understand and closely manage their own emissions and energy impact to ensure that risks of reputational damage and environmental taxes are mitigated and escalating energy costs are priced into their business models appropriately.
5. Service providers wishing to achieve success in the IT4ER market will require specialist expertise and understanding of the methodologies and standards for measurement and management of Greenhouse Gas emissions.
6. In addition to these specialist technical skills, service providers will also need to demonstrate expertise in the energy dynamics of specific asset types such as buildings or transportation systems. If such skills are not currently available then initial sales in this market will be dependent upon the rapid formation of service 'solutions' created through collaborative ventures with other specialist service providers.
7. Early success in this market will, over time, provide service providers with substantial cross-selling opportunities as clients focus their attention onto other elements of sustainable business practice, such as water consumption, waste management and the efficient use of the raw materials to which they add value.

Recommendations for IT Vendors

Drivers of the IT4ER market

- The UK Government has a clear publicly stated objective, which is legally binding via the Climate Change Act of 2008, to reduce its Greenhouse Gas Emissions by 34% against a 1990 base line by 2020 and by 80% against the same baseline in 2050.
- This means that the UK will need to reduce its national emissions from 695 $MtCO_2e$ (mega tonnes of carbon dioxide equivalence) in 2006 to approximately 500 Mt CO_2e by 2020 and 159 Mt CO_2e by 2050.
- These emissions objectives cannot be achieved without change in energy use and massive investment in infrastructure at a national, company and residential community level.
- Arguably no investment is more crucial to meeting this challenging transition than the investment in IT to support the measurement, management and optimisation of energy consumption required to support the reduction in the UK emissions.

This report provides an estimate for the first time of the amount of IT investment needed to reach these policy objectives. The compelling nature of the trend and the need for investment in the IT4ER market is clear.

For any vendor of IT Goods and Services considering how they may position themselves to benefit from this market growth, the following recommendations are made:

- **Understand the policy and relevant UK legislation underpinning the UK's goal of reducing Greenhouse Gas Emissions**

Vendors must have an appreciation of the legislative frameworks that apply to the emissions reduction objectives of the United Kingdom. Where appropriate the objectives of the devolved administrations should also be reviewed as some regions have different targets than those set at the UK level, Scotland in particular.

The legislative landscape is complex with many policy instruments each offering important market catalysts and deadlines for action. To evaluate the market opportunities that will present themselves in the coming decade, knowledge of this policy framework is vital.

- **Appreciate that the energy efficiency priorities of prospective clients in different industries will not be uniform**

Energy efficiency priorities vary across the industry sectors across the UK. These differences occur as a consequence of:

- variation in energy intensity of operations (how important is energy as a component of total operational costs). High energy intensity businesses are usually advanced in their focus upon energy savings due to the risks that rising energy costs have to their overall profitability.

- experience and history of management focus upon energy efficiency and emissions reductions initiatives. Although energy efficiency may already be an important driver of investment it does not necessarily follow that similar attention has been given to calculating and reporting upon greenhouse gas emissions.
- importance of emissions reductions to the overall strategy of the organisation. For example if Sustainability is seen as a key corporate goal then this issue will be a higher priority
- impact of high profile energy efficiency initiatives by key competitors
- significance of key stakeholder opinion, for instance where a sustainable brand image may be an important consideration for consumers
- differences in comparative energy consumption across different asset types, for example a bank will have a different energy use profile in comparison to a retail operator
- policy – different sectors have different regulatory and statutory obligations

All of these factors will combine to make one organisation more interested in earlier adoption of energy efficiency innovations over another. This knowledge is an important consideration as vendors seek to identify specific sectoral niches in the market to focus upon as part of the development of their wider sales and marketing strategy.

Vendors therefore need to identify the best target markets and prospects within them in order to ensure that sales and marketing activities are focused upon clients that have the greatest need and interest in energy efficiency and emissions reductions.

- **Recognise that IT procurement decisions in the IT4ER market will not always be driven by the IT function**

Our analysis of the various market sub-sectors indicates that energy efficiency and emissions reduction initiatives are likely to become a focus for different functions within an organisation. For example it is likely that investments relating to buildings will be influenced heavily by facilities managers or that transport policy will be in the remit of logistics managers or even human resources. Due to the reputational risks and significant calls on capital required to facilitate the transition to a low energy and emissions infrastructure, other functions such as Finance, Human Resources and Marketing may all have an interest and influence upon strategies in these areas.

Consequently vendors should recognise the key importance of engaging with audiences outside of the traditional IT function if they are to obtain early visibility of projects. Successful engagement will require a credible understanding of the issues created by energy efficiency across a wide range of functional groups. An appreciation of the relevance of legislation and relevant vocabulary for each function will also be essential to effective consultative dialogues with these clients.

- **Develop a sales and marketing strategy that recognises that the IT4ER market is a part of a broader IT for Sustainability (IT4S) market opportunity**

Although this research is centred upon the emissions reduction opportunity, many organisations are sincere in their wider ambitions to develop more sustainable businesses as defined on page 13.

As a result both social impacts and other environmental assets are or will become of increasing importance to them. Examples of other impacts that may be of significance include:

- Minimisation of the organisation's overall environmental impacts. This may include considerations of:
    - Water consumption
    - Discharge of hazardous waste or pollutants
    - Environmental impact and sustainability of key input materials
    - Recycling of excess production as a source material
    - The incorporation of climate change adaptation requirements into their standard planning and risk management processes
- Social aspects of Sustainability, which may include:
    - Sustainability of work practices within their supply chain e.g. prevention of child labour, provision of fair prices to suppliers e.g. Fair Trade.
    - Provision of fair sustainable pricing to smaller suppliers (Fair-trade practices)
    - Contribution to the local economy, social entrepreneurship, establishing a foundation that supports specific worthy causes

The reason for this is that all of the above aspirations present an opportunity to measure, manage and monitor current business impact as it relates to these wider objectives. The close alignment between these challenges means that many organisations are interested in developing IT strategies to manage all of these issues within a single measurement and analysis infrastructure. This wider opportunity affords greater deal complexity and value.

