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IT leaders must deal with the rising importance of environmental, social, and governance factors to drive business value while the demand for natural resources to power datacenters grows.

Data-Driven Strategies for Sustainable Datacenters

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Introduction

Sustainability has become a mainstream business topic and is considered a key business value driver. In IDC's 2022 *Global Environmental, Social, and Governance (ESG) Business Services Buyer Value Survey,* 74% of information technology (IT) decision makers considered ESG factors to be "very important" to the enterprise value of their organization. IT is a critical enabler for sustainable transformation, as organizations are struggling to solve the ESG data challenge while analyzing and reporting ESG information, and they are also looking at the sustainability credentials of the information technology that they are buying to improve their sustainability footprints.

AT A GLANCE

KEY STAT

By 2027, 34.9% of global datacenter energy consumption will be powered by renewable energy, according to IDC predictions.

WHAT'S IMPORTANT

There is a conflicting nature between environmental, social, and governance concerns and supporting the computing requirements of a growing digital economy. As a result, sustainability is the most urgent and critical issue within the datacenter space.

Although IT decision makers recognize the importance of environmental, social, and governance factors to the overall enterprise, this understanding often clashes with the increasing need for robust computing capabilities to support the expanding digital economy. The conflicting nature of these two corporate objectives has elevated sustainability as the most urgent and critical concern within the datacenter space. Despite the persistent emphasis on efficiency, the global energy consumption of datacenters continues to rise. IDC estimates worldwide datacenter consumption was 382TWh (terawatt-hour) in 2022 and is anticipated to reach 802TWh by 2027, reflecting a compound annual growth rate (CAGR) of 16.0% contributing to the escalating carbon emissions. Decarbonizing the datacenter requires innovative approaches and strategic solutions that harmonize environmental responsibility with the imperative of delivering resilient computing infrastructure.

Benefits

Given the magnitude of the challenge, improving datacenter environmental impact in the face of growing demand will be a continuous effort requiring the implementation of innovative technologies, operating methods, and management techniques.

The complexity of the challenge will yield a corresponding payoff for those who succeed. The most common benefits include:

- **Business growth.** With organizations digitalizing all aspects of their businesses, IT and datacenters are integral components for business value delivery. As utilities struggle to deliver power capacity in certain markets due to growing demand and geopolitical events that affect capacity, lowering the demand for datacenter energy consumption gives organizations more autonomy to support the delivery of new business services. Moreover, a commitment to sustainability can provide a competitive edge in markets where customers favor eco-friendly businesses.
- **Cost savings.** Adopting sustainability practices in datacenters carries profound financial benefits, acting as a compelling driver for modern businesses. Primarily, cost savings through improved energy efficiency have emerged as a crucial incentive for businesses to undertake sustainable measures. As energy consumption contributes significantly to the operational costs of datacenters, improving energy efficiency can lead to substantial savings. For instance, efficient cooling systems and server utilization can dramatically reduce power usage, consequently driving down energy costs. In addition, sustainable datacenters often utilize renewable energy sources, which, besides being environmentally friendly, offer price stability compared with fluctuating utility costs. By incorporating energy-efficient hardware, improving server utilization rates, and using renewable energy, datacenters can become more sustainable and financially viable.
- **Regulatory compliance.** In a regulatory landscape increasingly shaped by environmental considerations, sustainable datacenters play a pivotal role in ensuring compliance. Governments worldwide are imposing stricter regulations aimed at curbing carbon emissions and promoting energy efficiency. These laws often carry financial penalties or restrictions for noncompliance, making adherence a significant concern for businesses. By proactively adopting sustainable practices, businesses can stay ahead of evolving legislation, mitigating the risk of future noncompliance. Thus sustainable datacenters offer a dual advantage — they help organizations meet current regulatory demands and future-proof operations against upcoming environmental laws.
- **Improved public image.** Sustainable datacenters serve as a compelling and influential symbol of corporate social responsibility, bolstering an organization's public image. In a business landscape where consumers, investors, and stakeholders are increasingly environmentally conscious, adopting sustainable practices becomes a strategic differentiator. Organizations that invest in sustainable datacenters demonstrate their commitment to reducing environmental impact, which can lead to improved customer loyalty, attract socially responsible investors, and foster better relationships with stakeholders.
- **Operational efficiency/business continuity.** Sustainable datacenters are at the forefront of augmenting operational efficiency in the evolving digital era. These facilities are equipped with intelligent, autonomous energy-efficient hardware and advanced cooling mechanisms that not only minimize energy consumption but also optimize facility performance, making them easier to manage. In addition, server virtualization techniques are employed to maximize computational resources, thereby reducing the need for excessive physical infrastructure. The integration of artificial intelligence (AI) and machine learning (ML) can further fine-tune energy usage and system operations, promoting efficiency.

