techUK

Climate Change Agreement (CCA) for Data Centres

Target Period One: Report on findings

Abstract

This is our second report on the CCA for Data centres.

It explains how the CCA scheme works and how targets are set for the data centre sector. It sets out the performance of the sector against its first target under the scheme. The sector exceeded this preliminary target by a comfortable margin, which sets operators up well for their more ambitious second milestone.

Whilst interpretation of the results is inevitably limited by the fact that the reporting period was abnormally short, some very useful insights have emerged. These include the effect the scheme has had on energy stewardship, a better understanding of the barriers that are preventing the implementation of efficiency measures and some early indications of how the CCA is likely to influence the evolution of the sector as a whole.

The report also comments on the effectiveness of the CCA as a policy tool and makes observations on recent policy developments likely to impact the data centre sector, which remains in critical need of strong signals of support from government. The report concludes with a summary of the strategic implications of the CCA scheme for the sector.

Contents

Foreword

The UK data centre sector Climate Change Agreement was formalised just over a year ago, a development that we very much welcomed, and the scheme is now truly up and running.

Earlier in 2015 we passed our first milestone on the way to our 2020 targets, and are starting to see the impacts of the scheme on the sector, both on energy stewardship and investor confidence. More importantly we are starting to be able to document them with data generated by the scheme.

This report sets out our progress against our first target, which I am very pleased to share with you on behalf of the UK Council of Data Centre Operators. I am delighted to see that the policy objectives are clearly being realised and that the scheme is improving energy efficiency whilst protecting jobs and growth.

Andrew Jay, Chairman, UK Council of Data Centre Operators

The UK data centre sector has come a long way in the last four years in policy terms. Previously, there seemed to be a perception that data centres were big power-hungry sheds with no obvious function. Now government recognises data centres as part of our critical national infrastructure, underpinning the digital economy, improving competitiveness, generating jobs and driving growth. As a result we are now seen as a key priority sector.

Along with that recognition we must accept greater scrutiny, especially regarding energy use, and this scheme is an example of how such scrutiny can be applied effectively. We are learning a lot: in some cases we are confirming what we thought was true but there are also some surprises. The important thing is that we use

what we know to ensure that best practice is adopted throughout the entire sector. We hope you enjoy reading about the things we have learned.

Emma Fryer, Associate Director, techUK

After such a long journey it is evident that the CCA is cherished by the data centre sector. The sector clearly understands the quid pro quo that the CCA facilitates; a reduction on the Climate Change Levy and exemption from the Carbon Reduction Commitment in return for implementing energy saving measures.

Opportunities to reduce are largely well understood by the sector and the business case to implement under the CCA is now more compelling. However, through our dialogue on CCAs the barriers to implementation have become more clearly understood. Collaboration with the supply chain will be an important part of the strategy to realise future energy saving targets.

Julie Gartside, Technical Director, SLR Consulting

Executive Summary

A Climate Change Agreement (CCA) is a voluntary scheme with the dual purpose of protecting energy intensive sectors subject to overseas competition and driving improvements in energy efficiency within those sectors. Participants are eligible for reductions in, or exemption from, some carbon taxes but in return they must meet efficiency targets. The CCA scheme has been in place since 2001; its second phase started at the beginning of 2013 and runs until 2023. Targets for participants are split into milestones over the life of the scheme.

The CCA for Data Centres came into force on 01 July 2014 and the sector therefore entered phase II of the scheme near the end of the first target period. Although well over 100 facilities are now participating, the first cohort, comprising 98 of these sites, joined the scheme in 2014 and reported against the first target milestone at the end of 2014. This report presents the findings from those 98 sites during that period. The report does not include data from subsequent entrants (facilities joining in 2015).

Progress against target: facts and figures

The sector target for data centres is a 15% reduction in PUE over the life of the scheme, although this target is subject to review and may be increased if need be. The first milestone was a modest 1% to reflect the fact that sites joined the scheme almost at the end of the first target period so had little time to implement measures. Collectively the sector successfully met its first target milestone, although the margin by which it passed depends on the method of calculation adopted (see section III). At site level (98 sites) 12 sites failed and 86 sites passed. At Target Unit (TU) level (the sites make up 38 TUs - operators can bubble sites together into a single TU and then offset savings between sites), 29 TUs passed the target milestone and 9 TUs failed. All facilities chose to remain in the scheme and those who failed their targets purchased carbon credits to make up the shortfall (known as "buyout"). Buyout fees ranged from under £1,000 to just over £20,000. Total buyout was £61K.

In general the reasons for a site failing its target were that either a) the proportion of eligible activity was declining (e.g. a colocation facility lost clients or replaced colocation provision with servers supporting in-house computing activity) or b) new capacity was added but unfilled during the reporting period. Essentially all failures were the result of a decrease in throughput against a fairly constant energy baseload. This is a side-effect of a focus on efficiency and energy productivity rather than net emissions, and in these cases did not reflect a lack of good energy management.

There is one other factor to note: the reporting period (the time against which facility improvement was being assessed) was very short – instead of the two years from Jan 2013 to Dec 2014 companies were measured on their performance from joining the scheme until the end of 2014, which in most cases was only a couple of months. Any factors affecting performance, either positively or negatively in that period may have been magnified. We will have a much clearer picture after the end of 2016, the next milestone.

Energy stewardship

We took the opportunity presented by the reporting process to collect additional data by surveying participants. In fact, it is evident from the data we gathered, from anecdotal feedback from participants and from our own observations, that the CCA scheme has generated a bit of a step-change in energy stewardship within the sector. Better and more consistent energy measurement, including the obligation for all sites to implement sub-metering, is leading to better energy monitoring. The requirements of the scheme also mean that PUE[1] is now being measured more consistently and appropriately. It is also leading to more open customer-supplier dialogue on energy and has improved the business case for investment in efficiency measures. At a sector level we are gaining an unprecedented insight into energy use and energy management.

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1 PUE, or Power Usage Effectiveness is a measure of energy productivity widely applied to data centres. It is the ratio of energy delivered to the IT function divided by energy to the facility. The lower the PUE, the higher the energy productivity.

Barriers and lessons learned

However, a number of barriers have also been identified that are preventing operators from implementing much needed efficiency measures. Sometimes it is simply a question of timing, some issues relate to split incentives between landlord and tenant or between customer and supplier, some sites suffer technical constraints that limit what can be achieved in terms of retrofitting, and in some cases service level agreements or the perceived risk from implementing any changes are hampering progress. Now we have identified these we can start to address them.

Policy observations

We have taken the opportunity to comment on a number of recent policy developments that are pertinent to the sector. While Treasury's proposals to simplify energy taxes are extremely welcome, these bring an unavoidable period of uncertainty that needs to be resolved as soon as possible. Investors need to know that the industry will be viable in the long term, operators need certainty regarding policy direction and customers need to know that the UK will continue to provide an environment in which they can flourish.

Why do data centres need a CCA?

As mentioned above, the timing of this report coincides with Treasury's 2015 review of energy taxes, and CCAs are inevitably brought into the discussion. The data centre sector has already demonstrated its eligibility for the scheme, which is not in question. Nevertheless it is a good moment to revisit the reasons why data centres need this kind of support. These are simple: the sector is very energy intensive, the sector is highly vulnerable to overseas competition due to the mobility of digital data, and the sector is critically important to the UK economy.

Strategic implications

The report finishes by pulling together some of the more strategic implications of the CCA, which include obvious things like better energy stewardship and investor confidence, and some less obvious things like a vastly improved understanding of the energy demands of the sector and the consequent opportunities to ensure that policy decisions regarding this sector are properly informed.

Further information

If you have queries regarding the content of this report, need further information or wish to know more about techUK's data centre programme then please contact Emma Fryer, Associate Director, techUK, E emma.fryer@techUK.org.

I. Introduction

This section sets the scene and explains the scope and objectives of the report. It then provides some context for those unfamiliar with the CCA scheme, including a definition of climate change agreements and a quick recap of what we said in our interim report.

Scope and objectives of this report

We initially reviewed the Climate Change Agreement for Data Centres in our CCA First Findings Report, published in November 2014, once the first cohort of participants had registered. That preliminary report explained the scheme, its processes and objectives and reviewed the experiences of the various stakeholders involved. It identified lessons learned from the process and made some preliminary comments on the wider implications of the scheme for the UK data centre sector (see below).

Although this report may seem to follow hard on the heels of the first one, the focus is different. We have now passed the scheme's first milestone and so this time we will set out how we have performed against that first interim target both at sector level and participant level.
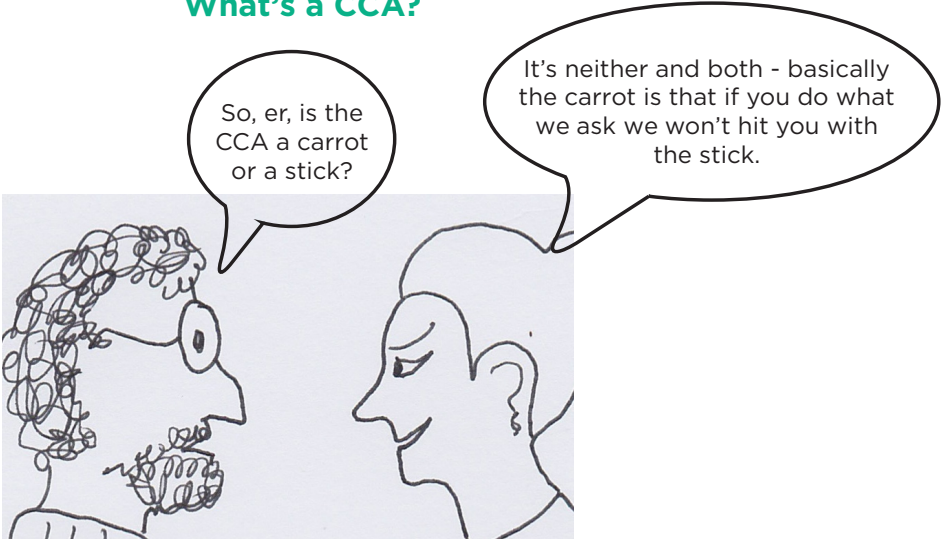
In view of recent and likely future changes in policy direction it is more important than ever that we can demonstrate the CCA is indeed fulfilling its policy objectives and stimulating good energy stewardship in the sector, whilst allowing us to remain competitive internationally. But the scheme is doing more than that: our CCA is also providing us with invaluable data, both at individual operator level and at sector level. Much of this we could only guess at in the past, so we will also comment on the understanding we are gaining of our sector's energy use, on best practice, and on identifying and addressing barriers to implementing efficiency measures.

Er, what's a CCA?

Climate Change Agreements (CCAs) are negotiated arrangements between government and energy intensive sectors. The objectives are to improve energy stewardship without damaging growth. Over 50 industry sectors are covered and the scheme has been running since about 2001. In return for a reduction in, or exclusion from, paying some carbon 'taxes' (CCL and CRC), participants are given energy efficiency targets. These targets are sector-specific so they can be focused exactly where they can deliver the most benefit. To date, CCAs have delivered greater energy savings among participating sectors than conventional policy measures would have achieved.

