



Technical Research Study



Grow and Innovate on an Energy-Efficient, Sustainable IT Infrastructure

Enterprises looking to decrease carbon emissions in the data center should consider hyperconverged infrastructure (HCI) to minimize their overall total impact on sustainability (TIS).

It's commonly known that the amount of data being generated and processed by businesses, governments, and organizations has grown exponentially in recent years. This growth has led to a corresponding increase in energy consumption by data centers, which now account for 1 percent of global electricity use.¹

This energy consumption has leveled out over the past few years due to efficiency improvements in IT hardware and cooling and a shift toward more efficient cloud operations. But the rise of demanding workloads, such as data analytics and artificial intelligence (AI)/machine learning (ML), has increased energy use by 10 to 30 percent per year.¹ As such, there is an immediate need for energy efficiency in IT infrastructure that can deliver the needed level of performance.

Increasing IT sustainability makes sense not only from an environmental standpoint, but it is also an increasingly desirable business practice that is already influencing infrastructure purchases:

- IDC predicts that **75 percent** of the largest global companies will soon require infrastructure vendors to prove progress on sustainability initiatives, as CIOs rely on vendors to help meet their environmental, social, and governance (ESG) goals.²
- **81 percent** of CEOs agree or strongly agree that digital investments are going to drive their ability to meet ESG goals.³
- IDC predicts that **60 percent** of the largest global companies will soon have environmental sustainability parameters firmly embedded in their businesses' key performance indicators (KPIs).⁴

Because IT sustainability is such a growing concern for businesses, Prowess Consulting is proposing a new approach to IT decision making. Instead of making separate decisions on hardware and software acquisitions to achieve sustainability goals, enterprises might instead view IT infrastructure systems holistically for their comprehensive benefits.

Much like how overall total cost of ownership (TCO) is a key metric for IT infrastructure purchases, the total impact on sustainability (TIS), with corollary capital and operating impacts (similar to capital expenditures [CapEx] and operating expenses [OpEx]), can be a strategic pathway for IT decisions. That is, an end-to-end hybrid-cloud infrastructure, built with sustainability in mind, can help enterprises achieve their business goals and meet environmental requirements simultaneously.

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In this paper, we look at two top IT vendors who have built sustainability into their enterprise solutions: Dell Technologies and Microsoft. As partners, Dell Technologies and Microsoft collaborate so their products, such as Dell™ PowerEdge™ servers and Microsoft Azure® Stack HCI, are integrated for optimal benefits to end users. To explore the TIS approach, we examine the ways Dell Technologies and Microsoft have incorporated the following three sustainability principles:

- Reducing energy consumption through modernized IT infrastructure
- Lowering carbon emissions with consolidated data center space requirements, workload observation and analysis tools such as Dell™ Live Optics, increased hardware utilization, and cloud adoption
- Integrating best practices for materials, including incorporating recycled materials in production and packaging

Optimizing Capital Sustainability

The foundational element for sustainable IT is the server hardware infrastructure, whether it sits in an on-premises data center, is used across a hybrid cloud environment, or is deployed at a branch office. Developments in hardware power management, optimized thermals, and design improvements from Dell Technologies have increased the energy efficiency of Dell™ servers wherever they are located.

Platform Power Management

Tools such as the Integrated Dell Remote Access Controller (iDRAC) provide telemetry for users to view power usage, and thereby manage and regulate power consumption. iDRAC is a piece of hardware that sits on the server motherboard and allows system admins to update and manage the server, even when it is turned off, through a web-based or command-line interface (CLI). Its capabilities include power monitoring (such as the ability to view power status, history of power use, current averages, and peaks), power capping (enabling users to view and set minimum and maximum power consumption), and power control (with the ability to power on/off, reset the system, and perform a graceful shutdown).

Another way to manage platform power is through other tools, such as Dell™ OpenManage™ Enterprise Power Manager. OpenManage Power Manager can help you reduce power consumption with the option to intelligently throttle power during off-peak hours and set policy controls. Users can identify issues on individual servers or racks and address those issues before they create a service-level agreement (SLA) impact. Power Manager also provides automated power thermal management, which lets IT admins know who is consuming power, with detailed historical reports (back to one year) for individual devices and racks/groups. Additionally, Dell Technologies is also the first tier-1 server vendor to provide a view of server carbon emissions in real time.

