White paper

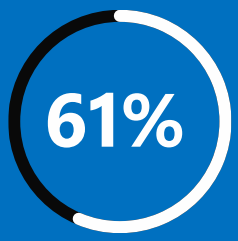
Modernize and drive sustainability with Azure hybrid solutions

Deliver higher efficiency and lower costs for sustainable IT operations with Azure Arc

Microsoft Azure

Forward-looking strategy has always focused on anticipating challenges and building business value. In today's increasingly connected and technology-powered world, business leaders need to keep their eyes on another ball as well: environmental sustainability. Business concerns about sustainability can be driven by many factors, including aligning with customer desires, meeting government mandates, and fulfilling moral responsibilities. And business leaders must do all this while still building better, more efficient businesses.

Enterprise leaders increasingly pivot on sustainability as a key element of their strategic planning. Per Accenture and the United Nations Global Compact, sustainability has become a top-10 business priority for the first time ever, with more than triple the interest from last year.[1] For a majority of businesses, sustainability is more than an aspiration or a priority—it's a strategic imperative. A report by Forrester report found that 61 percent of surveyed Fortune Global 200 companies created senior management and executive positions to lead sustainability programs.[2]



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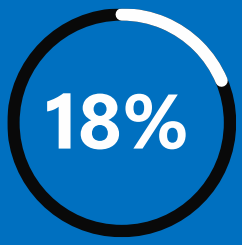


of companies have a sustainability strategy in place or have fully defined sustainable IT targets.[1]

The drive for greater sustainability on the part of the C-suite plays out directly in IT. The increasing computational power harnessed by modern business correlates with increased energy consumption—and can also equate to a larger carbon footprint. Yet currently only 18 percent of companies have a sustainability strategy in place or have fully defined sustainable IT targets.[1]

A company with global operations, Microsoft is very much aware of its responsibility with regard to sustainability. Since the issuance of the United Nations' Brundtland Commission report, Microsoft has joined with people, businesses, and governments to rally around four main principles for achieving a sustainable future:

- Carbon-negative—Using carbon-free energy, offsetting carbon energy used, and removing carbon used from the environment through reducing energy consumption by modernizing IT infrastructure and making use of Azure Arc–enabled data services
- Water-positive—Reducing water use through reducing cooling needs due to smaller datacenter footprints enabled by harnessing 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

Sustainability is critical to keeping our planet habitable, and Microsoft believes that everything from reducing waste to increasing energy efficiency and expanding the output of renewable energy sources is essential to creating sustainable economies and businesses. To this end, Microsoft has committed to becoming carbon negative by 2030 and to removing its historical carbon emissions from the atmosphere by 2050.

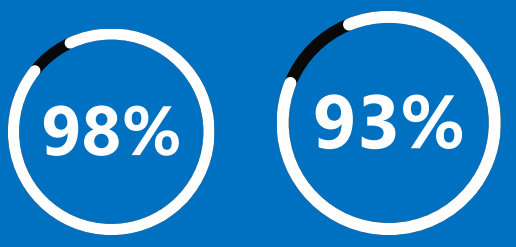
"This is the decade for urgent action, for Microsoft and for all of us to take bold steps forward to address our most pressing challenges. We hope you will join us on this journey."
— Satya Nadella[3]

Sustainability and the Azure cloud

Strategic integration of the Azure cloud accelerates both sustainability progress and business growth for your organization. Azure hybrid cloud solutions extend these benefits to your hybrid environment.

Improve your carbon footprint through Azure services and technologies

Accelerate your sustainability goals and increase the efficiency of your business by evaluating your compute resource utilization, storage, and networking efficiencies. You can cut your energy consumption and costs and reduce the physical footprint of your datacenters when you adopt Microsoft Azure cloud. Doing so also enables you to better develop sustainable products and solutions. You can achieve up to 98 percent more carbon efficiency and up to 93 percent more energy efficiency, compared to on-premises options, when you transition workloads to Azure (depending on specific server usage, renewable energy purchases made, and other factors).[4] In many scenarios, not all workloads can be migrated to the cloud. But even in those situations, Microsoft hybrid solutions can still deliver measurable sustainability benefits.