This is because the CCA really does change behaviour. A bespoke policy tool like a CCA at first glance seems to run counter to perceived wisdom, which takes the view that increasing energy costs forces people to take steps to improve efficiency – the basis of all "polluter pays" policy instruments. Instead the CCA provides compelling incentives to improve efficiency through a simultaneous carrot and stick – tough targets while providing companies with the means to invest in efficiency measures. Because CCAs accommodate growth by focusing on energy efficiency instead of net reductions, they are particularly suited to drive efficiency improvements in sectors like data centres that are energy intensive, growing fast, and vulnerable to overseas competition.

What's a CCA?

So, er, is the CCA a carrot or a stick?

It's neither and both - basically the carrot is that if you do what we ask we won't hit you with the stick.

For data centres, these efficiency targets take the form of a reduction in PUE[2]: the exact reduction required for each site depends on current performance. The scheme runs until 2023 (see the timeline illustration below) and the reduction target is spread over four target periods. Although not perfect, PUE was chosen because it is well understood and measurable.

Negotiations between techUK and the Department of Energy and Climate Change (DECC) started in 2009 and lasted for four years. The CCA was confirmed by the Chancellor in the 2013 Autumn Statement and was brought into law on 1st July 2014. The scheme is now in the second target period of its implementation phase.

How is the scheme administered?

The scheme is administered by three main parties: the Environment Agency (EA) administers and enforces it on behalf of DECC, techUK (the Association) acts on behalf of the sector with the assistance of SLR, and individual participants (data centre operators).

Data Centre CCA timelines

Many long term policy tools are multi-phase – for example the CRC (Carbon Reduction Commitment) and in EU ETS (Emissions Trading Scheme). Although CCAs started back in 2001, the current phase of the scheme began in January 2013 and is scheduled to run until 2023. Within that period the scheme is further broken down into four milestones. The chart below shows the timeline of the data centre sector's involvement in the CCA scheme.
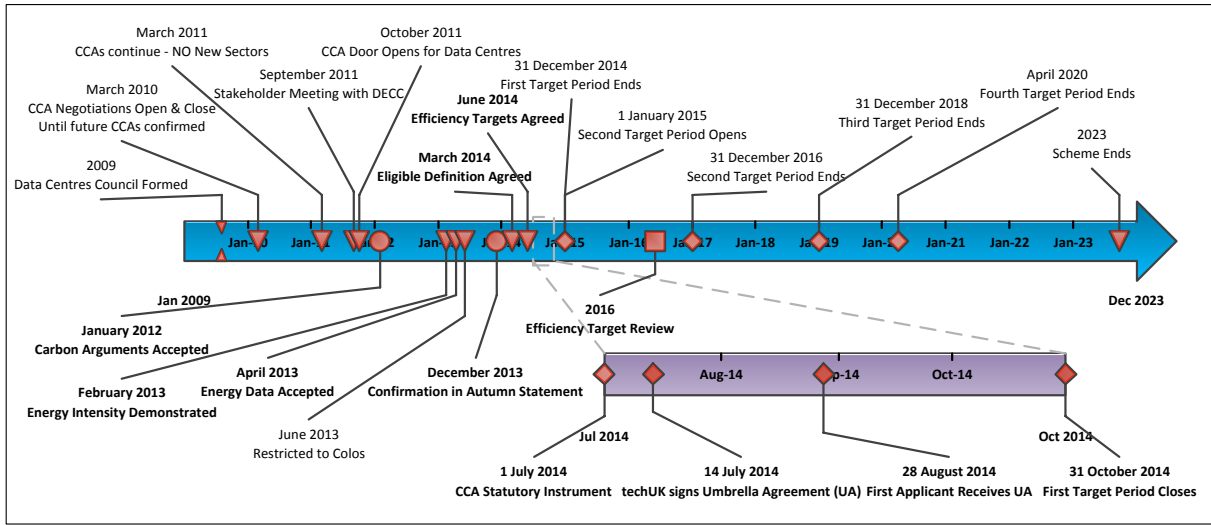
What did we say last time?

Our last report provided a brief introduction to the CCA scheme for data centres; it set out basic facts and figures on take-up – number of participants and base year performance; it reviewed the application process in terms of lessons learned and considered potential implications for the sector and how the scheme might develop in future. The contents are summarised below.

Uptake by the first cohort of registrants was better than expected, especially in view of the short application window: 100 facilities applied and 98 were successful – exceeding our prediction of 90 sites. Turnaround time from application to Agreement varied from 7 days to 100 days.

The average base year PUE was 1.93, very close to the PUE of 2 that we predicted. The average reduction target in PUE was 14.39%, again close to the 15% we negotiated for the sector. Targets ranged from just under 10% to just over 21%, depending on base year performance.

Total energy going through the scheme in the base year was just below 2TWh. For companies taking advantage of both CCL rebate and CRC exclusion, the average value of rebate (although in reality this varies wildly) was just under £275,000 per site, per year.

The registration process presented multiple learning opportunities: what we got right, what we got wrong, how the process was perceived by the different parties, the problems that cropped up and how we dealt with them - and how we will apply these lessons to the next cohort of applicants. Many participants had underestimated the complexity of the process and the rigour and attention to detail required in the supporting documentation. Coupled with the fact that a number of issues unique to data centres had to be resolved as we went along this made the application window extremely tight.

The last report also explored the wider implications of the CCA for the sector. These include formal recognition by Government that data centres exist and contribute to the economy, improved policy stability, which will drive greater investor confidence, improved competitiveness and better energy stewardship. We may also see changes in approaches to power purchasing. The CCA should be an effective tool in delivering policy objectives because of its ability to escalate targets and because it has wider reach, greater certainty and fewer perverse incentives than other schemes.

The report ended by looking further ahead at how the scheme might develop in a perfect world. We saw four main areas of opportunity – expansion to include enterprise operators, better informed policy dialogue, a better understanding of energy use at both facility and sector level and improved best practice through formal collaboration with existing industry tools and initiatives.

For a full copy of our First Findings Report please visit:
techuk.org/insights/reports/item/2773-climate-change-agreement-for-data-centres.

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2 PUE or Power Usage Effectiveness (see note 1). For the data centre CCA the PUE is measured as total delivered energy (ie in KWh or MWh), divided by total energy to the IT, annualised.

II. Data Centre CCA Target

This section explains the sector target we have to meet under the scheme and how it was calculated. It outlines how this is broken into target periods and how the target is amortised between the participants.

What is our "Sector Target"?

Under competition law, a tax concession like this can only be granted if the objectives of the tax are fulfilled in other ways, so in this case energy efficiency has to be improved by alternative means. To achieve this, participating CCA sectors are given efficiency targets. The data centre sector target has been agreed as a 15% reduction in PUE by 2020 over a 2011 baseline.

The sector target is broken down in two ways. Firstly it is divided over time; the scheme itself is broken down into four target periods each two years long (i.e. 24 months ending 2014, 2016, 2018 and 2020 - see below). Secondly it is amortised between all the participants who are given individual targets. The target setting process is tricky but important: the target needs to be high enough to drive ambition: if it is too low it will not change behaviour. On the other hand if it is set too high then companies will be unable to meet it and be penalised. The target also has to be shared between participants fairly without penalising early adopters.

How the target is spread over the life of the scheme

Timetable for CCAs	2013	2014	2015	2016	2017	2018	2019	2020	2021
Applications									
Submission of New Entrant Applications	Jan 13 to Oct 14		Jan 15 to Oct 16		Jan 17 to Oct 18		Jan 19 to Oct 20		
CCL Discount upon signing up to a new CCA		Date of assent to June 17			Date of assent to June 19			Date of assent to June 21	
Annual Reporting									
1st Target Period 2013-14	Jan 13 - Dec 14								
Reporting 1st Target Period		Jan -April							
CCL Discount for meeting 1st Target			July 15 - June 17						
2nd Target Period 2015-16			Jan 15 - Dec 16						
Reporting 2nd Target Period				Jan - April					
CCL Discount for meeting 2nd Target					July 17 - June 19				
3rd Target Period 2017-18					Jan 17 - Dec 18				
Reporting 3rd Target Period							Jan - April		
CCL Discount for meeting 3rd Target							July 19 - June 21		
4th Target Period 2019-20							Jan 19 - Dec 20		
Reporting 4th Target Period								Jan - April	
CCL Discount for meeting 4th Target								July 21 - March 23	

This diagram shows the way that this phase of the CCA scheme is broken down into shorter reporting periods. As mentioned above, CCA targets are spread over the life of the scheme and participants are obliged to meet milestone targets as well as the overall target.

In most CCAs the target profile is linear (i.e. the incremental improvement required is identical for each target period). However, we proposed – and it was agreed - that a non-linear series of interim targets for efficiency improvements in data centres would be most appropriate for the sector. The series is loaded so that the most ambitious targets occur in the second and third target periods rather than the first and fourth. The reasoning behind this is that it gives the sector time to implement efficiency measures but will still deliver approximately the same net carbon reductions as a linear target. This is illustrated in the chart and the detailed reasoning is explained in the box.

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The series is loaded so that the most ambitious targets occur in the second and third target periods rather than the first and fourth. The reasoning behind this is that it gives the sector time to implement efficiency measures but will still deliver approximately the same net carbon reductions as a linear target. This is illustrated in the chart and the detailed reasoning is explained in the box.
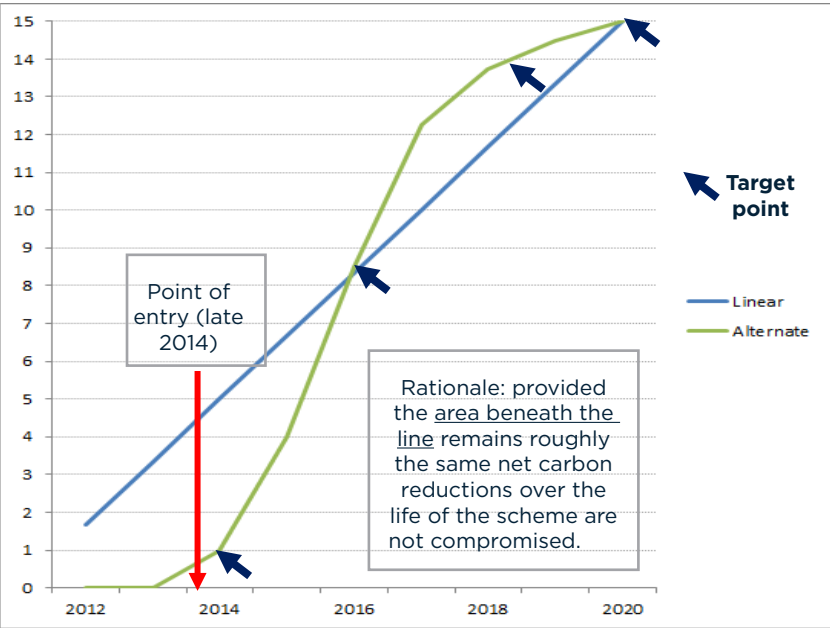

Chart of Target Profile

Summary of data centre CCA target breakdown

- First target period: 1% (under a linear model this would have been 5%);
- Second target period: 8.33% (unchanged);
- Third target period: 13.75% (Under a linear model this would have been 11.67%);
- Fourth target period: 15% (unchanged).