BIOS-level options can be configured to balance power efficiency with performance under various workload types. The PowerEdge system profile in BIOS enables IT administrators to easily change a group of settings that define how the server is configured. Admins can also choose a power-efficient scenario that provides recommendations for optimal power efficiency while still retaining high performance characteristics.

Smart Cooling

A sustainable server infrastructure integrates features and technologies that increase system cooling capacity and is designed for optimal thermal performance. Dell servers are designed with Smart Cooling options for air cooling and direct liquid cooling (DLC) that help reduce energy usage. Multi-Vector Cooling (MVC) features intelligent thermal algorithms that help minimize fan and system power consumption while maintaining component reliability. It also enables custom cooling options that can be managed via the iDRAC graphical user interface (GUI). DLC provides CPU cooling with liquid that holds up to four times the heat capacity of air, thus reducing the burden on a systems' fans and the data center's cooling infrastructure.

Increased system cooling capacity helps improve energy efficiency (in terms of power usage efficiency [PUE]), and it enables higher compute density and an improved return on investment (ROI).

Design Improvements

The latest PowerEdge servers are physically designed for improved thermal performance, allowing hot air to exit the system quickly with a reconfigured layout and high-performance fans. A balanced airflow design creates exhaust lanes for hot airflow from the CPUs to prevent overheating of downstream hardware components.

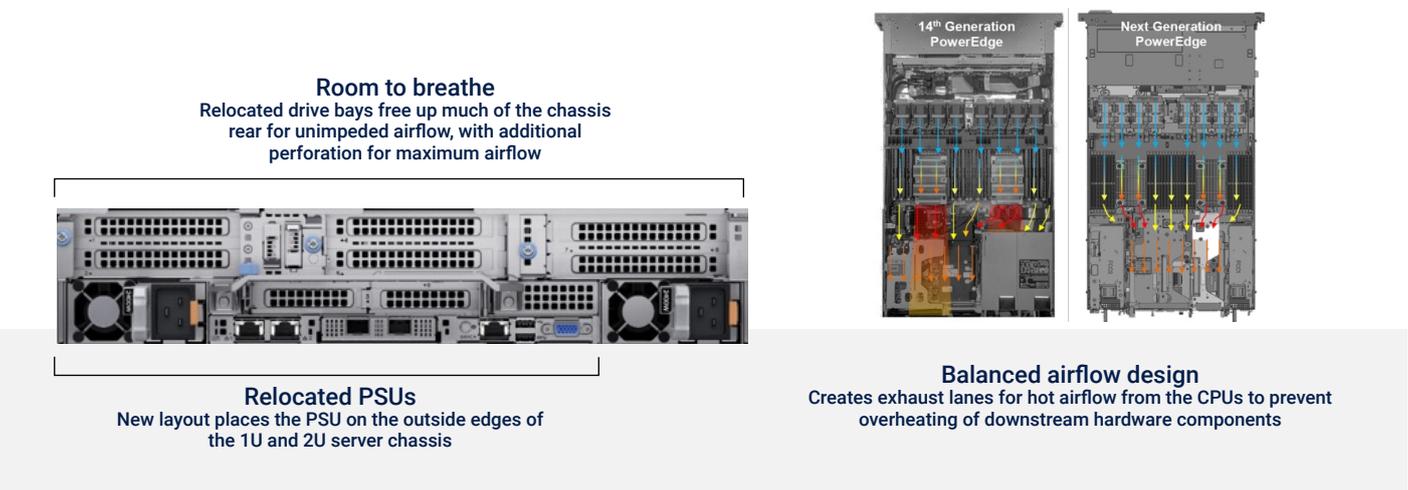


Figure 1 | Physical design elements can help reduce energy use by allowing air to flow and cool server components

Optimizing Operational Sustainability

Many enterprises are adopting a hybrid-cloud approach to IT infrastructure that can support their operational sustainability goals. Microsoft Azure hybrid-cloud solutions, which include Azure cloud and Azure Arc-enabled infrastructure, bridge the gap between on-premises infrastructure and the public cloud. This allows enterprises to bring the sustainability and business benefits of the cloud to workloads and data that cannot be moved to the cloud. Hyperconverged infrastructure (HCI) can go one step further to make hybrid cloud environments more manageable by combining compute, storage, and networking within a single system. This consolidation helps reduce space requirements, and therefore power consumption and cooling costs, providing an overall better TIS.