Workloads moved to Azure can produce up to 98% more carbon efficiency and up to 93% better energy efficiency, compared to on-premises options.[4]

Hybrid IT infrastructure is a bridge between on-premises infrastructure and the public cloud. When you deploy Azure hybrid solutions, they allow you to bring the sustainability and business benefits of the Azure cloud to workloads and data that cannot be moved to the cloud.

Do more with less with Azure hybrid solutions

The key to doing more with less with hybrid solutions is to modernize, optimize, and reinvest. You can modernize your IT infrastructure in order to build business agility while reducing energy usage and IT costs with Azure Arc–enabled infrastructure. And when you modernize your infrastructure in the cloud, you also reduce the amount of physical hardware you need to procure over time, which further lowers the carbon footprint of your IT infrastructure. For workloads that cannot move to the cloud, Azure Arc brings many of the efficiencies of the Azure cloud to your on-premises IT estate.

Azure Arc is a bridge that extends the Azure platform to help you modernize both your IT infrastructure and your applications. When you modernize your infrastructure in the cloud, you achieve consistent development, operations, and security. Azure Arc enables cloud-native app development—and cloud scale, cloud elasticity, and centralized management—on-premises on new, high-efficiency hardware and/or your existing hardware infrastructure, depending on your environment.

You can optimize your infrastructure and datacenter efficiency through best-practice guidance and Microsoft cloud expertise. Advice from Microsoft can help you optimize your workloads for security, reliability, cost efficiency, and sustainability for running apps and services on-premises. Optimization also takes the form of embracing the inherent flexibility of the cloud, which enables you to get the optimal amount of IT resources on demand so that you don't have to procure more hardware than you need for contingencies.

Finally, you can reinvest savings to enable your organization to develop innovative solutions to accelerate sustainability progress and build enduring business value. One way that reinvestment happens is when you use hybrid solutions to repurpose resources to gain efficiency while minimizing your impact on the environment. More fundamentally, hybrid solutions made possible by Azure Arc allow you to gain better, more centralized insight into every facet of your IT infrastructure and your IT needs. This insight helps you to make better strategic decisions about IT to further your sustainability goals and build enduring business value.

Efficiency benefits from Azure Arc and other Azure technologies

IT modernized with hybrid capabilities can help unlock greater sustainability in the enterprise. Hybrid solutions enabled through Azure Arc can help you gain greater efficiency with your infrastructure and data estate. When you update your current hardware with Azure Arc–enabled servers, you can achieve greater usage efficiency and also potentially benefit from management cost reductions in your existing environment. By using Azure Arc–enabled data services, you can further increase efficiency compared to traditional on-premises solutions by consolidating data workloads onto a smaller IT footprint that is more energy efficient.

You can gain measurable reduction in power consumption and reduction in the physical footprint of your datacenter when you modernize and consolidate IT to hyperconverged infrastructure (HCI) with Azure Stack HCI.[5] 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 you better allocate resources to flexibly grow business value and strategically attain your sustainability goals.