How is the target amortised between the participants?

We mentioned above that the sector target is shared between the participants and is set against a base year that in most cases was 2011. To spread the reduction requirement more fairly and avoid punishing early adopters who already have a low PUE, this sector target has been amortised between participants based on the application of a universal requirement to reduce non-IT energy by 30%. Individual site targets are expressed in terms of a reduction in site PUE over the same period but will depend on how the baseline PUE for that site compares to the baseline PUE for the industry which is set at 2 (See box). Put simply, sites with higher base year PUE have to make larger reductions than sites with lower base year PUE.

If your baseline PUE is...	Then your target is...	So your milestones are...	Target end 2014	Target end 2016	Target end 2018	Target end 2020	Your final PUE should be...
All figures relate to % reduction in PUE							
1	0%		0	0	0	0	0
1.5	10%		0.68	5.56	9.16	10	1.35
2	15%		1.00	8.33	13.75	15	1.7
2.5	18%		1.20	10.0	16.50	18	2.05
3	20%		1.33	11.1	18.33	20	2.4

Extract from our guidance note summarising the way the targets are broken down both over time and between participants using different examples of base year PUE. The 30% reduction in non IT power is a clever way of amortising the target fairly over the sector but the individual targets, just like the sector targets, are still expressed as a required reduction in PUE.

PUE is measured in a very specific way for the CCA and is rather similar to Green Grid PUE 2, in that it is the ratio of total cumulative energy to site divided by total cumulative energy to the IT but the key thing is that this measurement MUST be continuously metered and not calculated or derived from spot meter readings. Companies need 12 months of metered data to enter the scheme and those without appropriate metering in place have to wait until they do unless they are new build, in which case slightly different rules apply.

III. Sector performance against first target: Facts and Figures

Now we come to the meat of our report. This section explains how we have performed against the first target period at both sector level and at target unit (participant) level. It also provides basic facts and figures about the energy going through the scheme and participant numbers.

Sector results

The CCA is split into four target periods, each of which represents a milestone en route to the 2020 target. Participants have to report progress against each target period. The first target period ended in December 2014 and therefore is only applicable to facilities that entered the scheme during 2014. This means that the target period performance data published in this report only covers that first cohort of registrants (36 target units and 98 facilities from 26 companies).

Participating companies: The list of companies reporting at the first target period is as follows:

Ark Data Centres Limited	Level 3 Communications Ltd
CenturyLink Technology UK Limited	Next Generation Data Ltd
Colt Technology Services	Pulsant Limited
CSC Computer Sciences Ltd	Six Degrees Group
DataBanx Limited (Onyx)	Sungard Availability Services (UK) Limited
Digital Realty (UK) Limited	Talk Talk
Equinix	TATA Communications (UK) Ltd
Fujitsu Services Limited	TelecityGroup UK Ltd
Global Switch Limited	Telehouse
Gyron Internet Ltd	Telstra Limited
IBM Business Continuity and Resiliency Services	Unisys Limited
IBM United Kingdom Limited	Virtus
Iomart Hosting Ltd	Vodafone Ltd

Vital statistics for the population reporting at Target Period 1

The table below shows the figures for electricity use and the PUE:

	Base Year* (12 months)	Target Period 1 ** (actual data)	Target Period 1 ** (normalised to 12 mths)
Total energy use (MWh)	1,981,547	482,794	2,150,214
Primary energy (MWh)	5,179,327	1,255,264	5,590,557
Electricity used by the IT***(MWh) Primary Energy (MWh)	1,015,360 5,179,327	257,125 668,526	1,147,374 5,966,344
CO2e emissions	1,040.24	251.44	1,119.84
CCA PUE	1.959	1.878	

* Base Year: All companies participating in the CCA must submit a base year that is 12 months long. For data centre companies the actual dates for the base year ranged from 2011 to 2014. The value for electricity used in the base year has changed slightly since our previous report due to a company correcting their data.

** Target Period: As all sites in the data centre sector started their CCA quite a way into the first target period of 2013-2014, the target period measure for data centres was from the date the CCA started to the end of December 2014. i.e. if a CCA was signed by a company on 1st October 2014 then their target period was from 1st October to 31st December 2014. The table above shows the actual raw data reported for the various target period time periods (which range from 62 to 126 days), plus, the target period data annualised to allow for direct comparison against the base year.

*** Electricity used by the IT: This means electricity used by the servers and other IT equipment.

Target Period 1 sector result

There are various ways that you can evaluate the Sector's performance and these are presented in the table below.

(A) Absolute change in CO$_2$e emissions
• Total CO$_2$e emissions for all sites in their respective 12 month base years = 1,040.24; • Total CO$_2$e emissions for all sites during their Target Period all normalised to 12 months for direct comparison = 1,119.84. Hence absolute emissions have increased by 7.65% since the base year. This is not too surprising considering that the IT energy increased by 12.86% over that period.
(B) Change in PUE
• The PUE of the sector in the base year was 1.95; • The PUE of the sector in the target period was 1.87. The PUE reduced by 0.12 between the base year and target period; a 4.17% reduction
(C) Applying a 'NOVEM adjustment' at Target Unit level
This is the government's preferred approach and features in the Environment Agency's 'biennial report'. In 'simplistic' terms they look at what each target unit would have used in the base year if it had been at the same levels of IT energy use during the target period. Then add up all the 'revised' target unit base year energy usages to give a new sector baseline energy use and compare it against the actual energy used for the target period. Confused? Yes so were we! The example below hopefully shines some light on this approach. *For a Target Unit:* • Base Year CCA PUE = 1.5 • Target Period IT Energy (in primary energy) = 2,000 MWh; • The Base Year energy use would have been (1.5 x 2,000) MWh if the IT energy had been 2,000 MWh in the base year = 3,500 MWh; • If the actual energy used during the target period was 3,400 MWh then they had lowered their energy by 100MWh which is a 2.85% reduction. Applying this method for data centres shows a reduction of 6.54% in energy use by the sector.

After reviewing the various methods, we can conclude:

• We are a growing sector and hence our absolute CO$_2$e emissions are increasing;
• However, we are becoming more efficient in using our energy as the two methods; (B) and (C), for measuring improvements in energy efficiency show both are improving.

How the population performed at Target Period 1

The table below presents how each target unit[3] performed at Target Period 1.

	Passing	Failing
Number of Target Units	27	9
Tonnes of CO2e	Banked: 20,139	Bought: 5,092
Buy-out £k	n/a	£61k

If a target unit passes its target then it has reduced its PUE to below what it needed to. It automatically retains the entitlement to claim the Climate Change Levy (CCL) discount and continue to exempt its energy from the Carbon Reduction Commitment (CRC). The table below shows that the majority of target units surpassed the 1% target assigned to them.

If a target unit fails its target then to retain the CCL discount and exemption from CRC it must pay a buy-out fee to compensate for not meeting its target. The table below shows that 9 target units were in this position and between them they had to pay approximately £61k in buy-out fees.

Value of CRC exemption and CCL rebate

The CCA secures relief on the CCL and exemption from the CRC. The annual value of these benefits depends on how much electricity is consumed, the rate of CCL on electricity (it increases annually) and the value of CRC allowances (this also increases annually).

Many data centre companies procure 'green' electricity. Prior to 1st August 2015, CCL was not applied to such electricity contracts. From 1st August 2015 onwards CCL will be applied (where Levy Exemption Certificates (LECs) are not in place).

The numbers below show the estimated annual value of the CCL relief on the sector total electricity use (whether green or not) and CRC exemption to the sector (assuming that all companies would be in CRC if they did not have a CCA):

• Relief on CCL: £10.8m;
• Exemption from CRC: £18.7m;
• Combined annual average value per participating site if both CCL rebate and CRC exemption are claimed: £300k.

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3 A target unit is a site or collection of sites under one operator.

IV. Energy Stewardship

This section explores the impact of the scheme on energy stewardship within the sector. Has the CCA changed behaviour and if so, what are the impacts?

Whilst the sector was reporting its data at the end of the first target period, we took the opportunity to find out how participants were managing energy and what impact the CCA was having on their organisations. We asked questions on the following:
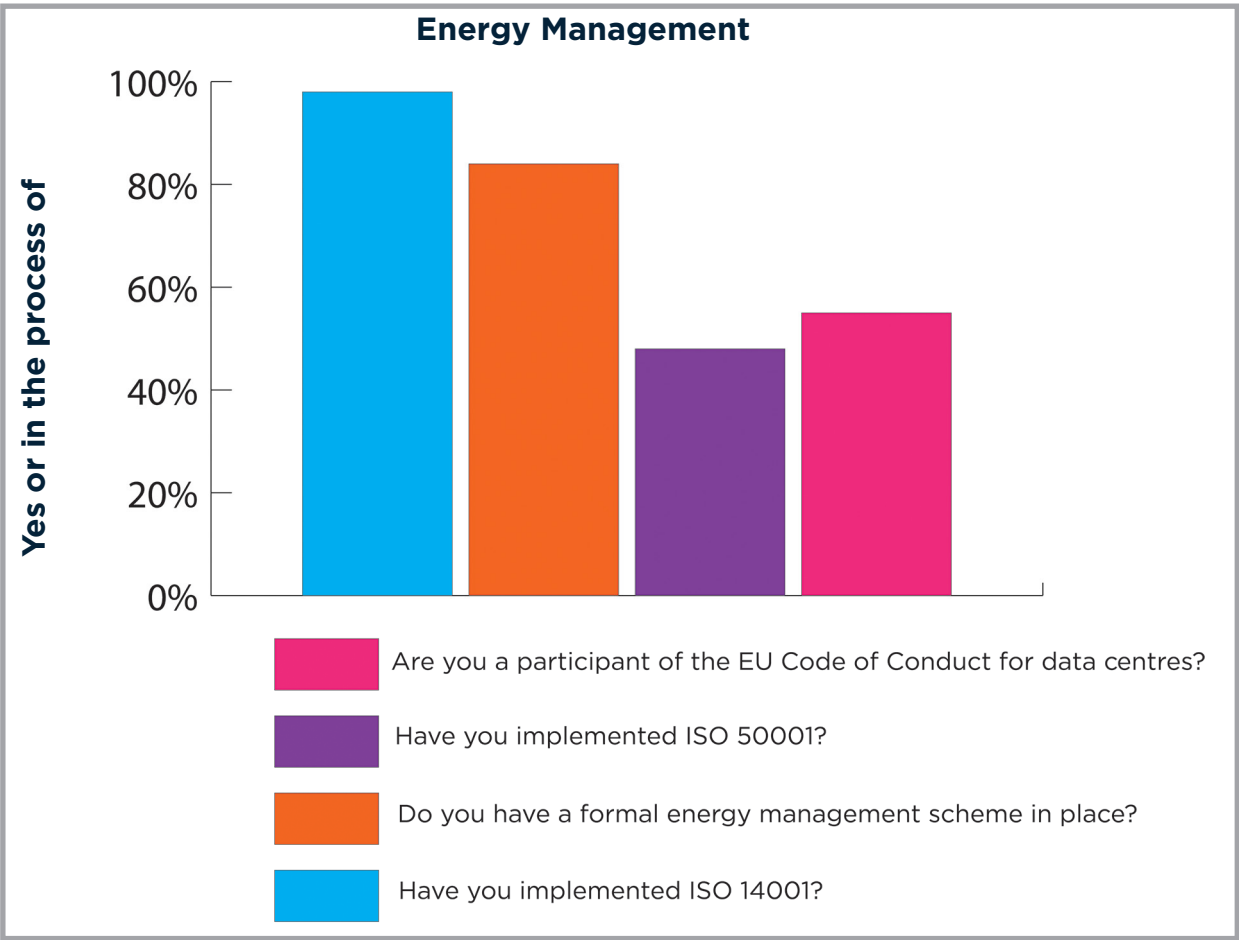
- Implementation of energy or environmental management systems;
- Adopting the EU Code of Conduct for data centres;
- Implementation of energy saving reduction measures relating to:
  - Heating, ventilation and air conditioning (HVAC);
  - Lighting;
  - Other peripheral energy consuming equipment.
- How the CCA has changed the business case on energy reduction projects.