Dell Technologies and Microsoft's partnership supports ongoing integration of their enterprise portfolios. Users gain the advantage of modernizing their IT infrastructures with purpose-built hardware and software solutions, while eliminating the need to manage multiple vendor contracts. Together, Microsoft Azure hybrid-cloud solutions on validated Dell servers can help enterprises streamline management and improve energy efficiency in several ways:

- Public cloud users can gain up to 98 percent more carbon efficiency and up to 93 percent more energy efficiency, compared to on-premises options, with their workloads on Microsoft Azure (depending on specific server usage, renewable energy purchases made, and other factors).⁵
- Dell platform-management tools integrate with Windows®, Microsoft® System Center, and Windows Admin Center for management of PowerEdge and Microsoft environments. IT admins can manage servers to run as efficiently as possible while meeting workload performance needs. Windows Server® helps users tune server settings to obtain performance or energy-efficiency gains, especially when the nature of the workload varies little over time. Windows Server helps balance needs according to power and performance to avoid running at maximum CPU frequency.
- With Azure Stack HCI, enterprises can take advantage of the latest hardware technologies to optimize resource utilization, allowing them to do more work on fewer servers that combine compute, network, and storage functions. Because Azure Stack HCI uses less hardware than legacy server solutions, it results in less heat generation.
- Hybrid solutions enabled through Azure Arc can help increase efficiency with infrastructure and data estate. When modernizing on Azure Arc-enabled servers, IT organizations can achieve greater usage efficiency and also potentially benefit from management cost reductions in their existing environments. Azure Arc-enabled data services further increase efficiency compared to traditional on-premises solutions by consolidating data workloads onto a smaller IT footprint that is more energy efficient.
- Beyond providing immediate efficiencies, implementing the type of centralized, modern IT management made possible by Azure Arc can provide clearer insights into IT resource usage and needs. These insights can help with resource allocation to flexibly grow business value and strategically attain sustainability goals.

Responsible Practices That Add Up

When it comes to IT sustainability, it makes sense to take a holistic look not only at a vendor's end products, but also at the entire lifecycle. How IT vendors conduct their day-to-day business matters to the triple bottom line. Vendors that have adopted innovative, sustainable practices consider the end-to-end impact to the environment of everything from internal operations and supply chains to product materials and packaging.

Recycled and Reduced Materials

One example of a company adopting innovative sustainable practices is the reuse and recycle best practices adopted by Dell Technologies, including a take-back process that provides material for reuse in new products. PowerEdge servers contain up to 35 percent recycled materials,⁶ with internal components such as latches, air shrouds, and casings using recycled plastics. Dell Technologies' goal by 2030 is to increase the recycled material composition of its products to at least 50 percent and to use recycled or renewable materials for 100 percent of packaging.⁷ PowerEdge components are already delivered in a corrugated paper box with up to 87 percent recycled fiber. These practices have earned Dell Technologies 37 Electronic Product Environmental Assessment Tool (EPEAT)-registered products, among the highest in the industry.⁸ Dell servers were the first to come to market with a Silver EPEAT rating, and many of the company's servers have earned an ENERGY STAR 3.0 rating from the US Department of Energy.