In this regard IT vendors also need to consider the role of new functions that are beginning to appear in the management hierarchy and buying coalition of clients, such as the Chief Sustainability Officer or Director, These roles have the responsibility of aligning all strategies and investment across an enterprise to ensure that its sustainability goals are achieved. Vendors will need to identify and engage effectively with these new emerging cross-functional roles if they are to maximise their opportunity in these emerging IT4S markets.

- **A review of channel strategies will be needed to execute effectively in the IT4ER market**

Successful entry and execution within the IT4ER requires some market knowledge and sales expertise to engage clients effectively. However any gaps in sales and marketing knowledge required by IT vendors can be bridged by the development of an effective ecosystem of partners that can bring relevant complementary skills and technologies to bear.

For example there are already nearly 60 enterprise scale software solution providers operating in the UK IT4ER market (**2**). In addition there are many consulting organisations both large and small with focused expertise in the management of energy or the reporting on greenhouse gas emissions.

The early stage of the market means that there is still considerable scope for new supply chains and partnerships to be formed, which IT vendors can orchestrate to their advantage.

However, as the development of this market accelerates it is likely that it will consolidate around a smaller number of larger players or supply networks and the associated barriers to market entry will rise. Vendors who are serious about gaining their share of this multi-billion dollar opportunity need to act quickly, whilst the market is in this early formation stage.

Further Information

If any readers of this report have further questions arising from the analysis presented here, please feel free to contact Cambium. This is best achieved by sending an email to: info@cambiumllp.com.

PART 2 – Detailed Methodology and Analysis

Summary of results from Methods 1-3

The results from the three Methods are as follows.

UK IT4ER Hardware results summary (Servers, Storage and Network)

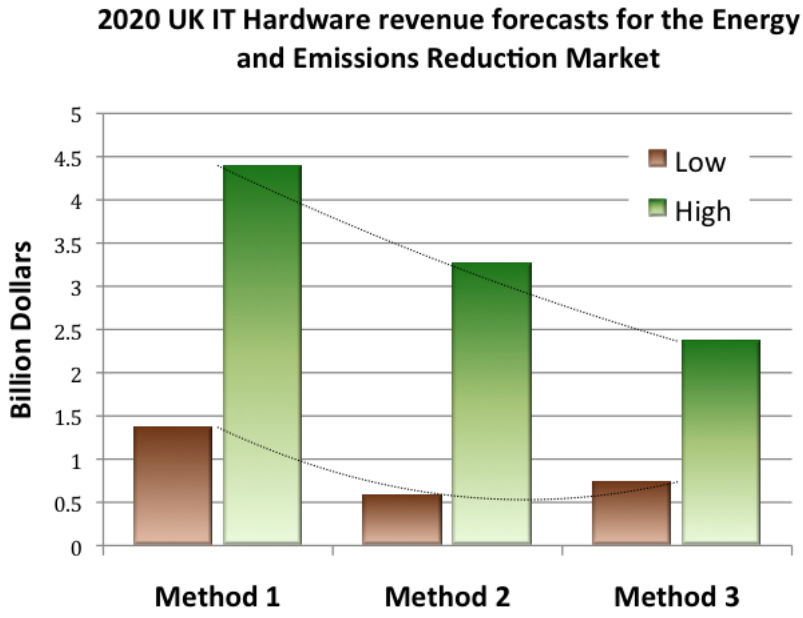
All values are in 2012 $Billion Dollars USA.

	2020 IT4ER Hardware Market ($ billions)		
Method	Low Value	Average Value	High value
1 Climate Group Global Study	$1.366 Bn	$ 2.880 Bn	$4.394 Bn
2 The Boston Consulting Group USA Study	$0.584 Bn	$ 1.901 Bn	$3,256 Bn
3 UK 2020 Emissions reduction target	$ 0.735 Bn	$1.551 Bn	$ 2.366 Bn
Lowest and Highest	**$0.584 Bn**	**$ 2.880 Bn**	**$4.394 Bn**
Averages	**$ 0.895 Bn**	**$ 2.111 Bn**	**$ 3.339 Bn**

Figure 13 Comparisons of Hardware Estimates from 3 Methods

It should be noted that the Hardware values in Fig 13 are estimated on a "balanced" and typical IT system using a mix of Servers, Storage and Network Systems and does not represent any one type of hardware. The total KW of the balanced IT system is used to calculate the amount of IT required and then that is turned into a value of IT Hardware in 2020 assuming an average spend on IT of $8,000 per KW (Plate Value) compared to around $20,000 in 2012.

On average, Method 1 gives the biggest estimate range of market size, Method 2 is 66% the size of Method 1 and Method 3 is 55% that of Method 1.



From the chart in Fig 14 it can be seen that the High estimate declines from Method 1 through to Method 3. However, the Low estimate is smallest in Method 2 where it is only 43% of Method 1.