We have summarised the findings below.

Energy management and standards

Almost all respondents have adopted the well-known environmental management standard ISO 14001. This standard is well established and widely adopted across many sectors. Energy can be part of ISO 14001 but most companies tend to implement a separate management system to focus on energy. The majority of sites do indeed have a formal energy management system and this is to be expected given the significant proportion of operating costs that energy represents within this sector. Almost half the sites have adopted the fairly new energy management standard ISO 50001. Although this standard is becoming more popular, the level of uptake is very high for a sector and we interpret this as a positive sign: the penetration of globally recognised energy management standards demonstrates a genuine commitment to improving energy stewardship.

The diagram below shows the percentage of sites that have adopted, or are in the process of, adopting management systems and standards:

Energy Management

(y-axis: Yes or in the process of — 0%, 20%, 40%, 60%, 80%, 100%)

- ■ Are you a participant of the EU Code of Conduct for data centres?
- ■ Have you implemented ISO 50001?
- ■ Do you have a formal energy management scheme in place?
- ■ Have you implemented ISO 14001?

Over half the sites have signed up to the EU Code of Conduct for Data Centres (EU CoC). The EU CoC is a set of widely respected best practices intended to drive good energy management in the data centre sector. Initially developed in the UK by members of the British Computing Society (BCS), the Code was taken up by the Joint Research Council (JRC) of the European Commission and has been administered as a voluntary scheme where participating companies ("Participants") register sites formally and submit data annually. While the technical content of the Code is very highly respected and the best practices (which are free to download) are implemented very widely, formal registration has been lower than anticipated. Therefore the fact that over 50% of the facilities within the CCA are Code Participants is evidence that energy management is a high priority for those in the CCA scheme.

Measures to reduce energy use

In conjunction with our members, we developed a list of energy saving measures that data centres might implement. The measures were for a range of technologies including lighting, cooling, motor controls, ventilation systems and power supply optimisation. We wanted to understand which measures were being adopted and which were not, and why. We therefore discussed the design of the questionnaire with members and realised that asking for a simple "yes" or "no" answer would fail to capture the reasoning behind a negative answer. We were particularly interested in understanding why efficiency measures relevant to data centre environments were not being implemented, what the barriers to uptake were, and whether any systemic issues could be identified. Therefore, when asking whether a particular measure had been adopted we changed the range of possible answers in line with the list below. The text in italics simply explains when each answer might be appropriate:

Definitely implemented
A nice firm confirmation when a site has implemented that measure

I think we have implemented
For those who may not have been involved directly with implementing such projects but have heard about them.

Not implemented yet
The sites could implement it but for whatever reason haven't yet.

Cannot implement or is not applicable
Because the site doesn't use the technology or processes applicable to that measure.
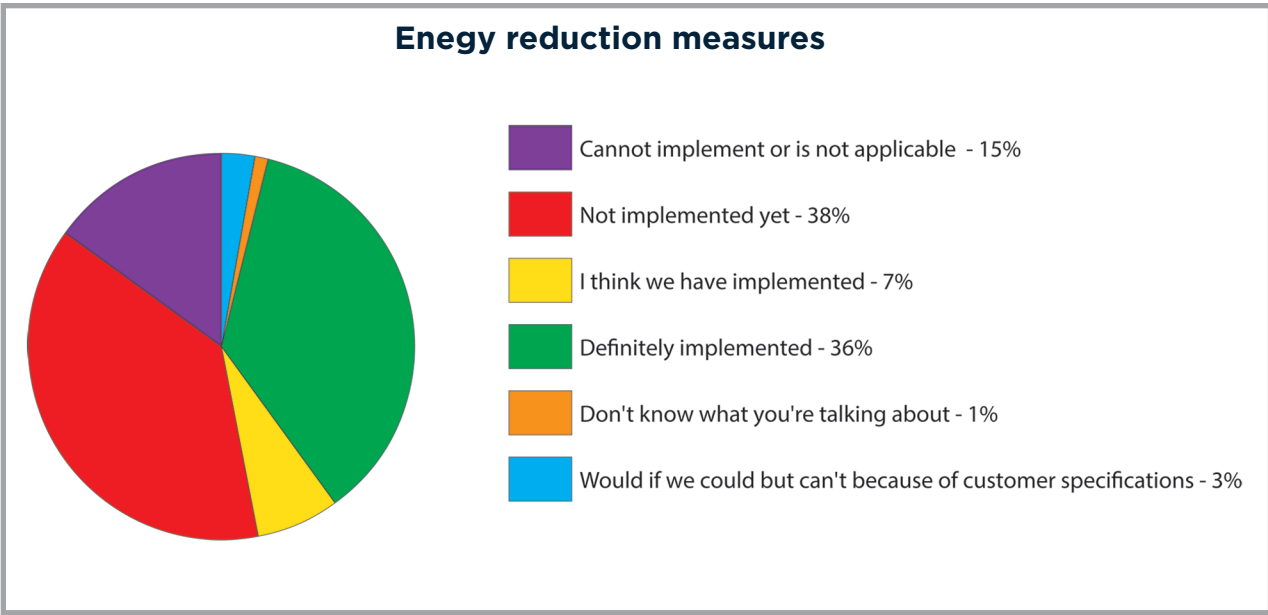
Would if we could but can't
The site has been prevented from implementing the measure for instance because a customer contract specifies certain operating requirements thus preventing the measure from being implemented.

Don't know what you're talking about
For when the site hasn't heard of the measure or doesn't recognise how we've phrased it.

Answers were sought for 16 different energy saving measures across the range of technologies mentioned earlier. The following pie chart summarises all the answers to all the questions to illustrate the average split of responses.

Enegy reduction measures

- ■ Cannot implement or is not applicable - 15%
- ■ Not implemented yet - 38%
- ■ I think we have implemented - 7%
- ■ Definitely implemented - 36%
- ■ Don't know what you're talking about - 1%
- ■ Would if we could but can't because of customer specifications - 3%

Some conclusions from this analysis:

1. Thankfully the number of instances when a site didn't know what we were talking about came in very low, at around 1%. This shows that the vast majority of measures are well understood by the sector;
2. Not all measures can be applied at all sites; this pie chart shows that some measures were not appropriate to 15% of the sites;
3. Removing (1) + (2) above, that leaves 84% of the site measures that have, can or could be implemented;
4. Implemented = 43% (36% green + 7% yellow), great work!;
5. 38% haven't yet – why? We discuss this further in the next section;
6. 3% could but can't – why? We discuss this further in section 5.

Impact of the CCA on energy stewardship

To date, CCAs have delivered greater energy savings among participating sectors than conventional policy measures would have achieved. Data centres are no exception. This is because the CCA really does change behaviour. Traditional approaches apply increases to energy costs to force people to take steps to improve efficiency – the basis of all "polluter pays" policy instruments. Instead the CCA provides compelling incentives to improve efficiency through a simultaneous carrot and stick – tough targets while providing companies with the means to invest in efficiency measures. The impact on energy stewardship was apparent to both scheme participants and to the administrators, and observations from both sets of stakeholders are captured below.

What the participants said

In addition to questions about energy management standards and reduction measures, we asked for feedback from participants on what they thought the CCA had done for the sector. Below are some of the most common responses.

1. **More standardised measurement:** Under the CCA all sites must be measured in broadly the same way, and crucially, in KWh (actual cumulative energy use, not theoretical or calculated energy use based on instantaneous power readings). Such standardisation is now allowing for consistent measures of key performance metrics;

2. **Better energy metering:** The CCA requires metering to be installed and, even better, cumulative energy use recorded. While many sites had the capacity to measure cumulative energy use as well as instantaneous power, surprisingly few sites actually recorded this data;

3. **Actual PUE revealed:** The industry measures PUE in a number of ways, and the metric has at times been used mistakenly as a marketing tool to make the case for one site over another. The CCA obliges operators to measure PUE on the basis of cumulative, annualised energy consumption by the site divided by that of the IT function (similar to Green Grid 2). The emphasis is on monitoring a site's performance against itself over time, which is in line with the correct application of the PUE metric. The standardised measurements have enabled a consistent measure of PUE to be established across all sites where the entire site is in the CCA (i.e. they pass the 70/30 rule[4] - the vast majority);

4. **Improved business case for investment:** Energy saving measures, like any other improvement projects, must provide an acceptable return on investment. There is no doubt that the financial incentive provided by the CCA has improved the business case and is encouraging further implementation of energy saving measures. One-size-fits-all carbon taxes like the CRC and CCL operate on a polluter-pays basis, charging per tonne of carbon or per KWh of energy use. The problem for operators is that they have to set aside money to pay these taxes and as a result their obligations under CRC and CCL essentially tie up funding that could be used to make investments in energy efficiency – a frustrating paradox. The CCA discount dramatically strengthens the business case for implementing energy efficiency measures because that money can be reinvested.

Our observations as administering association

While the following impacts may not have been so obvious to operators, as administering association we were in a perfect position to observe sector level trends and more collective changes in behaviour. We also picked up some interesting insights from customers of our data centre operators, some of whom are also our members. We have also been very pleased to see, where efficiency measures have already been implemented, operators passing back the savings to their customers. This in turn makes them more competitive whilst fulfilling the objectives of the scheme.

1. **Better information on sector energy consumption:** Prior to the CCA, the sector had no reason to report energy use or information on energy management collectively. The CCA captures, by energy use at least, the vast majority of the UK's colocation provider market and information on cumulative energy use and on the adoption of existing standards is now available for the first time. In turn this has stimulated interest in what this new data can be used for; eg benchmarking, evaluating impacts of energy policy and the progress of the sector against a range of environmental objectives, not just the CCA target.