- **Employee satisfaction and retention.** By committing to sustainable practices, organizations demonstrate a commitment not just to the environment but also to forward-thinking, responsible business practices. As organizations compete for scarce datacenter talent, well-run sustainable datacenters attract employees who want to work for a company that aligns with their personal values. Moreover, companies that prioritize sustainability often have a culture of innovation and continuous improvement, which can provide employees with opportunities for professional development and growth.

Trends

The topography of sustainable datacenters is undergoing a transformative shift as organizations prioritize both digitalization and sustainability and that shift often begins with aligning measures to desired outcomes. Historically, power usage effectiveness (PUE) has been the prevailing measure for datacenter efficiency and an indicator of sustainability. However, the strength and weaknesses of PUE is in its simplicity. While easy to understand, it fails to incorporate the efficiency of the IT equipment or the carbon impact energy source of the datacenter, which is why carbon usage effectiveness (CUE) is emerging as a standard for measuring datacenter sustainability. CUE is expressed as a ratio of total carbon emissions from a datacenter by the energy consumption of the IT equipment within it. A lower CUE indicates less environmental impact per computer capacity.

Better metrics can incentivize desired behavior, steer improvement efforts, and foster a culture of accountability and continuous improvement. The focus on carbon emissions has helped drive and quantify the impact of another key trend — renewable energy to power datacenters. These renewable sources such as solar, wind, and hydropower considerably curtail the carbon footprint, propelling the industry toward its sustainability targets. Predominantly driven by hyperscale and large colocation operators with pledges and measurable progress to be carbon neutral, the demand and the availability of renewable energy are transforming large-scale datacenters to grow while reducing their environmental impact. IDC predicts that 34.9% of global datacenter energy consumption will be powered by renewable energy by 2027.

A second measurement trend that drives subsequent datacenter sustainability trends is the increasing role of governmental organizations in managing carbon emissions. As governments are growing increasingly alarmed about the implications of climate changes and escalating carbon emissions, they are demanding greater transparency and accountability from industries. With reporting schemes expanding from Scope 1 (direct emissions from controlled and owned resources) to Scope 2 (indirect from purchased electricity, steam, heat, and cooling) to include Scope 3 emissions — all other indirect greenhouse gas emissions that occur in the value chain — organizations must take a more holistic view of sustainability.

A complete cradle-to-grave view revealed by measuring Scope 3 emissions has incented organizations to assess supply chain sustainability, recognizing that the actions and decisions made throughout the supply chain can have significant environmental and social implications. IT suppliers are now evaluated on the additional dimensions of the organization's sustainability credentials and the product-specific carbon impact of the product, from material extractions through retirement.

In addition, the focus on Scope 3 has increased interest in the circular economy principles, which is a transformative approach that involves rethinking and restructuring traditional economic models based on linear consumption (the make-use-dispose model) to embrace a more sustainable and regenerative model. This approach maximizes the financial and environmental return by extending asset utilization and then reusing the asset or recovered components and materials at the end of their service life. For the datacenter industry, implementing a circular economy strategy can result in significant benefits. Moreover, it fosters innovation in designing durable, reusable, and recyclable hardware.

