techUK
FOR WHAT COMES NEXT

techUK Cloud Insights:

Cloud computing and the path to a more sustainable future

November 2023

Committed to Climate Action

techUK Cloud Insights

This cloud insights paper brings together thought leadership and best practice from across the tech sector and explores key issues and trends in cloud computing.

Cloud computing and the path to a more sustainable future explores the key role of cloud in driving sustainability across the tech sector. This paper explores the core elements of a sustainable approach to cloud computing and highlights best practice from both cloud providers and their customers.

This document reflects the views of techUK members that contributed to its development but may not represent the position of all techUK members. The document also includes several "member spotlights" presenting insights, case studies and thought leadership from techUK members. The content of these sections are exclusively the views of the named organisation and are not an endorsement of content provided by other members.
You can find a full list of techUK members on our website.

About techUK

techUK is the trade association which brings together people, companies and organisations to realise the positive outcomes of what digital technology can achieve. With almost 1,000 members (the majority of which are SMEs) across the UK, techUK creates a network for innovation and collaboration across business, government and stakeholders to provide a better future for people, society, the economy and the planet. By providing expertise and insight, we support our members, partners and stakeholders as they prepare the UK for what comes next in a constantly changing world.

Committed to Climate Action

For organisations committed to climate action and decarbonisation, techUK has highly valuable insight and experience.

We support our members and those in the broader tech sector who are committed to net zero and climate resilience and we advocate for investment in digital transformation in other sectors to help meet their net zero ambition and future resilience.

We encourage you to get in contact with our Climate team to see how we can help you.

Visit our Climate Action Hub

Contents

Executive Summary

At a time when our commitment to mitigate the impact of climate change has never been more urgent, a sustainable approach to technology should be at the heart of any digital transformation strategy. Cloud computing has immense potential to help organisations drive down emissions and improve the sustainability of their IT estates.

This paper highlights **six core principles that are the foundation of a more sustainable future for cloud computing**. Underpinning these principles is a shared responsibility model that applies best practice at every level, with cloud providers ensuring the sustainability of the cloud and customers taking data-driven decisions to operate sustainably in the cloud.

By leveraging the inherent advantages of cloud, including more efficient use of hardware, investments by cloud providers in sustainable data centres, and the flexibility of an as-a-service procurement model, customers can often cut energy use and their overall carbon footprint, relative to legacy infrastructure, by moving to cloud.

To maximise those benefits, techUK is working to support cloud service providers on the path to achieving and maintaining the following **core principles of cloud sustainability**:

- **Comprehensive and transparent sustainability data available to customers.** This should include granular data regarding individual workloads and comprehensive and timely metrics relating to specific data centres or service regions.
- **Inclusion of Scope 3 emissions in all sustainability data** to give confidence to customers and make it easier for them to make informed decisions and implement impactful climate strategies.
- **Continued investment in sustainable infrastructure** including through renewables, energy and water efficient facilities and hardware, and efforts to reduce carbon associated with hardware lifecycles.

techUK has many cloud providers and data centre operators in membership and we are committed to accelerating progress in these areas. However, harnessing the full potential of cloud to achieve more sustainable digital transformation across the economy also requires a proactive approach from users of cloud services.

While cloud providers have made significant investments in renewables and more energy efficient infrastructure, moving to cloud will not automatically guarantee the maximum possible reduction in an organisation's carbon footprint and computing as-a-service does not necessarily equate to sustainability as-a-service. In other words, a "lift and shift" migration followed by a "file and forget" approach to data management can seriously undermine the sustainability benefits of cloud computing. To achieve the best outcomes for the planet, user behaviour is key.

To maximise the environmental potential of cloud computing, techUK is working to support cloud customers as they adopt the following core principles of cloud sustainability:

- **Develop a culture of sustainability by embracing GreenOps practices**, building on FinOps principles to put resource efficiency at the core of business operations.
- **Tackle the dark data challenge** by revising and monitoring data management policies to minimise the storage of unused data in cloud environments.
- **Harness green software principles and invest in cloud native technologies.** This can include reengineering legacy applications or developing and deploying new more sustainable applications. Organisations should also include energy efficiency as a performance metric for application development.

Following this path, techUK believes we can accelerate an industry-wide transition from simply reporting emissions to actively working to reduce them at every level. By maximising the potential of cloud computing to improve business efficiency and productivity while also driving down emissions, we are working towards a better future for people, society, the economy and the planet.

Introduction

At a time when our commitment to mitigate the impact of climate change has never been more urgent, a sustainable approach to technology should be at the heart of any digital transformation strategy. Cloud has immense potential to help businesses engage with this challenge and significant progress has been made across the industry to drive down carbon emissions and build more energy efficient infrastructure.

Cloud has become a key driver of the UK's digital economy, giving businesses of all sizes and sectors access to computing resources that are flexible and scalable on-demand. Applications, platforms, data storage and infrastructure can all be delivered as a service, allowing for more flexible and efficient use of resources and potentially a reduction in energy use, water consumption and carbon footprint relative to legacy infrastructure.

This makes cloud an appealing option for many organisations, with a recent Gartner CEO survey reporting that 70% of business leaders focusing on sustainability initiatives will look to public cloud to achieve these outcomes by 2026.[1] The good news is that many cloud providers recognise this demand and are investing in renewable energy, hardware recycling and more efficient energy and water use in data centres.

However, while cloud offers many advantages for sustainability, achieving the best possible environmental outcomes requires both providers and users of cloud services to take shared responsibility for sustainability and regularly review best practice at every level.

For cloud providers, this means continued investment in energy and resource efficiency and giving customers access to more granular and specific data about the environmental impact of their cloud consumption, including access to Scope 3 data wherever possible.

For business users, this means fostering a "GreenOps" culture of sustainability by adapting FinOps practices to track and report carbon metrics, revising data strategies to minimise the storage of unused data in the cloud, and harnessing green software principles to develop and deploy more energy-efficient applications.

As an industry, we should take a holistic view of cloud sustainability, considering what we can do as individuals, as organisations, and as a society to consume cloud as efficiently as possible. This approach will be essential as demand for cloud services grows further, through more widespread digital transformation and the adoption of emerging technologies like artificial intelligence (AI).

Ultimately, as consumer demand and increasing pressure from governments and investors drives businesses across the economy to look for more climate-friendly technologies, cloud computing can play a key role in delivering a more sustainable future.

This *techUK Cloud Insights* paper highlights why organisations looking to make a positive contribution to sustainability should consider the advantages of cloud computing, and why this can only be achieved through a shared responsibility model, where cloud providers and their customers work in partnership to transition from emissions reporting to emissions reduction.

Chapter 1 explores the benefits of cloud computing for improving the sustainability of our underlying digital infrastructure and sets out some core best practice principles for how cloud providers could further empower their customers to operate more sustainably. Chapter 2 establishes the need for cloud customers to take an active role in building a sustainable future and proposes best practice principles for maximising the environmental benefits of cloud services.

Throughout the document we have included “member spotlight” sections, written by techUK members, highlighting their work on cloud sustainability and their commitment to reducing the environmental impact of the tech sector and the wider economy.

This paper establishes six core principles of a sustainable approach to cloud computing and makes best practice recommendations for both cloud service providers and their customers that highlight how techUK and its members are working towards a more sustainable future. By following this path, techUK believes we can achieve better outcomes for the planet, empower businesses to be more efficient, innovative and productive, accelerate digital transformation across the economy, and grow the market for digital services.

Chapter 1: The role of cloud in a greener future for the tech sector

As governments, investors and customers increasingly prioritise sustainability, businesses are under growing pressure to operate in a way that minimises their environmental impact. Set against a backdrop of net zero targets, supply chain pressures, and instability in the cost of electricity, cloud computing has an important role to play in helping companies be more energy and resource efficient and meet the climate challenge.

