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Piece for Friends of Europe

Emma Fryer: Does the ICT sector hamper or help reduction of carbon emissions?

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The Information and Communications Technology (ICT) sector has grown rapidly over the last two decades and data flows are increasing exponentially, driven by policy agendas, the adoption of digital delivery channels by government and business, and consumer preferences. Way back in 2007, Gartner observed that ICT energy use was significant but under-reported, asserting that the sector's carbon footprint was similar to the airline industry. Although a flawed comparison[1], it stimulated a stream of articles and studies, many claiming that ICT energy use was exploding and would spiral out of control when the Internet of Things (IoT) becomes a reality and a new global middle class comes online.

The truth is more mundane. ICT energy consumption is increasing, but incrementally rather than exponentially. This is because the relationship between activity and energy use is more complex in ICT than in sectors like farming and manufacturing. However, the sector's share of electricity is non-trivial, which is challenging for governments because ICT pervades all fields of our economy (rather like eggs in a cake) so it is very hard to attribute consumption accurately or implement effective policy measures.

Even within the sector it's complicated: the proportion of energy used by devices, networks and data centres respectively is constantly changing. End user devices have proliferated – there are now more mobile phones than people – and dependence on remote, centralised data processing and storage is increasing. On the other hand, on-premises IT is declining as applications are migrated or outsourced to cloud[2] and third-party data centres. As a result, commercial data centre operations are expanding, with the most conspicuous growth in hyperscale cloud providers[3].

ICT's role in mitigating climate change is dual. Firstly, it can address sector emissions through energy efficiency and renewables uptake. Secondly, and more importantly, it has the potential to deliver emissions reductions across the wider economy.

In terms of efficiency, progress is good. Rapid technological evolution has improved processor efficiency by around seven orders of magnitude over the last three decades. Apply that to air travel and we would now get from London to New York in seconds, using less than a litre of kerosene. These improvements are augmented by developments like virtualisation, improved server tolerance to heat and humidity and innovative cooling technology. Trends like consolidation (moving servers from cupboards to purpose-built facilities) reduces energy consumption by around two-thirds.

The same is true of our communications networks: each evolution of mobile infrastructure delivers a step change, so 5G is massively more efficient than its predecessors. Energy dominates operational costs for network and data centre operators which strongly motivates good stewardship. Adherence

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[1] The ICT sector is many times larger than aviation, uses electricity not fuel and delivers third-party carbon reductions

[2] Gartner predict that 80% of enterprises will shut down on-premise data centres by 2025 in favour of outsourcing to third party providers : Gartner, From Hyperscale to the Edge: 2019 tech trends, from Kickstart Europe 2019 Outlook, 15/01/2019

[3] In the UK this part of the sector consumed 2.57TWh, or 0.8% of UK electricity in 2016 (0.28% of the UK's total primary energy supply). techUK: Data Centre CCA report progress against second target: 2017

to relevant standards like ISO50001 is exceptionally high[4]. British data centre sector also participates in a government scheme that incentivises energy saving investments and makes energy consumption transparent and accountable.

Renewable adoption is also good. The ICT sector now buys a higher proportion of certified renewable power than any other industry, generally through power purchasing agreements[5] and is driving demand for investment in additional supply. Many ICT companies are also exploring both on-site and off-site renewable generation. Certain types of data centres are 'location agnostic' and can make use of existing, underused renewable power sources. As a result, large hyperscale operators, currently accounting for the majority of sector growth, are expanding operations in regions like Scandinavia.

Although ICT depends wholly on electricity, core digital infrastructure installations like data centres maintain emergency generating capacity in the form of diesel plant, plus short-term battery storage. They can therefore contribute to load-balancing, which is critical in handling intermittent renewables. Moreover, operators are actively driving R&D in battery technology to extend storage capacity and others are trialling fuel cells. Heat reuse is at an early stage in the UK due to lack of infrastructure but is well established in Scandinavia and being rolled out in the Netherlands.

But it is the net impact of ICT that is the most important. ICT is adopted in the private and public sectors because it improves productivity and efficiency. This has been demonstrated in fleet logistics, computer-aided design, in-silico modelling, predictive maintenance and dematerialisation (where physical journeys and media are minimised or eradicated). Estimates suggest that the intelligent application of ICT can reduce global carbon emissions by around 20%.[6]

Let it not be forgotten that without ICT we could not monitor and model climate change or conduct a global conversation about it. Even those organisations most critical of ICT make extensive use of digital media to communicate their messages.

However, we can't assume that ICT automatically delivers emissions reductions. A market-based taxi system may reduce car numbers in American cities with limited public transport but in European cities the opposite may happen if cars displace public transport journeys. And there are other issues to consider. ICT is increasingly becoming a utility like electricity or water, and highly price-elastic. We flush our toilets and wash our cars with drinking-quality water because it is cheap. Likewise, the more efficient ICT is, the more we use it[7].

Moreover, the widely adopted freemium and advertorial business models are very effective in driving innovation, but do not give consumers any indication of the carbon impact of their digital activity. It's easy to be profligate with something that is cheap, or free. That said, the same price-elasticity acts as a controlling valve on energy consumption: if it does escalate, the market will apply financial signals. Imagine the impact of even a small charge for each picture uploaded on Facebook.

In conclusion, the ICT sector is making a significant contribution to emissions reductions. Efficiency continues to improve at every level: component, device, infrastructure and even in terms of business models. Renewable adoption is high and ICT delivers economy-wide improvements in carbon

[4] Even by 2015 50% of commercial UK data centres had implemented 5001: techUK, Data Centre CCA report: progress against first target, 2015

[5] commercial PPAs are fixed term contracts with the generator. This approach facilitates the financing of distributed generation

[6] See studies such as GeSI Smart 2020 and Gesi Smarter2030, BT Accenture

[7] Jevons paradox explains that improving efficiency may increase rather than decrease net consumption, because lower prices stimulate uptake.

productivity. Nevertheless we cannot be complacent and must maintain a watchful eye on business processes and trends. ICT does not automatically improve efficiency: digital technology must be deployed intelligently if we are to optimise its capabilities, so continuous scrutiny is essential. We also need to understand energy flows better within the sector, and we need to make consumption more transparent, especially for consumers.

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