DIGITAL TECHNOLOGY SERVICES

HARNESSING CLOUD INNOVATION FOR STRATEGIC CARBON REDUCTION:

A PATH TO A GREENER FUTURE DRIVEN BY COLLABORATION, ORGANISATIONAL TRANSFORMATION AND CLEAR MEASUREMENT OF SUCCESS

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01 INTRODUCTION

Data has an economic and environmental side effect that is little noticed but very potent: it is highly energy intensive. The energy consumption of data centers alone is projected to rise from 200 Terawatt hours (TWh) in 2016 to a staggering 2967 TWh in 2030. By comparison: in 2022, China produced approx. 5,800 TWh of energy from coal.

Data usage and consumption are not only an increasing cost factor, but the subject is encroaching into environmental, social and governance (ESG) and sustainability discussions. This is especially due to data's vast and increasing growth and the tremendous consumption of energy — the CO_2 footprint and other waste created when storing and handling data. As with the entire ESG movement, there is also a risk of revenue churn due to increased customer pressure for environmentally conscious behavior and actions.

Organisations, regulators and ultimately society must become much more conscious of the cost associated with data handling and storage organisations. This article attempts to describe how organisations might want to go about it. The bottom line: the use of cloud computing and the pursuit of ESG driven business models go together very well.

They also come with a similar set of challenges: the implementation of both needs to carefully navigate a jungle of rules, pitfalls and opportunities. In a recent article, our colleagues Vic Svec and Stefanie Weiler have outlined a number of ESG priorities in order to avoid getting lost in details: **A&M ESG Viewpoint: Five Sustainability Trends to Drive Value in 2024.** This article covers some ground with respect to cloud computing.

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THE CLOUD AS A KEY DRIVER TO SUSTAINABLY MANAGE COST AND RESOURCES

Cloud computing has functioned as a key tool to optimise the cost and efficiency of IT departments across all industries for quite a while. This is done by leveraging economies of scale as well as enhancing an organisation's ability to respond and adapt quickly and easily to changes in demand with regards to computing power, storage and other factors.

These same effects can be leveraged to drive the journey towards sustainable operations and to get a better grip on the increasing cost of energy and CO2 management and while easily adapting to new ESG regulations. Cloud transformation — if done right — can help to drive fundamental business value through lower costs, higher revenues and increased valuations.

WHAT IS THE CLOUD AND HOW DOES IT RELATE TO THE COST OF DATA AND ASPECTS OF SUSTAINABILITY?

What exactly is the cloud? At its core, the cloud refers to a network of remote servers, typically hosted on the internet, that store and manage data, run applications and deliver services to users and organisations around the world. This virtual infrastructure has revolutionized the way we interact with technology, offering scalability, flexibility and accessibility that has transformed the way we work, communicate, and innovate. Cloud technology is the foundation to innovate in data and use artificial intelligence.

THE CLOUD HAS MULTIPLE FACETS

It is crucial to understand each of the facets of cloud technology.

Public Cloud

The “purest” form of cloud is the public cloud, leveraging infrastructure which is run and operated by a cloud service provider (CSP) and provided to multiple businesses. This does not mean that data or systems in a cloud are publicly available or shared — modern public cloud environments are built to cater to all privacy, security and regulatory requirements such as geographical limitations of a business — but that the infrastructure underneath is at a scale, which allows for much more efficient operations both from a cost perspective as well as from a sustainability view.

Private Cloud

This model involves organisations managing their cloud infrastructure within dedicated data centers. It offers even greater control over infrastructure, data and applications but is usually at a significantly smaller scale than public cloud environments.

Hybrid Cloud

A blend of both private and public cloud services, the hybrid cloud provides businesses with flexibility and scalability. It allows them to keep sensitive data on-premises while utilizing the cloud for other workloads.

Multi-Cloud

Multi-cloud strategies involve using multiple cloud service providers simultaneously. By leveraging the strengths of different providers for specific purposes, organisations enhance resilience and avoid vendor lock-in.