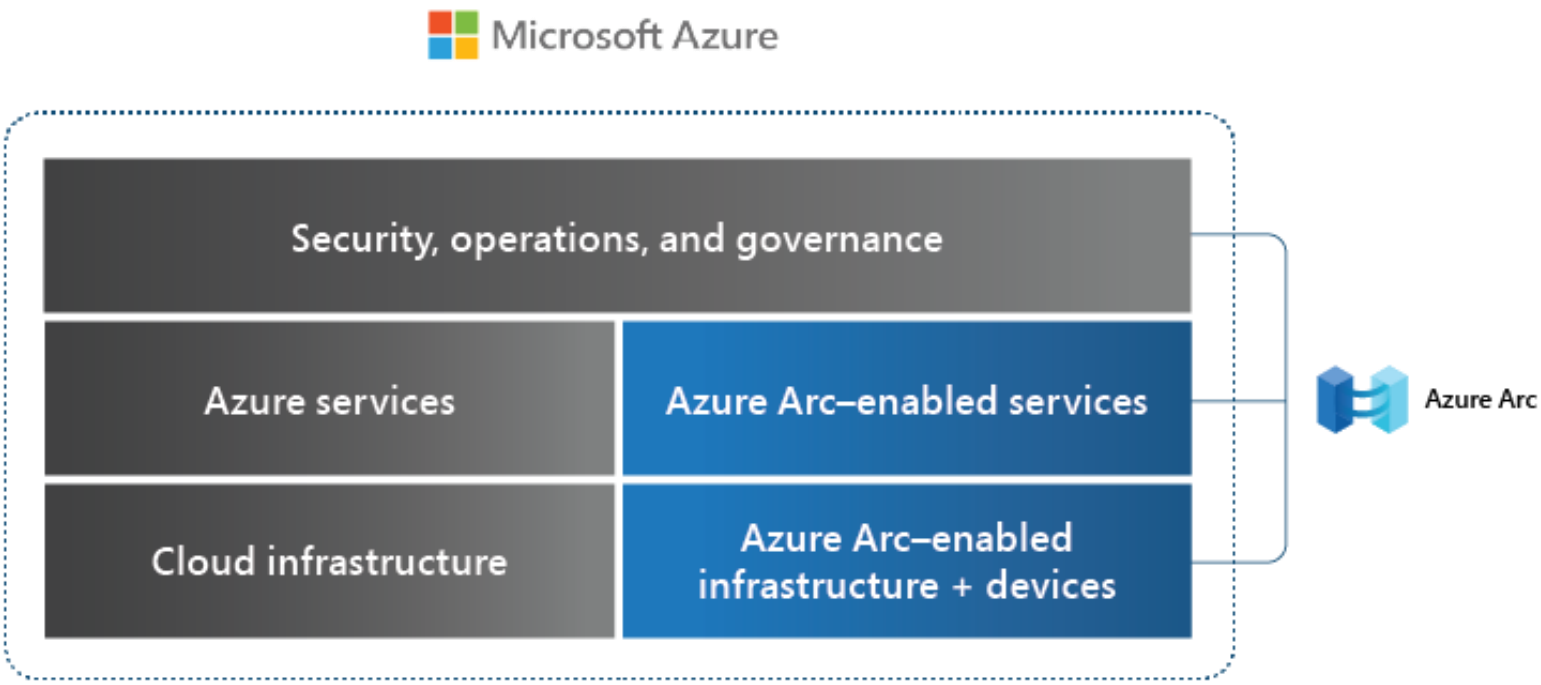


Figure 1. How Microsoft Azure and Azure Arc fit together

Improve your IT estate efficiency with Azure Arc–enabled servers

Azure Arc–enabled servers let you manage Windows and Linux physical servers and virtual machines (VMs) hosted outside of Azure, on your corporate network, or with other cloud providers. This capability means you can reinvest and/or repurpose your existing hardware while reaping the efficiencies of central IT management with Azure.

