YOUR FIVE-STEP DECARBONISATION PROGRAMME

Rich Kenny, managing director of Interact, offers his top tips

Sustainability regulation for the data centre industry is fast becoming a reality, with the coming of mandatory reporting under the Corporate Sustainability Reporting Directive (CSRD). There's a growing recognition within the sector that decarbonisation is both necessary and inevitable, offering companies who take the lead enhanced brand reputation, greater investor confidence and increased resilience to oncoming legislation, in other words, a competitive advantage. If decarbonisation is here to stay, how can data centres facilitate what can seem like an overwhelming task?

THE GREAT CARBON OFFSET DEBATE

Many of the most recent 'Net Zero' emissions claims by data centre operators have come with the caveat that they are reliant on carbon credits. One of the problems with carbon credits is that they do not address emissions reductions, which is where we need to focus to achieve a balance between carbon emissions and carbon capture. Another criticism is that many have been found to be 'low value'.

Investing in green tech is a higher value proposition than planting trees and highly relevant to sectors in which there are no other viable decarbonisation initiatives, such as the aviation sector. Not so the data centre sector which has plenty of alternative strategies to adopt in their pathway to net zero.

Most of the large cloud providers have, at least, improved their sustainability commitments from carbon neutrality to net zero in recent years. Amazon have pledged to reach net zero carbon emissions across their operations by 2040, while Google have gone further, aiming to 'achieve net zero emissions across all of our operations and value chain, including our consumer hardware products' by 2030. Microsoft have gone public about becoming carbon negative by 2030 through investment in carbon capture technology.

SO, WHAT DO YOU DO IF YOU ARE NOT A HYPERSCALER?

Before getting down to the nuts and bolts, it is important to point out that all carbon reduction schemes are not created equal. Sustainability reports use a variety of terms to account for emissions, including 'carbon neutrality' and 'net zero'. Carbon neutral companies calculate their emissions and then compensate for these by buying carbon offsets. A Net Zero Pledge is different. It means that, 'companies should prioritise decarbonisation of Scope 1, 2 and 3 emissions... over and above offsetting on their journey to net zero,' according to the Carbon Trust. If carbon credits are not the answer, what does a strategic framework to support a net zero pathway look like? It can be summarised in the following 5-point plan:

1. MEASURE AND REDUCE

The first step in your net zero pathway is to measure your company's Scope 1 and 2 emissions and set a science-based target for reducing emissions across your operations. There is a growing recognition that IT efficiency has a huge part to play in reducing energy use and carbon emissions for data centres. As servers are responsible for 65% of the energy draw of a data centre on average, it makes sense to start there. This is where our transparent grading mechanism comes in, to measure the energy efficiency of servers, grading them from most to least efficient.

Once emissions are measured, action can be taken to reduce emissions, in other words, to make your equipment do more for less energy.

2. MAXIMISE ENERGY EFFICIENCY

The next stage of a net zero plan is to increase energy efficiency through digital transformation strategies.

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Energy and carbon reduction strategies focused on the energy-hungry server estate can be focused on consolidation, decommissioning, refresh, reconfiguration and new server procurement. Due to the low utilisation rates of most data centres and high numbers of zombie servers, consolidation and reconfiguration projects can provide the same compute at the same utilisation but much more efficiently.

3. CONTRACT GREEN POWER ALTERNATIVES

The next step of the framework is to decarbonise energy supply by signing green electricity contracts and finding alternatives to diesel back-ups. Large cloud providers such as Amazon and Google, have been exploring green power alternatives for some time. In Amazon's 2021 Sustainability Report, it claims to be the world's largest corporate purchaser of renewable energy and is on track to power its operations with 100% renewable energy by 2025.

4. REDUCE SUPPLY CHAIN EMISSIONS

As the industry grows more aware of Scope 3, there is a push to address environmental impact through a circular economy model. This would reduce emissions associated with the products and materials in the supply chain as well as reducing emissions at end of life. The idea is that by prolonging life, designing for prolonged life and recovering materials rather than mining them, we will reduce the high CO_2e emissions associated with manufacture and mining.

