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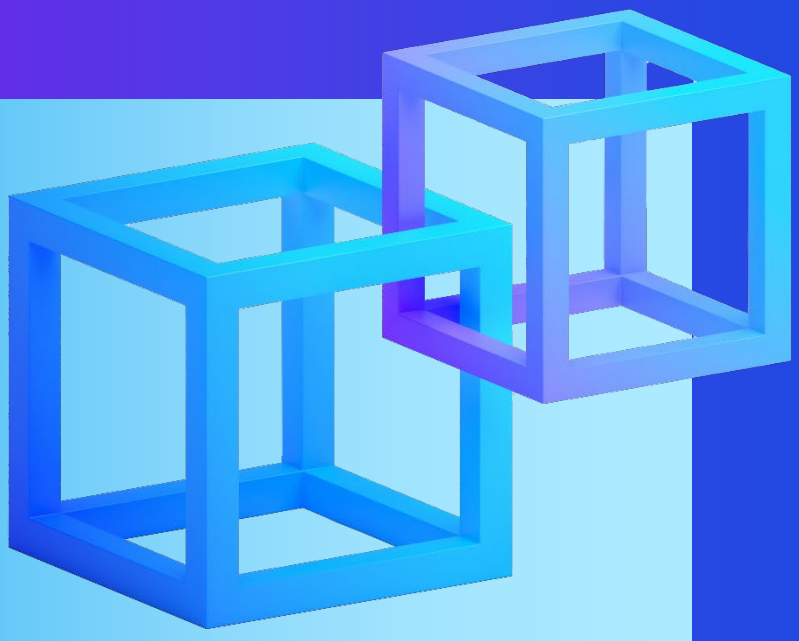


Why controlling IT carbon emissions should be central to your Sustainability strategy?

May 2024

Carbon Footprint of IT

When organisations are planning their sustainability initiatives, IT is often the last in the consideration list for transitioning to Green Operations.

The ever-evolving landscape of technological innovations in IT sector is accompanied by significant environmental and societal impacts. Sustainable IT practices are critical to foster innovation, minimise carbon footprint, boost circular economic practices, and promote responsible sourcing of materials. Significant strides can be made in IT to achieve sustainability goals and the initial success can enable a positive reinforcing loop to the other departments in achieving sustainability goals.

Embedding a sustainable IT strategy into an enterprise-wide strategy not only mitigates environmental impact but also drives cost savings, enhances operational resilience, and inspires process and product improvements. With the rapid surge in environmentally conscious demographics, embracing sustainable IT demonstrates commitment to environmental stewardship and promotes brand loyalty. Long term business success is predicated on adoption of technological advancements and appealing to the emerging demographics of customers, thus prioritising sustainable IT will future proof and ensure sustained success in the long run.

A few key statistics are discussed below that highlight the personas interested in sustainable Business practices and how IT is material in shaping sustainable outcomes.

Key drivers for sustainability initiatives

- Investors
- Consumers
- Government
- Employees

2-3% The tech sector is responsible for 2 to 3 per cent of global greenhouse gas emissions. – source

3.7% The carbon footprint of our gadgets, the internet and the systems supporting them account for about 3.7% of global greenhouse emissions. – source

135 kg A typical business user creates 135kg (298lbs) CO2e from sending emails every year, which is the equivalent of driving **200 miles in a family car**. – source

14% The IT industry's greenhouse gas emissions are predicted to reach **14%** of global emissions by 2040. – source

Information and Communications Technology accounts for about 4% of global electricity consumption, and 1.4% of global carbon emissions. source

Datacentres and the networking equipment make up the lions' share, responsible for 1% of energy-related global GHG emissions. source

Environmental impact of Datacentre

To support Data Centre operations, continuous supply of natural resources are needed. Vast amounts of electricity is consumed by a Data Centre to power the servers, operate the cooling systems to regulate and maintain optimal temperatures in Data Centre and run the humidification systems to alleviate static electricity build up.

Majority of the Data Centres employ water-based cooling and produce coolant waste. Additionally small and mid-sized datacentres use non-renewable sources of energy, housed in suboptimal locations (hot and humid geographies, water stressed regions), old buildings which result in inefficient usage of natural resources.

Compounding to the above problems, Data centres are not fully utilised because the capacity planning and deployment decisions assume peak usage of resources, and this results in excess idle capacity during BAU periods.