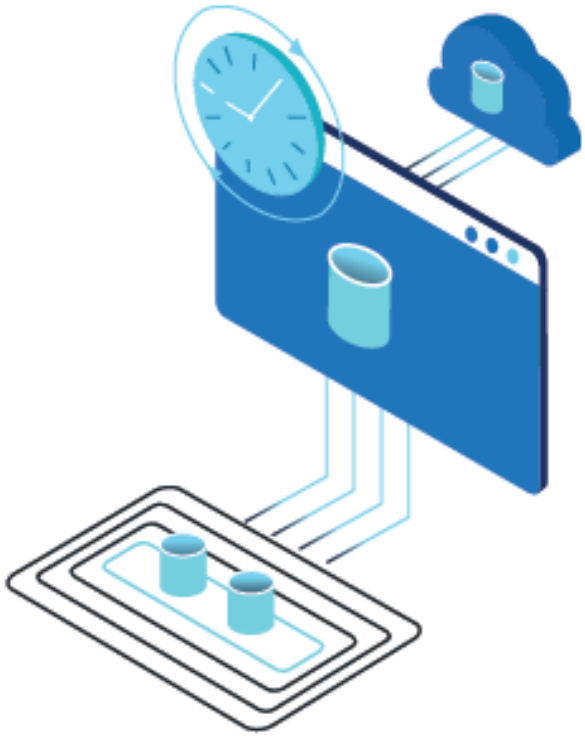
More efficient management helps drive better resource management. Managing what you already own through Azure with greater efficiency will help optimize the physical consumption of those resources. These management improvements help save on IT waste by reusing existing infrastructure, and they can help drive more efficient IT management as well.

Improve resource utilization with Azure Arc–enabled SQL Managed Instance

Azure Arc–enabled SQL Managed Instance combines the benefits of managed Microsoft SQL Server instances in a hybrid and multicloud environment with the flexibility and control of running database workloads on-premises or in other clouds. Azure Arc–enabled SQL Managed Instance has near-100-percent compatibility with the latest SQL Server database engine, and it enables existing SQL Server customers to lift and shift their applications to Azure Arc–enabled data services with minimal application and database changes while gaining better utilization of their existing hardware, with no migration required.

You can improve existing hardware utilization by moving to an Azure Arc–enabled SQL Managed Instance deployment and sharing the resources of a given server between multiple SQL Server instances. Better utilization equates to less power consumption for power and cooling. For example, Azure Arc–enabled SQL Managed Instance can run up to 15 percent faster than SQL Server 2019 Enterprise edition,[6] which can either drive server consolidation or power database servers at high capacity for less time.

Or consider another example that illustrates how Azure Arc–enabled SQL Managed Instance can drive more efficient use of your current hardware investments. Imagine that you have two workloads. Workload 1 is a SQL Server instance that you primarily use during business hours for serving data to a business application, and that you have on hand for light usage during non-business hours. Workload 2 is a SQL Server instance that you use for batch data-processing at night and for light usage for reporting on that processed data during business hours.



With Azure Arc–enabled SQL Managed Instance, rather than using two separate servers for these workloads, you could deploy both of these SQL instances on the same server with 64 cores. During the day, you could allot 60 of those cores to Workload 1 and allot four of the cores to Workload 2. After-hours, you could invert the allocation and give Workload 1 four cores and give Workload 2 60 cores.

Doing something similar to this configuration with SQL Server running in VMs using VMware solutions is possible, but would require complex, custom scripting (especially if you want to avoid application downtime). However, you can scale workloads up and down with Azure Arc–enabled SQL Managed Instance with a single command:

```
az sql mi-arc update --core-limit 4 --name sqlinstance1
```

And if you use Azure Arc–enabled SQL Managed Instance Business Critical, you can switch between both of these SQL instances on the same server with no application downtime. The consolidated hardware uses less power and fewer resources.

Multiply efficiencies with Azure Stack HCI

The Microsoft Azure Arc–enabled infrastructure solution called Azure Stack HCI is an HCI cluster solution that hosts containers and virtualized Windows and Linux workloads and their storage in a hybrid environment. This environment combines on-premises infrastructure with Azure cloud services. Because Azure Stack HCI combines compute, storage, and networking capabilities in a single system, it can help you reduce power consumption, space requirements, and cooling costs in two principal ways.

First, Azure Stack HCI enables efficient hardware utilization. With Azure Stack HCI, you can take advantage of the latest server hardware technologies to optimize resource utilization. This means that you can get more work done with fewer servers, reducing power consumption and space requirements in your datacenter. And because Azure Stack HCI uses less hardware than more traditional (legacy) server-SAN solutions, it generates less heat, which reduces the cooling requirements for the datacenter, further lowering energy costs.