Once your server estate has been analysed, you can identify best candidates for extending product life and achieving emissions overall. Reducing the amount of equipment you buy will also have a beneficial effect on Scope 3, Category 1, purchased goods and services. Aside from that, circular economy has long been seen as a 'good idea' for other materials like rare earths and precious metals.

Google claims that 27% of the components it used in server upgrades in 2021 were refurbished inventory. Microsoft operates 'circular centers' to refurbish old servers and says more than 80% of its decommissioned assets will be repurposed by 2024. Hyperscalers will find this easier to do than smaller players because they control the whole value chain. However, there are tools on the market like Interact, which can help. With reliable analysis on which servers to remove and – more importantly – how to upgrade others to make them more performant, data centres can vastly reduce the amount of new IT equipment they buy.

5. OFFSET THE REST

Correctly managed offsets do have a part to play in the net zero pathway, but they should only be considered after science-based reductions have been implemented. One of the key reasons that offsets should be used as a last resort is the time lag between emissions and impact of the offset. Companies relying on carbon offsets in place of reductions run a real risk of greenwashing accusations in our increasingly environmentally aware world.

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THE IMPORTANCE OF SUSTAINABILITY

Maha Aziz, KTP Associate at Cistor, shares how to embark on the journey of decarbonising IT by adopting remanufactured networking technology

In recent years, the focus on sustainability has gained significant importance across industries. The IT sector is no exception, although some might say it has been late to the party. The increasing demand for technology-driven solutions and products has led to a significant increase in carbon emissions and electronic waste. As a result, IT sustainability has become a critical issue to address. This article will highlight the importance of sustainability in the IT sector and share the initiatives being taken by our company, Cistor, part of the Circularity First Group, to promote sustainability.

WHY IS SUSTAINABILITY IMPORTANT IN THE IT SECTOR?

The IT sector is one of the largest consumers of energy and a significant contributor to carbon emissions. The use of data centres, servers, and other hardware requires huge amounts of energy, which leads to a substantial carbon footprint. ICT is estimated to be 4% of global emissions. Along with in-use energy, there is also the embodied carbon to consider, the carbon that has been created to manufacture the technology in the first place. Moreover, the rapid pace of technological advancements leads to the generation of electronic waste (e-waste, one of the world's fastest growing waste streams) which is also driven by the unnecessarily short perceived lifecycle of IT hardware and procurement policies that mandate only brand-new technology.

CHALLENGES

Let's walk through some challenges that can be resolved by using remanufactured equipment rather than opting for new hardware:

- **Finite natural resources:** By utilising non-new technology, we save on the consumption of natural resources and critical raw materials. This supports businesses to manage their resource consumption more effectively and minimize their full environmental impact.
- **Carbon reduction:** It is often estimated that at least 60% of the carbon footprint of IT hardware comes from its manufacture. Our company, Circularity First, tore apart commonly used networking equipment to start to understand the embodied carbon within it and our research suggests similar numbers. Utilising remanufactured technology has a lower carbon footprint than new. For example, our study showed that in a typical 200 persons office that might use 6 network switches, 3 routers, 20 wireless access points and 200 IP phones, a 57% reduction in carbon emissions could be achieved by using remanufactured technology over new.
- **Long lead times for equipment:** The need for physical equipment and infrastructure, such as servers and data centres can lead to longer lead times when ordering new equipment. However, if we move towards using remanufactured hardware, it can help eliminate the delays associated with long lead times for new equipment and enable industries to become more agile and responsive.
- **Saving money:** Moving towards remanufactured equipment often has a commercial benefit too that has a vital importance in our current economic climate as it allows investment in other areas of IT infrastructure. Collectively, we need to break the linear model for IT i.e., take, make, use, dispose and rather move towards a more sustainable approach where technology is kept in use for longer, by aligning technology to the circular economy principles with recycling being the last resort.

REMANUFACTURED TECHNOLOGY

One question that we often hear IT professionals ask is, 'is remanufactured hardware as reliable as new?' This is a question we are keen to address. Although we have supplied remanufactured technology in mission critical environments (like aircraft carriers, hospitals and financial institutions), we still hear concerns.

Cistor Limited, part of the Circularity First group, supplies authorised remanufactured technology, and has provided a more sustainable solution to IT infrastructure for the last 14 years.