Multiple Hosting Options

These cloud models are shaping how businesses manage their data, applications, and IT resources in today’s tech-driven world. Opposed to these various models of cloud technology are more traditional ways of hosting your data and applications. In many companies there is still some mix between cloud and traditional setups.

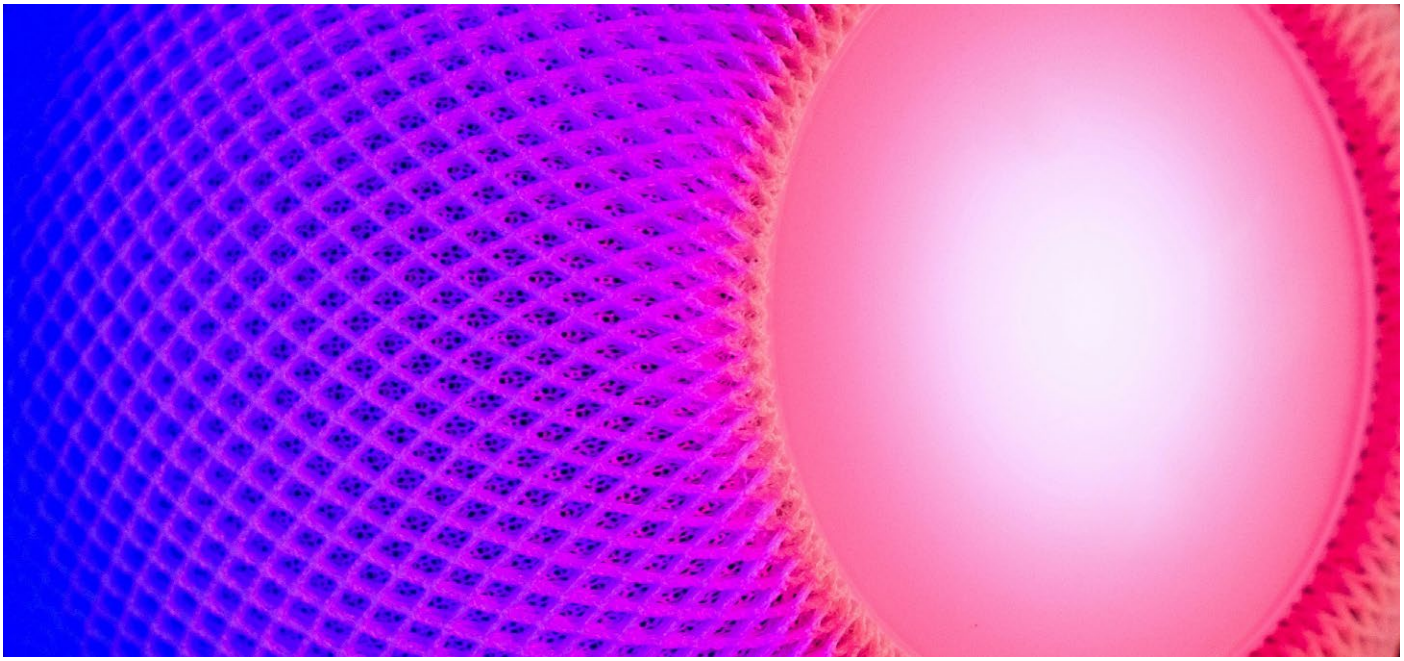
On Premise Hosting

This is the very early and initial way businesses stored their data and hosted applications. On premise hosting means using self-bought and owned hardware, typically in an organisation’s own data center within business locations or dedicated sites. This model offers full control from hardware to data, but it is also the smallest scale and requires an organization to maintain and operate everything on by themselves, from data center facilities to networks and servers.

Colocation (Colo) Hosting

In this setup, businesses rent physical space in data centers to house their servers and equipment. This arrangement provides enhanced security, as well as increased scale and redundancy.