Second, Azure Stack HCI uses more energy-efficient hardware than most legacy hardware deployments. For example, Azure Stack HCI supports the latest energy-efficient hardware technologies, such as solid-state drives (SSDs), which consume less power than traditional spinning disks. Efficiencies realized in running your hardware further reduce server energy consumption and cooling requirements, which helps optimize datacenter efficiency.

Azure Stack HCI efficiencies also extend to workload monitoring and management. Azure Stack HCI enables you to manage your workloads more efficiently, which can result in lower power consumption. For example, you can use Azure Stack HCI to consolidate multiple workloads onto a single system with less need to keep excess capacity in reserve due to automated management from Azure Stack HCI. Streamlining your hardware-capacity needs can help reduce the number of servers required and can thereby reduce power consumption, lessening your environmental impact in the process.

Combine efficiencies with Azure Virtual Desktop

Azure Virtual Desktop provides another way by which you can increase several efficiencies within your organization. With Azure Virtual Desktop, you can set up a scalable and flexible environment and create full desktop-virtualization environments in your Azure subscription. Doing away with even a portion of your physical laptop and desktop computer fleet reduces your carbon footprint by decreasing your hardware procurement needs, as you can modernize your infrastructure in the cloud. Cutting dependency on physical laptops and desktops also provides you with greater flexibility to scale your desktop fleet up and down as your business needs change.

Azure Virtual Desktop also helps you conserve energy. VMs running in Azure consume less energy than physical desktops because VMs lack separate computer components such as fans or hard disk drives that need to be powered whenever a physical laptop is running. Moreover, with the new Windows 11 and Windows 10 Enterprise multi-session capability (exclusive to Azure Virtual Desktop and the Remote Desktop Session Host [RDSH] role on Windows Server), you can greatly reduce the number of VMs and the amount of operating system (OS) overhead required while still providing the same resources to your users. For situations in which you have high data gravity or data sovereignty, you can benefit from Azure Virtual Desktop but use it on-premises with Azure Virtual Desktop for Azure Stack HCI. For Azure Virtual Desktop—and for all of Azure Arc—centralization brings numerous efficiencies with it. The same number of user desktops (or servers, for that matter) can be efficiently managed with fewer resources by harnessing Azure and Azure services on-premises. But centralization and management using Azure and Azure Arc provide another important efficiency that is often overlooked: security.

Increase sustainability with centralized hybrid security

Security deepens sustainability for organizations like yours in multiple ways. Azure security tools and controls are built into the platform, making them easy to discover and turn on. Both Azure and Azure Arc also offer broad policy support, automation, and actionable best practices to streamline security. And, like modernized management using Azure Arc, security based on Azure reduces the resources that you need to successfully defend your IT infrastructure. Crucially, from the standpoint of business and environmental sustainability, these resources encompass both staff and physical infrastructure. The need for less of the latter creates a more sustainable IT organization and business.

Beyond more efficient security, *effective* security provides sustainability benefits as well. Remediation and recovery after a security or data breach is very resource-intensive. This process consumes essential staff hours and other resources in a crisis-driven environment that is never efficient.

Azure hybrid solutions for sustainable industries

Beyond operational efficiency for all companies, the Azure services made available on-premises through Azure Arc can meet specific needs in different industry verticals. The following are some examples.

Retail

Digital store twins, autonomous and semi-autonomous stores, and micro-warehouses with robotic fulfillment: all of these are manifestations of "smart stores" made possible through technologies such as artificial intelligence (AI) and the Internet of Things (IoT). Azure Arc makes it possible to bring the Azure services that can power these retail-efficiency multipliers to brick-and-mortar store locations that might have limited IT resources or internet connectivity. For example, retail IT administrators can inventory, organize, and provision resources for point-of-sale apps and other apps at the edge by using Azure Resource Manager through Azure Arc, or they can deliver infrastructure as code at the edge at retail locations by using Azure Automation via Azure Arc.

