The CSP Sustainability Challenge

Pathfinder Report

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About this paper

A Pathfinder paper navigates decision-makers through the issues surrounding a specific technology or business case, explores the business value of adoption, and recommends the range of considerations and concrete next steps in the decision-making process.

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Bobby Clay serves as a Senior Consulting Analyst on the TMT Consulting team, primarily focused on cloud and datacenter technologies. He has a unique mix of technical and business skills, having led both engineering and marketing teams at Fortune 50 companies and multiple startups, building and deploying networks, networking products and cloud solutions. Bobby holds a Bachelor's degree in Computer Engineering from Auburn University.

Executive Summary

Cloud service providers (CSPs) are beginning to experience regulatory, societal and market pressures to integrate sustainability considerations into their business strategies. CSPs face the challenge not only of migrating their business to a more sustainable model but measurably validating the sustainability of their datacenters to provide environmental, social and governance (ESG) transparency and tools to quantify clients' carbon usage and savings. This is necessary to respond to solidifying government regulations and customer ESG visibility requests, as well as to help customers reduce their environmental footprint, meet demands for acceptable environmental practices and compliance, and achieve their sustainability and climate goals.

With ESG reporting now mandatory in many countries, businesses are seeking ways to gain visibility into their carbon emissions, both internally and across their supply chains, to assess the environmental costs of their operations in order to plan carbon management and reduction strategies. CSPs also feel pressure to provide their customers with operational data on carbon efficiency, carbon transparency and environmental impact. As concerning as this may seem, it can be a win-win for both the CSP and the end customer. Optimizing workloads and infrastructure helps reduce waste and therefore reduces energy consumption, driving down the cost to operate.

In this 451 Research Pathfinder report, we explore requirements for CSPs to become more sustainable, as well as existing and emerging tools to aid them in measuring and reporting progress toward their sustainability goals.

Key Findings

- Established companies expect their vendors and partners to be sustainable. Over the last decade, and particularly the last five years, enterprises across the globe have recognized the significance of ESG factors and corporate responsibility. In line with the nations that have signed on to the Paris Agreement, which seeks to level off greenhouse gas (GHG) emissions as soon as possible and achieve GHG-neutral status in the second half of this century, large companies are making similar, and in some cases more aggressive, pledges to their headquarter countries. In turn, these corporations are asking their supply chain and service providers to begin reporting their emissions data for a full accounting of the upstream and downstream impact.
- As a top consumer of electricity, the datacenter industry has been a target of sustainability concerns for some time. According to 451 Research's Datacenter Market Monitor 2021 estimates, all datacenters consumed 478 TWh of electricity in 2019. According to the International Energy Agency, the world produced 27,044 TWh of electricity in 2019, putting datacenter consumption at 1.77% of the world's production. As digital transformation intensifies, the datacenter industry's energy appetite will continue to increase. It is possible that in some countries, the industry's new energy demand may outpace the availability of energy supply.
- Renewable energy is a major component in calculating sustainability, and 451 Research's latest Voice of the Enterprise (VotE): Datacenters report shows that datacenter sustainability is moving from a nice-to-have, to an enterprise must-have. In other research, there is evidence that company leaders are willing to pay a premium for more sustainable products and services.
- The hyperscalers are recognized as among the largest electricity consumers and have responded to energy-consumption concerns by making strong commitments to become 100% powered by renewable energy and move to a net-zero carbon footprint. To this end, they have all entered power purchase agreements (PPAs) for renewable energy and are ranked among the top renewable energy purchasers, having purchased more than 32 gigawatts of renewable capacity.
- Two of the hyperscalers and several large datacenter operators are members of the RE100, the global corporate renewable energy initiative bringing together hundreds of large businesses committed to 100% renewable electricity.

Government Environmental Regulations

New sustainability regulations will affect every business and are particularly expected to impact datacenter providers over the next few years. For example, in the U.S., the ESG Disclosure Simplification Act of 2021 requires the Securities and Exchange Commission (SEC) to formulate ESG metrics for public companies to make specific ESG disclosures in their SEC filings. Consequently, improving the environmental metrics of a company may directly correlate to perceived company value.