Green IT Initiatives

Dell Technologies has numerous sustainability goals in place, including net zero greenhouse gas emissions across Scopes 1, 2, and 3 by 2050, reducing Scope 1 and 2 greenhouse gas emissions by 50 percent by 2030, and sourcing 75 percent of electricity from renewable sources across all Dell Technologies facilities by 2030—and 100 percent by 2040.⁷

Likewise, Microsoft has taken the stance to become a carbon-negative corporation by 2030, with the additional goal to remove its historical carbon emissions from the atmosphere by 2050.⁹ Since the issuance of the United Nations' Brundtland Commission report, Microsoft has joined with people, businesses, and governments in support of four main principles for achieving a sustainable future:

- Carbon-negative—Using carbon-free energy, offsetting carbon energy used, and removing carbon from the environment by modernizing IT infrastructure and making use of Azure Arc-enabled data services
- Water-positive—Reducing cooling water use due to smaller data center footprints using Azure and Azure Arc for hybrid solutions
- Zero-waste—Reducing waste by increasing current hardware utilization and adopting cloud flexibility to reduce IT hardware procurement
- Healthy ecosystems—Protecting habitats through using resources for IT more efficiently

Microsoft also has created Azure sustainability guidance that is focused on helping customers and partners achieve sustainability goals. The initial focus of the guidance is on workload optimizations geared to encourage more sustainable application design and storage options, strategies for continuous integration (CI)/continuous deployment (CD) pipelines and automation, and network considerations that reduce traffic and the amount of data transmitted to and from applications, to name a few.

Using Technology for a More Sustainable Future

With the imperative to incorporate sustainability for business and environmental reasons, enterprises today need to carefully consider their total impact on sustainability throughout the technology stack. With dedicated sustainability practices, companies like Dell Technologies and Microsoft can help the industry move forward and achieve carbon neutrality and more sustainable IT.

Start achieving your sustainability goals today. Visit

www.dell.com/en-us/dt/corporate/social-impact/advancing-sustainability/climate-action.htm.



Modernize with Windows Server 2022. The cloud-ready operating system that boosts on-premises investments with hybrid capabilities.

¹ IEA. "Data Centres and Data Transmission Networks." September 2022. www.iea.org/reports/data-centres-and-data-transmission-networks.

² IDC. "IDC FutureScape: Worldwide Future of Digital Infrastructure 2022 Predictions." Doc #US47441321. October 2021. www.idc.com/getdoc.jsp?containerId=US47441321.

³ IDC. "Driving ESG from IT: Key Takeaways from IDC's Global CIO Advisory Board – May 2022 Edition." Doc #US49423022. July 2022. www.idc.com/getdoc.jsp?containerId=US49423022.

⁴ IDC. "IDC FutureScape: Worldwide Sustainability 2022 Predictions." Doc #US48300021. October 2021. www.idc.com/getdoc.jsp?containerId=US48300021.

⁵ Microsoft. "The carbon benefits of cloud computing." 2020. http://download.microsoft.com/download/7/3/9/739bc4ad-a855-436e-961d-9c95eb51daf9/microsoft_cloud_carbon_study_2018.pdf.

⁶ Dell Technologies. "Sustainability on Dell EMC PowerEdge." 2021. www.delltechnologies.com/asset/en-us/products/servers/briefs-summaries/poweredge-sustainability-overview.pdf.

⁷ Dell Technologies. "Our purpose in action." 2022. [//www.delltechnologies.com/asset/en-us/solutions/business-solutions/briefs-summaries/delltechnologies-fy22-esg-report.pdf">www.dell.com/en-us/dt/corporate/social-impact/esg-resources/reports/fy22-esg-report.htm?hve=read%20report#pdf-overlay>//www.delltechnologies.com/asset/en-us/solutions/business-solutions/briefs-summaries/delltechnologies-fy22-esg-report.pdf](http://www.dell.com/en-us/dt/corporate/social-impact/esg-resources/reports/fy22-esg-report.htm?hve=read%20report#pdf-overlay).

⁸ Global Electronics Council. EPEAT registry. Accessed April 2023. <https://epeat.net/computers-and-displays-search-result/page-1/?size=252&countryId=112&manufacturerId=317&productName=Latitude&productStatusId=1>.

⁹ Microsoft. "Microsoft CEO Satya Nadella on Microsoft's Commitment to Become Carbon Negative by 2030." January 2020. www.youtube.com/watch?v=LeOxTI-s48A.



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