Figure 14 Graph of IT Hardware estimates for 2020

The total size of the UK IT Market 2012 – 2020 (14)

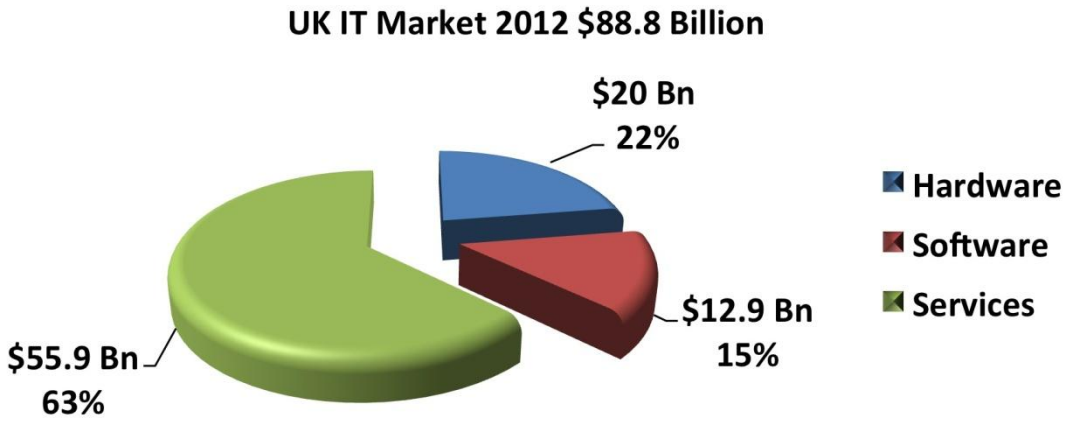


Figure 15 UK IT Market in 2012

The UK IT market at $ 88.8Bn in 2012 is expected to have the following growth rates from 2012 to 2016

1. Hardware market will grow at 6% CAGR
2. Software Market will grow at 5% CAGR
3. Services market will grow at 7% CAGR after a flat start to 2012 due to reducing Government programs but picking up from Outsourcing and Cloud

Assuming these rates of growth and that they are maintained, then 2020 could look like this.

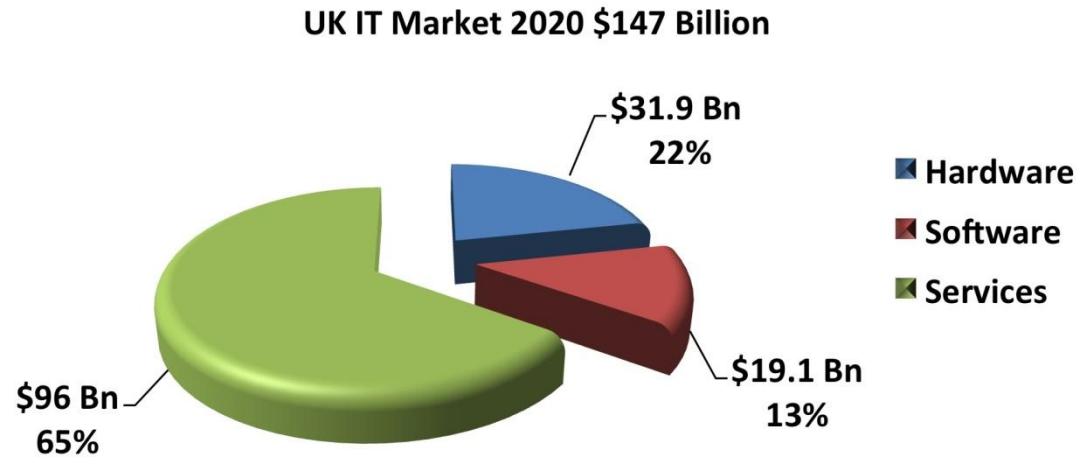


Figure 16 UK IT Market in 2020

2020 UK IT4ER Hardware, Software and Services results summary

By using the expected share of hardware, software and services from fig 16 page 41, the potential range of values for software and services to support the IT4ER market in 2020 can be estimated.

It is important to remind the reader that the IT hardware numbers used below assume that 25% of the hardware to support energy and emissions reductions is replaced each year in a continuing rolling programme. The actual capital value of the required hardware that is installed at any one time is therefore four times higher than the annual sales value below. The software and services values are recurring annual amounts to build, run and maintain the systems in place.

The first row of the following table shows the hardware values derived at the end of fig 13 page 40.

		IT4ER Market 2020 ($ Billions)		
		Low Value	**Average Value**	**High Value**
Hardware	Methods 1,2,3 (Fig 3 averages)	$0.895 Bn	$2.117 Bn	$3.449Bn
Software	(HW x 60%) from Fig 16	$ 0.537 Bn	$1.270 Bn	$2.003 Bn
Services	(HW x 300%) From Fig 16	$ 2.685 Bn	$ 6.351 Bn	$ 10.017 Bn
Totals		**$ 4.117 Bn**	**$ 9.738 Bn**	**$ 15.359 Bn**
As % of UK IT Market		**2.8%**	**6.6%**	**10.4%**

Figure 17 Comparisons of Hardware, Software and Services Estimates from 3 Methods