The economy of scale in a cloud environment offers sustainability benefits compared to traditional on-premises (on prem) and colocation (Colo) setups. Cloud providers operate large data centers that optimise resource use, enhance energy efficiency, and employ green practices. This shared infrastructure reduces waste, energy consumption, and carbon footprints. In contrast, classical setups often struggle with resource inefficiencies, higher maintenance costs and limited scalability, making the cloud a more environmentally friendly choice. Lastly, it is essential to underscore that both cloud providers and, ultimately, clients of CSPs will contend with soaring energy costs, akin to traditional data center owners. Therefore, efficiency and adherence to a strategic plan incorporating ESG components are imperative for achieving CO2, ESG, innovation and cost objectives.



03 EFFICIENCY WITHIN CLOUD ENVIRONMENTS AND DATA/COMPUTE POWER AS COST DRIVERS

In the realm of cloud computing, data management is paramount for operational efficiency and cost containment. It involves strategic practices such as data deduplication, tiered storage and lifecycle management to reduce the footprint and optimise cloud resource utilization.

Critical cost determinants in cloud data management hinge on data volume and storage class selection, encompassing both performance tiers such as provisioned Input / Output Operations per Second and access patterns, such as hot, cool or cold data. Data egress fees — costs associated with data retrieval from the cloud — are also a significant factor, particularly when data is frequently accessed across the network. Moreover, redundancy strategies like geo-replication, while crucial for disaster recovery and high availability, inflate costs due to the extra storage and operational overhead.

Advanced data management tools that automate tiering, provide in-depth analytics, and facilitate compliance governance contribute to overhead but are essential for maintaining a secure and regulatory-compliant cloud environment.

Navigating these technical cost drivers is essential for deploying a cloud architecture that balances performance, scalability, and cost-effectiveness. In conclusion, the impact of data mishandling in cloud implementation can be substantial, leading to increased costs and decreased operational efficiency, and finally lead to missing ESG targets.

Cloud virtualization allows for the creation of multiple virtual instances on a single physical server, optimising resource allocation. Simultaneously, containerization, through technologies like Kubernetes, encapsulates applications and their dependencies, enhancing portability and scalability. By leveraging these cloud-native technologies, workloads are streamlined onto fewer servers, resulting in a significant reduction in energy consumption. This not only improves resource utilization but also aligns with sustainable practices, minimizing the environmental footprint associated with cloud operations.

While applying these cloud optimisations, organisations should consider the impacts of Idle Time Reduction Techniques, that is, implementing power management features, scheduling tasks to avoid peak-usage periods and utilizing load balancing to spread workloads evenly across servers. This helps reduce energy consumption during periods of low demand, further minimizing the environmental impact.

04 WHAT MAKES THIS JOURNEY TO A SUSTAINABLE CLOUD ENVIRONMENT SUCCESSFUL?

To achieve this optimised handling for data and computing and follow the organisation's ESG goals, it is essential to focus on the right cornerstones during the transition to a cloud-based solution: Transformation, Optimization and Measurement.