Similarly, in June 2021, the European Commission adopted a Corporate Sustainability Reporting Directive proposal that requires all large financial and non-financial corporations to release periodic reports on their environmental and social impact activities. In February 2022, the U.K. Department for Business, Energy & Industrial Strategy issued guidance — its Mandatory Climate-Related Financial Disclosure by Publicly Quoted Companies, Large Private Companies and LLPs — to help companies understand how to meet the disclosure requirements under the Companies Regulations 2022 and Limited Liability Partnerships Regulations 2022. Also, the International Financial Reporting Standards Foundation recently started developing a new global framework for sustainability risk.

Cities and countries around the globe have started placing restrictions on datacenters. These restrictions range from power usage effectiveness (PUE) mandates to outright bans on new datacenter builds. PUE is a metric used to determine the energy efficiency of a datacenter and is determined by dividing the total amount of power entering a datacenter by the power used to run the IT equipment within it. These PUE mandates can impact equipment choices and infrastructure efficiency enhancements, and even escalate datacenter refresh cycles for power efficiency improvements.

In China, where we have seen the most stringent legislation to date, the government is mandating that older, less efficient and underutilized datacenters be closed, and dictating where new datacenters can be built and for what purpose. Figure 1 below illustrates a sampling of regulations from different parts of the world.

Figure 1: Regulations Impacting the Datacenter Industry

Location	Regulation
U.K.	Special environmental permitting required for datacenters/campuses of greater than 1 MW
Dublin, Ireland	Moratorium on new datacenter builds until 2028
Netherlands	Moratorium on large-scale (>10 hectares, >70 MW) datacenters anywhere in the country until 2023
Amsterdam, Netherlands	PUE of 1.2 or below; maximum 10-year power budget of 670 MW for new datacenter builds (2020-2030)
Haarlemmermeer, Netherlands	PUE of 1.2 or below; maximum 10-year power budget of 750 MW for new datacenter builds (2020-2030)
Hebei, China	Large datacenters with a PUE greater than 1.3 must close by 2025
Jiangsu, China	PUE of 1.3 or below; must reach utilization of at least 65% by 2023
Ningxia, China	PUE of 1.3 or below
Shandong, China	PUE of 1.25 or below; projects that are 65% pre-sold will be prioritized
Yunnan, China	PUE of 1.3 or below
Singapore	Three developments per year, totaling a maximum of 60 MW; PUE of 1.3 or below; BCA-IDA Green Mark Platinum rating; prioritization given to facilities that "maximize strategic value for Singapore"