Remanufactured technology provides solutions to business challenges. For example, due to lead times of more than six months, our telecommunications client was unable to execute its data centre expansion within the intended timeline. Significant project delays were costing the client money and time. Cistor was able to switch from a linear to a more circular supply model by working with them. With a cost reduction of 18% on the firewalls, the multi-million-dollar project got off the ground quickly and the project has a measurable impact on the organisation's sustainability targets.

Back in 2021, Cistor began to explore what data existed to compare the performance of remanufactured networking technology with new. It was soon realised that limited data exists in this regard. In response, the team at Cistor applied for and was granted Knowledge Transfer Partnership funding through Innovate UK. It is a collaboration between three bodies: the company; Cistor Ltd, the government funding body; Innovate UK, and the university; University of East London which serves as the academic source and knowledge base of this project.

I was lucky enough to be selected as the KTP associate for this project, to conduct the research and I am now nine months into the project. As a software engineer by background, my experience is in developing software applications and I have relocated from Pakistan to Manchester to work on this KTP project. This is a two-year project, and we'll share our findings and outcomes from this case study as evidence that encourages a more sustainable approach to how IT is used. Under this project, we are developing a REMA (Remanufactured and Recycled Networking Equipment Analyzer) tool that will help people to compare remanufactured and new equipment. Moreover, this software tool will help the IT professionals predict which hardware would be better for their network infrastructure. This study will build a true picture of the use phase impact, embodied carbon impact and reliability analysis of new networking equipment vs remanufactured. It will demonstrate the environmental and economic opportunities to keep networking equipment in use for longer time and inspire industry-wide behavioural change, to significantly reduce ICT's environmental impact.

We will build underlying data models and will incorporate machine learning on the data regarding the performance of remanufactured equipment. Moreover, we also aim to address any reliability concerns. We recognise that the environmental impact alone will often not be sufficient to encourage all users to consider remanufactured technology.

The IT sector has a significant role to play in promoting sustainability. As technology continues to play an essential role in our lives, it is critical for the industry to address its environmental impact. Through initiatives such as green data centres, sustainable hardware, and energy-efficient software, the industry is taking steps towards a more sustainable future. Furthermore, by promoting responsible e-waste management, recycling, and carbon offsetting, the IT sector can demonstrate its commitment to sustainability and contribute towards creating a cleaner and greener planet. We hope our project provides further evidence of the benefits that taking a more circular approach towards technology can bring.

LET'S ACT ON IT TOGETHER

Now is the time to come together for promoting the use of remanufactured equipment and decarbonising our environment. To achieve this, we require some log-book data on networking equipment from companies that can help us build our analysis on the reliability of remanufactured hardware. The data might include the reason for network equipment failure and the age of the equipment when the failure occurred (i.e., the number of days between the date of commissioning and the date when malfunctioning was observed). We will ensure the anonymity of all the data we receive and will destroy it after use. If you'd like to contribute data to this study, please email maha.aziz@circularity-first.com and in return we will give you first access to our findings and research. So, lets collaborate on this and make it happen!

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IS NET ZERO ENOUGH TO SAVE THE PLANET?

Deborah Andrews, professor of design for sustainability and circularity at London South Bank University, asks, is it possible to achieve net zero without considering factors other than carbon and equivalent greenhouse gases?

Scientific data clearly shows the parallel increase in CO_2 and other greenhouse gas emissions human activity and climate change since the industrial revolution. Consequently, it is easy to understand why carbon and carbon equivalents have become identified as something to be measured, limited and reduced in our attempt to mitigate climate change. The latest drive – 'net zero' – is incredibly ambitious and aims to reduce greenhouse gas (i.e. carbon and equivalent – CO_2e) emissions to as close to zero as possible by 2050; where this is not possible the gases should be absorbed by the ocean and forests for example. In terms of real sustainability however we should consider whether net zero is enough to 'save the planet' and whether, in the quest to reduce carbon emissions, we could be creating other short- and long-term environmental, social and economic problems. For example, during the 1990s the British public were encouraged to drive diesel vehicles because they were more fuel efficient and emitted less carbon per km driven than petrol vehicles. However, diesel combustion produces particulates which adversely affect air quality and human health, the cumulative effect of which is particularly bad in urban areas. In this instance the response to reduce carbon emissions exacerbated another problem!