Azure Stack HCI makes it possible to make use of the efficiency and power savings of Azure in edge retail locations. Retailers can easily deploy energy-efficient HCI to retail locations that might lack onsite administrators. And admins in retail businesses can use Azure Policy and Azure Arc to maintain organizational data-sovereignty requirements for customer data running on Azure Stack HCI.

Azure Arc–enabled SQL Server is ideal for maintaining server-based applications, reusing existing datacenter and SQL Server investments, and managing all SQL Server operations from one place.

Retailer consolidates virtual desktop infrastructure and saves big on power consumption[7]

A food-and-beverage retailer operating out of the United Kingdom and across 36 countries worldwide had a hybrid IT environment but needed capabilities to freely move workloads between its on-premises datacenters and the Azure cloud. To meet this need, the retailer migrated its on-premises servers to Azure Stack HCI. The resulting on-premises infrastructure reduced processing time for its world-wide virtual desktop infrastructure (VDI) by 50 percent. Only after the deployment was complete did the retailer also discover that the Azure Stack HCI infrastructure consumed 100,000 kWh less energy per year compared to its previous on-premises servers, which goes a long way toward helping the company's IT team meets its portion of the company's aggressive sustainability goals.

Manufacturing

Modernized IT can lead to closer collaboration with suppliers for manufacturing firms. Tighter supplier-provider collaboration can help manufacturers source materials more cheaply, better manage their internal production and business processes, and get a more holistic view of their products' overall sustainability profiles, from processing through production. With the right IT, manufacturers can even help their customers run their plants and deliver services more effectively, efficiently, and sustainably.

The key to greater transparency in manufacturing is IT that can span multiple clouds and extend on-premises. Such IT—made possible through Azure Arc—can help manufacturers navigate changing business landscapes and gain better strategic insights into their sustainability.

Manufacturers can also increase operational efficiency and productivity by moving computing to the edge. Azure Arc enables companies to use Azure IoT Edge to bring cloud intelligence to the IoT devices that they use to monitor their production lines. Companies can run Azure SQL Managed Instance on Azure Stack HCI in order to take advantage of its onsite scalability and intelligence for localized insights, with minimal latency. And they can use Azure Machine Learning on Azure Stack HCI to run AI models where they are used on production lines. Operational and IT efficiencies made possible with Azure hybrid solutions such as these can boost productivity and increase overall sustainability.

Tile manufacturer reduces carbon footprint and enhances operational performance[8]

A major ceramic tile manufacturing company in the Netherlands was at a crossroads. Historically, it had supplied its IT department with self-managed, on-premises datacenters. However, the company's IT environment was aging. It was based on older hardware that couldn't be cloud-integrated or centrally managed, and its various support contracts were ending. At the same time, the company couldn't fully move to the cloud either; the manufacturer needed to retain workloads on-premises because it ran applications that required low latency and on-premises support, it had IoT applications that needed local connections, and it had compliance and regulatory considerations to contend with. The company needed a reliable, consistent solution to ensure that business-critical applications were always performing, while simultaneously leaning into the flexibility, scalability, and manageability of the cloud.

The ceramic manufacturer ultimately chose Azure Stack HCI because it was the right tool for the company to build an environment that was cloud-based and easy to manage, but that also made it possible for the environment to remain on-premises. With Azure Stack HCI, the company brought the cloud to its production facilities, and it now runs its most vital, business-critical workloads on Azure Stack HCI. Azure Stack HCI also enabled the company to drastically consolidate its server infrastructure, going from two full 19-inch racks to one half-rack per datacenter, which saves power and reduces the company's carbon footprint.