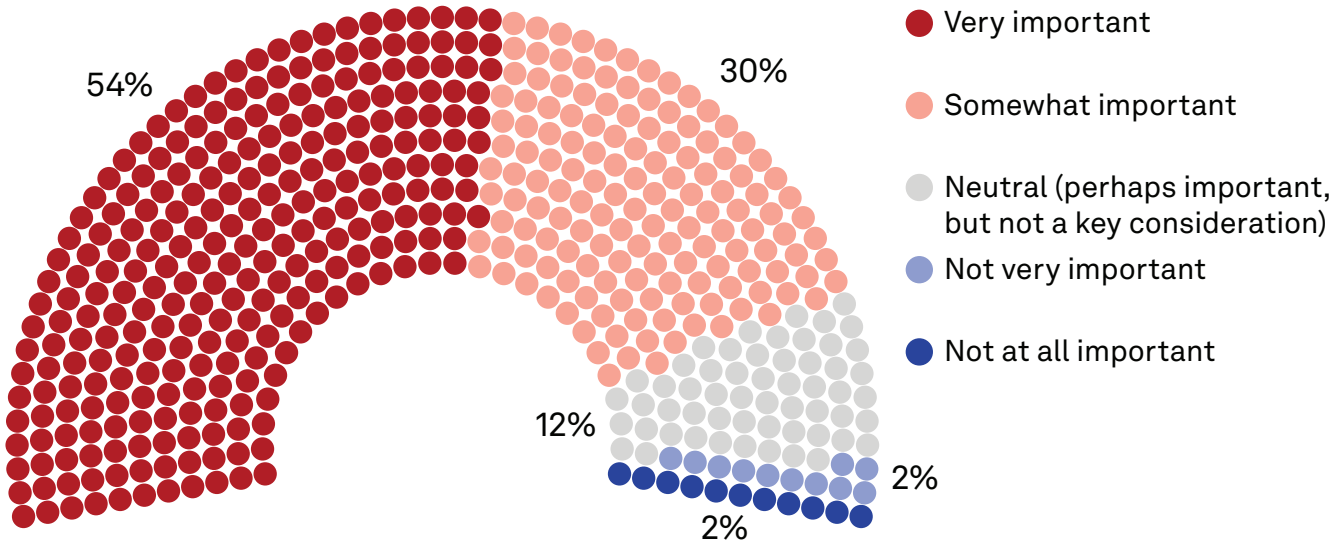
Source: 451 Research 2022

CSPs with datacenters that fail to meet sustainability targets may lose clients and pay higher rates, and they may even be forced to pay carbon taxes or fees introduced by governments to penalize less "green" companies. In a more stringent regulation and legislation scenario, datacenter operators that are less efficient or not focused on sustainability will likely face direct margin pressure and increased capital costs if they cannot comply with ESG regulations.

Why Is Sustainability Important to Cloud Service Providers?

The more pertinent CSP question is, "Why is sustainability important to CSP enterprise customers?" In the recent VotE survey, 79% of colocation customer respondents stated that the overall efficiency and sustainability of a datacenter was either very or somewhat important to them. In a separate 451 Research survey of Asia-Pacific-based CIOs, 93% of participants said they would pay a higher price for a more sustainable technology solution, all else equal. Our VotE: Datacenters survey shows that 54% of IT and line-of-business decision-makers say sustainability is very important, and another 30% say it is somewhat important (see Figure 2). Thus, 84% of enterprise decision-makers are thinking about sustainability when they make business decisions, and CSPs must now consider the impact on their business as they make decisions regarding sustainability practices and investments.

Figure 2: Importance of Datacenter Sustainability to Facility Owners or Owner/Operators



Q. Overall, how important to your organization is the efficiency and sustainability of its datacenters, whether owned or leased?

Base: Organizations that own and operate datacenters or server rooms/closets, or own facility but contract for management and operations (n=489)

Source: 451 Research's Voice of the Enterprise: Datacenters, Sustainability 2022

Another consideration is that enterprise datacenter closures are linked to public cloud migration, with improving carbon footprint also on the list of reasons for migration. Of the companies that plan to close datacenters soon (17%) or have recently closed datacenters (13%), the primary driver for those closures is migration to public cloud services (42%), according to results from the VotE: Datacenters, Sustainability 2022 survey.

Given the consumption model of cloud computing, ethical procurement is an important consideration for cloud platform operators. Also, multicloud deployments are prevalent among enterprises — 76% of enterprises use more than one cloud platform, according to our VotE: Cloud, Hosting & Managed Services, Workloads & Key Projects 2021 survey. As noted in another 451 report, The Sustainable Cloud: A Real Business Imperative, this makes prioritizing environmental cloud procurement straightforward — if an enterprise cannot reach its ESG goals with one cloud platform operator, it can (albeit with some degree of difficulty) migrate those workloads to a more ecologically suited cloud.

Carbon Footprint and Scope 3 Emissions

CSPs must understand how companies are defining their carbon footprints and how that data will be used. One way it may be used is in calculating their Carbon Disclosure Project (CDP) score. A company's CDP score is a carbon disclosure rating and a measure of the environmental sustainability of a corporation. It is administered by CDP, a not-for-profit organization that runs a global disclosure system to help investors, companies and governments report and manage their environmental impacts. CDP collects self-reported survey responses from just under 6,800 participating companies.