2. **More open operator-customer dialogue:** We are already seeing greater transparency regarding energy use within the sector and a number of operators have reported that customers are seeking more information on energy use than previously. This is leading to a more open dialogue about energy use in the data centre environment.

3. **Information sharing:** The collaborative, sectoral approach promotes sharing of information and best practice within the industry. We have been surprised and encouraged by the quality of information that has been shared in workshops and discussions as a result of the scheme. Other instruments lack frameworks to encourage collaboration of this type.

4. **Passing savings to customers:** We have also been very pleased to see, where efficiency measures have already been implemented, operators passing back the savings to their customers. This in turn makes them more competitive whilst fulfilling the objectives of the scheme.

What we expect to see more of

1. **Increased consolidation:** The CCA inevitably encourages the consolidation of computing resource from a "distributed" model (servers in cupboards and box rooms) into larger, purpose built, efficient facilities. This single act can reduce energy demand by two thirds. To some extent it may also encourage outsourcing to third parties as companies reviewing their IT estate consider what to do with their server rooms and distributed computing assets. However, it is early days and we have yet to see much firm evidence of this.

2. **Improved competitiveness:** With the capability to invest in energy efficiency measures, companies are already realising financial savings as their energy performance improves. This in turn makes them more competitive as they can deliver services to their customers at lower cost. They can also provide evidence of good energy stewardship, which is increasingly becoming a requirement in procurements. Customers can also request that data centre operators participate in a CCA as a condition of service, driving competition on energy efficiency within the supply chain.

3. **A stimulus for the adoption of energy efficiency technologies within the sector:** The CCA efficiency targets are focused on the implementation of tried and trusted efficiency technologies and the increased uptake will in turn help drive the development of energy saving technologies and services relevant to data centres. The CCA is particularly suitable for an industry where technology is developing rapidly because it can drive innovation. We see this as an opportunity for tie-in with the Energy Technologies List, which has not been fully exploited within the sector to date.

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4 The 70/30 rule is a threshold: as a pre-requisite of entry each site has to perform an energy audit and if over 70% of the energy used is being consumed by eligible activity (i.e. energy used by the IT and supporting plant for the provision of colocation or colocation style services) then all the energy to that facility is eligible for the rebate. So if a site was only 50% dedicated to colo provision it would not pass the 70/30 rule.

V. Barriers to improving energy efficiency

This section documents some of the barriers that operators faced when considering how to implement energy efficiency measures, how some of them were overcome and how we think we might tackle the more problematic ones.

In section IV, the pie chart illustrated that 38% of site measures could be implemented but have not, and 3% could be implemented but cannot because of customer requirements. We explored the situations behind these answers to identify the hurdles or barriers that need to be overcome to implement energy efficiency measures. The common themes are described below.

Timing

We stated earlier that the business case for implementing measures has improved significantly since the introduction of the CCA. For some companies, it is a simple matter of securing the funds and scheduling in the projects so that energy efficiency savings can be achieved.

Leases

Data centres are quite flexible in terms of where they can be located; the key requirements are robust electricity and connectivity feeds, a low level of physical risks like flooding, and sufficient security. Some data centre sites have been established in buildings or on land without the benefit of long lease periods (e.g. where leases are only a few years in duration). Deciding to upgrade such facilities is a difficult financial decision if the payback period is more than (or close to) the length of time left on the lease. If the lease is not renewed then the data centre company will not benefit from the improvements if the project is associated with the building or the equipment belonging to the building.

Service Level Agreements

A Service Level Agreement (SLA) is the contract between the customer and data centre company. Quite literally it lists what the customer can expect under the contract. Many SLAs contain clauses to specify the environmental conditions surrounding the customer's servers. For example an SLA may require that the temperature surrounding the customer's server should be at 18°C or be within the range 15°C to 20°C. Modern servers operate reliably in much broader temperature ranges than this, so data centres under SLAs with narrow temperature and humidity ranges will not be operating at maximum efficiency. Data centre companies do try to negotiate energy efficient contracts, however, the implementation of best practice is often prevented by lack of understanding or confusion.

For instance there may be a perception that constant conditions will guarantee best server performance when in fact empirical studies have demonstrated that server performance is unaffected even by quite wide variations in temperature and humidity. Another issue with SLAs is their length; i.e. for how much longer the contract runs. This has two potential impacts: firstly it dictates how much longer restrictions will be in place that prevent improvements in efficiency. Secondly if the contract is very large but short term, the operator might be hesitant to invest without certainty of a customer.

Customer Engagement

Customer engagement is a very important factor in implementing energy efficiency measures in data centre environments. Our ambition is always to see customers working together with their data centre service providers towards best practice. But this doesn't always happen.

- For some customers, who may be in other sectors, the energy use of their IT can be a very small percentage of their overhead so they may not share their supplier's interest in efficiency: they have other priorities within their corporate activity that they believe should take precedence. For instance a fleet operator will be focusing primarily on optimising route planning and improving driving technique, and the IT function housed in the data centre, including the logistics software that actually enables this optimisation, will (and should) be a much lower priority;

- In a retail colocation environment, there may be hundreds of different customer servers located in the same area and the data centre operator will have to negotiate with a number of separate individuals to introduce changes;

- Some customers may worry that changing any kind of specification may introduce additional risk to their IT function and those running mission critical activities will have far less interest in energy efficiency than in security and resilience;

- And just as with leasing arrangements, customers coming to the end of a contract are unlikely to be interested in revisiting contract terms, though a contract renewal would certainly provide an opportunity to introduce efficiency measures that are in both parties' interests;

- While most contracts specify energy charges, there are some business models in the data centre that charge the customer an all-in fee and customers in these contracts will have no incentive to jump through hoops to deliver savings that they do not stand to benefit from. The good news here is that the CCA is driving a different kind of discussion on energy between customer and operators, as mentioned above. While there are very good reasons for the different pricing models in the industry and we would not necessarily seek a more standardised pricing model, it is good news that operators and their customers are addressing split incentives in a constructive way;

VI. Policy Observations

This section explores the role of the CCA as a policy tool and makes some brief observations on recent policy developments including Treasury's proposals to reform energy taxes in the UK and some worrying policy developments at EU level that will have repercussions for data centre operators in the UK.

We mentioned in our last report that the CCA is more than a tax concession. It is also formal recognition by government that the data centre sector exists and will be here for the foreseeable future, that it is important and that it is a significant contributor to the UK economy, to growth and jobs. The Chancellor also recognised the importance of protecting the sector's international competitiveness by, at least partially, levelling the playing field for UK operators competing against overseas counterparts. The CCA added some much needed stability to the policy landscape and has also created a conduit for constructive policy dialogue going forward.

The CCA as a policy tool – does it work?

Unilateral carbon and energy taxes handicap energy intensive industries in their efforts to compete with overseas counterparts who are not under similar regulatory or financial constraints. Moreover, ill-informed policy tools have the potential to drive business out of the UK and cause carbon leakage. The purpose of the CCA is not to give energy intensive businesses a free ride but to protect them from competition from counterparts operating in less regulated areas. By doing so it also limits the scope for carbon leakage.

At the same time, the CCA is explicitly intended to improve energy efficiency and, as mentioned above, the combination of carrot and stick – providing companies with the means to invest in efficiency measures and a strong reputational and cost incentive for actually doing so, has delivered greater savings than anticipated and has also led to a number of additional benefits. However, one of the most important benefits of the CCA is that it does not penalise growth. While we have already explored the impact of the scheme on energy stewardship, it is clear that the scheme is also effective in delivering a wider range of benefits. These include:

Reduced carbon leakage: Carbon leakage happens when energy intensive organisations locate their operations overseas to avoid carbon taxation and end up in areas where the generation mix may be more carbon intensive. It is an unwelcome side effect of unilateral carbon taxation or regulation. Because energy is such a predominant cost for data centres and because data is so easily transmitted over long distances, data centres are very susceptible to carbon leakage. The CCA provides policy stability and some relief from unilateral carbon taxes that might otherwise encourage offshoring.

Greater certainty of meeting policy outcomes: The clear target set in a CCA provides much more clarity of final outcome than an uncapped CRC or other polluter pays mechanisms like CCL, or a scheme like ESOS that obliges companies to undertake audits but does not require them to implement the findings. It gives the potential for government to set stringent targets taking the unusual circumstances of data centres into account such as relatively fast equipment replacement rates. Regular review of progress towards targets keeps minds focused and if they start to look too unambitious, target renegotiation can ensure they remain challenging.

Fewer perverse incentives: Because the CCA rewards energy efficiency rather than demanding simple net reductions it encourages the flow of work to where it can be done most efficiently, making those efficient companies more competitive. It therefore works in the opposite way to the first iteration of CRC which penalised growth. Unlike those one-size-fits-all approaches, the CCA applies bespoke targets that are designed to drive change where it is most needed.

Greater reach for the policy instrument: The CCA is open to operators that fall below the threshold for other policy measures such as CRC or GHG accounting or ESOS, so as a policy tool it has wider reach than those approaches. All participants have to implement sub-metering and audit energy use as a pre-requisite to entry and previous experience tells us that this will be new territory for many of these smaller entrants. Moreover they will be bound by energy efficiency targets for the first time, so the CCA is capturing a wider cohort of energy users than other policy tools. Even for those not under the regulatory radar, the CCA is much more ambitious than ESOS.

Greater flexibility in addressing sector specific issues: CCAs are flexible enough to take into account sector characteristics. A data centre comprises a complex array of different technologies and a system level approach is needed when implementing efficiency improvements.

Enabling the enablers: Data centres underpin the transition to a low carbon economy: they enable smart grid, smart cities, broadband and a huge range of ICT-enabled low carbon technologies from vehicle logistics to teleworking, from earth surface monitoring to building management systems. The more efficient our data centre functions are, the more compelling these alternative, dematerialised, approaches become.

Limitations of the CCA scheme

The CCA scheme is not perfect and it has several limitations. One is that the incentive is not sufficient to drive investment in the really big ticket items with payback over three years, and supplementary incentives such as enhanced capital allowances or zero interest loans (as provided under the ETL) might help here. Secondly, while the CCA target is correctly focused on energy productivity, it works best when the level of industrial activity is relatively stable. To some extent meeting the target is dependent on "throughput". Operators who lose customers or whose throughput diminishes for some other reason will struggle to meet their targets, irrespective of the efficiency measures they put in place, and in some cases the opposite can also be true.

Domestic policy developments

Treasury proposals to reform energy taxes: The current Treasury proposals to reform the carbon and energy tax landscape for businesses are generating mixed reactions. On the one hand the objectives of simplifying the existing policy landscape, reducing compliance costs, protecting international competitiveness and using effective incentives for improving energy efficiency are very welcome indeed, and we as a sector would find it very hard to argue against these objectives. On the other hand, the exercise is signalling that the policy landscape regarding energy taxation will continue to be volatile for some time to come, and uncertainty is very damaging for growth industries. Those who want to invest in the infrastructure need to know that their facilities can still be competitive in five or ten years' time, and potential customers need to be confident that the UK will continue to be an attractive place for them to do business. So there is an important balancing act to be done and it is critical that government continues to send a strong message of support to this sector.