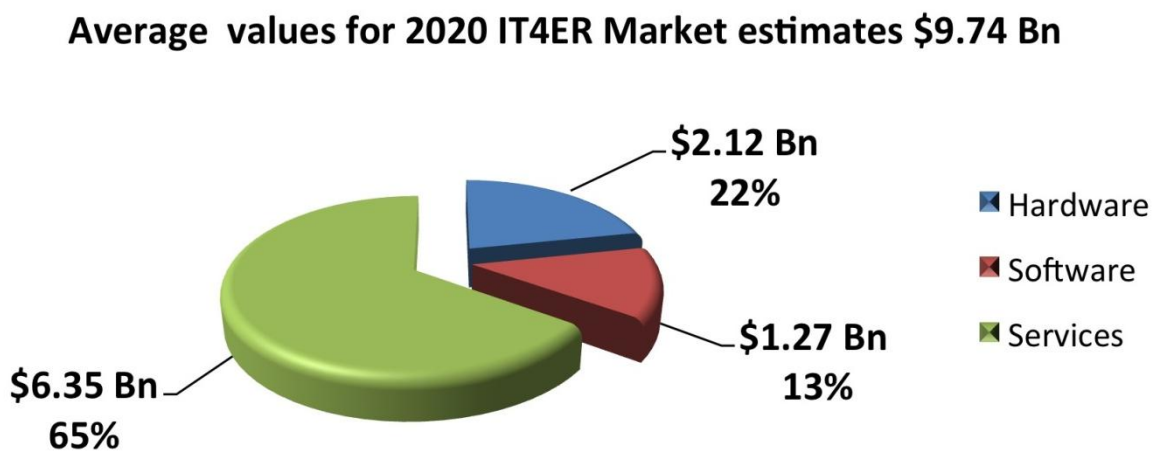


Figure 18 Average of Market Estimates for IT4ER in 2020

IT4ER See Appendix A page 47 for details.

Each of the reports used as sources have differing taxonomies for how they view

1. The total range of where IT can be used to reduce emissions
2. How that range is broken down into differing target markets

Cambium has listed the full scope and segmentation of each of the source reports and then defined a Cambium Unifying Taxonomy which is a Super-set of these reports. This has then been used to synthesise a segmentation that encompasses each of the source report segmentations. From this it can be seen that some of the reports do not cover all of the Unifying Taxonomy segments. All the source taxonomies and the derived Cambium Unifying Taxonomy are shown in Fig 21 page 48.

It should be noted that all four of these highly detailed source reports are used to define the size, scope and segmentation of this Meta Study.

By using the low, average and high values for the range of the projected UK IT4ER Hardware, Software and Services spend in 2020, these revenue potentials have been allocated across the six different segments described in the Unified Taxonomy.

			IT4ER Market 2020 ($ Billions)		
	Unifying Taxonomy		Low	Average	High
Solution Area	**Totals from Methods 1-3**	**Market Share**	**$ 4.117 Bn**	**$ 9.738 Bn**	**$ 15.359 Bn**
1A+1B	Buildings Old & New	**19%**	0.782	1.850	2.918
2	Transport	**24%**	0.988	2.337	3.686
3	Remote Work	**7%**	0.288	0.682	1.075
4	Dematerialisation	**16%**	0.659	1.558	2.457
5	Industry	**11%**	0.453	1.071	1.689
6	Energy Supply	**23%**	0.947	2.240	3.533

Figure 19 Share of IT spend across the Segments

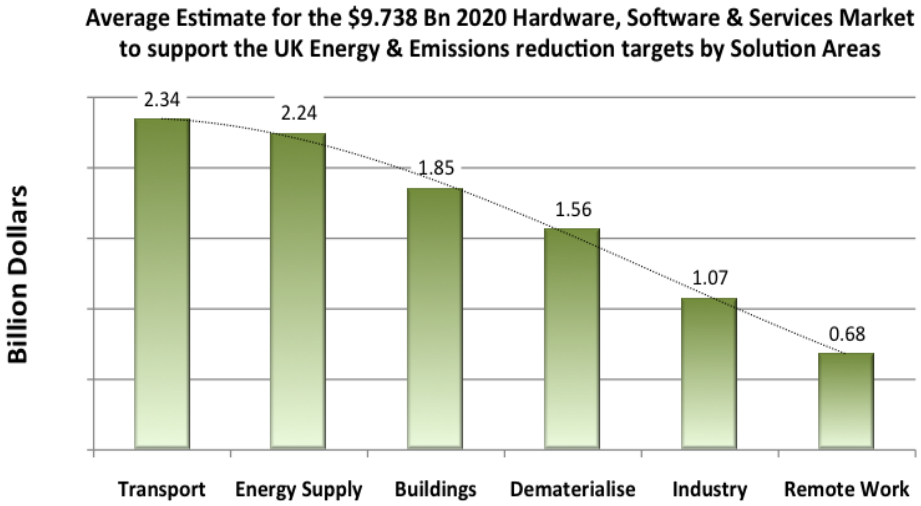


Figure 20 Average Total IT estimate for spend by Segment

Figure 20 shows the Solution areas sorted by size based on the average total estimated market for IT of $9.738 Billion using the averages from Methods 1, 2 and 3.

References

1. *Carbon Plan*, HM Government –December 2011
2. *An analysis of Sustainability Software Vendors (SSV) operating in the UK market*, Cambium Research Ltd , to be published in September, 2012
3. *Capitalising on the transition to Sustainable Business* – Cambium Whitepaper- July, 2012 www.cambiumllp.com
4. *High Tech: Low Carbon - The role of ICT in tackling climate change* Intellect UK–2008 http://www.intellectuk.org
5. *Department of Energy and Climate Change accessed July, 2012* http://www.decc.gov.uk/en/content/cms/statistics/climate_stats/data/data.aspx
6. *Mandatory Greenhouse Gas Emissions Reporting* -Department for Environment, Food and Rural Affairs accessed July, 2012 - *http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/*
7. *Enabling the low carbon economy in the information age* - Smart 2020 – The Climate Group – GeSI - June 2008 http://www.gesi.org/ReportsPublications/Smart2020/tabid/192/Default.aspx
8. *Enabling the low carbon economy in the information age* Smart 2020 – Boston Consulting Group – GeSI - – United States Report Addendum. November 2008 http://www.smart2020.org/_assets/files/Smart2020UnitedStatesReportAddendum.pdf
9. *Information and Communication Technologies: The Power of Productivity.* - John A. Laitner and Karen Ehrhardt-Martinez, February 2008 – ACEEE - http://www.aceee.org/research-report/e081
10. *Sizing the Climate Economy.* HSBC Climate Group, September 2010http://www.research.hsbc.com/midas/Res/RDV?ao=20&key=wU4BbdyRmz&n=276049.PDF
11. *The Potential global CO2 reductions from ICT use, - Ecofys – WWF, May 2008.* http://www.wwf.se/source.php/1183710/identifying_the_1st_billion_tonnes_ict.pdf
12. *Conversion Factors: Energy and carbon conversions.* Carbon Trust 2011.http://www.carbontrust.com/media/18223/ctl153_conversion_factors.pdf
13. *Department of Energy and Climate Change* accessed July, 2012 http://www.decc.gov.uk/en/content/cms/emissions/carbon_budgets/carbon_budgets.aspx
14. *United Kingdom Information Technology Report*– Business Monitor International, Q2- 2012