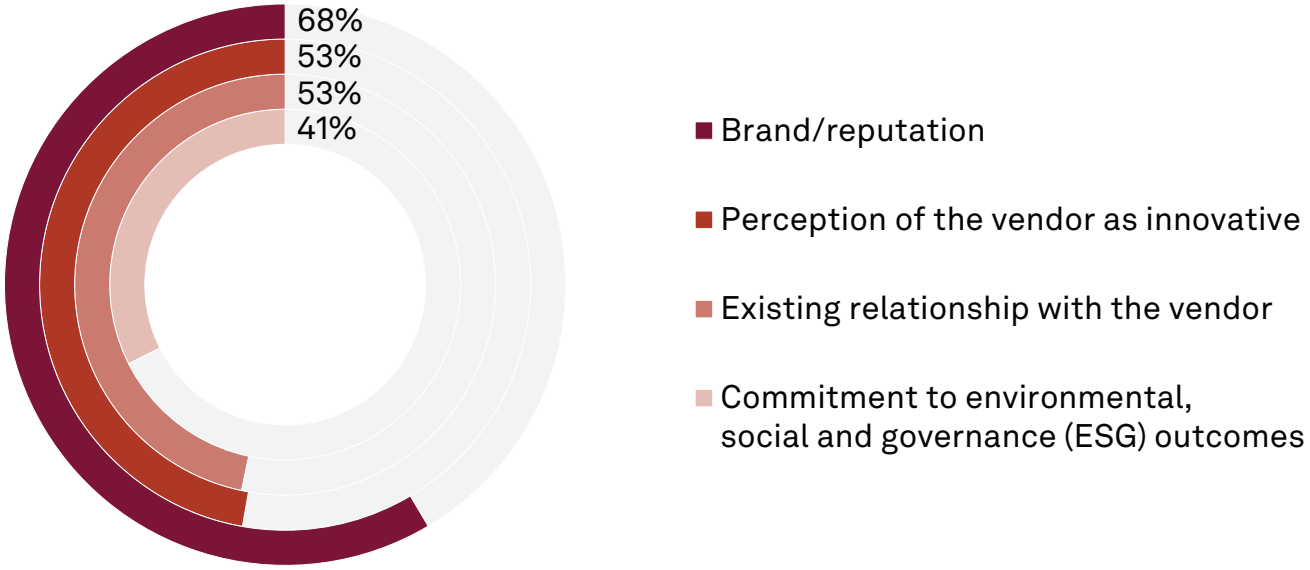
The Greenhouse Gas Protocol is an industry-standard way to report carbon emissions. The GHG Protocol Corporate Standard classifies a company's greenhouse gas emissions into three "scopes."

- Scope 1 emissions are direct emissions from owned or controlled sources.
- Scope 2 emissions are indirect emissions from the generation of purchased energy.
- Scope 3 emissions are all indirect emissions (not included in scope 2) that occur in the upstream and downstream supply chains of the reporting company.

When enterprises move workloads from on-premises datacenters into public clouds, their responsibility shifts from Scope 1 and Scope 2 into Scope 3, and the cloud provider becomes accountable for Scope 1 and Scope 2 stewardship. Cloud carbon tracking is necessary because customers want to know the environmental impact of choices they make in their upstream supply chains. According to 451 Research's VotE: Cloud, Hosting & Managed Services, Vendor Evaluations 2021 survey, 41% of IT decision-makers consider providers' commitment to ESG outcomes "very important" when selecting a public cloud vendor.

From a cloud customer perspective, emissions from deployed cloud workloads are accounted for as Scope 3 indirect emissions. Each cloud workload deployed generates a fraction of the total emissions from each of the previous scopes. The actual amount varies per workload and depends on several factors including the cloud services utilized (compute/storage /network), the energy consumed by those services, and the carbon cost of power supplied by utilities to the cloud datacenters.

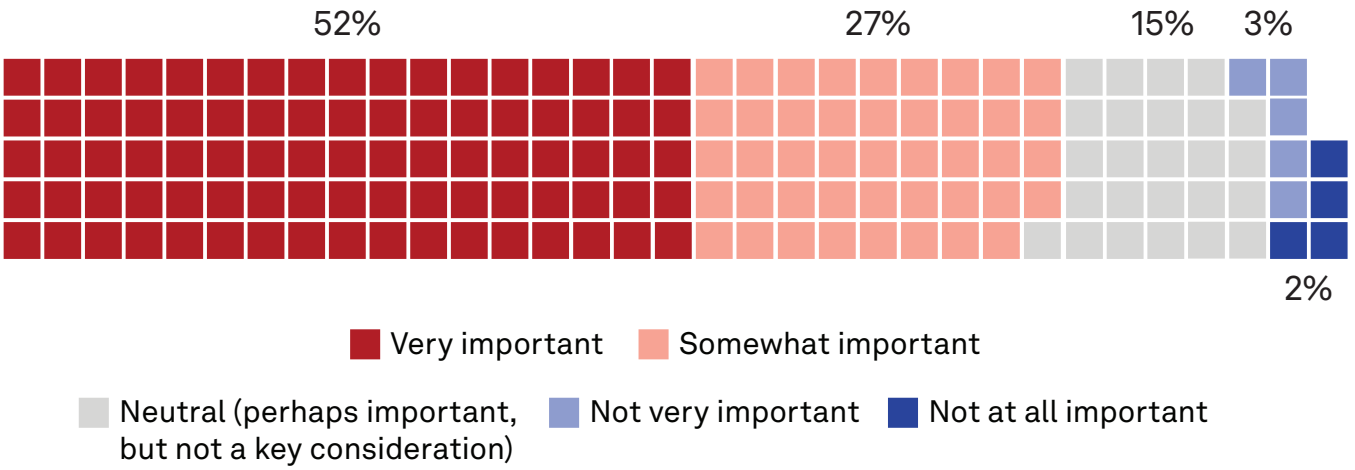
Figure 3: Vendor Attributes Considered "Very Important" in Selecting an IaaS/PaaS Provider