As highlighted in techUK's Cloud 2020 and Beyond[2], cloud computing has some inherent advantages for sustainability, including more efficient use of hardware through virtualisation and multi-tenancy, the flexibility to dynamically match provisioning of services to business needs, and the ability of customers to benefit from ongoing investments made by cloud providers without the need for their own capital investment. By moving to cloud, businesses can often cut their energy consumption and carbon footprint relative to legacy infrastructure.

According to a report by Accenture, cloud utilisation can reduce carbon emissions by 35-45% compared to legacy IT.[3] This is supported by recent research into the energy efficiency of European data centres that suggests the higher utilisation rates and more frequently updated technology of cloud infrastructure could reduce energy usage of running business applications by nearly 80% when compared with on-premises enterprise data centres.[4]

Data from Google[5] on electricity savings resulting from a move to cloud paints a similar picture,[6] and Kainos has helped both a global NGO and a UK Government department reduce carbon emissions through cloud migration, resulting in significant reductions in operational carbon emissions.[7]

However, there is still progress to be made across the industry, and techUK believes that meeting our environmental obligations to wider society, and to the planet, requires a shared responsibility model where cloud providers and their customers work in partnership to adopt best practice at every level.

This chapter sets outs several core principles that can maximise the sustainable benefits of cloud computing, and help cloud providers further support customers, including greater transparency and the inclusion of Scope 3 emissions wherever possible, developing tools to provide customers with more granular and specific data, and continued investment in more sustainable infrastructure.

Underpinning these best practice principles is a clear role for cloud providers to educate and clearly communicate to customers the environmental implications of poorly optimised cloud spending. This will make it easier for organisations to consume cloud responsibly, give UK Government and businesses across the economy confidence that cloud providers have taken every possible step to build a more sustainable cloud future, and help to accelerate adoption of cloud and grow the market in the long-term.

This paper is focused primarily on the carbon footprint and energy use of computing and data storage, as these are of most pressing concern for customers of cloud providers, but it should be noted that other issues, including resource circularity, water consumption, and biodiversity and habitat loss, are also important aspects of building a sustainable future.

Core Principle: Present comprehensive and transparent sustainability data to customers

techUK members are working to improve transparency across the industry by giving cloud customers access to more comprehensive metrics and more granular sustainability data. The more customers understand about the sustainability of the cloud, the easier it will be for them to optimise their own workloads to operate sustainability *in* the cloud.

Evaluating the environmental impact of cloud spending (which can include IaaS, PaaS and SaaS) can be a complex task, especially if the data is spread across multiple providers or service locations. In some cases data can be inconsistent across providers, lack clarity or be based on differing methodologies, or be presented in a general format that is not sufficient to support customer best practice (e.g. the GreenOps approach outlined in Chapter 2).

Cloud providers have taken steps to address these challenges in recent years and many companies across the tech sector are developing tools to support cloud carbon accounting.

For example, Google Cloud launched its Carbon Footprint tool for customers in 2021, providing a range of energy usage data and carbon insights via a dashboard, and other major cloud providers have similar offerings.[8] Equally, third-party services such as Kainos's Cloud Carbon Reduction Calculator can help businesses identify the sustainability benefits that a cloud migration could unlock.[9]

Tools like these are important steps on our path to a more sustainable cloud future and can educate customers on the potential sustainability benefits of cloud. It is hugely encouraging to see so many techUK members developing services to help customers understand the climate impact of their cloud spending.

To build on this progress, cloud providers should make best efforts to align their disclosures of information relating to carbon, energy costs and water usage to improve industry-wide transparency. More robust frameworks for calculating and presenting data to customers would facilitate better decision-making and more rapid optimisation of cloud spending.

Access to more granular and specific data regarding individual workloads and more comprehensive and timely metrics relating to specific data centres or service regions would further improve a customer's ability to consume cloud responsibly. By following this path, we can accelerate the transition from emissions reporting to emissions reduction across the industry.

Core Principle: Inclusion of Scope 3 emissions in sustainability data

For a cloud customer to build an impactful climate strategy, all carbon emissions should be considered and accounted for. techUK believes that cloud providers should be proactive in finding ways to be as transparent as possible with their customers, including the methodologies used, and take steps to include Scope 3 emissions in all sustainability data.

It is worth noting that the International Sustainability Standards Board (ISSB) issued inaugural standards for sustainability-related disclosures in June 2023[10], including Scope 3, followed by a UK Government consultation on the possibility of endorsing the ISSB framework in the UK[11], reflecting growing international attention on Scope 3 emissions.

What is carbon Scope 3?

First appearing in the Greenhouse Gas Protocol of 2001, the scoping system forms the basis for Greenhouse Gas (GHG) reporting in the UK and is the most widely used set of standards for carbon accounting globally.[12] Scoping is a way of categorising the different kinds of emissions a company creates in its own operations and in its wider 'value chain' (its suppliers and customers).

Scope 1 - Emissions from sources that an organisation owns or controls directly – for example from burning fuel in their fleet of vehicles (if they're not electrically-powered).

Scope 2 – Emissions that a company causes indirectly and come from where the energy it purchases and uses is produced. For example, the emissions caused when generating the electricity that we use in their buildings would fall into this category.

Scope 3 - Emissions that are not produced by the company itself and are not the result of activities from assets owned or controlled by them, but by those that it's indirectly responsible for up and down its value chain. An example of this is when they buy, use and dispose of products from suppliers.

Due to the indirect nature of scope 3 emissions, businesses will sometimes fail to claim responsibility for the emissions produced or find these difficult to calculate. However, it is critical to record the climate impact caused by scope 3 emissions. Scope 3 is often the largest source of emissions as it can include everything from transporting goods to the footprint of data centres that power the cloud. For tech-first businesses, they may find most of their carbon emissions fall into scope 3.

Core Principle: Ongoing investment in sustainable infrastructure

As cloud and edge computing infrastructure scales over time, with an increasing number of businesses across the economy undergoing digital transformation and embracing emerging and enabling technologies built on that underlying infrastructure, data centre operators and cloud providers will have an ongoing responsibility to make sustainability investments. From how energy is generated to how cloud infrastructure is cooled, maintained and replaced over its lifecycle, it is essential the tech sector continues to mitigate its own carbon footprint while working with customers to help them adopt sustainable business practices.

The good news is the cloud industry has been focused on energy and hardware efficiency for many years and is still innovating in this area. For example, OVHcloud, in addition to its water-cooling technology, has recently developed a hybrid immersion cooling system that eliminates the need for pumps or fans in data centre cooling. Their direct-to-chip cooling system and passive immersion cooling system, using water and a non-volatile hydrocarbon fluid, reduces power consumption by at least 20% compared to air-cooled systems and 7% compared to water-cooled servers. This has the potential to significantly reduce OVHcloud's global data centre power consumption.[13]

Cloud providers are also broadening the range of compute options they offer to allow customers to increase the efficiency of their deployments. For example AWS has created the Graviton line of processors, the latest generation of which can use 60% less energy to complete a given task than the processor used in their comparable instances.[14]

Moreover, tech firms such as NetApp are working with data centre operators to deploy analytics to help them make better decisions regarding data storage and management, resulting in improved efficiency and sustainability.[15]

It is also important to recognise that cloud is an integral part of an interconnected technology supply chain that is pushing forward cutting-edge innovation that, in turn, is accelerating use of supporting cloud infrastructure. For example, cloud plays a role in the transfer, analysis and storage of data for some high performance computing (HPC). More recently, the explosion in the use of Generative AI is placing fresh demand on associated HPC and cloud infrastructure. Therefore, as this new and exciting market grows, it is critical to support increased investment in the most sustainable infrastructure that supports the effective delivery of cloud services.

Fortunately, many cloud providers and data centres operators are already at the forefront of innovation in heat reuse, water recycling, renewable energy, and efficient hardware lifecycles. These practices that are integral to data centre sustainability have ensured notable improvements, with average Power Usage Effectiveness (PUE) reducing from an average of 2.5 (1995) to 1.55 (2021).[16]

It is also important to consider the role of telecoms networks in measuring the total carbon footprint of a distributed computing ecosystem (including cloud and edge), although the complexity of global data flows presents a significant challenge in assessing this component of an organisation's carbon footprint and goes beyond the scope of this report.