Appendices

Appendix A - Source Report Taxonomies

Cambium have listed the full scope and segmentation of each of the source reports and then defined a Cambium Unified Taxonomy which is a Super-set of these reports. It should be noted that all four of these highly detailed source reports (7), (8), (10), (11) are used to define the size, scope and segmentation of this Meta Study.

However, two of the reports have lower values in trying to calculate the absolute size of the UK IT4ER market in 2020 for the following reasons.

- The HSBC report (10) is about a good segmentation and then a view of the overall market spending in these areas. It does not break down the spending to categories such as Technology, Infrastructure, and ICT etc. Hence it cannot be used well to develop the sizing data for the IT4ER market.

- The WWF report (11) is included in this analysis since it is the most comprehensive analysis amongst these sources for a possible breakdown of the main markets and their many sub-markets. It goes on to talk about spending but is only looking at where the key areas of initial spending will occur rather than having an insight into total spending required on IT in 2020.

A Unified Taxonomy

Unifying Taxonomy		The Climate Group Global (7)	Boston Consulting Group USA (8)	HSBC Global(10)	WWF Global (11)
1A	**Buildings Old**	• Smart Buildings • Smart Logistics* • Dematerialisation* • Smart GRID*	• BMS • Voltage Optimisation • Lighting • HVAC Automation • Other • Run better • Use less space	Building efficiency	Legacy Building - ICT to run better
1B	**Buildings New**				Planning and operating new buildings
2	**Transport**	• Smart Logistics • Private Transport • Dematerialisation* • Efficient Vehicles • Traffic Flow monitoring planning and simulation	• Itinerary Planning Commercial • Route Planning Commercial • Supply Chain Design • Eco-Driving Commercial • Individual Logistics • Individual Eco-Driving	Transport efficiency	• Modal shift enabled by better urban planning • In-Vehicle ICT • Intelligent Transport Infrastructure
3	**Remote Work**	These are imbedded in other areas – see * items in text above and below	• Flexible Work • Virtual Meetings	NA	• Telecommuting • Virtual Meetings
4	**Dematerialise**		NA	NA	• E-Commerce • Dematerialisation
5	**Industry**	• Smart Motors • Process Automation • Dematerialise*	This area not covered in their report	Industrial efficiency	• Energy Efficiency in Industry • Process design • Operations
6	**Energy Supply**	• Smart GRID • Efficient Generation CHP	• Integrated renewable Energy • Reduce Transmission & Distribution losses (T&D) • Consumer Awareness	Energy Storage Smart GRID	ICT in Energy Supply System

Figure 21 A Unified Taxonomy

Appendix B - Scaling factors for differing sources

The different source reports split the potential emissions reductions into differing percentages by Segment. These differing weightings can be combined into a Meta Emissions Weighting. Those Meta Weightings can then be reallocated back to the segments in the source reports to derive a scaling factor for each report to make up for any "missing" segments. It should be noted that the Global study by The Climate Group covers all the sub-segments of the Cambium Unified Taxonomy but in a different way, therefore it has a scaling factor of 100%.

REALLOCATION OF THE META SEGMENTS EMISSIONS % BACK TO THE SOURCE REPORTS

SOLUTION AREA	META SEGMENTS	% OF EMISSIONS ASSUMED BY CAMBIUM BY COMBINING THE SOURCE REPORT WEIGHTINGS = META EMISSIONS WEIGHTINGS	THE CLIMATE GROUP GLOBAL	BOSTON CONSULTING GROUP USA	HSBC GLOBAL	WWF GLOBAL
1A+1B	Buildings Old+New	**19%**	25%	19%	Not covered	19%
2	Transport	**24%**	31%	24%	Not covered	24%
3	Remote Working	**7%**	In above/below	7%	Not covered	7%
4	Dematerialisation	**16%**	In above/below	Not covered	Not covered	16%
5	Industry	**11%**	14%	Not covered	Not covered	11%
6	GRID	**23%**	30%	23%	Not covered	Not covered
	TOTAL %	**100%**	**100%**	73%	NA	78%
		SCALING FACTOR	**1**	**1.37**	**NA**	**1.28**

Figure 22 Assignment of Emissions by Segment

Appendix C - Methodology used to calculate the IT4ER values for the UK

Method 1 – The Climate Group Global Study

Method 1 Approach

June 2008 Smart 2020 – The Climate Group – for GeSI - Enabling the low carbon economy in the information age (7)

This report, published in June 2008, focused on the areas of Global emissions that can be reduced by the application of ICT technology. The steps used in this section are

1. Size the global emissions enabled by IT in Tonnes CO2e in 2020 (from the report)
2. Convert the emissions to a Global KWh value using an average CO2 burn rate per Kwh
3. Convert emissions KWH to a Global high/low range IT Kwh (using the ACEEE study)(9)
4. Convert the Global IT KWh to an annual Global cost of IT spend on Hardware
5. Pro-rata the Global IT spend to a UK IT spend on the basis of UK share of Global emissions in 2020
6. Reverse engineer the 2013 UK IT4ER market high and low values by assuming a CAGR factor and scaling backwards from 2020 at that rate