Carbon counting was initially based on operational energy consumption, which is relatively easy to measure and suits energy hungry sectors like the data centre industry. However, results can be highly misleading if they exclude embodied energy and carbon emissions associated with materials, manufacture and end-of-life processing: for example, how do we know whether a product with high operational energy consumption is 'better' than a product with low operational energy consumption when the embodied impacts of the products are not presented? In some cases, energy efficient products have very high levels of embodied carbon which could make overall impact higher than that of the energy hungry product. Measuring combined operational and embodied carbon of a product or service allows for slightly more accurate comparison, but the assessment of carbon and equivalents alone still excludes thousands of inputs and outputs which can give misleading impressions about their real impact.

This is particularly important when considering electrical and electronic equipment which includes many high impact materials. For example, mining and end-of-life treatment can create significant impacts especially if they include toxic processes and emissions. Gold – which is found in circuit boards – is often mined via unregulated and artisan processes, which include use of cyanides, sulphides and chlorides that pollute surface water, groundwater and rivers. Furthermore, when the tailings (waste) dry they release toxic gases all of which cause long-term environmental damage and once in the food chain and water supply, they damage human health and can cause death. At end-of-life NiCd (nickel cadmium batteries) are often included in household waste and sent to landfill or incinerated; again cadmium is both highly toxic and carcinogenic and as the batteries breakdown they leach into the soil and can enter the food chain and eventually people. These are only two examples of inputs and outputs that are omitted from carbon assessment and there are thousands more per product, many of which are also highly damaging. Materials availability and risk to supply are also omitted from carbon assessments; concern about this factor is growing and the EU Commission has identified thirty Critical Raw Materials (CRM). These are defined as such because the quantity of unmined reserves is limited, they are located in geo-politically sensitive areas and the current recycling rate is either low or zero. Exclusion from carbon-only assessments further exacerbates/compounds their inaccuracy.

KICK STARTING A CIRCULAR ECONOMY

The CEDaCI project was launched in 2018 to kick start a circular economy for the data centre industry. The key outputs include comprehensive Life Cycle Sustainability Assessments, which identify the environmental, economic and social impacts of a range of data centre equipment. The project has focused on servers because they have the highest environmental impact and the primary source data was collected by disassembling/reverse engineering products, building inventories of components, their materials and manufacturing processes and operational energy consumption. A range of end-of-life scenarios was also created: standard recycling (which reclaims iron/steel, copper, aluminium and gold), a new enhanced recycling scenario (where many CRM are also reclaimed), product life extension (through reuse and component upgrade) and landfill, which is included to highlight the benefits of recycling and reuse. The models all include thousands of inputs and outputs in addition to carbon and equivalents and, because they are based on primary rather than secondary source data, extrapolations and assumptions, are robust. The models underpin the Circular Data Centre Compass (CDCC) – a free to use online tool – that helps stakeholders to make informed decisions about the purchase of new/second life equipment and treatment at end-of-life. Comparative studies of two servers clearly illustrate the difference between carbon only assessment and comprehensive Life Cycle Assessments as follows: the studies are based on a four-year lifespan, average NW European energy generation mix older and a less energy efficient server (e.g. from 2003) and a newer more energy efficient server (e.g. from 2016).

When the operational and embodied impacts are split and compared the results for a carbon only assessment of the older server show the ratio of operational to embodied impact is 85% to 15%; i.e. the operational impact is much higher than the embodied carbon and associated impacts. The results of the comprehensive life cycle assessment of the same server show the ratio shifts to 70%-30% because thousands of inputs, outputs and impacts are included in addition to carbon. The pattern is the same for the newer more energy efficient server and the carbon only assessment shows a ratio of 80%-20%. However, the comprehensive LCA results are really surprising and show that the ratio of operational to embodied impact is 50-50!