Q. How would you rate the level of importance of each of the following attributes when evaluating an IaaS/PaaS public cloud vendor?
Base: Current or future IaaS/PaaS/public cloud users
Source: 451 Research's Voice of the Enterprise: Cloud, Hosting & Managed Services, Vendor Evaluations 2021

In 451 Research's VotE: Datacenters 2021 survey, 79% of colocation customer respondents stated that the overall efficiency and sustainability of the datacenter was either very or somewhat important to them. Enterprises do not always have to pay a premium for more sustainable options, however. In another survey, 451 Research analysts found that organizations could reduce the carbon footprint of cloud-based workloads and at the same time reduce cloud spending, with the potential cost being higher latency (451 Research's VotE: Cloud, Hosting & Managed Services, Vendor Evaluations 2021).

Figure 4: Importance of Efficiency and Sustainability to Colocation Customers



Q. When selecting a colocation provider, how important are overall efficiency and sustainability of the energy available?
Base: Rents space in colocation center(s) (n=163)
Source: 451 Research's Voice of the Enterprise: Datacenters 2021

This willingness to "go green" is more than just theoretical. In our VotE: Datacenters 2021 survey, companies reported actively making decisions for the sake of sustainability. Of companies that intended to close company-owned datacenters in the next two years, 27% cited improving carbon footprint as the primary driver. Likewise, 34% of respondents that intended to open a new datacenter in the next two years were doing so to improve the organization's carbon footprint. And 18% of respondents that lease space from a colocation provider said they do so to access renewable energy or improve efficiency.

Ways CSPs Can Reduce Enterprise Emissions

When organizations go about reducing overall emissions, the best place to start is by squeezing out every possible inefficiency, and then working to decarbonize the energy sources being supplied to the infrastructure. In this way, energy resources — however renewable — are not being wasted on inefficient systems. In IT infrastructure, efficiencies can be found in the newest chip architectures, which can do more processing per watt than their predecessors, and by ensuring those processors are optimally utilized (generally that sweet spot is 70%-80% utilization). Further, the datacenters that house this infrastructure can be optimized through the use of current-generation cooling equipment that can help drive down PUE and thus cut down on waste.

CSPs facilitate higher-productivity use of IT infrastructure to optimize cost and improve their sustainability profile over traditional enterprise datacenters via multi-tenant and oversubscription operating models. The orchestration of secure resource pool operating models — virtualizing compute, storage and network for intelligent hypervisor workload sizing and scheduling management — securely maximizes operational efficiency across shared resources, reducing idle time, which helps to eliminate capacity waste. This allows for fast, dynamically scaling solutions that ultimately deliver a smaller carbon footprint for enterprise workloads through the elimination of waste, and it enables the dual enterprise infrastructure economic values of increased sustainability and decreased resource costs, as well as improved performance.

Furthermore, CSPs are typically more focused on efficiencies and utilization rates than other enterprises because, frankly, these speak directly to the margins they can command. This is ultimately true of other enterprises as well, but cloud and datacenter providers tend to be more intently attuned to it because it more directly maps to the bottom line. This is critical, and in managing the correct service level for the workload, CSPs can use intelligent solutions to balance optimum performance on newer hardware than most enterprises can. For this reason, as companies work to decarbonize the energy mix of their datacenters, especially when moving to an hour-by-hour accounting model rather than annualized, and as they reduce their building carbon footprints, simply migrating workloads to the cloud is an obvious path.