Core principles for cloud service providers

- **Comprehensive and transparent sustainability data available to customers.** This should include granular data regarding individual workloads and comprehensive and timely metrics relating to specific data centres or service regions.
- **Inclusion of Scope 3 emissions in all sustainability data** to give confidence to customers and make it easier for them to make informed decisions and implement impactful climate strategies.
- **Continued investment in sustainable infrastructure** including through renewables, energy and water efficient facilities and hardware, and efforts to reduce carbon associated with hardware lifecycles.

Member Spotlight
Arm

Arm's Sustainability Strategy includes a long-term ambition to contribute to decarbonising compute, and we are working towards this goal by first seeking to reduce our own carbon emissions. We have committed to cut our absolute emissions across all scopes by 50% (from a 2019 baseline) by 2030, following a 1.5° Celsius pathway. Our data centre usage contributes to this commitment.

Microprocessor design is a highly computationally expensive process, and like most silicon designers Arm maintained a global footprint of dedicated datacentres to support that activity. As the number and complexity of Arm's designs grew each year, the company's need for compute increased continually.

To address this in a sustainable fashion, Arm partnered with AWS to shift their growth into the cloud. However, rather than using the cloud as a "virtual datacentre," Arm chose to architect a cloud-native environment to undertake the High Performance Computation needed to validate their designs.

By using services such as AWS Batch, Arm was able to ensure that the number of systems in use for their computation was always matched to the workload, growing with peaks in demand but also shrinking when compute was no longer needed. As well as reducing the cost to run the platform, this approach ensures that resource is only using energy when productive.

Arm chose to use Spot instances as their primary way of consuming compute. These are servers that would otherwise be sitting idle in the cloud provider, and are thus made available at a substantial discount. Moreover, by reducing the number of systems idling in the cloud provider, using Spot instances drives up the overall energy efficiency of the provider's datacentre and reduces the requirement for further physical hardware to be provisioned.

Finally, Arm has been working to migrate their workloads onto AWS Graviton processors. These deliver energy savings in two dimensions; first, the power consumption of the silicon is lower than comparable platforms, meaning that the instantaneous draw on the grid is reduced. Secondly, instances based on these processors are able to complete tasks more quickly, further reducing the total energy consumption.

Member Spotlight
Digital Realty

Powering progress: sustainable data centre design

As the world becomes more digitally connected, data centres have cemented their position as the central nervous system of the economy. However, as the digital economy continues to grow and thrive, and society's reliance on digital services and devices deepens, the data centre industry must do its part in futureproofing our carbon footprint. As a result, sustainability sits at the heart of modern data centre design.

It is essential to consider sustainability in the design phase of a data centre to ensure that the facility is efficient and optimized for energy consumption when operational. Some of the key factors to consider when designing sustainable data centres include: energy efficiency, renewable energy, green building design, waste reduction, and water conservation.. All these factors align with the objectives of the Climate Neutral Data Centre Pact, a self-regulatory framework developed in collaboration with the European Commission, designed to make the industry more sustainable.

Here's what we're doing at Digital Realty:

- **Energy efficiency:** we optimise our data centres for energy efficiency by using technologies such thermal monitoring software, efficient cooling systems, airflow management, CFD modelling, economisation and free-air cooling, and energy management tools to reduce energy consumption.
- **Renewable energy:** we match the energy used to power our U.S. colocation facilities and entire European portfolio with 100% renewable energy. We also have more than 1 GW of wind and solar projects under contract globally, bolstering our renewable energy portfolio.
- **Waste reduction:** we adopt circular economy principles and practices to help reduce waste. For example, we separate recyclable materials on new developments to maximise diversion from landfills. Where feasible, we re-use materials on-site during construction, such as re-purposing demolished concrete for use as a sub-base material.

- **Water conservation and efficiency:** we've effectively designed out the continuous consumption of water in our new data centre designs. Instead, we use systems that take advantage of free cooling for thousands of hours each year. Where we do use water, we ensure it's used efficiently and reused wherever feasible. For example, we've invested in innovative technological solutions, like our River Cooling solution in Marseille and dock water cooling solution in London, both of which use the surrounding water to cool our facilities and then immediately return it back to where it came from, helping to minimise energy usage.
- **Energy re-use:** in several countries around the world, we're involved in district heating network programs. These involve recycling the waste heat from our data centres and using it to heat surrounding homes and businesses for free.

As one of the largest data centre operators globally, we have a duty to do right by our customers, the communities in which we operate, and the environment more broadly. We're proud of the work we're doing, but know we need to go further and push the boundaries of what's possible. As the industry continues to innovate and develop more sophisticated designs, it'll play a pivotal role in building a more sustainable and resilient future.

By Lex Coors, Chief Data Centre Technology and Engineering Officer

Member Spotlight
OVHcloud

Sustainable by Design

Sustainability goes through OVHcloud's business like letters through a stick of rock– and it always has. Since our founding in 1999, sustainability has been designed to run through every single area of our operations, from how our servers are built to how our facilities developed, how our staff and suppliers conduct themselves and how we measure and evaluate our success. In particular, we have focused on a select number of developments and behaviours that we believe are crucial to us being part of the solution to the climate crisis.

OVHcloud is not just a technology company, but also an industrial company; we assemble all our servers in our factories around the world. This allows us more flexibility than other organisations – for example, we developed our own water-cooling technology in 2003 that cools the server CPUs and GPUs. This is used in our datacentres around the world, and captures approximately 70% of the heat from servers, transferring it to a closed-loop system that circulates the liquid outside for cooling. This gives us approximately 50% energy savings compared to mechanical air cooling, reducing our global power and carbon footprint considerably.

Innovation at the heart of our energy efficiency performances

Even with our good performance in energy efficiency, we keep on innovating: in 2022, we developed our new hybrid immersion cooling system, which combines direct-to-chip cooling and submerging servers using two fluids. This not only reduces power consumption by 20% compared to air cooling, but also removes the risk of dust contamination entirely.

Beyond energy performances: our commitment to frugal water uses and circular economy

Reducing energy use is a priority for cloud providers but OVHcloud is also focused on reducing its environmental impact in other ways.

Notably, OVHcloud is careful about its water usage at it became a major concern at local level. Our water-cooling technology enables highly efficient water usage effectiveness: the equivalent of a glass of water to cool down a server during 10 hours of use. While the cloud industry average WUE reaches 1.8l/kWh, OVHcloud stands out thanks to its closed-circuit system that limits fluid waste, but also thanks to the use of dry coolers, and the absence of air conditioning in its server rooms.

Our industrial model allows us to act on the main challenge for cloud providers' carbon footprint: increasing hardware lifetime and reducing component waste. OVHcloud dismantles all servers at end-of-life and examines whether components could be re-used or re-cycled. As a result, 25% of all components in servers are reconditioned, extending their service life and avoiding carbon emissions associated with acquiring or building new machines.

The same philosophy is followed in sourcing our data centres: 24 of our 38 DCs were renovated from older buildings, rather than built from scratch, avoiding carbon emissions associated with the typical construction process.

Transparency for our users at the heart of our values

As an organization, we are committed to openness and transparency about our power consumption and water usage; our average PuE is 1.28, WuE is 0.26 l/kWh and CuE is 0.2 tCO2e / MWh, and 77% of the energy we use is renewable. Our PuE and WuE measurements are transparent, in line with global ISO standards to Scope 3 measurement, and unlike other companies, our carbon footprint measurement includes all aspects of our operations and manufacturing, not just the electricity used by the DC.

All these figures are available online and are updated annually.

To complement our commitment to transparency OVHcloud will implement, by end of 2023, a carbon calculator directly from its platform to give our customers an understanding of their actual cloud carbon IT footprint.

Reaching sustainability as a collective endeavor

Finally, OVHcloud holds itself and all employees to a high standard of conduct, and also operates a code of conduct agreement with our suppliers. All OVHcloud suppliers in turn agree to a code of conduct which specifies (amongst other things) the need for recycling, re-using, elimination of waste, avoidance of using harmful materials and chemicals, and reducing emissions wherever possible.