The amount of electricity consumed, source to generate the electricity and the associated by-products makes the entire value chain unsustainable depleting the already scarce natural resources.

What are the options to promote sustainability?

Migrate to public cloud

Improve Datacentre efficiency

How do Public clouds fare well vis-a-vis on-premise data centres?

Hyperscalers (Public Cloud) Data Centres also consume substantial amounts of energy and demand cooling systems but due to the massive scale of operations they are able to achieve maximum resource utilisation reducing the need for idle hardware provisioning. Due to the large scale, they can continuously pivot their focus on enabling dynamic provisioning, improve capacity planning, deploy optimal hardware configurations, invest in sustainability initiatives, deploy energy Public Cloud Service Providers have undertaken significant investments for their own data centre management leveraging natural cooling mechanisms by testing plausibility of underwater datacentres alleviating the need for cooling systems entirely, deploying AI solutions to inform optimal time to run and power off cooling and humidity systems, continuously investing in carbon offset programs and procuring energy through renewable sources. The hyperscalers purchased or generated renewable electricity to match 100 percent of their data centre energy consumption.

Subsequently Cloud is more eco-friendly than their on-prem counterparts if operated efficiently (The make-up of the factors that contribute to efficient operations and sustainability are elaborated in section titled – "The road to sustainable cloud operations"). Among the hyperscaler cloud providers, there is no clear winner across all regions. Each region is powered and operated differently. Consequently, evaluating sustainable operations comes down to identifying and selecting the least carbon intensive CSP in the region. However, for similar workloads, generally, operations on cloud are lower in emission factors than the On-premise counterparts.

In the chart, we have highlighted a few statistics that demonstrate percentage of Public Cloud run Data Centres operated on renewable energy sources, designed for energy efficiency (PUE)*, and utilised more than their on-premise counterparts. The public cloud service providers also handle lifecycle management of hardware procurement, maintenance, and disposal responsibly at scale. The waste generated is redirected from landfills, by finding alternative disposal methods thus conserving resources and promoting sustainability. Examples include hardware purpose-built for component reuse (refurbishment) and hardware configurations purpose-built enabling recycling and circular economy.

Cloud Sustainability Initiatives

The chart shows a brief comparison of key sustainability metrics between on-premise data centres and cloud data centres.

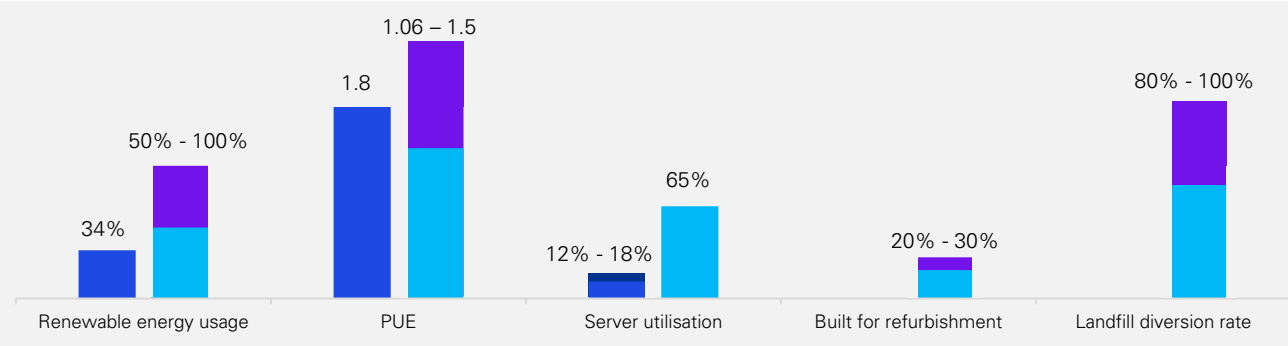


Figure 1: Key sustainability metrics comparison

Data Sources: REU, PUE, Server Utilisation, Built for refurbishment, Landfill diversion rate

*Data not available for refurbishment and landfill diversion rate for on premise Data centres

Key Sustainability Initiatives by public cloud vendors.