Transformation: Cultivating a Culture of Sustainability

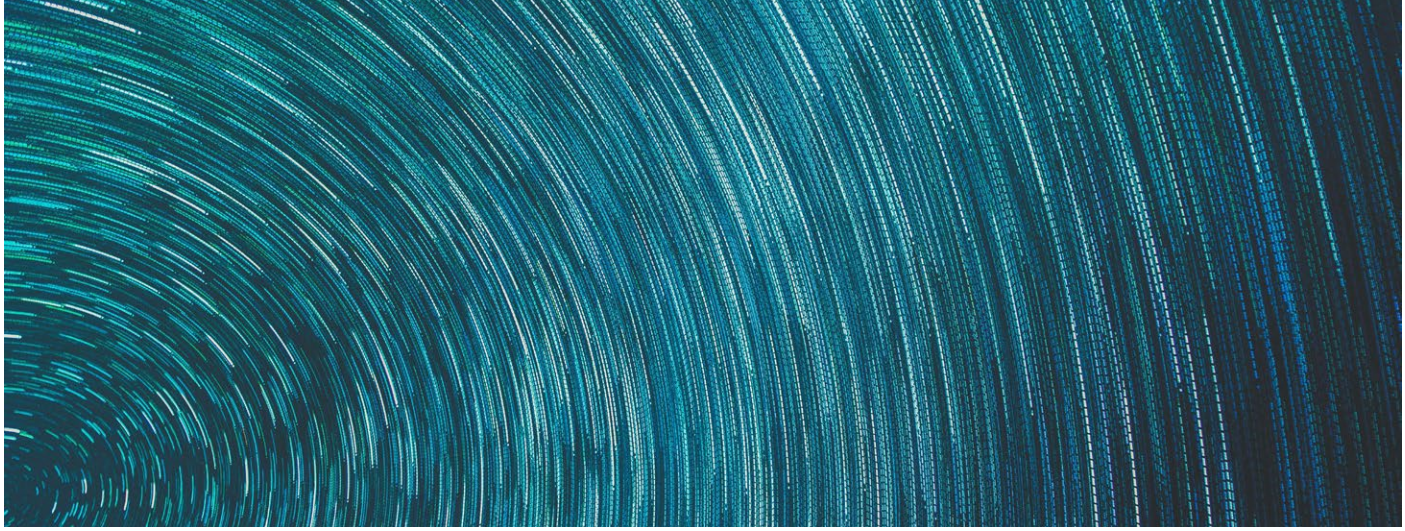
- **Realigning Processes and Workflows:** Migration to energy-efficient cloud services and infrastructure, such as serverless computing and containerization, facilitates scalability and agility without compromising environmental sustainability.
- **Sustainable Data Management:** As data proliferation mirrors environmental challenges, advanced storage optimisation strategies, including data deduplication and compression, reduce energy consumption and carbon emissions.
- **Embracing Automation:** Leveraging automation streamlines tasks optimises resource utilization and reduces energy consumption by eliminating manual intervention and minimizing human error.
- **Educating and Empowering Stakeholders:** Fostering a culture of sustainability involves training cloud providers, users and developers in sustainable practices, dismantling the notion of data as a "free resource."
- **Procure Along ESG Targets:** Procurement departments must include ESG criteria in cloud platform requests for proposals. This ensures the selection of environmentally responsible solutions, aligning with global sustainability goals and corporate responsibility commitments.
- **Embed DevOps and FinOps:** DevOps and FinOps practices boost sustainability by streamlining processes for efficiency and cost-effectiveness. DevOps fosters collaboration, accelerating software delivery and reducing energy consumption. FinOps, emphasizes financial accountability in cloud operations, optimising resource use and cost-efficiency.

Optimisation: Focus on Technical Strategies to Minimize the Environmental Footprint of Cloud Operations

- **Energy-Efficient Cloud Services:** Prioritizing energy-efficient components and serverless computing reduces energy consumption, shrinking the cloud's environmental impact.
- **Workload Optimisation:** Dynamic resource provisioning, auto-scaling and load balancing optimises resource utilization, mitigating overprovisioning and waste.
- **Cloud Virtualization and Container Orchestration:** Advanced virtualization and containerization, coupled with cloud-native technologies, streamlines workloads, substantially lowering energy consumption and aligning with sustainability goals.
- **Idle Time Reduction Techniques:** Power management, smart scheduling, and load balancing during periods of low demand contribute to reduced energy consumption.
- **Green Cloud Certifications:** Choosing sustainable cloud providers with certifications like LEED Gold signals a commitment to eco-friendly practices.
- **Cloud Cost Management:** Employing cloud cost management tools optimises spending, fostering both financial and environmental sustainability.
- **Data Lifecycle Management:** Strategic data classification and automated tiering reduce energy usage by placing data in optimal storage solutions—from high-performance to low-energy tiers — according to access frequency. Implementing deduplication and compression shrinks the data footprint, conserving energy and aligning with green computing initiatives, while also enhancing system performance and reducing costs.