We are constantly examining our business for opportunities to play our part in combating the climate crisis, and at the heart of that are our leadership team and people, every one of whom is responsible for helping us to drive lasting change.

Member Spotlight
BT

BT has committed to be net zero for its own operations by 2031 and for its supply chain and customers by 2041. We've also committed to helping our customers save on 60 million tonnes of CO2 by 2030 through digital products and to be a circular business by 2030. Reducing emissions across our operations is focused on three key areas covering our fleet, buildings and networks.

We're currently working on switching our Openreach fleet vehicles to low carbon alternatives and already have 1500 EVs on the road today. We're also deploying new technologies into our buildings to drive energy efficiency and decarbonise. And across our networks we announced our deployment of Ericsson's latest ultra-lightweight Massive MIMO radio technology, which will also deliver a reduction in energy consumption of up to 40% less than the previous generation of radio equipment.

To help our customers on their own sustainability journey we've recently launched the Carbon Network Dashboard to help them measure and optimise the carbon impact of running applications and cloud workloads across their network. Customers will have global infrastructure providing connectivity into cloud provider environments but today many of the carbon dashboards offered by cloud providers exclude the lifecycle carbon emissions impact of the core devices making up the network.

The Carbon Network Dashboard provides them with this data to help organisations map the impact from network to cloud. Additionally, these tools enable the BT network design and service teams to help managed customers to configure and optimise their networks for low carbon impact as they virtualise their environments and migrate workloads and applications to the Cloud.

Member Spotlight
VMware

VMware is a leading provider of multi-cloud services for all apps, enabling digital innovation with enterprise control. Headquartered in Palo Alto, California, VMware is certified carbon neutral and committed to building a better future through the company's 2030 Agenda, a strategy to decarbonise digital infrastructures, increase equitable access to opportunities through distributed workforce technology, and earn trust with enhanced security and transparency.

As a provider of critical digital infrastructure to companies around the world, sustainability is core to VMware's business. VMware's sustainability strategy is grounded in three approaches:

- **Visibility** – We can't measure what we can't see
- **Efficiency** – Optimise resource utilisation
- **Renewables** – Substitute dirty energy for clean power

When executed together, VMware empowers stakeholders to achieve their environmental goals as VMware operationalises its own.

Since the company's founding, VMware's intrinsically sustainable virtualisation technologies have helped customers reduce power consumption, resulting in avoided emissions even as IT workloads have grown. Today, VMware continues to innovate by providing deeper insights into the carbon emissions of customers' data centre infrastructure to help them improve their energy and carbon efficiency. VMware further promotes sustainability by engaging the entire IT value chain to adopt renewable energy-powered data centres. Here a few examples of VMware's cloud sustainability progress from the past year:

- VMware launched the Green Score feature in VMware Aria Operations providing recommendations for customers to further optimise energy and carbon in their cloud environments, considering various factors such as workload efficiency, resource utilisation, virtualisation rate, power source and hardware efficiency.
- With application development and AI becoming critical capabilities in every organization, VMware committed to evolve best practices that help developers and operators run more efficient, sustainable applications and clouds as a member of the Green Software Foundation and the European Green Digital Coalition.

- VMware expanded its **Zero Carbon Committed** initiative by adding 24 more VMware Cloud Services Provider partners committed to 100% renewable energy powered data centres or carbon neutrality by 2030, reaching a total of more than 50 partners.
- VMware enabled an international telecom company to build a private cloud that transformed their IT services delivery and optimised IT resources, leading to **reduced energy use and carbon emissions** while running the same number of applications on ten times fewer servers.
- VMware took a leading role in developing **Information and Communications Technology sustainability innovations**, both internally and through projects with partners by implementing new strategies to help service providers and their customers across four pillars: improving energy and resource efficiency; using renewable energy sources; reducing greenhouse gas emissions; and overcoming institutional barriers.

Together with stakeholders, VMware will continue to make progress as we build a more sustainable, equitable and secure future.

Member Spotlight
Pulsant

Pulsant is a digital edge infrastructure company that provides colocation, cloud and connectivity services to UK businesses. Regional enterprises and service providers use Pulsant's edge infrastructure platform to build, connect and deploy the applications they need to innovate and grow.

The company has recently launched Pulsant Cloud at locations across the UK. The new platform combines virtual private cloud and hybrid-cloud with powerful automation workflows, high-performance storage, in-depth reporting and cost analysis, and advanced security in an evolving suite of services.

Pulsant Cloud is delivered nationally across Pulsant's edge infrastructure platform. For clients this means they can develop edge applications within a hybrid cloud environment and deploy them rapidly across the UK, using a dedicated, resilient, high-speed 100Gbps network fabric to ensure low latency services.

The organisation has Science Based Targets for carbon reduction and pledged to reach Net Zero by 2050 across all scopes. Given 100% renewable energy has been well established, data centre efficiency is front of mind, with targets taking the estate to a PUE of 1.3 by 2030. Pulsant is working towards ISO50001 certification of energy management systems across all data centres.

It is key that cloud clients remain connected to the environmental impacts of their cloud services. However, arriving at a simple and meaningful set of figures to support this can be complex.

There is variation between major cloud carbon accounting methods that potentially result in very different outcomes. These include (1) in whether the design- or the actual- hardware utilisation rates are used, (2) translating power consumption into carbon emissions – whether in recognition of renewables, or in the regional or even hourly variation of the local grid average - and (3) data quality in calculating embodied and end-of-life carbon in the technologies and supporting infrastructure.

In arriving at a method for a cloud footprint calculation, we must be cognisant of the intended use and clear on its limitations. We support our client's dependency on providers for sufficient quality of information to allow them to make informed choices, between alternative deployments, and in understanding the most impactful ways to optimise their consumption.

Helen Munro, Head of Environment & Sustainability

Chapter 2: Sustainable best practice for customers of cloud providers

The previous chapter demonstrated why cloud computing can be an attractive option for businesses looking to improve the sustainability of their IT estate, and set out some core principles for how service providers can help customers further reduce their environmental impact by leveraging the benefits of cloud.

Harnessing the full potential of cloud to achieve more sustainable computing requires a proactive and transparent approach from both cloud providers and users of cloud services – a shared responsibility model that applies sustainable best practice at every level.

While cloud providers have made huge investments in sustainable infrastructure, moving to cloud will not automatically guarantee the maximum possible reduction in an organisation's carbon footprint and computing as-a-service does not necessarily equate to sustainability as-a-service. In other words, a "lift and shift" migration followed by a "file and forget" approach to data management can seriously undermine the sustainability benefits of cloud computing. To achieve the best outcomes for the planet, user behaviour is key.

This chapter outlines best practice for customers of cloud providers to help them operate more sustainably in the cloud. techUK believes the core principles outlined below will support an industry-wide transition from emissions reporting to emissions reduction.

Core Principle: Developing a culture of sustainability through GreenOps

What is GreenOps?

GreenOps is defined by IDC as "an operating model that integrates the technologies, techniques, and business practices designed to maximise efficiency in the cloud while reducing environmental impact." The term is closely related to FinOps, a financial management discipline and cultural practice combining the efforts of teams from across the business to measure and track spending, optimise cloud usage, and make better data-driven decisions. GreenOps adapts that focus on transparency, accountability, and workload efficiency, to drive better environmental outcomes.[17]

The shift from a CapEx to an OpEx environment gives customers a high degree of flexibility and allows for more dynamic and elastic provisioning of IT resources. This is one of the core benefits of cloud computing and it has huge potential for more efficient and agile practices that minimise the energy consumption of digital technologies. However, harnessing the full potential of this operating model to build a more sustainable future means embracing a GreenOps culture.

Like FinOps, GreenOps should not be seen as a cost centre but as a way to streamline business operations and embed best practice within the culture of an organisation. By making sustainability a core performance metric, business leaders can empower teams to identify waste, lower carbon emissions and energy consumption, and mitigate the environmental cost of cloud services further than a simple rehosting migration could achieve alone.