Microsoft

- In 2020, Microsoft made industry-leading commitments to be carbon negative, water positive, and zero waste by 2030.
- In FY22, the business grew by 18% and overall emissions were down 0.5%.
- In FY22, Microsoft signed new power purchase agreements around the globe, bringing their total portfolio of carbon-free energy to over 13.5 GW.
- By 2050 Microsoft has committed to remove from the atmosphere an equivalent amount of all the carbon dioxide the company has emitted either directly or by their electricity consumption since inception in 1975.
- Microsoft's Circular Centre program will reuse or recycle 90% of datacentre decommissioned cloud computing hardware assets.
- 2023 carbon removal key projects
  - Climeworks offtake.
  - Climate Robotics.
  - O.C.O Technology.
  - CommuniTree.

Source

Google Cloud

- Google has committed to achieve net-zero emissions across all their operations & value chain & replenish 120% of the freshwater volume they consume on average, across offices and data centres by 2030.
- In 2022, Google introduced the Carbon Sense Suite, enables Google Cloud customers to accurately measure, report, and reduce their cloud-related carbon emissions.
- By 2022 on average, a Google-owned & operated data centre was more than 1.5 times.
- As energy efficient as a typical enterprise data centre.
- In 2022, Google reached 64% carbon-free energy globally on an hourly basis.
- 38% of Google-owned and operated data centres had achieved Zero Waste to Landfill by 2022.
- Use recycled or renewable material in at least 50% of plastic used across our consumer hardware product portfolio by 2025.

Source

aws

- Amazon has pledged to reach net-zero carbon emissions across Amazon by 2040, achieve water positivity for Amazon Web Services and Power all their operations with 100% renewable energy by 2030.
- 90% electricity consumed by Amazon was attributable to renewable energy sources in 2022.
- In 2022, Amazon joined the Low Carbon Fuels Coalition to drive adoption of more low-carbon fuel standards.
- As of 2022, 20 data centres use recycled wastewater in cooling systems.
- 2.4B litres of water is expected to be replenished per year through water-restoration projects completed or underway in 2022.
- In 2022, Amazon's absolute carbon emissions decreased by 0.4%, even as year-over-year net sales grew 9%.
- Amazon's carbon intensity decreased by 7% from 2021 to 2022, and by 24% since 2019.

Source

The move to Cloud and optimising Workloads

Does moving to cloud mean it is equivalent to operating sustainably?

Not entirely!

Due to the easy availability, quick provisioning and cost-efficient nature, cloud is the easiest path to adopting sustainable operations. However, inefficiencies are possible in individual cloud migration and adoption journey due to heavy reliance on traditional IT processes, over provisioning, improper planning of workload deployments, existence of shadow IT, and not modernising the workloads on cloud. **All of which are addressable through proper planning, and careful execution on cloud.**

On the other hand, on-premise Data Centre can be modelled to reduce overall environmental impact as well. But this would mean heavy capital investments which could be **cost prohibitive** for small players and individual organisations, who operate smaller chunk of workloads, to achieve the same levels of efficiency as that of the public cloud providers.
The carbon footprint and thus the emissions are mostly predicated upon the **electricity consumption, water consumption, and lifetime of servers** to power the workloads.

KPMG Sustainable-IT solution is designed cutting across the Data Centre and cloud operations to **improve utilisation rate of resources** and model the workloads to run on **greenest public cloud regions**(where applicable) leveraging **low carbon intensity data centres across the operating geographies.** Where Data Centre operations is unavoidable, our solution is aimed to improve efficiency at Data Centre through virtualisation and designing energy aware workloads.