ESG Toolsets and Emissions Accounting

The ability for users to track and predict emissions generated from their cloud usage is already an enterprise expectation and is critical for organizations' emissions accounting. With increased focus on sustainability and the looming specter of climate regulations driving businesses to consider the environmental costs of their operations, as well as rising costs of electricity, enterprises are evaluating CSPs' sustainability ratings, sustainability reporting and management tools in addition to their cloud costs and performance.

Climate impact considerations are yet another element of the cost of doing business/cost of goods sold, which CSPs must factor in and transparently communicate to their enterprise customers. Current carbon footprint tools provided by the hyperscalers exemplify the market demand for carbon measurement. Current common capabilities include:

- Presenting the level of carbon emissions attributable to customers' historical usage of compute, storage and other services, and projecting how their carbon footprint will change over time.
- Monitoring gross cloud emissions over time by project, product and region, providing developers metrics that can help them improve their carbon footprint.
- Providing gross emission reduction estimates outlining reductions that could be achieved by removing idle projects.
- Enabling enterprises to record, report and reduce their environmental impact.

CSPs also leverage these tools to demonstrate the environmental benefits of shifting on-premises workloads to the cloud. Simple open-source tools even exist to calculate the cloud usage carbon footprint and enable companies to gauge their current carbon footprint across hyperscaler multicloud deployments.

Existing sustainability tracking and measurement tools, however, are in the early stages of development and do not give companies complete data on net effect. And although APIs and SDKs exist for hypervisor management, they offer little or no sustainability metric management capabilities. Customers now expect the ability to measure and track their carbon footprint in a cloud datacenter. Looking ahead, it is likely that companies will want to manage the sustainability of their IT infrastructure holistically and will require tools for hybrid deployment to gather and correlate ESG data for public cloud and on-premises datacenters concurrently.

Current orchestration and scheduling tools incorporate cost logic and manage dollars spent but do not yet consider power used. Building on the current foundation of resource/cost management, future cloud workload scheduling may automatically consider sustainability for time-of-day energy consumption and potential geographic job placement to optimize compute energy usage, cooling requirements and water consumption, and even data transport. This, coupled with intelligent orchestration that manages resource provisioning and takes into account sustainability constructs while optimizing utilization and availability, will enable intelligent automated conservation, eliminate unnecessary overprovisioning and further increase cloud datacenters' environmental efficiency over traditional enterprise datacenters. The actual extent to which CSPs and their enterprise customers can control and measure Scope 2 indirect emissions and Scope 3 upstream and downstream emissions will depend upon how robust these scheduling and orchestration tools become.

The evolution of sustainability tools will far exceed just backward-looking reporting and simple energy-saving algorithms based on eliminating idle VM instances. Tools will evolve to provide predictive models beyond the "defined ideal situation," and simple scripted trigger responses will account for dynamic application workloads and intelligent autoscaling. Increased instrumentation and the incorporation of machine learning will support predictive performance analysis based on application type and utilization statistics; optimal region placement and zone selection for power-consumption considerations; application colocation for latency efficiency and capacity management; and dynamic shifting of workloads across the hybrid environment using sustainability metrics and performance/costs. Add to this infrastructure as code and automation advances, and intelligent workflow automation will replace the manually scripted workflow models widely deployed today, with the potential to eliminate incorrectly planned deployments via dynamic resource allocation based on past and predicted utilization. With the increase in operational efficacy coupled with sustainability considerations, CSPs will be able to demonstrate conservation and carbon-footprint reduction and provide measured, reportable metrics to their enterprise customers.

Conclusions

Current data shows that cloud datacenters' sustainability efficacy is superior to that of legacy enterprise datacenters, and enterprises are taking into account the ESG performance of their cloud providers in making vendor/partner decisions. Today's cloud management tools and dashboards are just beginning to calibrate for sustainability. ESG is adding a new dimension to what current monitoring, management and optimization tools address. Sustainability management will become part of the next generation of unified orchestration and scheduling functions, providing solutions to address business KPIs to the organization as a whole, blending sustainability emissions accounting with utilization and cost reporting.