To maximise the impact of these tools and practices, organisations operating in the cloud should develop a robust GreenOps strategy that includes a framework for transparency and reporting, engages with customers and suppliers, and builds sustainability considerations into training and institutional culture. Organisations can go a step further by including C02 footprint in the business case for new IT projects and integrating internal carbon pricing into business operations.

Developing a GreenOps culture is equally important for public sector customers, where the shift from CapEx to OpEx can be even more challenging. techUK would like to see UK Government develop cloud sustainability guidance for public sector bodies that embraces GreenOps and tackles the dark data challenge. This guidance should be embedded in the Government Cloud Principles set out in the Cloud First policy and One Government Cloud Strategy.

Core Principle: Revising data strategies to tackle the dark data challenge

What is "dark data"?

Gartner defines dark data as the information assets organisations collect, process and store during regular business activities, but generally fail to use for other purposes (for example, analytics, business relationships and direct monetising). Similar to dark matter in physics, dark data often comprises most organisations' universe of information assets.[18]

A key pillar of a sustainable approach to cloud computing is revising data management policies to minimise the storage of unused or infrequently used data in the cloud. According to NetApp's Data Waste Index, a survey of UK tech leaders, forty-one percent of data is "unused or unwanted,"[19] and the estimated economic cost to businesses of this unused data is £3.7 billion a year.[20] Veritas estimates that "Dark Data", that is data which is not currently being used, accounted for 52% of worldwide stored data in 2020 and generated 6.4 million tonnes of CO2.[21]
This research clearly demonstrates that a new approach to data management is needed.

Of course, data is the lifeblood of a modern business, and effective and innovative use of data can vastly improve efficiency, productivity, cost savings, and sustainable practices. However, environmentally responsible use of cloud computing must be underpinned by backup and data retention policies that minimise the carbon impact of unused data.

techUK recommends that business users of cloud services should establish data retention policies that ensure infrequently used data is moved to more energy efficient storage tiers or deleted if not needed for legal or compliance purposes, disaster recovery, or other clearly defined use-cases.

Core Principle: Harness green software principles and invest in cloud native technologies

What is Green Software?

Green software, which can also be known as sustainable software, is defined as "software that is designed, developed and implemented to limit energy consumption and have minimal environmental impact." [22]

Using cloud sustainably can also involve actively reducing emissions through application design and deployment choices that make software part of the solution.

techUK recommends that all users of cloud services should consider the benefits of adopting green software principles and how this approach can help organisations further mitigate their impact on the environment. Consideration should also be given to the upstream and downstream carbon footprint of software at all stages of its lifecycle - in development, deployment and maintenance, and the impact on end-user devices.

Examples of best practice in this area can be found from the Green Software Foundation,[23] established in 2021 to develop common standards for green software and help organisations exchange best practice. The foundation is working to put sustainability at the core of software development and support technologists in thinking about how an application uses energy alongside other key metrics such as performance, cost, security or accessibility.

What is Cloud Native?

The Cloud Native Computing Foundation offers the following definition:

"Cloud native technologies empower organisations to build and run scalable applications in modern, dynamic environments such as public, private, and hybrid clouds. Containers, service meshes, microservices, immutable infrastructure, and declarative APIs exemplify this approach. These techniques enable loosely coupled systems that are resilient, manageable, and observable."

A cloud native approach produces software that is designed to fully exploit the flexibility and agility of the cloud.[24]

Cloud native technologies can also help users operate more efficiently and sustainably in the cloud. This is particularly important for organisations that are looking to replace existing on-premises IT systems with cloud services and are considering simply rehosting legacy applications in the cloud.

Cloud native can facilitate more efficient and dynamic use of resources, allowing users to scale up or down their compute and data storage needs as required, further reducing the environmental impact of idle, or "always on", on-premises hardware. The advantages of a cloud native approach can include greater flexibility and scalability, reduced costs, improved resilience, and more efficient systems. The CNCF Environmental Sustainability Working Group[25] is a good example of cross-industry collaboration driving progress in this area.

Core principles for cloud customers

By taking responsibility for optimising their cloud spending and actively reducing emissions through the best practice outlined in this chapter, customers of cloud providers will achieve a greater benefit to the environment than those that simply outsource this responsibility to their cloud provider. techUK recommends that all users of cloud services should:

- **Develop a culture of sustainability by embracing GreenOps practices**, building on FinOps principles to put resource efficiency at the core of business operations.
- **Tackle the dark data challenge** by revising and monitoring data management policies to minimise the storage of unused data in cloud environments.
- **Harness green software principles and invest in cloud native technologies** to reengineer legacy applications or develop and deploy new more sustainable applications. Include energy efficiency as a performance metric for application development.

Member Spotlight
Red Hat

Open Source is at the heart of Red Hat, and Open Source is core to our approach to Sustainability. Red Hat[26] is investing in open source software, standardisation projects, and communities, such as the **CNCF Environmental Sustainability Working Group**, to harness the power of open source to help customers, partners, suppliers, and other stakeholders to meet their climate goals and improve emissions.

For IT organisations to quantify and make meaningful changes to their energy consumption and carbon emissions, one of the key things they have to be able to do is measure the energy consumption of the applications they operate.

Project Kepler[27] (Kubernetes-based Efficient Power Level Exporter) is a CNCF Sandbox. The project was founded by Red Hat's emerging technologies group with early contributions from IBM Research and Intel. It is a community-driven, open-source project that captures power-use metrics across a wide range of platforms, focusing on reporting, reduction and regression so IT organisations can better understand their energy consumption.

Kepler utilises proven cloud-native methodologies and technologies–such as extended Berkeley Packet Filter (eBPF), CPU performance counters and machine learning models–to estimate power consumption by workloads and export them as metrics. These metrics are then used for scheduling, scaling, reporting and visualisation, which arms system administrators with information on the carbon footprint of their cloud native workload.

Kepler can enable a host of new innovations in the open-source community that allow service providers to better observe, analyse, optimise and document power consumption of cloud native applications, for example - power consumption reporting, combining energy consumption and carbon intensity for GHG reporting, platform and application optimisation based on energy consumption.

Red Hat plans to make Kepler available on Red Hat OpenShift in the coming months. As the name suggests, Kepler was originally developed for Kubernetes but work is now taking place in the upstream project to enable it for Red Hat Enterprise Linux (RHEL).

Get involved with the Kepler project via GitHub[28] and learn more on Red Hat's Emerging Technologies blog.[29]

Member Spotlight
The Oakland Group

The Oakland Group is a B-Corp Certified data consultancy providing Strategy, Governance, Platform Engineering, Analytics, and AI to business leaders from VC-backed start-ups to some of the UK's most influential organisations. Oakland helps organisations bridge the gap between where they are today and the technology of tomorrow, giving them the freedom to use their data more effectively and sustainably.

Platform

The largest and most instantaneous gains you will make in sustainability from a cloud perspective are the decisions you make when designing your software or data platforms. You will need to consider the orchestration of your platform from three perspectives:

- **Storage:** "Hotter" data storage uses more energy, so you should consider cooler and archival storage as part of your architectures. Think about frequency of access and provide storage for different levels of frequency. Don't need it on a regular basis? Put it in cool or archival storage – simple!

- **Orchestration:** When you run your critical heavy compute processes – if you change the time that they run to a time when the grid is less carbon intense, you can reduce the carbon intensity of the energy you use. It doesn't conserve energy, but it does reduce carbon emission!

- **Utilisation:** ensuring that on/off resources (like Virtual Machines) are automatically switched off when not in use. 90% of energy consumption in data centres is spent on idling machines! On the other hand, rightsizing resources and using only what you need is another key step to managing the energy intensity of your cloud estate.

