techUK Data Centres Group

IETF: Industrial Energy Transformation Fund
Informal Comments

May 2019

We are pleased to have the opportunity to provide input to this consultation. techUK represents the UK data centre sector, an electro-intensive, growing and economically valuable modern industry.

Introduction: What do data centres do?

Data centres represent a fundamental – but often unrecognised - part of our national infrastructure and enable the full suite of digital activities across government, business and society. Our digital economy and our highly networked society rely on data and connectivity being managed securely and efficiently. Data centres underpin an internet economy that contributes over 10% of UK's GDP, is estimated to contribute £225 billion to our economy and is growing at 10%, faster than any other country in the G-20[1]. Data centres are where our industrial strategy meets our digital strategy.

The UK data centre sector is a major business success story, is leading-edge in terms of technological development and is globally important. The London market is the second largest data centre cluster in the world and is dominant in Europe with over 40% of the Tier 1 capacity[2]. The sector is a significant exporter of digital services such as data hosting, processing, transactions and storage to customers around the world, and acts as the entry point to the rest of Europe for many global data-dependent businesses. The UK sector also exports expertise in construction, engineering and training plus investment, brokerage and other professional services. But the critical economic contribution that data centres make is indirect: this core digital infrastructure stimulates a high-value supply chain at one end whilst at the other enabling growth and competitiveness in an astonishing range of customer businesses[3].

Routes to Decarbonisation

Data centres are electro-intensive and emissions are almost entirely Scope 2, so our routes to decarbonisation are through conversion to renewable supply. The priority is that our purchasing decisions stimulate investment in renewables rather than simply consuming available renewable supply.

The options are therefore limited to three: onsite renewable generation, locating new data centres near to underused renewable sources, and Power Purchase Agreements. There are limited opportunities for onsite generation (particularly retrospective) in the UK and underused renewable power tends to be in Scandinavia. So Power Purchase Agreements are the preferred route for UK operators.

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[1] Boston Consulting Group 2013, The 4.2 Trillion Opportunity: The Internet Economy in the G-20

[2] Largest global data centre clusters – colocation (commercial) facilities. Tier 1 means the four key European markets: London Frankfurt, Amsterdam and Paris. See Fast Facts for more information.

[3] See Data Centre Engines of Growth and Data Centre Business Models: The Sherry Trifle

Data centres are large energy customers. The commercial sector alone consumes over 2.5TWh of electricity a year, and the demand is stable and predictable. We believe that the sector can play a greater role in stimulating investment in additional renewable supply. We would be interested to discuss whether a policy tool could provide a positive stimulus here.

Scope for efficiency and demand reduction

Commercial data centre operators are already very focused on energy efficiency because electricity represents such a large proportion of operating costs. The Climate Change Agreement is a positive influence because it lengthens the horizon for investment. The combination of stick (a challenging target and the obligation to buy out shortfall) – together with carrot (levy concession which means operators have the money to invest) seems to work well in changing behaviour[4]. This differs from conventional carbon taxes, charges and levies, which tend to deprive operators of the very resource they need to make the changes. However, the CCA does not extend investment horizons far enough to enable operators to implement high capital, longer term improvements.

There are two areas where there is scope for major energy savings; 1) updating, removing or replacing old, inefficient IT hardware and 2) consolidating distributed IT. We believe the potential annual savings are in TWhs and would be very interested in discussing whether policy instruments could accelerate improvements in these areas. There are several challenges – if it were easy we would already have done it!

Inefficient IT hardware

Current schemes and funds tend to be focused on technology and physical equipment: in our case, the infrastructure that houses the IT hardware on which functions and applications run. The talk is all about variable speed drives, adiabatic lapse rates, computational fluid dynamics and thermal envelopes. There is much less focus on the efficiency of the IT itself although this is what drives overall demand. In fact, the "efficiency" of a data centre is often described by the proportion of total energy that the IT consumes: the more, the better[5]. IT hardware efficiency varies, so an efficiently operating data centre infrastructure may include inefficient ICT.

Computer servers should be refreshed[6] regularly to take advantage of new processor technology[7] : commercial operators running cloud services tend to do this as a matter of course but many organisations depend on ageing server stock. An old server is an inefficient one: the recent EURECA project[8] reviewed 350 public sector data centres. Key findings were that the majority were very small, - 80% had fewer than 25 racks – and that over 40% of the servers within them were over five years old. More worryingly, these servers performed 7% of the compute functions but consumed 66% of the power (see illustration extracted from project findings). Moreover, most servers were underutilised (running at 15-25% of capacity). We believe that very significant energy savings could

[4] The sector reports formally on its performance at the end of each target period.