Assumptions

1. Business cases for IT Hardware are over a 4 Year period
2. IT Servers will improve by an annual 15% to 20% in work done per KWh from 2012 to 2020
3. Servers will reduce in cost per KW by 6% per Year from 2012 to 2020.
4. A balanced IT system of Servers, Storage and Network will go from an average cost of $20,000 per KW of equipment in 2012 to a cost of $8,000 per KW of equipment in 2020
5. The UK IT4ER market compared to the global market will be proportional to the UK share of Global emissions at 1.4%. This is a minimal assumption because the UK is expecting to do more than its fair share of Global reductions by 2020.
6. Growth of the IT4ER market will range from 9% to 13% CAGR from 2012 to 2020. In this case an average of 11% CAGR is used.

Method 1 Analysis

	Step	Input	Calculation	Output
1	**Size of global emissions enabled by IT in 2020 (Source #1)**	**7.8 GT CO2e**		**7.8 GT CO2e**
2	**Convert (1) to KWh using this average of Co2 emissions per KWh of power consumption from Carbon Trust ratios**	**0.300** KG CO2 emissions per KWh of consumption across average fuels mix	7.8 GT CO2e / 0.3	**2.6E+13 KWh**
3	**Convert (2) to Lowest IT KWh using ACEEE study (Source #3)**	Lowest rate of required IT based on **1KWh** of IT per **13.5KWh** of emissions But if IT workload performance increases by 20% per year since 2009 to assumed value of 1Kwh per **100.3KWh** in 2020	2.6E+13 KWh / 100.3	**2.6E +11KWh** of IT capacity
4	**Convert (2) to Highest IT KWh using ACEEE study**	Highest rate of required IT based on **1KW**h of IT per **6.7KWh** of emissions But if IT workload performance increases by 15% per year since 2009 to assumed value of 1KWh per **31.2KWh** in 2020	2.6E+13 KWh / 31.2	**8.3E +11KWh** of IT capacity
5	**Lowest KWh IT Capacity required on the ground in 2020**	From (3) **2.6E +11KWh** of IT power used in the Year. Used power is 70% of Plate value and only 70% of ICT is central IT systems	2.6E +11KWh x 0.7 / 365 / 24 /0.7	**29,556,941KW** of IT on the ground
6	**Highest KWh IT Capacity required on the ground in 2020**	From (4) **8.3E +11KWh** of IT power used in the Year. Used power is 70% of Plate value and only 70% of ICT is central IT systems	8.3E +11KWh x 0.7 / 365 / 24 /0.7	**95,112,131KW** of IT on the ground
7	**Lowest Capital cost of IT amortised per Year (= Capex each year to refresh IT)**	Assuming **4 year** period of operation and **$8,000** per KW of a mixed IT capacity in 2020	29,556,941KW x $8,000 /4 Years	**$59,113,882,077 of capital cost**
8	**Highest Capital cost of IT amortised per Year (= Capex each year to refresh IT)**	Assuming **4 year** period of operation and **$8,000** per KW of a mixed IT capacity in 2020	**95,112,131KW** x $8,000 /4 Years	**$190,224,262,641 of capital cost**
9	**Convert from Global to UK value for Lowest spend/yr on IT hardware in 2020**	UK at 1.4% of Global Emissions in 2020 – This is conservative since UK IT spend will be more than an average global rate	**$59,144Bn * 0.014**	**$1.366 Billion**
10	**Convert from Global to UK value for Highest spend /yr on IT hardware in 2020**	UK at 1.4% of Global Emissions in 2020	**$190,224Bn * 0.014**	**$4,394 Billion**
11	**Predicting the UK IT for Emissions Hardware market in 2013**	Growth predictions for this market up to 2020 averages 11% CAGR	**Reversing the CAGR from 2020 using nos. in (9) and (10)**	UK IT4ER Hardware market in 2013 ranges from **$0.538** Billion to **$1.730** Billion

Figure 23 Method 1 Analysis

Proportion of Global Emissions Reduction spend on IT4ER in 2015

An estimate for what percentage of emissions reduction spend needs to be spent on Information Technology

The UK Government 2018-2022 Carbon Budget (13) announced in 2011

"58. For industry, the global low carbon market is projected to reach £4 trillion by 2025 as economies around the world invest in low carbon technology. The innovation challenge for industry is in business models as well as technologies, with electric vehicles, renewable electricity and solid wall insulation requiring upfront investment, but delivering large savings in operating costs."

From this value of £4 Trillion in 2025, using the expected growth in spend up to that point, a value of £3.6 Trillion in 2020 is calculated.

From Method 1, regressing Global IT4S markets in 2020 that range from $59 Billion to $190 Billion, an average CAGR of 11% is used to derive a Global IT4ER market in 2015 from $33 Billion to $106 Billion.

This would give IT Hardware as a proportion of the Global spend on low Carbon Technology in 2015 as a range from 0.9% to 3.0%. This is a useful overall rule-of-thumb.

On this same basis (Software being around 65% of Hardware spend) the Global Enterprise Software spend on IT4ER in 2015 varies from 0.6% to 1.9%.

This gives a total of Hardware and Software spend at 1.4% to 4.9% of Global spend on low carbon technology spend in 2015 or an average of 3.2%.

The overall rule-of-thumb

For every $1 Billion spent on low carbon technologies, spending of around $32Million on IT systems will be needed to support that technology.