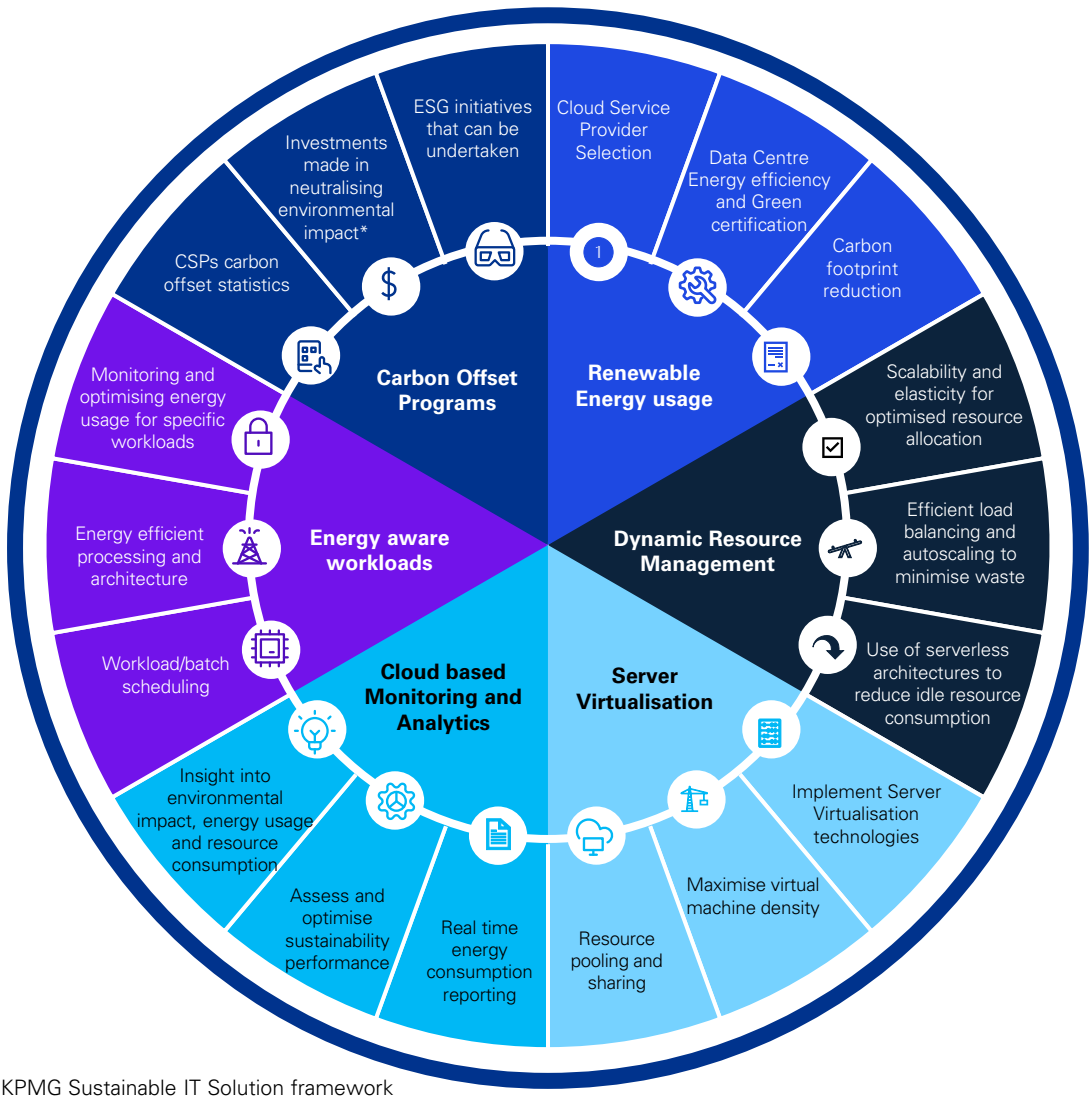


Figure 2: KPMG Sustainable IT Solution framework

The road to Sustainable Cloud operations

Despite the promise of sustainability and cost- efficient operations, organisations are still not operating and unlocking the cloud-native features.

Organisations still have cloud deployments that are not optimised to fully unlock sustainability benefits from cloud. Here are a few scenarios:

1. Greener Regions:

Limited awareness on provider ecosystem that are completely running on low carbon intensity profiles. Organisations are thus not acting towards leveraging the low carbon emission regions for jobs that can be scheduled and run in Green regions.

2. Dynamic Resource Management:

Over provisioning resources, not leveraging event driven architectures, and not terminating idle instances on cloud is leading to wasteful usage on cloud, in turn contributing to higher emissions.

3. Cloud based Monitoring and Analytics:

Not configuring real time monitoring to alert on workload anomalies in energy consumption. Inefficient workloads not contribute to emissions but also degrade performance and result in poor customer experience.

4. Energy awareness through Cloud native architecture:

Lift and shift migrations and non-cloud native architectures on cloud result in sub-optimal architectures on cloud as they cannot leverage scalability and elasticity on cloud. By modernising workloads using cloud native capabilities such as containerisation, micro services, dynamic scaling, and load balancing abilities; workloads are provisioned and scaled based on demand rather than being run indefinitely at peak capacity on cloud.

5. Carbon intensity variations among the hyperscalers:

While cloud is more eco-friendly than a typical data centre, there are a few hyperscalers that are more efficient than the others based on regional carbon intensity and efficiency of regional operations of service by the hyperscalers. Leveraging such regions can optimise carbon footprint associated with IT operations.