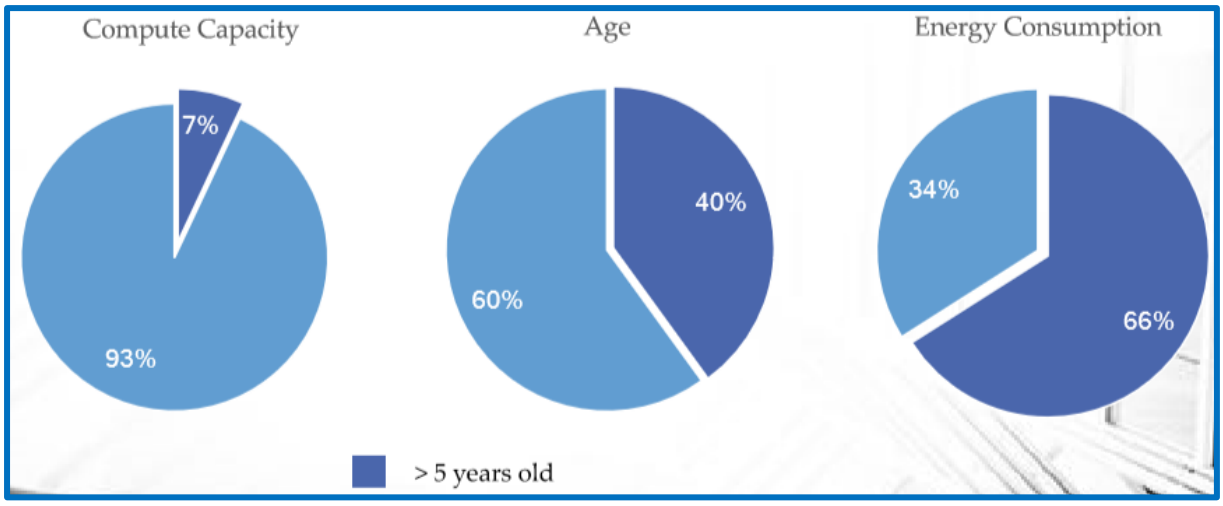
[5] In terms of energy reaching a site, we expect at least 50% to be consumed by the IT functions. No more than 50% should be consumed by the supporting infrastructure. The ratio between the energy arriving and the energy dedicated to IT in a data centre is called PUE – power usage effectiveness. The higher the PUE, the less efficient the facility. A PUE of 1.1 means that for every 11 KWh of power used by the facility, 10 is consumed by the ICT. A PUE of 7 means that 70KWh are needed by the site for every 10KWh consumed by the ICT- a very inefficient facility.

[6] This could mean replacing the whole server or replacing parts within the server

[7] Processors are doubling in efficiency approximately every 18 months. So for servers, which are always, on, use phase is very dominant in terms of energy consumption over the life cycle.

[8] see https://www.dceureca.eu/

be achieved by replacing old devices, by virtualisation (which increases utilisation) or by outsourcing to cloud. New servers entering the market must meet high standards of efficiency both in active and idle modes, but the EURECA figures suggest that a large proportion of the servers currently in use are legacy (old) models.



Consolidating Distributed IT

Within our sector the greatest scope for energy savings would come from moving activity to where it can be done most efficiently. By and large this means consolidating activity.

Most incentives, initiatives and energy saving schemes are preoccupied with making individual sites more efficient. This approach neglects the most significant opportunity for energy savings, which is consolidation. By tackling infrastructure inefficiency at an individual site level, there is scope to reduce consumption incrementally. In the commercial sector the target is to reduce the proportion of energy dedicated to infrastructure by 15% and a quick, very approximate, calculation suggests that this should deliver an overall reduction in the region of 0.75TWh over the 8-year life of the scheme. The CCA works well but only applies to sites above a specific size threshold that operate commercially (see below). Outside the commercial sector the CCA does not apply and there is no scrutiny of site infrastructure, no targets and no incentives.

Data centres in the UK take two main forms:

1) Commercial data centres, which provide services to third parties and collectively consume 2.57TWh of electricity a year[9].

2) "Enterprise" or in-house data centres (facilities run by banks, supermarket, government rather than providing services for third parties). These may consume nearly as much again – we don't know for certain because, unlike the commercial sector, they do not report data centre energy consumption.