The company has been able to maintain operational integrity, which is crucial for a factory that needs to run continuously to produce its tiles. The company has realized greater scale, flexibility, and reliability with less effort and outlay, and the centralized management that the company has gained with Azure Stack HCI has resulted in greater efficiency and productivity. Azure Stack HCI was the right solution for the company to ensure the performance of its business-critical applications.

Stainless-steel maker forges sustainable business and IT operations[9]

A leading steel producer based in Finland sought to institute not just operational changes but also cultural changes in the company through digital transformation. Steel smelting and forging is enormously energy-intensive, and the steel-maker worked to digitalize operations end-to-end at its largest plant in order to save power. Digitalization ultimately enabled the company to achieve the lowest environmental footprint in the steel industry. More dramatically, digitalization powered by Azure helped the company increase production at its flagship plant by 10–15 percent and reduce quality defects by 40 percent.

Transformation with Azure has helped make the entire corporate culture of the steel company more data-driven. Not only has this changed how the firm makes decisions—shifting from intuition founded on experience to analysis based on data—but it has also helped the company narrow the skills gap between its veteran employees and its new hires. Experienced employees can build data-powered models that newer employees can use to immediately become more productive.

Not all of the company's workloads can be moved to Azure. In order to bring the same transformative benefits of Azure to its remaining workloads—and to further improve IT efficiencies—the steel firm is now also integrating Azure Stack HCI for its on-premises IT operations. The company expects to reap continued benefits by further expanding its digital transformation, both to improve its operations and to increase its overall sustainability.

Sustainable resource company unites on-premises and cloud infrastructure into a single monitoring solution[10]

A major South African natural-resources firm began its transformational IT upgrade journey in 2017. Before this transformation, the company had struggled to manage its widespread infrastructure. For example, the company has teams that work across a range of sites that include field locations, production sites, manufacturing facilities, and branch offices. Because managing this variety of hardware deployments was such a challenge for the company's IT staff, the company expanded its scope of transformation and sought to consolidate and enhance oversight of its operational technology (OT), IoT, and IT environments in Azure.

The company was an early adopter of Azure Arc. It now runs more than 200 Azure Arc–enabled servers—and that number is growing. The company achieved much-needed visibility while uniting its infrastructure across both its on-premises and cloud environments.

Investments in the cloud have helped fuel the company's wider sustainability initiatives. Consolidating some workloads on Azure and centralizing management from the cloud has brought the company closer to building a substantial, renewable-energy-based business for South Africa, all while providing the company with more efficient IT and business operations.

Public sector

For the public sector, where cost pressures are especially high, Microsoft hybrid solutions can bring reductions in infrastructure and management costs. Azure Arc can help governments and other public institutions unlock efficiencies in management, security, and resource utilization. And Azure Stack HCI can increase power and other efficiencies on-premises while increasing performance and flexibility.

Smart city built with Microsoft hybrid solutions[11]

A municipality in Taiwan was saddled with inefficient data management. Facing the growing burden of siloed data, sprawling IT projects, and a wide variety of non-standardized data types to work with, this city opted to implement the first municipal hybrid deployment of Azure Arc in Taiwan in order to better manage all of its data.

The built-in high-availability (HA) capabilities of Azure Arc reduced management overhead for the city. Moreover, adopting Azure Arc–enabled SQL Managed Instance cut deployment time for new databases down to an hour. Previously, this was a time-intensive and complicated process that required significant effort from municipal IT workers.

The hybrid capabilities of Azure Arc produce additional efficiencies for the city by providing an elastic environment with cloud-extension services. A prime example for the city is IoT integration; city engineers can now more quickly and efficiently track down physical infrastructure problems such as potential sewage leaks. Previously, such troubleshooting had to be done manually, which was both time-intensive and dangerous, as the process potentially exposed city workers to raw sewage. City workers can now perform the same task simply by measuring municipal IoT data.