Analytics and AI

Analytics and AI are steaming forward with the democratisation of analytical and AI models; we need to consider a number of things when introducing these concepts into our organisations;

- **Self-Serve vs. Centralised:** Developing an analytics operating model that enables flexibility without rework is critical. Storing your one-off Power BI dashboards on your device is much more carbon-efficient than

publishing them into the Power BI service. However, when the same report is created by 10x users and stored locally, then the inverse is true. Having an operating model that enables common insights to be easily accessed from a central location but also flexibility to enable tactical access to centrally stored data is critical.

- **Efficient Model Design:** AI processes use tremendous energy with their underlying Machine-learning algorithms. New modelling techniques are always emerging – so ensure that your developers take advantage of new and more efficient models.

Strategy

60% of businesses now have sustainability as one of the key elements of their strategy. It's a value-adding piece to businesses - adding 5-10% on stock valuation.

Most will be looking to reduce their carbon emissions in some way. From a data perspective, we can start looking at carbon efficiency as an opportunity rather than a regulation we need to comply with. There are two opportunities that data can present to you:

1. **The opportunity to use data to drive down organisational carbon emissions through reporting**
2. **The chance to drive down the carbon emissions of your data estate**

Aligning your Data Strategy with the wider goals of the business not only assists with buy-in but also gives data a more significant voice in the boardroom.

Governance

A core process within governance is setting data retention periods. Ensuring that "old" data is archived into less compute-intensive resources is the activity that will underpin the carbon-efficient layered storage architecture that your platform team will be so hard-pressed to deliver!

Another area where governance can support sustainable initiatives is by including duplicated data as a core KPI for data quality monitoring. Like with retention periods, this pertains directly to the deletion of unnecessary data. By removing duplicate data (one of the targets of your data quality strategy) you're taking steps to lower your emissions.

At the end of the day, you can have the most carbon-efficient platform in the world from a design and operational perspective. However, if it's filled with old and unnecessary data, then your emissions will still be much higher than necessary.

Implementing these recommendations can establish a robust foundation for adopting a GreenOps approach to data, which can be supported by each of your core business lines and contribute to the success of your organisation's sustainability initiatives.

Member Spotlight
CGI

Guy Wolfenden. Vice President Digital Transformation
William Soper. Senior Sustainability Consultant

Leading Sustainability Through Cloud Technology

An astonishing 90% of the world's data has emerged in just the past two years, with 68% having only been accessed once. As data continues its rapid expansion and corresponding infrastructure grows to accommodate it, responsible cloud management and a pivotal data ecosystem becomes paramount to achieving climate and sustainable development objectives.

Our GreenOps and overall transformation approach is centred around making carbon-conscious technology decisions. We follow a client attested and comprehensive four-step process guided by our Climate Change and Sustainability Advisory encompassing green IT, the infusion of business ethics into IT practices, environmentally mindful AI and green software deployment.

Late investment in this domain has the potential to more than double the expenses associated with achieving net zero decarbonisation goals, particularly as we approach 2030. This underscores the compelling need for immediate action to save costs through a just and balanced transition.

The work we are doing to apply GreenOps practices in everything we do includes:

Developing a culture of sustainability

We train our consultants and engineers in green software skills including the Green Software Practitioner course, equipping them to assess the resources they consume using tools such as Azure's Well Architected Framework. We baseline initiatives through our Strategic Benefits Management framework. This ensures a sustainable return on IT operations investment and applies expertise from organisations including the Institute of Environmental Management to validate our work, with measurements meeting internationally accepted benchmarks such as the Greenhouse Gas Protocol and ISO14040.

We work with cloud providers to feedback improvements to FinOps and Emissions Impact dashboards. A recent example enabled one of our teams to optimise the system logging regime, saving the carbon equivalent of seven round trips by car from London to Rome. Our ESG Solutions Expertise (ESGSE) can rapidly deploy, configure and integrate digital reporting solutions, working with our partners in a solution agnostic approach, regardless of the platform, infrastructure or services used.

Tackling the dark data challenge

We apply data management best practices to reduce the environmental impact of data that is no longer used for its intended purpose, but still consumes resources. This includes maintaining an up-to-date data inventory, collection and disposal processes and a formal data lifecycle incorporating secure data destruction prerequisites, providing clear stakeholder visibility of associated costs and environmental impact of continuing to hold dark data.

Harnessing green software principles to develop and deploy sustainable applications

We apply eco-design principles throughout the delivery lifecycle. At the design stage, we apply practices described in Defra's Planet Centred Design Principles and our green software engineering principles (to be published in 2023), developed with leading industry and academic organisations as part our UN-backed SEEDS programme. Throughout development and support stages, we use GreenOps tooling to regularly inspect code and CI/CD pipelines to identify continual improvements for energy conservation.

Investing in cloud native technologies

We apply the government 'Technology Code of Practice' to improve system sustainability throughout the software lifecycle. Initiatives include the transformation of legacy applications through sustainable microservice architectures and application performance management to automatically manage performance and availability in line with actual usage.

Example: In a recent project we used the WeNR system footprint tool to measure the environmental impact of a public sports website in France. We identified and removed unused user journeys, then optimised image formats and JavaScript libraries and rationalised error logs, resulting in a reduction of page weight by 28%, requests by 46% and load time by 46% to improve user experience and environmental footprint.

Member Spotlight
Accenture

Financial services company uses Accenture's Green Cloud Advisor (GCA) tool to unlock an 82% reduction in carbon emissions.

A financial services company wanted to reduce the quantity of greenhouse gas emissions produced by its IT estate. It needed to establish a baseline to evaluate the potential benefits of migrating servers to cloud with a view to reducing emissions by at least 25% and lowering energy costs.

Accenture used GCA to analyze data and calculate the CO2e emissions of the client's four main DCs and provide a detailed sustainability assessment:

- Produced energy consumption and power utilization data based on annual power consumption, annual facility consumption, PUE (Power Utilization Effectiveness) and the number of servers in scope.

- Showcased the sustainability impact of 385 servers that were migrated to the cloud, 628 servers that are being migrated to a next-gen DC, and 120 servers that were remaining in their legacy DC.

In days, Accenture produced a comprehensive report highlighting the sustainability impact and emissions improvement. Projections revealed a potential 82% emissions reductions via cloud migration. Accenture determined year-on-year carbon emission reduction percentage, the carbon intensity improvement potential based on the client's energy profile, and renewable energy potential across different Cloud Service Providers. The next step is to help the client embark on this migration journey.

Member Spotlight
FSP

Sustainable Cloud Transformation

The climate crisis is the biggest threat we face as a society, and there is increasing awareness that carbon offsetting is not the solution. At FSP, we believe that it is everyone's responsibility to actively reduce their carbon emissions for the benefit of all. That is why we are so passionate about helping organisations to transform not only the technology they use – adopting more modern and efficient cloud technologies – but also helping to change people's behaviours creating more efficient and sustainable ways of working.

As FSP, we take a holistic approach to helping clients manage and ultimately reduce their emissions, including:

- Incorporating emission forecasts into architectural designs to assess upfront the impact of technical changes
- Building emission dashboards and technology maps to monitor and analyse consumption and emission trends
- Integrating sustainable practices into our clients' operations to drive a continuous approach to sustainable transformation
- Embedding behavioural change into our delivery to increase adoption of new technology and more efficient ways of working

Recently we have worked with a large government department to quantify the carbon footprint of their data storage, helping them build a case for reducing ROT (redundant, obsolete and trivial) data which leverages the carbon reduction benefits alongside the cost savings, productivity improvements and strategic benefits of improved information management.

We are also working with a large professional services organisation to map their IT landscape and help them better understand both their value chain and the impact their operations have on their emissions. This insight is driving behaviours to reduce emissions and adopt more efficient, consumption-based cloud services.

Member Spotlight
TCS

Cloud is not a carbon-free ride

Through migrating to Cloud, you can immediately benefit from highly efficient data centres, but seismic gains can also be made through operational changes once you're there. Two key principles for reducing your emissions in the cloud are improving efficiency and reducing digital waste.