Sources:

451 Research's Voice of the Enterprise: Datacenters, Sustainability 2022

451 Research's Voice of the Enterprise: Datacenters 2021

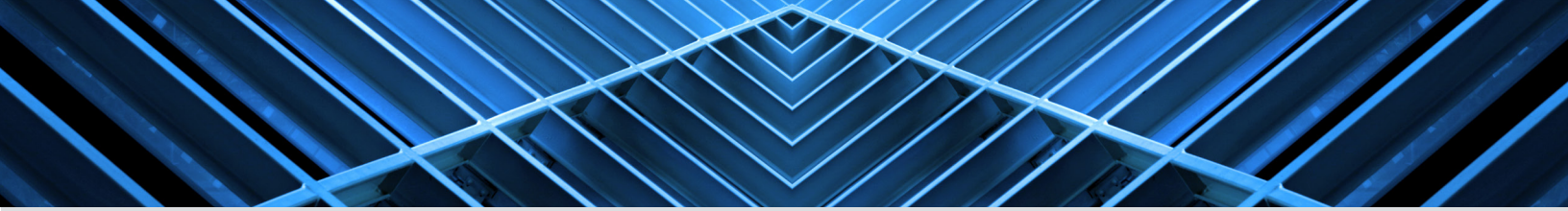
451 Research's Voice of the Enterprise: Cloud, Hosting & Managed Services, Vendor Evaluations 2021

451 Research Technology & Business Insight report, "The Sustainable Cloud: A Real Business Imperative," Oct 2021

Greenhouse Gas Protocol frequently asked questions

CDP

RE100



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Moving to the cloud is a complex task, and Enterprises need to ensure they choose the right cloud not only for cost and performance but also, as this document has discussed, a cloud that addresses their core ESG strategy. VMware Cloud Service Providers deliver secure cloud solutions and managed services that can help Enterprise businesses realize their cloud and ESG strategies. Using VMware technology, founded upon industry-proven VMware technology that has already saved the world 1.2 billion tons of CO2e and is in use with hundreds of thousands of Enterprises today, VMware has the power to impact the carbon efficiency of your data centers. As already stated, Cloud Service Providers need to start thinking and actioning the shift in responsibility enterprises need from them to support their indirect carbon emission supply chain. To help Enterprises find the right supply chain partner VMware has implemented a 'Zero Carbon Committed' partner program to accelerate Cloud Verified partner sustainability and aims to:

- Catalyze the transition to a zero-carbon internet through our partnerships with public cloud providers.
- Help customers reach their sustainability and decarbonization goals by connecting them with VMware Cloud Service Providers that have aligned goals.

To become a Zero Carbon Committed partner, our validated partners must have a public commitment to power their global public cloud operations including VMware data center(s) using 100% renewable energy by 2030. Their renewable energy procurement must be backed by Guarantees of Origin certificates in Europe or Renewable Energy Guarantees of Origin (REGO) in the UK, or similar. And lastly on an annual basis, agree to verify, confidentially, with VMware that they (1) continue to meet VMware's Zero Carbon Committed qualification criteria for renewable energy-powered data center operations and (2) demonstrate annual progress toward goal.

As well as programs to support supply chain Zero Carbon commitments, VMware has the innovative technology to support VMware cloud service providers. VMware Cloud Director, the core service provider platform supports secure multi-tenanted cloud services to help partners achieve optimal hardware usage and hence minimize carbon impact. Cloud Director uses NSX-T layer 2 network segmentation to securely segregate customers, combined with intelligent placement policies and Distributed resource scheduling, customers achieve optimal performance and providers meet SLA expectations without impacting performance.

Using resource pools Cloud Director can allocate differing models of consumption over virtualized resources. VMware Cloud Service Providers can offer elastic, CPU speed, CPU and memory limits allocations and guarantees (including GPU resources). This can deliver the purist optimization, not all workloads need the allocated resources and customers should balance their workload performance needs with the intelligence options to ensure they get the performance when they need it, not necessarily always on, which is costly and not energy efficient.

To help VMware Cloud Service Providers and Enterprises understand the impact of these models, we have a Carbon Calculator for free access. This allows Cloud Providers to sit down with customers and plan their estate whilst considering the differing allocation models from Cloud Director and to see the carbon and energy savings they generate with each option. The calculator can be run looking at 1 or many customers, to help VMware Cloud Service Providers engage in conversations about Cloud energy usage or assess how Cloud Director could impact their entire existing estates.

VMware Cloud Director is front and center to the VMware Cloud Service Provider strategy and the core of the cloud platform for VMware Cloud Service Provider partners. Try the calculator today, understand how you can change your sustainability position using this solution and provide better supply chain sustainability transparency to your existing or new customers.

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