Measurement: Quantify Success for Continuous Improvement. Enable organisations to monitor and enhance their cloud sustainability performance

- **Energy Consumption:** Tracking energy usage of cloud infrastructure and applications provides insights into the environmental impact, facilitating targeted improvements.
- **Data Efficiency Metrics:** By measuring the efficiency of data storage and access patterns, organisations can pinpoint areas for improvement in their cloud sustainability performance. Metrics such as data retrieval times, storage input/output operations, and the ratio of active-to-idle data can guide efforts to reduce energy consumption.
- **Resource Utilization:** Monitoring resource utilization rates identifies inefficiencies, optimising resource allocation and reducing energy consumption.
- **Carbon Footprint:** Calculating carbon footprints based on input gains prominence in a world where carbon pricing becomes widespread, motivating further environmental responsibility.



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KEY STAKEHOLDERS — CSPS, CLIENTS, AND SYSTEM INTEGRATORS: A COLLABORATIVE EFFORT FOR SUSTAINABLE CLOUD STRATEGY IS NEEDED

Achieving enduring success in cloud transformation goes beyond individual efforts; it demands a harmonious collaboration among CSPs, clients and system integrators. This intricate partnership involves a multifaceted approach, where each entity plays a pivotal role in steering organisations towards a sustainable cloud strategy. The collaborative effort encompasses tool provision, technology alignment, and joint operational evolution, ultimately contributing to both technological advancement and environmental stewardship.

Cloud Service Providers are integral architects in the sustainability narrative. Their expansive infrastructure and commitment to environmental responsibility position them as catalysts for change. CSPs go beyond providing cloud services; they furnish organisations with sophisticated tools and frameworks designed to meticulously measure and manage their carbon footprint. These tools empower clients to embark on a journey of proactive environmental impact reduction, aligning cloud adoption with broader sustainability goals.

Clients, the driving force behind cloud transformation, are not passive recipients but active participants in the journey towards sustainability. Beyond leveraging CSP-provided tools, clients bring their unique organisational needs and objectives to the collaborative table. The collaboration is not a one-size-fits-all approach; instead, it involves a tailored alignment of technology solutions with specific client requirements. Clients, by integrating cloud adoption with broader organisational transformation, ensure a holistic shift towards energy-efficient operations and contribute substantially to the sustainability agenda.

System Integrators, with their expertise in aligning technology solutions with organisational needs, serve as orchestrators in the collaborative triad. Their role extends beyond mere technology alignment; system integrators act as facilitators, ensuring that the joint operational evolution is seamlessly integrated into the client's existing framework. This orchestration involves navigating the complexities of organisational transformation, where both technological and operational aspects are synchronized to drive sustainable outcomes.

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SUMMARY AND CONCLUSION

The complexity of the collaborative effort among all stakeholders is underscored by the understanding that a successful transformation is not solely about the adoption of technology; rather, it necessitates a fundamental shift in how these partners jointly operate. It requires a shared commitment to align cloud adoption with organisational transformation, fostering an environment where energy consumption is proactively reduced, and sustainability becomes a shared responsibility.

It is for these reasons that Alvarez & Marsal has emerged as the ideal consulting partner for navigating the cloud sustainability journey. With a strong track record of organisational transformation, strategic collaboration with CSPs, clients and system integrators, and a commitment to the three pillars of sustainable cloud adoption, A&M is well-positioned to guide businesses towards a greener, more sustainable future. Choosing Alvarez & Marsal is not just a strategic decision; it's a commitment to environmental responsibility and innovation in cloud usage.

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