DC Optimisation

01

Leveraging clean energy/renewable energy to power the Data Centres.

02

Optimising energy efficiency and using energy efficient hardware and software.

03

Increasing virtualisation and reducing physical server deployment.

04

Automating Data Centre operational workflows based on real time parameters to ensure efficient and effective usage of equipment.

05

Adhering to the server lifecycle management and decommissioning obsolete/legacy servers.

Although cloud brings a host of ways to improve sustainability performance, Environmental impact can be tackled and addressed at source, partially, in on-premise Data Centres as well, some of which have been listed on the left. In cases where Data Centre exit is not possible owing to application constraints, they can be treated as exceptions and run in Optimised Data Centres.

Anti Patterns

While promoting sustainable IT operations, Organisations should be aware of Anti Patterns to effectively reduce carbon footprint.

Below are some anti patterns to be mindful of during sustainability journey.

- **Un-optimised cloud environment**

  Transitioning to cloud without optimising the IT footprint may inadvertently increase environmental footprint.

- **Inefficient Workload placements**

  Deploying workloads farther from the users results in excessive data transfer operations between the regions that consumes unnecessary energy.

- **Green washing**

  Making exaggerating claims on sustainability efforts without implementing meaningful sustainable practices across the Enterprise value chain.

- **Tunnel vision**

  Focusing only on the short-term gains on most known parameters such as carbon emissions overlooking environmental impacts during the lifecycle across the value chain (supplier, transport, end of life waste disposal).

- **Vendor lock-in**

  Relying heavily on a single provider adopting proprietary technologies will stunt flexibility, innovation and probable mis-alignment on long term horizon when vendor's focus on sustainability diverges from organisation stance.

Benefits of promoting sustainable operations

Sustainability initiatives often yield unforeseen benefits beyond the primary environmental goals. These benefits range from lower operational costs, improved efficiency, positively disrupting the business models, setting the culture of innovation, reduced risk profile and talent attraction and retention. A few high impactful scenarios are discussed further:.

01

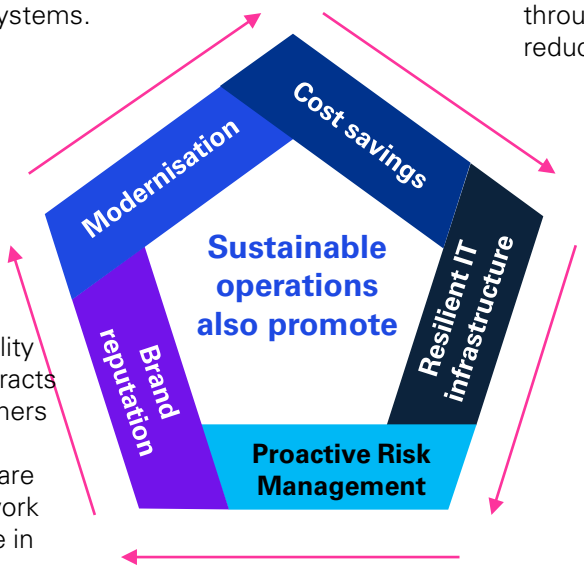
Modernisation

Migration to cloud and operating from a Green data centre opens avenues to modernising the legacy systems.

02

Cost Savings

Energy efficient on prem data centres and cloud promote cost savings through optimal resource usage, and reduced energy consumption.



05

Brand reputation

Commitment to sustainability enhances brand image, attracts investors, customers, partners and employee loyalty. Customer and employees are inclined to purchase and work in organisation that partake in sustainability initiatives.

03

Resilient IT Infrastructure

Adopting sustainable practices enhance operational resilience (less outages, downtime etc) by reducing dependency on specific resources. Cloud inherently provides fault tolerance, high availability and redundancy.

04

Proactive Risk Management

Modernised workloads can be configured to perform auto-recovery and mitigate unforeseen risks.

Incorporating sustainable IT into the wider enterprise strategy can be achieved through a two-pronged approach –

1. Migrating to cloud and leveraging cloud native architecture.
2. Improving efficiency at hardware and software level for on premise environments.

Migration to cloud provides a holistic approach to achieve sustainability goals and should be the de-facto standard of operations. Operating out of Data Centre should only be considered for exceptional situations where Data Centre exit is detrimental to the Business.

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