Improve Efficiency

Region Choices

Cloud data centres are spread across the planet and powered using different energy sources. Making informed decisions around where to deploy your workloads can significantly impact the emissions your solutions produce.

Platform Modernisation

- Consider options for containerising workloads for deploying application components with more granularity
- Evaluate moving to serverless workloads to avoid idle resources
- Build cloud-native apps allowing the platform to handle scaling, availability, and performance.

Software Development

Building "green" software involves improving efficiencies across the development process, deployment, usage, and maintenance. Organisations can incorporate reusable components to reduce the application development time. Doing a customer-journey analysis to look at various paths taken by a customer and optimizing individual paths is a good starting point for carbon-footprint reduction.

Remove waste from the system

Cost optimisation can be used as a proxy for a sustainable cloud environment. Reducing unnecessary spending lowers the number of excessive emissions from deployed workloads. For example, using spot VMs, otherwise wasted capacity—at significantly reduced prices—contributes to a more sustainable platform design.

Member Spotlight
Kainos

Reducing environmental impact through GreenOps

Sustainability is a top priority for Governments, organisations and individuals. GreenOps, a relatively new term, is a model that seeks to maximise the efficiency of technology, development, operations and business processes to reduce environmental impact.

A complementary set of practices to FinOps, GreenOps shares many of the same capabilities. A typical public cloud customer might save 40% - 60% on costs through a GreenOps model whilst reducing environmental impact.

However, empirical evidence on the effectiveness of GreenOps is limited.

Without a concerted effort by the hyperscalers to improve access to data and provide transparent sustainability information, accurate reporting remains challenging. Given this gap, open standards are emerging, such as the Software Carbon Intensity Specification from the Green Software Foundation.

Whilst reporting matures, it doesn't mean you should do nothing now. Our top 5 GreenOps initiatives that have an immediate impact are below:

1. Reduce waste and optimise your workloads to use only what is needed through **right sizing** saving up to 70%
2. **Introduce intelligent scheduling to only run workloads when they are required saving up to 64%**. For example, running development environments during working hours only reduces the required uptime by two thirds. **For energy intensive workloads such as ML model training** you can develop this further to only run workloads where the grid energy mix favours renewable sources.
3. **Implement event driven serverless architectures enabling 'scale to zero' patterns** when there is no demand saving between 15%-70%.
4. **Manage your data lifecycle to move to less energy intensive storage** and most importantly, delete data that is no longer required saving up to 100%!
5. Move your workloads to a more modern, **energy efficient service families** to **save up to 20% whilst improving performance**.

Member Spotlight
NetApp

Evolving your data strategy to practice data minimalism

The value of data is beyond dispute. The way we generate and use data isn't going to disappear from our lives, so businesses must find ways to identify potential infrastructure savings and eliminate waste.

Creating and following a data strategy which has data minimalism at its heart will allow businesses to ensure they are only storing the data they need, while also being one step closer to meeting **Environmental, Social Governance (ESG) targets**.

An astonishing 41% of data currently stored by U.K. organisations is unused or unwanted according to the Data Waste Index report released this month from NetApp. This data will never be used again, often because companies haven't worked out how to gain value from it, or simply because it's just data that serves no further purpose beyond what it was created for.

So how can businesses refine and evolve their data strategy to ensure they are practising data minimalism? Well, it starts with truly understanding the data footprint they have.

Businesses need to know how much data they have, what the data is and where it is located. Visibility across your data landscape is essential whether on premises, or in hybrid cloud and cloud environments. This requires effective data management software that works across all their data siloes to understand how much data they can reduce. From this action, businesses have the ability to remove data that is clearly unnecessary, inactive or duplicated.

Making informed decisions can only happen once leaders understand all these details. Once a business knows what their current data footprint looks like, they can then start to consider their options.

Bringing on board a trusted advisor at this stage might be useful to provide extra support here. For example, are there ways to become more efficient about where data is being stored? Can data be consolidated to fewer locations and then cached to save costs? Could an organisation move more of their data into the public cloud, and work with one of the hyperscaler providers to improve the environmental impact storing and managing their data is having?

In many cases storing data in the Cloud for production, development, archive, or backup can improve the situation, and drawing on the expertise of vendors and partners who can offer the tools, analytics and understanding will help you to make better environmental decisions. With help, organisations can reduce both their energy cost exposures and their carbon emissions.

Member Spotlight
Fujitsu

Fujitsu is committed to making 'the world more sustainable by building trust in society through innovation'. We work with customers on a global scale to analyse and improve their cost conscious, sustainable business practices. Organisations continue to ask themselves: how can we manage our compute infrastructure more efficiently and economically whilst considering performance, flexibility and reducing carbon emissions? Sustainable cloud is often seen as the answer.

The cloud offers several sustainability benefits: reducing energy consumption, lowering carbon emissions, and promoting circular economy principles. Public and Private Cloud providers have economies of scale to invest in energy-efficient infrastructure shared across customers. They are also committed to sustainability initiatives and business practices and regularly invest in renewable energy sources.

Cloud providers continuously optimise server usage, reducing power consumption as well as scrutinising server efficiency via the Energy Star SERT measure. This is complementary with Fujitsu practices, where our servers are some of the best in class for energy efficiency, delivering additional benefits such as reduced air conditioning. Consequently, clients deploying a hybrid cloud strategy are assured that on-prem servers are as economical, if not more, than services procured in the cloud.

Enabling the transition

Fujitsu has several proven techniques to help customers achieve their optimal cloud strategy, including HXD7. Its initial 'Discovery' phase evaluates problems and determines the best, agreed course of action with regards to sustainable cloud and data management practices an organisation seeks. This informs the design and build phase to drive the right principles for the architecture and hybrid/multi cloud solution, ensuring that sizing is optimised for payloads and minimising emission outputs.

We used our approaches to deliver Whitbread's transition to cloud, for multiple critical applications. We leveraged our Springboard™ for Azure framework to co-create a secure, enterprise-grade Azure foundation aligned to their business requirements. This carbon neutral project delivery assisted with the migration whilst increasing agility of data management practices, reducing data centre management costs and advancing them towards their emissions goal of net zero by 2040.

We have delivered similar benefits for other organisations, including The Environment Agency's Alert-as-a-Service Flood warning system on AWS, highlighting the cross sector and industry value of Fujitsu's work in sustainability.

Summary

Sustainability benefits of cloud/hybrid cloud will only increase with efficiency improvements & greater adoption of renewable energy sources, as well as expansion of green standards. Innovation will herald new benefits such as AI optimising energy consumption and cooling. One creative idea has also seen infrastructure cooling utilised to heat a swimming pool!

As data growth spirals, a targeted data strategy needs to be established, underpinning your (hybrid) cloud approach. This will create highly efficient on-premises data storage integrated with cloud that optimises performance and energy efficiency.

Optimised hybrid implementations deliver significant, positive impacts. A Public Cloud's carbon footprint can be 70-98% more efficient than a traditional data centre. Optimised on-prem infrastructure can deliver reduced power usage with up to 30%+ savings vs last generation hardware. With continuous innovation, this will grow well into the future.

Member Spotlight
Google Cloud

Organisations are now called upon to help create a cleaner, more sustainable world, and they need new technologies that help them make progress. Indeed, according to Harris Poll survey data from 2022, 93% of the executives surveyed in the UK agreed that technology makes it possible for their organisation to be more sustainable.

For over a century, readers in the UK have turned to The Telegraph for award-winning journalism. Many years ago, The Telegraph turned to Google Cloud to support faster and more flexible ways to build the systems and services that deliver content, provide compelling experiences to readers, and reduce its environmental impact with tools running on low-carbon cloud options.

Supported by Google Cloud's scale and services, they have been able to move quickly from virtual machines to microservices and now to serverless. This transition has also allowed The Telegraph to shift workloads around the globe to trade off cost and latency as well as improving their sustainability initiatives with robust carbon emissions reporting tools. With the scalability of cloud computing, the company can rapidly analyse data about the stories it publishes in real-time, put this data in the hands of the appropriate people immediately and enhance its readers' experience.