These results not only highlight the difference between CO_2e only and full life cycle assessments, but they also clearly illustrate the limitations of carbon only assessment and underestimate the significance of physical materials etc. Carbon measurement is very important as part of the journey to net zero but the data centre industry (and other sectors) need to be aware of its limitations and, wherever possible, obtain comprehensive life cycle assessments to make well-informed decisions for business, the environment and society to ensure that, while reducing carbon, we don't create other short- and long-term problems.

"Carbon measurement is very important as part of the journey to net zero but the data centre industry need to be aware of its limitations and, wherever possible, obtain comprehensive life cycle assessments to make well-informed decisions for business, the environment and society."

Deborah Andrews is professor of design for sustainability and circularity at London South Bank University.

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HOUSE AD

DATA CENTRE SUSTAINABILITY: A GUIDE TO NET-ZERO OPERATIONS

Gregory Ratcliff, chief innovation officer at Vertiv, shares how to decrease operating costs, increase financial flexibility, and reduce the risk of stranded or obsolete assets

Climate change issues are rising to the top of every leader's agenda. This is due to both the desire to be good corporate stewards and the growing impact of climate change in the form of more frequent and severe weather events, rising sea levels, more dangerous wildfires, floods and droughts. At the same time, data centre owners and operators want to ensure that their businesses can flourish in any regulatory market or environmental condition.

As a key focus of sustainability initiatives, data centre operators have made significant progress in improving data centre energy efficiency over the last decade, but as digital transformation advances, capacity growth is working to offset some of those savings in terms of total energy consumed. In 2020, data centres consumed between 200 and 250 terawatt-hours (TWh) of electricity, or nearly 1% of global electricity demand, and contributed 0.3% of all global carbon dioxide (CO_2) emissions.

The industry's ability to meet growing demand for capacity could also be limited by resource constraints. Water availability is becoming an issue in some areas of the world and the United Nations has cautioned that global water demand could increase 20% to 30% above current levels by 2050, while over 2 billion people already live in countries experiencing high water stress. A 15-megawatt data centre can use up to 360,000 gallons of water a day depending on thermal management practices, and some municipalities are becoming reluctant to meet those demands.

These factors are creating pressure on data centre owners and operators from internal and external sources, including boards of directors, the media, regulators, customers, shareholders and employees - the industry is responding.

Hyperscalers are amongst those leading the way. Apple and Google Cloud have achieved net zero carbon, Amazon intends to do so by 2040, and Microsoft intends to become carbon negative by 2030. In China, technology companies Chindata, Alibaba, Tencent, GDS and Baidu are also making progress on reducing carbon from their operations.

INNOVATIONS FOR DATA CENTRE EFFICIENCY

As laid out in Vertiv's Guide to Sustainability, a number of new innovations have entered the fold to help data centre operators increase asset utilisation, maximise efficiency and reduce emissions and water consumption:

Intelligent power management

Intelligent equipment and new controls enable data centre operators to improve the utilisation and efficiency of the critical power systems required to achieve high levels of data centre availability. Strategies being used by organisations to handle short and infrequent demand peaks, rather than oversizing equipment based on these peaks, are utilising the overload capacity designed into some Uninterruptible Power Supply (UPS) systems or relying on battery reserves.

Renewable energy

There are numerous ways to leverage renewable sources, including purchase plan agreements, renewable energy certificates and migrating loads to cloud or colocation facilities that have made the commitment to carbon-free operations.

Some operators are looking at opportunities to power data centres through locally generated renewable power, which can be accomplished by matching renewable energy sources with fuel cells, systems that can produce clean hydrogen from renewable energy and UPS systems with dynamic grid support capabilities.

Fuel cells, in particular, are emerging as a promising technology for powering data centres. These devices use an electrochemical reaction to convert fuel, such as hydrogen or natural gas, into electricity, producing fewer emissions than traditional generators. In addition, fuel cells supported by a Battery Energy Storage System (BESS) and a UPS can provide a reliable, uninterrupted power supply that can keep critical data centre systems running during power outages or other disruptions.

Water and energy-efficient thermal management

Thermal management systems are typically the largest contributor to data centre power usage, so there has been

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a concerted effort to drive down their impact on power usage effectiveness (PUE) by using more energy-efficient cooling technologies. There has been an increase in the use of thermal management systems that improve cooling efficiency by using water to expand the number of hours the system can operate in free-cooling mode. Chilled-water free-cooling systems help strike a balance between water utilisation and energy efficiency, but for areas where access to water is limited, a water-free direct expansion (DX) system can be employed.