Given the magnitude of the datacenter sustainability and decarbonization dilemma, datacenter operators will need a multitude of technologies and techniques to demonstrate significant measurable progress. While the views, measurements, and incentives have matured to a more comprehensive view on sustainability and decarbonization, energy efficiency remains an important topic and trend. Reducing energy consumption reduces carbon emissions, unless powered by renewable energy. Datacenter operators are implementing energy efficiency changes throughout the technology stack.

In the wake of an accelerated digital transformation wave, organizations are striving for differentiation through advanced intelligence, recognizing data as an increasingly critical asset. This paradigm shift has subsequently led to surging storage requirements. Industry trends indicate a preference for technologies that leverage solid state drives (SSDs), owing to their superior efficiency in power consumption and reduced heat generation. Moreover, enterprises are proactively deploying solutions adept at data duplication and compression, further bolstering efficiency. These mechanisms significantly decrease the storage capacity required, resulting in a notable reduction in both energy consumption and embedded carbon. Such trends underscore the imperative for innovative, sustainable solutions in data management and storage in the digital age.

New server technologies are significantly contributing to energy efficiency, with vendors reporting an impressive reduction of over 80% in server energy intensity. Having the capacity to execute tasks equivalent to approximately 5 servers from 10 years ago leads to a remarkable reduction in the energy requirements of datacenter operations. In addition, servers are undergoing a trend of downsizing while maintaining optimal performance. This is exemplified by the emergence of low-power servers, which draw inspiration from smartphone computing technology to strike a harmonious balance between performance and energy efficiency.

Advanced cooling techniques are swiftly emerging, highlighting the industry's progressive adoption of innovative, eco-friendly technologies. One prominent trend is the implementation of liquid cooling solutions, which offer superior heat dissipation capabilities compared with traditional air-based cooling methods. In addition, the use of AI and ML in thermal management is on the rise, helping optimize cooling systems' performance through predictive maintenance and dynamic load adjustment.

Considering Hitachi Vantara

Hitachi Vantara is a global data storage and digital solutions company that helps organizations harness the power of data to gain valuable insights and drive business growth. With a strong focus on data-driven innovations, Hitachi Vantara offers a comprehensive portfolio of products, services, and solutions designed to enable digital transformation across various industries. Leveraging its deep domain expertise and cutting-edge technologies, Hitachi Vantara aims to empower enterprises to unlock the full potential of their data assets. The company's consolidated revenue for fiscal year 2022 (period ending March 31, 2023) totaled ¥10,881.1 billion, with 696 consolidated subsidiaries and approximately 320,000 employees worldwide.

Hitachi Vantara is committed to sustainability. Internally, the company has set aggressive goals to achieve carbon neutrality by 2030 and throughout its entire value chain by 2050. The company leverages new technologies to deeply understand the digital impact on the planet and prescribe recommendations and best practices. It seeks to identify the leading causes of companies' carbon emissions, the hot spots, potential areas to decarbonize, and where to develop actionable remediation plans.

Hitachi aims to be a social innovation business, creating a sustainable society through the use of data and technology. The company solves customers' and society's challenges with Lumada solutions leveraging IT, operational technology (OT), and products. Hitachi operates under the business structure of:

- **Digital systems and services.** Supporting Hitachi Vantara's customers' digital transformation
- **Green energy and mobility.** Contributing to a decarbonized society through energy and railway systems
- **Connective industries.** Connecting products through digital technology to cocreate solutions that drive sustainability, innovation, and growth in various industries

Digitalization reduces complexity and enables the discovery of sustainability opportunities in all areas of the enterprise, from infrastructure, across the cloud, to the entire data ecosystem. It brings instant visibility into operations and helps determine whether ESG goals are being met or where action is needed to be taken. Although more organizations understand the imperative, many organizations still lack the maturity and sophistication to craft meaningful, transparent sustainability plans for their operations and supply chains. Hitachi Vantara can help customers use data to drive sustainable practices across its entire organization through a framework of:

- **Discovering an organization's sustainability potential.** Uncover all factors that can impact Scopes 1, 2, and 3 emissions. Through insightful and granular dashboards, Hitachi Vantara can help customers identify carbon "hot spots" and prioritize solutions to achieve your carbon goals.
- **Planning the pathway.** Define a realistic and measurable road map to achieve carbon neutrality. Combining the deep industry expertise and innovative technologies of the wider Hitachi group, the company can find the right solution that fits an organization's strategy and define measured, discrete steps to create real impact.
- **Transforming an organization.** Implement more efficient processes to reduce resource intensity through new ways of working, new technologies, and new ways of approaching the operations of an organization and its suppliers.

Challenges

Hitachi Vantara is an organization committed to its own sustainability as well as helping its enterprise customers achieve their sustainability goals, yet the biggest challenges revolve around organizations' sustainability maturity. Many organizations are still in the beginning of their sustainability journey and lack sophistication around data and reporting. Without guidance or education, companies gravitate toward quantifying and reducing their Scope 1 and Scope 2 emissions because they are easier to collect and straightforward to calculate and understand. As a result, data-driven decision making can lead organizations to make decisions on energy efficiency alone without factoring in the carbon footprint of manufacturing, asset life cycle, and asset disposition resulting in choices that increase their carbon footprint, when they seek the opposite result.

The problem around reporting is exacerbated by a lack of uniform standards in the industry, and certifications can vary significantly in their scope, rigor, and credibility. Vendors often make sustainability claims with parameters that favor their credentials. Most vendors are truthful, but the lack of standards makes it difficult for organizations to properly evaluate them.

The datacenter sustainability challenge requires not only technological innovation and operational efficiency but also a nuanced understanding of the environmental impacts and trade-offs associated with datacenter operations. Hitachi Vantara has an opportunity to overcome these challenges by educating organizations on these trade-offs to distinguish itself as a sustainability leader in the IT industry.

Conclusion

As organizations prioritize both digital transformation and sustainability, the datacenter industry is facing the challenge of balancing the growing demand for computing capabilities with the urgent need to reduce environmental impact. By leveraging data-driven innovations, enterprises can unlock the full potential of their data assets while driving sustainability across their operations and supply chains. By providing education, highlighting the importance of holistic sustainability measures, and offering tailored solutions, Hitachi Vantara can address the challenges as outlined in this paper, and if so, the company has the opportunity to lead the way in the IT industry and enable its customers to make informed decisions that align with their sustainability goals.

About the Analysts

Bjoern Stengel, *Global Sustainability Research and Practice Lead*

Bjoern Stengel is IDC's Global Sustainability Research lead. His research focuses on how environmental, social, and governance (ESG) topics impact and shape business strategies and technology usage. He provides insights into market opportunities, adoption strategies, and use cases for sustainability-related technologies and services. Bjoern helps IDC's clients understand the impact of technology-enabled, sustainable transformation processes in the context of sustainable business strategies, operations, and products and services through research reports, news publications, and speaking engagements at industry events such as Climate Week NYC.

Sean Graham, *Research Director, IT Datacenters*

Sean Graham is a research director, Cloud to Edge Datacenter Trends at IDC. He focuses on providing insights and analysis to the IT infrastructure vendors, datacenter and colocation providers, cloud service providers, and datacenter services firms. Hardware areas of coverage include generators, UPS, CRAC, cabling, LAN/WAN, storage, racks, and servers. Software covered includes DCIM, building automation, artificial intelligence and machine learning, and predictive analytics. Services include datacenter design, construction, and running and operating of datacenters. All the aforementioned coverage areas will have an overarching theme of sustainability and trust. Mr. Graham draws on 25 years of industry experience to provide insights and actionable advice to assist vendors in developing, marketing, and delivering datacenters.

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