Method 2 – The Boston Consulting Group USA Study

Method 2 approach

November 2008 Smart 2020 – Boston Consulting Group – for GeSI - Enabling the low carbon economy in the information age – United States Report Addendum (8)

This report, published in November2008, focused on the areas of US emissions that can be reduced by the application of ICT technology. The steps used in this Method are:

1. Figure 24 page 54 - (Columns 1 to 4) Calculate the share of 2020 USA emissions abatement potentials for each of the key segments listed in the report (Column 5 shows the proportions within a segment)
2. (Columns 6 & 7) Calculate how those abatement potentials for each segment compare to the expected total target emissions level for 2020 in USA
3. (Columns 8 & 9) Apply that same share proportion to the UK totals emissions target for 2020 to derive the possible abatement potentials in Million Tonnes CO2e for each segment at High and Low levels
4. The total for these ranges is shown in the bottom right cells in the table below
5. Convert the emissions abatement potential to a UK KWh value (as in Method 1)
6. (Source #3) Convert emissions KWH to a UK high/low range IT Kwh **(using the ACEEE study)(9)** (as in Method 1)
7. Fig 25 page 55 - Apply the Scaling Factor calculated earlier for this report Fig 22 page 49 (1.37)
8. Scale back to allow for fact that the UK ENERGY Intensity is only 87% of the USA
9. Reverse engineer the 2013 UK IT4ER market high and low values by assuming a range of CAGR factors and scaling backwards from 2020 at those rates (as in Method 1)
10. Apply the proportions from columns 6 & 7 to apportion the UK IT4ER market to key segments

Assumptions

1. Business cases for IT Hardware are over a 4 Year period
2. IT Servers will improve by an annual 15% to 20% in work done per KWh from 2012 to 2020
3. Servers will reduce in cost per KW by 10% per Year from 2012 to 2020
4. A balanced IT system of Servers, Storage and Network will go from an average cost of $12,754 per KW of equipment in 2012 to a cost of $8,000 per KW of equipment in 2020
5. The UK has a similar business profile to the USA
6. The UK has an emissions intensity of 87% of the USA
7. The Scaling Factor of 1.37 will correct for areas of the Cambium Unified Taxonomy that the Boston Consulting Group Report does not cover (Dematerialisation and Industry)
8. Growth of the IT4ER market will range from 9% to 13% CAGR from 2012 to 2020. In this case an average of 11% CAGR is used.

1	2	3	4	5	6	7	8	9
Sub Segments	**Total US Emission levels in 2020**	**Abatement Potential**			**% impact on US emissions reductions**		**Pro-rata impact on UK based on 509Mill TCO2e v 6380Mill TCO2e**	
		Million TCO2e			**6380 MillTCO2e Total USA Plan in 2020**		**509 MillTCO2e Total UK Plan in 2020**	
		810	**1410**		**12.7%**	**22.1%**	**ICT enabled UK reduction**	
	Total Emissions of segment				**Low**	**High**	**Million TCO2e**	
		Low	**High**		**% of USA**			
Smart Grid	**2630**	**230**	**480**		**3.6%**	**7.5%**	**18**	**38**
Integrated renewable Energy		130	260	56%				
Reduce T&D losses		60	120	25%				
Consumer Awareness		40	100	19%				
Road Transportation	**1580**	**240**	**440**		**3.8%**	**6.9%**	**19**	**35**
Itinerary Planning Commercial		60	110	29%				
Route Planning Commercial		15	20					
Supply Chain Design		70	70	21%				
Eco-Driving Commercial		25	50	12%				
Individual Logistics		45	120	23%				
Individual Eco-Driving		25	70	15%				
Smart Buildings	**1760**	**270**	**360**		**4.2%**	**5.6%**	**22**	**29**
Building Design - Better Design		120	140	41%				
Building Design - Reduce Space		20	30	9%				
Building Tech - BMS		40	55	16%				
Building Tech - Voltage Optimisation		35	45	13%				
Building Tech - Lighting		20	35	9%				
Building Tech - HVAC Automation		15	25	6%				
Other		20	30	6%				
Travel Substitution	**1370**	**70**	**130**		**1.1%**	**2.0%**	**6**	**10**
Flexible Work		50	100	75%				
Virtual Meetings		20	30	25%			**Million TCO2e**	
							65	**112**

Figure 24 Method 2 Analysis

Method 2 Results for UK

UK IT (HARDWARE) ENABLED EMISSIONS IN 2020

FROM TABLE ABOVE	LOW VALUE	HIGH VALUE
Mill Tonnes CO2e	**65**	**112**
UK is only 87% Carbon intensity of USA so multiply by 0.87	**57**	**97**
Unified Taxonomy correction x 1.37	**77**	**134**
From ACEEE method (9) the IT4ER GW of IT equipment capacity on the ground needs to be	0.292 GW	1.628 GW
The value of IT4ER in UK is	$0.584 Bn	$3,256 Bn
Regression back from 2020 to get value of **2013** IT4ER market with CAGR of 11%	$0.258 Bn	$1.440 Bn

Figure 25 Method 2 Results for UK

Method 3 – UK Government targets for 2018-2022 Emissions reductions

Method 3 - Approach

From the UK Government 2011 Carbon Budget (13)

1. UK emissions were 775Million TCO2e in 1990
2. In UK Government Plans for 2018-2022 the 2020 levels need to be 35% lower
3. From Method 1 Report, IT can enable 7.8GT/21.9GT of required reductions = 36%
4. 36% of 35% = 12.5%
5. @12.5% reduction = 0.125 * 775 = 97 Million Tonnes CO2e of IT supported reduction in 2020
6. From the ACEEE method this requires IT4ER HW spend of $0.735 Bn to $2.366 Bn

Appendix D – About Cambium

Cambium is a specialist consultancy based in the UK and launched in 2008. Our business uses a combination of research, consultancy and training to help technology businesses with IT and Clean Technology innovations to accelerate their sales and capitalise on the opportunities as businesses seek to become more sustainable in their operations.