But we also must consider the multitudes of small server rooms and cupboards – generally known as "Distributed IT, which are not data centres but perform data centre-type functions. Despite being the

[9] Measured data for 2016 from the Climate Change Agreement. 2018 figures will be available shortly.

antithesis of the consolidated model that a data centre represents, they are often considered to be part of the sector – along with their energy consumption. Estimates vary wildly regarding their energy use because nobody has any idea how many of these cupboards and rooms there are: there could be 10,000, there could be 100,000. All we know is that there are lot of them, and that their aggregate annual electricity consumption could be as much as 5TWh.

Unfortunately, running data centre functions in server rooms, cupboards and small in-house facilities is notoriously inefficient. Again, data from the EURECA project on small public sector data centres (larger than server rooms but suffering from similar challenges) reported relatively poor efficiency. PUE (see note 4 above) ranged from 1.5 (very good) to 7 (terrible) with an average around 4. This means that for every 4 KWh of power entering the data centre only 1KWh gets used by the ICT itself. When you add to that the inefficiency of the ICT already demonstrated and the low utilisation, the result is an exercise in energy profligacy. By comparison, commercial PUE is below 1.8.

There are plenty of reasons why this happens. One is the business model (see table below). Commercial operators are incentivised to optimise the infrastructure. In house operators with large facilities who are treating the data centre like a business unit are also strongly motivated to optimise both IT and infrastructure. However, distributed IT and small data centres are often just run as part of operational costs. Moreover, they may be starved of the investment needed to make them fit for purpose. They may also be run like private fiefdoms - anecdotal evidence from local authorities includes one that refused to consolidate and outsource because the costs would be £30,000. Their current arrangements were "free". In fact, their current arrangements cost them £150,000 a year: they had just never segregated them from the overall overhead. Another authority could not outsource because their IT department blocked all initiatives. They had to wait until their IT manager retired before they could outsource their data centre functions.

Incentives	Commercial	In-house	Distributed
Cost drivers for efficiency: energy as % turnover	Electricity is a high proportion of turnover as data centre operation is the only thing they do	While data centre energy costs may be high, they may not represent a significant proportion of turnover.	Data centre electricity costs are usually not segregated but likely to be a lower proportion of turnover than commercial facilities.
Extent of efficiency measures available	May not own the servers so efficiency measures limited to infrastructure	Own and operate the IT so efficiency measures apply across both infrastructure and IT hardware and software.	Own and operate the IT so efficiency measures apply across both infrastructure and IT hardware and software
Data centre function run as a business unit?	Always run as a business unit.	Data centre may be run as a business unit- costs often transparent.	Data centre activity rarely run as a business unit – costs often hidden in organisational overhead.

The EURECA project's dataset demonstrated that implementing better energy stewardship in multiple individual small data centres could deliver marginal improvements, but consolidating the same activity into larger, purpose-built facilities could be transformational. We estimate that such a move could reduce energy demand by at least half. So the emphasis on changing lightbulbs and adopting variable speed drives is misplaced. It is the equivalent of encouraging 30 people travelling to the same place to drive their cars more conservatively instead of taking a bus together. The real gains are in changing the business model.

This is already happening in the UK public sector through hugely successful initiatives that encourage the movement of activity to cloud (GCloud) or to colocation (Crown Hosting). While central government activity has largely adopted an outsourced model, there is considerable inertia regarding smaller-scale activities. A policy instrument that accelerates this process across both public and private sector could deliver very significant energy savings. It would need to help aggregate demand for outsourcing and overcome cultural and organisational inertia.

Conclusion

We are aware that we have not followed the flow of the consultation or answered the specific questions posed. This is one of several instruments that present our members with a high bar to entry for low or uncertain return. A bidding or auction model may be cost effective for government, but it is not necessarily cost effective for business. As a result, it is difficult to generate enthusiasm among individual operators. There is also a degree of industry fatigue with multiple instruments focused on the part of the sector that is performing well, where energy use is transparent and accountable, rather than the part that is performing badly, where energy use is a matter for conjecture.

Because this is an informal consultation, we have taken the opportunity to provide a broader response that sets out where we think the biggest energy saving potential is in our sector and our willingness to support the development of policy instruments that will help us realise them. A sector level approach may be more productive and appealing.

Do please get in touch if you think there is scope for further discussion, or if you need more information on the characteristics of the sector.

Further Reading

Ten Myths About Data Centres

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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. 950 companies are members of techUK. Collectively they employ more than 700,000 people, about 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. www.techuk.org