Finally, The Telegraph delivers hundreds of thousands of newspapers daily. Optimal management of print production is therefore crucial to its business. With the power brought to it by cloud computing machine learning, it is better able to predict the demand for physical newspapers, maximizing sales and minimizing waste. The Telegraph is using the cloud to reimagine media operations to benefit its business, readers, and the environment.

Member Spotlight
AWS

Data storage is climbing the ladder of sectors responsible for the largest carbon footprints, accounting for more carbon emissions than the commercial airline industry.[30] As an aspiring leader in environmental sustainability, Snowflake's goal is to provide the best data cloud with the lowest carbon footprint on the planet. Snowflake understands that organizations and individuals need data to act urgently to mitigate climate change and enables every organization to unite siloed data, discover and securely share data, and execute diverse analytic workloads with the Snowflake Data Cloud.

By transitioning virtual warehouses to AWS Graviton-based instance types, Snowflake reduced its carbon footprint per Snowflake virtual warehouse credit by an estimated 57%. Snowflake is also delivering a 10% performance benefit for its customers after leveraging AWS's innovative energy efficient products.

In December 2021, Amazon Web Services (AWS) launched the Sustainability Pillar of the AWS Well-Architected Framework[31] which defines sustainability in the cloud as a "continuous effort focused primarily on energy reduction and efficiency across all components of a workload by achieving the maximum benefit from the resources provisioned and minimizing the total resources required." Snowflake separates compute and storage resources in its architecture, which enables users to scale processing power independently of their storage needs. This type of architecture allows Snowflake to quickly take advantage of cloud sustainability best practices and pass those savings on to customers.

Snowflake made progress towards its sustainability goals related to carbon emissions by using instance types with the least impact.[32] AWS Graviton-based instances offer the best performance per watt energy use in Amazon Elastic Compute Cloud (Amazon EC2) by leveraging the new energy efficient AWS Graviton processors, which use up to 60% less energy for the same performance than comparable EC2 instances.

Snowflake is now using Graviton-based instances across 17 AWS regions, and is continuing to expand into other regions so it can meet customer demand sustainably even as compute requirements continue to grow. Snowflake operates in nine AWS regions that are powered by over 95% renewable energy (as of 2021), and provides customers the ability to choose an AWS region for their Snowflake deployment that align with their own sustainability goals.

Conclusions and Recommendations

At a time when our commitment to mitigate the impact of climate change has never been more urgent, a sustainable approach to technology should be at the heart of any digital transformation strategy. techUK believes there are many more businesses across the UK that can, and should, be looking to cloud computing to support that objective.

This *Cloud Insights paper* has highlighted six core principles that are the foundation of a more sustainable future for cloud computing. Underpinning these principles is a shared responsibility model that applies best practice at every level, with cloud providers ensuring the sustainability ***of*** the cloud and customers taking data-driven decisions to operate sustainably ***in*** the cloud.

By following this path, techUK believes we can accelerate an industry-wide transition from simply reporting emissions to actively working to reduce them at every level. By maximising the potential of cloud computing to improve business efficiency and productivity while driving down emissions, we work towards a better future for people, society, the economy and the planet.

Six core principles for a sustainable cloud future:

Cloud Service Providers

1. **Comprehensive and transparent sustainability data available to customers.** This should include granular data regarding individual workloads and comprehensive and timely metrics relating to specific data centres or service regions.

2. **Inclusion of Scope 3 emissions in all sustainability data** to give confidence to customers and make it easier for them to make informed decisions and implement impactful climate strategies.

3. **Continued investment in sustainable infrastructure** including through renewables, energy and water efficient facilities and hardware, and efforts to reduce carbon associated with hardware lifecycles.

Cloud Users

4. **Develop a culture of sustainability by embracing GreenOps practices, building on FinOps principles to put resource efficiency at the core of business operations.**

5. **Tackle the dark data challenge** by revising and monitoring data management policies to minimise the storage of unused data in cloud environments.

6. **Harness green software principles and invest in cloud native technologies** to reengineer legacy applications or develop and deploy new more sustainable applications. Include energy efficiency as a performance metric for application development.

References

1. https://www.computerweekly.com/opinion/How-to-build-an-environmental-cloud-sustainability-strategy
2. https://www.techuk.org/resource/techuk-launches-cloud-2020-beyond-report.html
3. https://www.accenture.com/gb-en/insights/strategy/green-behind-cloud
4. https://www.spglobal.com/marketintelligence/en/news-insights/research/improving-datacenter-efficiency-in-europe-the-role-of-pue
5. The Carbon Benefits of Cloud Computing: A Study on the Microsoft Cloud
6. Google Apps: Energy Efficiency in the Cloud
7. Helping a global NGO harness cloud to increase agility and reduce carbon emissions
   Helping a UK government organisation migrate to the cloud and modernise sustainably
8. https://azure.microsoft.com/en-us/blog/microsoft-sustainability-calculator-helps-enterprises-analyze-the-carbon-emissions-of-their-it-infrastructure/
9. https://cloud.google.com/blog/topics/sustainability/new-tools-to-measure-and-reduce-your-environmental-impact
10. https://www.ifrs.org/news-and-events/news/2023/06/issb-issues-ifrs-s1-ifrs-s2/
11. https://www.gov.uk/government/calls-for-evidence/uk-greenhouse-gas-emissions-reporting-scope-3-emissions
12. https://ghgprotocol.org/about-us
13. https://www.techuk.org/resource/sustainable-by-design-putting-climate-at-the-heart-of-the-cloud-guest-blog-from-ovhcloud.html https://corporate.ovhcloud.com/en-gb/newsroom/news/immersioncooling-ocp/
14. https://aws.amazon.com/ec2/graviton/
15. https://www.techuk.org/resource/how-organisations-and-the-planet-can-benefit-from-a-sustainable-cloud-environment-guest-blog-from-netapp.html
16. https://www.techuk.org/resource/the-overlooked-role-of-it-hardware-in-decarbonization-of-data-centers-guest-blog-by-sls.html
17. https://blog-idceurope.com/finops-and-greenops-strategies-in-2023/
18. https://www.gartner.com/en/information-technology/glossary/dark-data
19. https://www.cloudcomputing-news.net/news/2023/apr/03/41-of-uk-data-is-unused-or-unwanted/
20. https://www.techuk.org/resource/the-data-waste-index-2023-41-of-uk-data-is-unused-or-unwanted.html

21. https://www.veritas.com/content/dam/www/en_us/documents/at-a-glance/AG_uk_databerg_report.pdf
22. https://learn.greensoftware.foundation/introduction/
23. https://greensoftware.foundation/
24. https://github.com/cncf/toc/blob/main/DEFINITION.md
25. https://www.cncf.io/blog/2022/05/31/cncf-wg-environmental-sustainability/
26. https://www.redhat.com/en/about/press-releases/red-hat-announces-intent-reach-net-zero-operational-greenhouse-gas-emissions-2030
27. https://sustainable-computing.io/
28. https://github.com/sustainable-computing-io
29. https://next.redhat.com/2023/02/21/sustainability-the-cloud-native-way/
30. https://thereader.mitpress.mit.edu/the-staggering-ecological-impacts-of-computation-and-the-cloud/
31. https://docs.aws.amazon.com/wellarchitected/latest/sustainability-pillar/sustainability-pillar.html
32. https://docs.aws.amazon.com/wellarchitected/latest/sustainability-pillar/sus_sus_hardware_a3.html

techUK
FOR WHAT COMES NEXT

About techUK

techUK is a membership organisation that brings together people, companies and organisations to realise the positive outcomes of what digital technology can achieve. We collaborate across business, government, and stakeholders to fulfil the potential of technology to deliver a stronger society and more sustainable future. By providing expertise and insight, we support our members, partners and stakeholders as they prepare the UK for what comes next in a constantly changing world.

linkedin.com/company/techuk

@techUK

youtube.com/user/techUKViews

info@techuk.org

Image credits

iStock by Getty Images, Adobe Stock and OVHcloud