Withdrawal of green power exemption for CCL: In August 2015 the CCL[5] exemption for green power was withdrawn following changes made in the summer budget. While unpopular in some quarters, this move aligned the CCL with CRC and GHG accounting (which treated green power differently) and to some extent levelled the playing field for the purchase of green power from grid providers. While we do not perceive the removal of CCL exemption as a major issue for those not engaged in onsite generation, it was a signal that significant policy changes are likely in the short to medium term.

Brexit: The UK's Referendum on EU membership is generating anxiety within the sector and could have an impact on some investment decisions. Global real estate company CBRE has monitored colocation supply statistics since 1999 and Andrew Jay, Executive Director, commented that the UK's EU referendum is causing anxiety within the sector "The probability of a Brexit is unknown but even a low likelihood presents the kind of business risk to operators and investors that they cannot ignore. We are engaged in data centre transactions on a daily basis and the uncertain situation is attracting comment. Some observers believe that it has the potential to generate planning blight in certain parts of the market; data centres are long term investments and there is concern that this uncertainty will generate a temporary paralysis just when an unprecedented number of strategic investment decisions are being made by major industry players. At the same time the presence of many other attractive locations in Europe could ultimately affect the UK's strategic advantage in this market".

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5 The CCL costs about 0.5pence per KWh and was applied to energy derived from fossil fuels. It is sometimes shown as a separate line on energy bills. Renewable power purchased from grid providers used to be exempt. These energy providers issued levy exemption certificates (LECs) to their customers. Those buying renewable power tended to pay a premium to the supplier for taking some of the UK's renewable allocation (they didn't of course actually receive green energy because they got the same grid mix as everyone else, and the premiums they paid did not incentivise additional renewable generation because this is done through the RO (Renewables Obligation) and other incentives in the UK). The result was that companies could often buy green power cost neutrally – i.e. for about the same price as "brown" power because the premium they paid was usually equivalent to the CCL. This made sense from a marketing point of view, especially for those operators whose customers require them to use green power (an increasingly common requirement) but it also meant that some energy providers could charge a super normal premium for green power when they were already being paid for this activity through the RO equivalent incentives. This change means that companies buying green power will now have to pay a genuine premium (or as some observers have stated, put their money where their mouth is). This has already had an impact on the premiums that energy suppliers can demand for green power and as a result has levelled the playing field somewhat. However, it is a controversial area and will be an interesting space to watch.

Problematic EU policy developments

Safe Harbour: The negative impacts of a possible Brexit look set to be further exacerbated by recent European legislative developments. In particular the timing of the CJEU Ruling on Safe Harbour could prove very unfortunate for the UK's commercial data centre sector. The recent CJEU ruling backed up the opinion of Attorney General Bot that the US Safe Harbour agreement is invalid. The Safe Harbour agreement allowed for the transfer of data between the EU and US. This has huge implications for the future of international data transfers and it is possible that this will lead to the creation of "Regional" or "European Cloud". Regional Cloud is essentially the development of a cloud computing infrastructure determined by geographical borders. For example data created, processed, shared, accessed and managed must be stored and managed only within the borders of the European Union. Data would be legally prevented from moving or flowing freely to jurisdictions outside EU Member States).

This is likely to have a negative impact right across the board but particularly on demand for existing colocation services, inward investment and domestic new build. Industry analysts from a number of companies have already reported that US firms seeking to respond to the CJEU ruling by investing in existing European data centre capacity or investigating opportunities for new build are opting for Ireland or mainstream Europe and are avoiding the UK because of the risk of a Brexit. As one potential investor put it "*CJEU gives us a problem, so we need to expand our European operation but we aren't going to invest $100M in the UK and then find two years later that they've left the party and we have to start over*".

GDPR: A second legislative development is the General Data Protection Regulation (GDPR), which at time of writing is in Trilogue. Depending on the outcome of negotiations on joint and several liability and on the respective definitions of data processor and data controller, this single piece of legislation could either underpin or undermine the development of the digital economy in the EU. This would not differentiate the UK from the rest of the EU but it would take business out of the EU altogether.

VII. Why do Data Centres need a CCA?

This section explains why the UK data centre sector needs a Climate Change Agreement. It sets out the current vulnerabilities of the UK market to competition, especially from the rest of Europe, how the UK compares to other EU nation states on energy costs and the activities of competing markets to attract inward investment from data centre operators.

Data centres are important

Data centres need a strong signal of support from government because they are energy intensive, because they are highly vulnerable to overseas competition (they produce the most mobile commodity on earth), and because they are critically important to the UK economy.

Operating a data centre is not the digital equivalent of underwater basket weaving: an obscure or fictional activity involving a few eccentric practitioners and delivering no tangible economic benefit. The UK data centre sector is globally important and protecting it should be at the very top of our priority list.

Data centres underpin the digital economy, they are engines of growth and they improve productivity and generate employment across multiple business sectors. Building and operating a data centre is an advanced commercial engineering project; it depends on a complex and specialist supply chain and drives a demand for professional services and high value-add engineering and technical jobs. But that is just the supply chain: once in operation, a data centre is essentially a platform that enables a multitude of different business activities to function simultaneously, and can therefore facilitate an astonishing range of offerings from web-hosting to computer aided design. In this way a single data centre supports multiple levels of economic activity.

Risks to the UK data centre market

Particular care is needed because, although the UK is Europe's largest data centre market by a significant margin, over recent years its dominance appears to be under attack both from other European locations and from further afield: Whilst the London market is around twice the size of its nearest rival (348MW against Frankfurt's 177MW and Amsterdam's 153MW[6]), the rate of demand across the three markets does not reflect this, with quarterly increases in occupied space (in terms of actual MW) on a par with these markets rather than exceeding them as its size would suggest.

Total available supply in MW (excluding retail shell)						
	2010	2011	2012	2013	2014	2015 Q2
Amsterdamn	21	15	22	27	26	27
Frankfurt	22	17	24	15	33	38
London	39	53	72	67	78	78
Paris	7	12	22	18	15	16

Source CBRE

London has over twice as much vacant supply as any other market.

As a result of this trend, the London market is now characterised by oversupply compared to the other large European markets of Amsterdam and Frankfurt that compete against it for European data centre business.

Total available supply in MW (excluding retail shell)						
	2010	2011	2012	2013	2014	2015 Q2
Amsterdam	21	15	22	27	26	27
Frankfurt	22	17	24	15	33	38
London	39	53	72	67	78	78
Paris	7	12	22	18	15	16

Source CBRE

2014/YTD 2015 take-up levels have balanced out between the major 3 markets; leaving London's high level of vacant supply even more glaring.

6 Source: CBRE Data Centre Marketview, Q2 2015

In fact, market analysts at CBRE, who have been tracking European data centre markets for 15 years, describe the London market as "vastly oversupplied" compared to European counterparts. The charts show that London has sufficient spare capacity to accommodate demand at the current rate of growth without having to build anything new for nearly four years. What this means in real terms is that London data centre service providers are finding it more difficult to attract new customers to take space in their facilities. They attribute this to a number of factors, which are discussed below.

Market Absorption

The number of years it would take current vacant supply to be fully let based on a 5-year average for take-up.

London is vastly oversupplied with nearly 4 years of vacant supply based on recent demand. This figure is closer to 6 years when retail shell is included.

Source CBRE
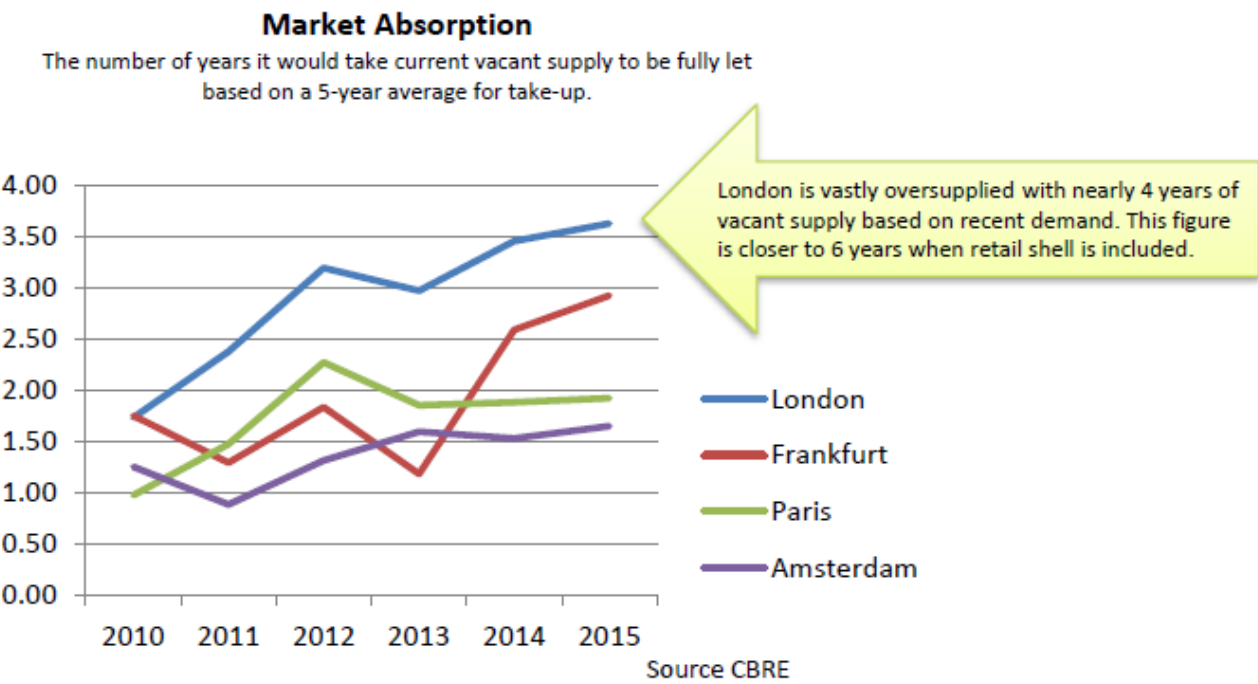
These reasons can probably be divided into three categories: costs, including both energy prices (commodity and non-commodity) and land, the evolution of the industry into a broader mixture of business models that are less dependent on the UK's unique offering, combined with improved offerings (especially connectivity) in other locations, and unexpected policy developments that are having far reaching consequences on the industry. What this really boils down to is that this is a very bad moment to start reintroducing old carbon taxes or introducing new ones: either route would send a very negative message to the sector.