The introduction of new refrigerants that don't affect the ozone layer and are more eco-friendly is another innovation helping data centres to become more sustainable. These refrigerants can be used in cooling systems such as chillers and computer room air conditioning (CRAC) units to improve efficiency and reduce emissions.

Optimising the supply chain
The supply chain for data centres is complex and optimising it can be a challenge. However, a focus on sustainability in the supply chain can help data centre operators reduce environmental impact while improving efficiency and cost-effectiveness. There are a number of considerations:
Select suppliers who prioritise sustainability: Data centre operators should work with suppliers who share their commitment to sustainability.
Adopt circular economy principles: Data centre operators should look for opportunities to reuse or repurpose equipment, rather than sending it to a landfill.

Minimise packaging waste
Packaging waste can be a significant contributor to a data centre's environmental impact. Data centre operators should work with suppliers to reduce packaging waste and consider reusable or recyclable packaging materials.

Consider the environmental impact of transportation
Data centre operators should work with suppliers to minimise the environmental impact of transportation, including by choosing modes of transportation that are more fuel-efficient or emit less greenhouse gases.

Reduce e-waste
E-waste, discarding electrical or electronic equipment, is a significant environmental concern and data centres can generate a lot of it. Data centre operators should work with suppliers to reduce e-waste by choosing equipment that is designed to be easily recycled or repurposed.

MEASURING AND REPORTING DATA CENTRE EFFICIENCY AND EMISSIONS

To reduce their environmental impact, data centre operators need to understand how much energy they are consuming and how much carbon they are emitting. This requires accurate measurement and reporting of energy use and emissions. The good news is that there are a number of frameworks and metrics that data centre operators can use to measure and report their environmental impact:

Power Usage Effectiveness (PUE)
PUE measures how much energy a data centre is consuming relative to the energy delivered to its IT equipment. A lower PUE indicates better energy efficiency.

Carbon Usage Effectiveness (CUE)
CUE is similar to PUE, but it measures a data centre's carbon emissions relative to the energy used by its IT equipment.

Water Usage Effectiveness (WUE)
Water Usage Effectiveness (WUE) is a metric developed by The Green Grid to measure data centre sustainability in terms of water usage and its relation to energy consumption. It is the ratio between the use of water in data centre systems (water loops, adiabatic towers, humidification, etc.) and the energy consumption of the IT equipment. The calculation helps organisations to make a decision between water vs electricity usage. In locations where water is plentiful, water usage could be much higher than PUE, but the metric is still useful to ensure that resources are utilised as efficiently as possible.

The Greenhouse Gas (GHG) Protocol
The GHG Protocol provides comprehensive, standardised global frameworks that industry organisations can use to understand, aggregate, quantify and reduce their emissions and work with value chain partners to do the same. GHG Protocol provides calculators and FAQs to help organisations quantify emissions.

Renewable Energy Certificates (RECs)
RECs allow data centre operators to purchase renewable energy and offset their carbon emissions. One REC represents one megawatt-hour of renewable energy.

The European Code of Conduct for Data Centres
The European Code of Conduct for Data Centres provides guidelines for data centre operators to improve the energy efficiency of their facilities.

A BRIGHTER, GREENER FUTURE

Pressure to reduce environmental impact in data centres is continuing to grow, with stakeholders calling for more action to reduce the sector's carbon footprint and water consumption. While operators have made progress in improving energy efficiency, much remains to be done to meet the demand for capacity growth while reducing emissions.
The path towards net-zero data centres requires clear goals, frameworks, metrics and prioritisation of opportunities. It is also essential to adopt innovative solutions that leverage strategies such as intelligent power management, renewable energy, and water and energy-efficient thermal management.

By taking action and implementing sustainability practices in data centres, operators can lower operating costs, increase financial flexibility, and reduce the risk of stranded or obsolete assets.

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LEARN MORE:
About implementing sustainability practices in data centres by reading Vertiv's Guide to Data Centre Sustainability at www.vertiv.com.