Cambium was founded upon two core beliefs that:

1. New ideas and technologies are essential to enable any business to become more sustainable.
2. Sales and marketing functions are a powerful force that can play an essential role in enabling this transition to a more sustainable world.

What makes Cambium different is that as well as being scientists or engineers, the organisation also possesses pragmatic knowledge and experience of successful B2B sales and marketing execution. This experience and perspective is used to help our clients maximise their opportunity in this rapidly growing and important market.

Our consulting services are particularly relevant to any innovative business product or services that can help business become more sustainable in the following areas:

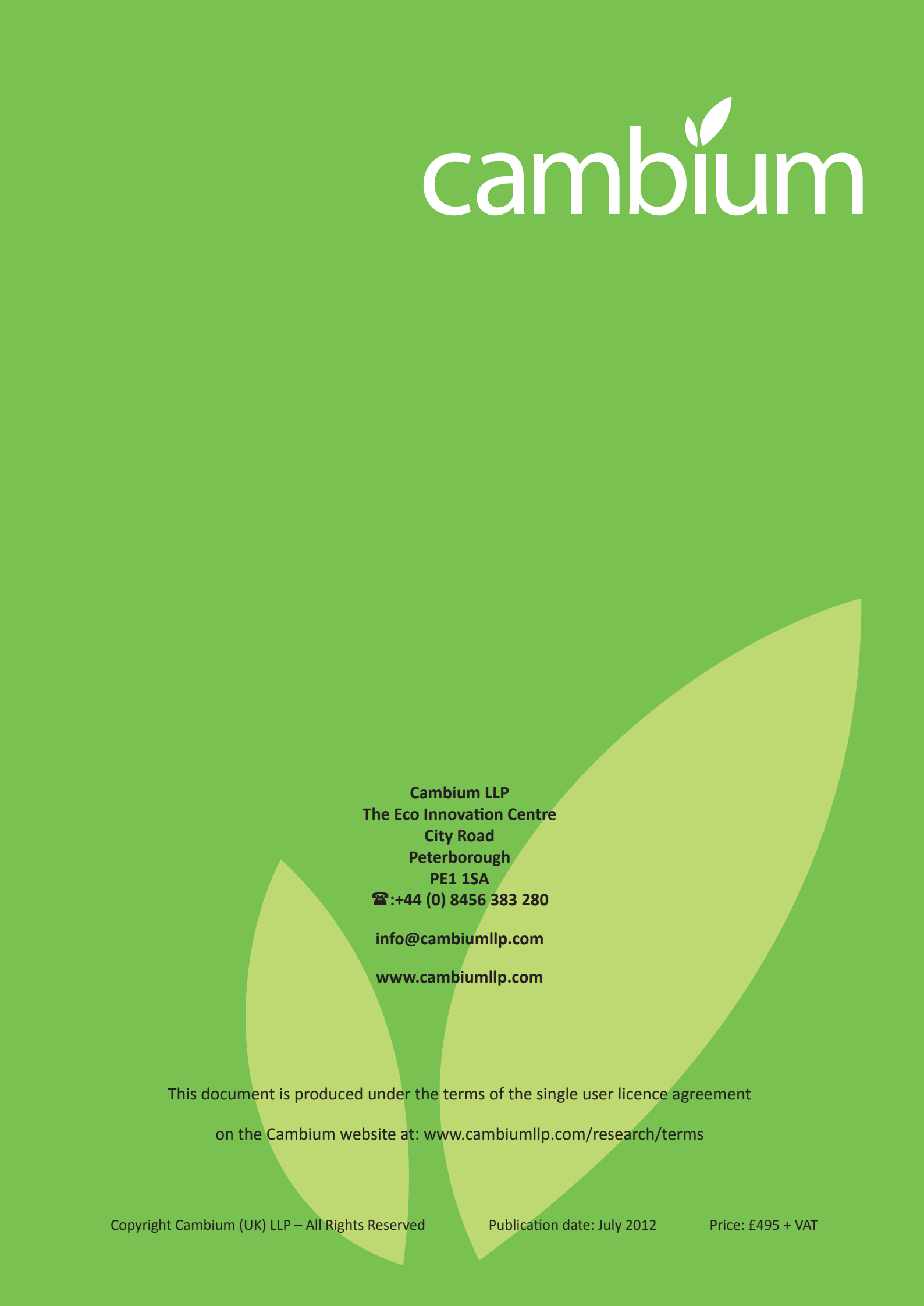
- Corporate Social Responsibility
- Employee Engagement
- Energy Efficiency
- Greenhouse Gas Reporting
- Information Technology
- Manufacturing
- Renewable Energy
- Supply Chain Management
- Sustainable Buildings
- Sustainable Procurement
- Transport and Logistics
- Waste
- Water

Cambium's Services

For businesses that want to accelerate their ability to capitalise upon any of these exciting new market opportunities, Cambium offers consulting services that enable them to reach their target market quickly and to accelerate their sales revenues. This impact is achieved by providing practical answers to the following key questions:

1. **Where is my best market opportunity?**
2. **How effective is my sales proposition?**
3. **How do I identify my best prospects?**
4. **What do my sellers need to know?**

To find out more about our approach please visit our website – www.cambiumllp.com call +44 (0) 8456 383 280 or email us at info@cambiumllp.com for a free no obligation consultation.



Cambium LLP
The Eco Innovation Centre
City Road
Peterborough
PE1 1SA
☎:+44 (0) 8456 383 280

info@cambiumllp.com

www.cambiumllp.com

Publication date: July 2012 Price: £495 + VAT