Electricity prices

It is worth having a more detailed look at electricity costs, particularly non-commodity costs, because they present a very real problem for UK data centres. Paul Cranfield, Director of Power for Digital Realty, one of the larger UK data centre operators and a major inward investor, commented:

"Our challenge here is that operations are becoming more and more sensitive to the total cost of delivered power, including wholesale power prices, transmission & distribution costs and levies. We are acutely aware that the way these components are combined in different markets means that taxes and levies can have a profound impact on competitiveness. Offering an alternative to a carbon levy through a CCA enables participants to control cost exposure and offer keen end-to-end power prices to customers and end users. Our customers are often very agile, with the ability to land/deploy in any of the FLAP (Frankfurt, London Amsterdam, Paris) locations, Dublin or further afield and the cost of power is a significant differentiator."

The following two charts provide some useful context. The first chart shows the wholesale base load cost of electricity in Europe (before distribution and taxation). The second chart compares non commodity costs between different EU states. Both charts are of concern to operators and investors.
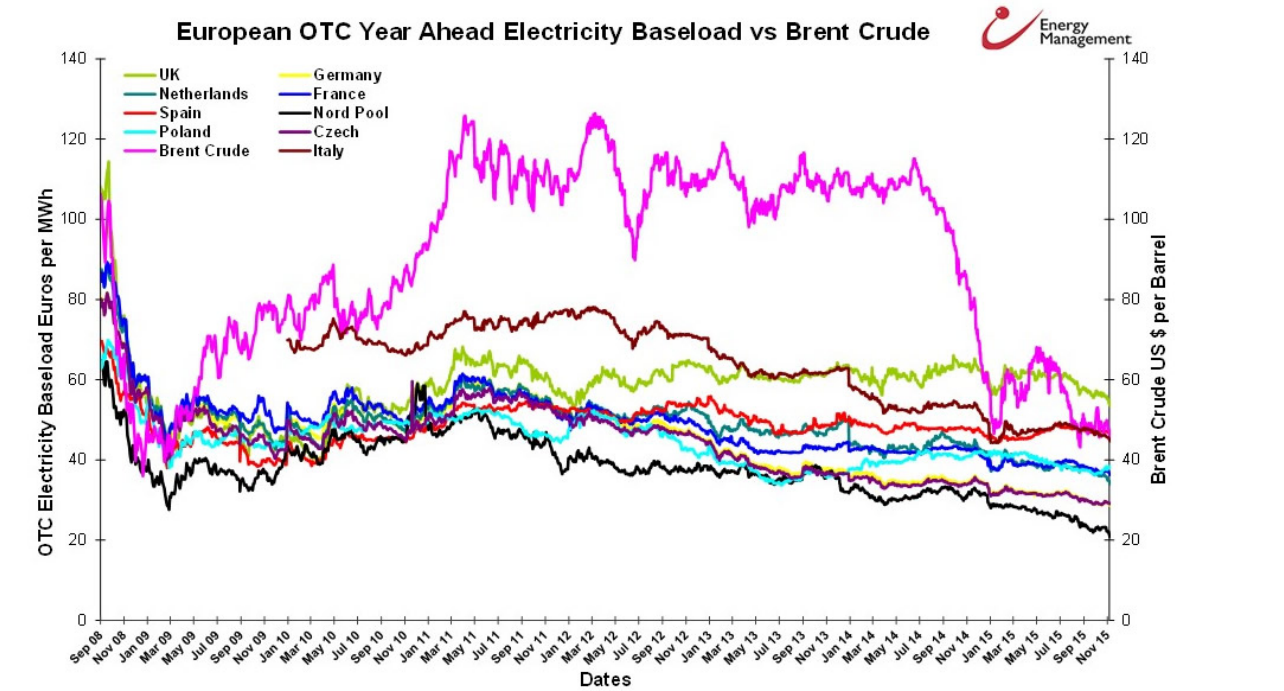
This chart above was submitted by **Pip Squire of Ark Data Centres**, who made the following comment: "The attached chart shows the wholesale base load cost of electricity in Europe (before distribution and taxation). UK is the green line, the high dark pink line is the cost of Brent Crude just to show how little the electricity price is impacted by the oil price. You will see from this that UK wholesale energy is around 60 Euro/MWhr; Netherlands, France & Poland are less than 40Euro/MWhr; Germany & Italy are less than 30Euro/MWhr and the Nord Pool (Scandinavia) are around 25Euro/MWhr. It is not surprising that over the last 3 years we have seen > 20MW of data centre space go to Amsterdam and > 50MW of data centre space go to Dublin. I recognise that these decisions have not been based purely on the cost of energy; taxation (exemptions) have also played a significant role, but never the less it is one of the main reasons multi-nationals take their data centres to Europe rather than the UK. This is a serious issue, Safe Harbour will not protect us and the CCA for data centres is fundamental in helping us remedy the situation (although other EU governments have similar schemes in place to reduce delivered electricity prices closer to the wholesale price)".

Figure 1-2b: Indicative incremental impacts in 2011, 2015 and 2020 on electricity price (£/MWh, 2010 prices) of energy and climate change policies – Sensitivity using market forecasts of EUA prices[14]
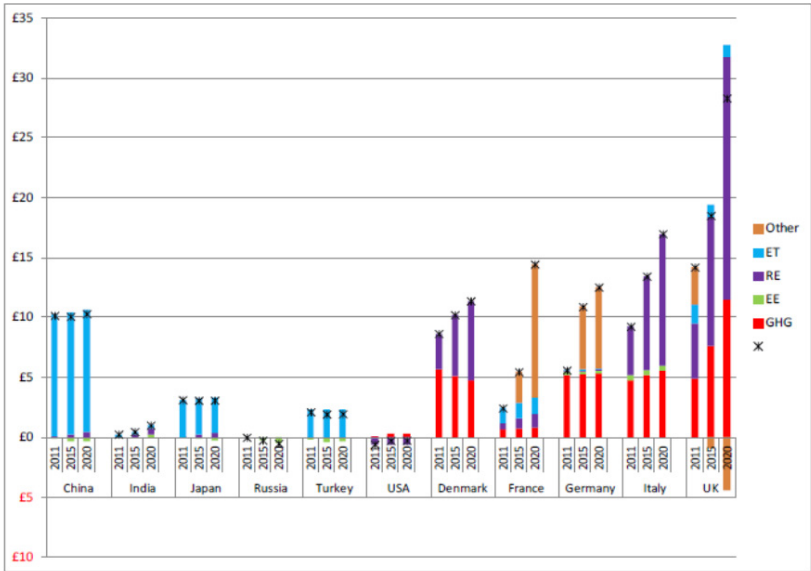
This chart, provided by BIS as part of a presentation on mitigating non commodity energy costs, shows a comparison of incremental non commodity costs on energy. We believe the source to be DECC. It is important to note that these are additional costs, presented as though energy is priced equally across Europe, which it is not.

What are other countries doing?

Although the UK's data centre market is the largest and best developed in Europe, other countries are not sitting around idly. Within Europe, nation states are competing fiercely for inward investment; some are providing tax breaks and other discounts on energy, some are investing in connectivity and all are rolling out a range of other incentives. A few examples are listed below.

Ireland: Incentives include low corporate tax of 12.5% and plans to halve that for revenue pegged to patents and intellectual property; ACA (Accelerated Capital Allowance) Scheme; a tax incentive that aims to encourage investment in energy saving technologies (companies can write off 100% of the purchase price of registered energy efficient equipment against their profit in the year of purchase). IDA (Industrial Development Authority) Grant Scheme; government agency encouraging foreign direct investment into Ireland through grants, e.g. €10k/employee hired for up to 10 years. Retrofit Grant; Sustainable Energy Ireland is steering a bill through government to enable organisations to receive grants for retro-fitting energy hungry environments.

Sweden: Fast track planning process enabling the approval of planning permission within weeks rather than months. A regional data centre strategy that includes education, research and other supporting activities for growth in energy-efficient data centre establishments, e.g. a 2MW research and test environment for data centres funded by local government. Investment subsidies are available in certain areas.

Iceland: Iceland offers low corporate tax but the primary attractant is power that is priced among the lowest in the world, available in up to 20 year contracts. Iceland's electrical grid is regularly ranked among the top three in the world for reliability. All power is sustainable - dual sourced from geothermal and hydroelectric. New direct investment projects can apply for an investment agreement, ensuring generous regional incentives. General incentives for SMEs, R&D and environmental protection are also available.

Germany: Germany's high internet bandwidth capacity, low perceived risks, its low rate of inflation and stable political system contribute to the country's attractiveness when choosing a data centre location. Companies can qualify for 90% relief on energy taxes if they have an energy management system in place such as ISO 50001 or EMAS and companies documenting improvements can benefit from simpler policy measures.

Netherlands: The third biggest European market, the Netherlands has significantly lower electricity costs and operates a system of 'Long Term Agreements' (loosely equivalent to CCAs) that are aimed at promoting energy savings in certain industries.

Luxembourg: In recent years, Luxembourg has made huge investments into connectivity and now boasts high speed low latency connections to all of the major European Internet hubs – Amsterdam, Frankfurt, London and Paris through a wide choice of fibre optic providers.

VIII. Conclusions: Strategic implications

In this final section we share some thoughts on the broader implications of the CCA on the sector.

In this report we have explained how the CCA scheme works and how targets are set for the data centre sector. We have set out the performance of the sector against its first target under the scheme and are very pleased that the sector exceeded this preliminary target by a comfortable margin, which sets us up well for our more ambitious second milestone. Whilst interpretation of the results is inevitably limited by the fact that the reporting period was abnormally short, some very useful insights have emerged. We have explored the effect the scheme has had on energy stewardship, but more importantly have gained a much better understanding of the barriers that are preventing the implementation of efficiency measures. We have also explored how the CCA is likely to influence the evolution of the sector as a whole. We have also shared our thoughts on recent policy developments likely to impact this sector. We have reviewed the CCA as a policy tool and explained why the UK data centre sector remains in critical need of this kind of support. In this final section we sum up some of the more strategic implications of the scheme including greater investor confidence, an enhanced understanding of how the sector uses energy, also, with data centres now firmly on the policy radar, a conduit for constructive policy dialogue going forward.

Energy stewardship: As documented in the previous sections, initial feedback on the impact of the scheme on energy stewardship is very encouraging and we are also learning invaluable lessons about the barriers to implementing improvements. We will continue to monitor the sector very closely on the ways that the CCA is driving behaviour change.

Investor confidence: Data centres are unusual in that the sector has seen more significant growth than perhaps any other CCA sector over the last few years and is also one of the most location agnostic sectors: unlike manufacturing where products need to be transported physically to their markets, data is the most mobile commodity on earth and can be transported at almost negligible cost and with almost negligible delay. Although some data centre services are location sensitive, many are not, especially those where there is greatest growth potential, such as cloud. So the sector is perhaps the best placed of any CCA sector to act as a barometer for the effectiveness of the policy tool in terms of protecting UK competitiveness.

So far the feedback has been mixed: While market analysts report plenty of investor activity and healthy interest in data centre acquisitions, which is a very encouraging sign indeed, on the other hand there is a high level of vacancy on the London market, which suggests that the playing field is not quite level enough for the UK to be able to compete on equal terms.

Improving our understanding of the sector's use of energy: As mentioned above, the CCA provides us with an invaluable source of real data about the sector and we plan to make good use of this moving forward. The Environment Agency, through its Biennial reports, publishes data about the CCA (participants, site numbers, energy passing through the scheme and recorded improvements) and this means that energy data about the sector is more transparent than ever before, which we see as a positive development. However, as the sector association we have our own expanding energy performance datasets, augmented by qualitative information that we have collected from participants. We also have a better appreciation of the barriers to implementing energy efficiency measures. As a result we have information about the sector and its use of energy that has simply not been available before. We now have scope to use the information to implement benchmarking or best practice, to monitor sector level improvement, to highlight differences in efficiency across the sector and to identify how best to drive a continuous cycle of improvement.

Informing the policy dialogue: Feedback from policy tools like the CCA can be instrumental in helping policy makers understand sectors better and we are in a perfect position to aggregate and present that intelligence to government and ensure that the policy process is properly informed. We see two opportunities here: firstly in terms of understanding and communicating the effectiveness of the CCA in driving behaviour change and good energy stewardship in the sector and secondly in terms of the way that operators perceive the UK as a place to do business – to locate new facilities or expand their operations.

Our final conclusions very much echo those of our interim report, published last year. The CCA is an important milestone for the UK data centre sector because it is more than a tax concession. It is also formal recognition by government that the data centre sector exists and will be here for the foreseeable future, that it is important and that it is a significant contributor to the UK economy, to growth and jobs. In his 2013 Autumn Statement, the Chancellor also recognised the importance of protecting future investment and growth by, at least partially, levelling the playing field for UK operators competing against overseas counterparts. DECC (the Department for Energy and Climate Change) demonstrated that they can design, adapt and deliver intelligent policy tools that can drive carbon reductions whilst encouraging growth. By so doing they also demonstrate that there is not always a binary choice between carbon and growth. The CCA also adds some much needed stability to a disconcertingly volatile the policy landscape.

Annexe 1. Target Unit Results

Extract from Environment Agency Report released 29 October 2015

TU Identifier	Operator name	CCA emissions tCO2e	Target passed?	Buy-out purchased?
DATC/T00025	Ark Data Centres Limited	1,087.45	N	Y
DATC/T00028	Ark Data Centres Limited	692.83	Y	N
DATC/T00004	CenturyLink Technology UK Limited	7,018.60	Y	N
DATC/T00027	Colt Data Centre Services UK Ltd	7,550.96	Y	N
DATC/T00032	CSC Computer Sciences Ltd	6,103.13	Y	N
DATC/T00017	DataBanx Limited	155.26	Y	N
DATC/T00018	DataBanx Limited	1,009.38	Y	N
DATC/T00019	DataBanx Limited	105.00	Y	N
DATC/T00003	Digital Realty (UK) Limited	31,843.87	Y	N
DATC/T00010	Enfield DC Service Company Ltd	2,121.75	Y	N
DATC/T00011	Equinix (UK) Ltd	27,749.02	Y	N
DATC/T00030	Fujitsu Services Limited	5,604.65	Y	N
DATC/T00005	Global Switch Ltd	46,321.77	Y	N
DATC/T00015	Gyron Internet Ltd	3,876.10	Y	N
DATC/T00024	IBM United Kingdom Limited	1,202.68	Y	N
DATC/T00026	IBM United Kingdom Limited	3,424.49	N	Y
DATC/T00022	IBM United Kingdom Limited	3,872.70	N	Y
DATC/T00023	IBM United Kingdom Limited	4,330.80	Y	N
DATC/T00014	Iomart Hostings Ltd	4,425.21	Y	N
DATC/T00020	Level 3 Communications Ltd	7,740.77	N	Y
DATC/T00021	Level 3 Communications Ltd	1,315.22	N	Y
DATC/T00001	NEXT GENERATION DATA LIMITED	3,185.23	Y	N
DATC/T00012	Pulsant Limited	5,854.66	Y	N
DATC/T00002	Six Degrees Technology Group Ltd	2,261.97	Y	N
DATC/T00006	Sungard Availability Services (UK) Ltd	14,580.06	Y	N
DATC/T00034	Talk Talk Group	776.44	Y	N
DATC/T00035	Talk Talk Group	521.87	Y	N
DATC/T00036	Talk Talk Group	465.35	N	Y
DATC/T00037	Talk Talk Group	67.20	Y	N
DATC/T00038	Talk Talk Group	256.11	N	Y
DATC/T00007	TATA Communications (UK) Ltd	2,759.37	Y	N
DATC/T00013	TelecityGroup UK Ltd	19,886.79	Y	N
DATC/T00031	Telehouse International Ltd	13,754.85	N	Y
DATC/T00029	Telstra Limited	2,634.91	Y	N
DATC/T00008	Unisys Limited	2,007.47	Y	N
DATC/T00009	Vodafone Ltd	14,884.37	N	Y

Annexe 2. Rationale - non-linear target

A low first target (1% rather than 5% for the end of the first target period) was agreed for the following reasons:

1. The data centre sector joined the CCA scheme over three quarters of the way through the first target period. Companies registering as participants even at the earliest possible opportunity would only start being eligible for rebate in the latter half of 2014, towards the end of this first target period. Although many of these companies were already implementing measures that were cost effective, their obligations under CRC and CCL essentially tied up funding that could be used to make further investments in energy efficiency. Once they obtained the CCL discount the business case for implementing energy efficiency measures was strengthened and that money could be reinvested. The outcome of that reinvestment would only just start being realised by the end of the first target period. Anything other than a low target for the first period was considered unrealistic;

2. From an implementation point of view, major changes do not just need budget provision, they also rely on customer engagement and agreement, and this takes time, especially for retail colocation providers who may have many customers all with different service level agreements and expectations;

3. A low target for the first period also reduced the risk that companies could have to buy out carbon against this first target even though they ultimately meet their 2020 scheme targets;

4. A relatively low first target also avoided the risk of reputational damage for the sector and for the scheme: a lack of familiarity with the facts does not necessarily prevent third parties making observations and an unreasonable target in the first period may lead to comments either about the sector having failed at the first post or the scheme being ineffective in delivering its policy objectives. We would much rather avoid the possibility of its function being misunderstood and misrepresented in this way;

5. The data centre sector was new to the CCA scheme and there was a shortage of relevant data. There was a possibility that the true average 2011 PUE for the sector was higher than the baseline PUE chosen and there was a consequent risk that the targets could prove punitive. A cautious approach to the first target would provide the "least regrets" option all round.

Rather than simply back-loading (i.e. delaying) the targets we stepped up the targets again in the second and third periods. The second target is as close as possible to the target we would have had under a linear model at 8.33% but the third target is 13.75% - above the 11.67% that would result from a linear target. This is to ensure that the total energy saved under the scheme will be as close as possible to the total energy that would have been saved under a linear target (see chart). The rationale for this was:

a) A challenging target in the second period will focus minds in the sector and will accelerate the deployment of efficiency measures;

b) From a reputational point of view we ensure that the sector cannot be accused of weakening its obligations or reducing the requirements of the scheme by delaying its targets;

c) The carbon objectives of the scheme are not compromised.

Annexe 3. CCA information sources

Data Centre CCA Guidance notes:

Note 01 What is a CCA
Note 01a Strategic Implications Summary
Note 01b Target Profile
Note 01c techUK CCA Briefing May 2014
Note 01d EUETS, CRC and CCA and, er, data centres
Note 01e Buying Green Power from the Grid

Note 02 CBRE CCA Savings Template
Note 02a CBRE ready reckoner buyout

Note 03 Er what is a data centre
Note 03a CCA Decision Tree
Note 03b Do I need an energy consultant

Note 04 Applying for a CCA
Note 04a CCA Supporting Documentation
Note 04b Sub metering
Note 04c Measuring your base year data
Note 04d Measuring fuel to your generators
Note 04e CCA Application Form

Note 05 Explaining figures in your UnA

Note 06 HMRC PP10 and PP11 Forms

Note 07 Target Period 1 reporting

Note 08 CCA maintenance and audits

Note 09 Glossary and list of Notes

Coming soon:

• The 70:30 Rule for Tiny Tots;

• How to make the business case for CCA participation;

• What speeds up your CCA application and what slows it down.

Annexe 4. Abbreviations

These are common abbreviations associated with the CCA scheme:

AEA	Ricardo-AEA (EA's technical adviser/facilitator)
CCA	Climate Change Agreement
CCL	Climate Change Levy
CHP	Combined Heat and Power
CHPQA	Combined Heat and Power Quality Assurance
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CRC	Carbon Reduction Commitment
DAA	Directly Associated Activity
DECC	Department for Energy and Climate Change
EA	The Environment Agency
ESOS	Energy Savings Opportunities Scheme
EU ETS	European Union Emissions Trading System
GCV	Gross Calorific Value
GHG	Greenhouse Gas
HMRC	Her Majesty's Revenue & Customs
PDU	Power Distribution Unit
PUE	Power Usage Effectiveness
RRC	Reduced Rate Certificate
SLR	SLR Consulting Limited (techUK helpdesk/administrators)
TU	Target Unit: a facility or collection of facilities with a single operator that report collectively within the CCA.
UPS	Uninterruptible Power Supply

About techUK's Data Centres programme

techUK is proud to represent the UK data centre sector and offers a comprehensive and influential programme of activity. Our objective is to ensure that the UK continues to offer a business and regulatory environment in which the sector can flourish. We specialise in matters relating to public policy, regulation, reputation, professionalism and energy efficiency.

techUK Data Centres Council: techUK's Data Centres Council was established in 2009 as the UK Council of Data Centre Operators and is a decision making body that sets strategic direction, defines the outputs that techUK will develop on behalf of the sector and agrees the level of our external stakeholder engagement.

The Council is chaired by Andrew Jay of CBRE and the vice chair is Rob Coupland of TelecityGroup. The Council is supported by a Technical Committee, chaired by Professor Ian Bitterlin with Mark Acton as vice chair, which provides expert technical input.

techUK Data Centres Group: Our data centre interest group comprises over 400 members from across the industry. These include data centre operators (both colocation and enterprise providers) companies who manufacture the IT and communications hardware that occupy these facilities, those in the data centre supply chain, and customers, who either lease space for their own corporate function or sell services from the data centre. Specialist activities are devolved to sub-groups.

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Links

Data centre programme pages: techuk.org/datacentres
Data centre publications: techuk.org/datacentrepublications

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tech UK

techUK represents the companies and technologies that are defining today the world that we will live in tomorrow.

The tech industry is creating jobs and growth across the UK. In 2015 the internet economy contributed 10% of the UK's GDP. 900 companies are members of techUK. Collectively they employ more than 800,000 people, over half of all tech sector jobs in the UK.

These companies range from leading FTSE 100 companies to new innovative start-ups. The majority of our members are small and medium sized businesses. techUK is committed to helping its members grow, by:

- developing markets
- developing relationships and networks
- reducing business costs
- reducing business risks