Transportation driven by data keeps residents on the go[5]

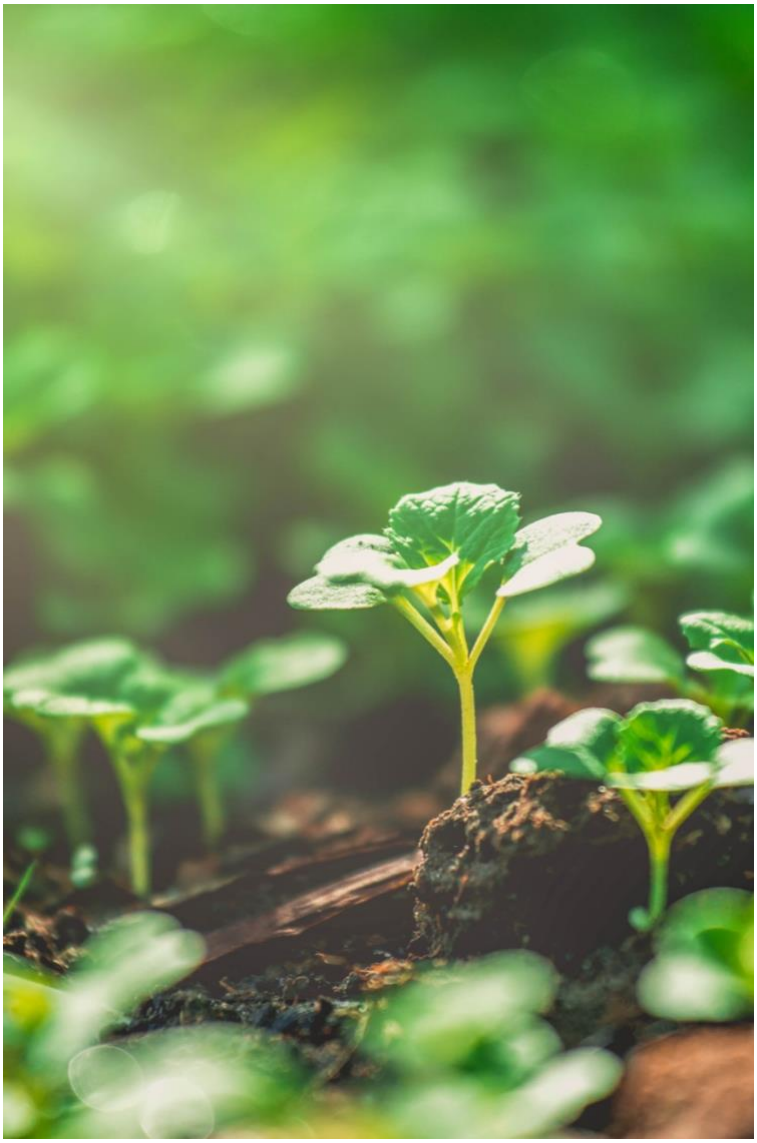
The transport authority for a major city in the United Kingdom undertook the project of modernizing its datacenter as its existing IT infrastructure began approaching end of life. The administration had the explicit goal of creating a hybrid approach to combining cloud management and monitoring services with on-premises infrastructure to provide a more modern and secure datacenter.

Azure Stack HCI gave the transport authority the opportunity to do just that. Azure Stack HCI consolidated the authority's physical servers and replaced on-premises services with cloud-based services. The government agency also migrated its large file services to Azure Files, which left a smaller on-premises storage footprint. With this reduced footprint, the transport authority achieved energy reduction in the range of 30–35 percent.

Improve your business while helping improve the planet with Azure hybrid-cloud solutions

Embracing sustainable IT is crucial not just for the future of the planet, but for the future of your business as well. Azure hybrid cloud solutions can provide sustainability advantages that can also deliver tangible and immediate benefits to your organization. Workloads moved to the Azure cloud can generate as much as 98 percent lower carbon emissions and consume upwards of 93 percent less power.[4] Moving server management to the cloud with Azure Arc can provide better insights into your IT estate. Doing so can also enable you to reuse your existing infrastructure, with improved operational efficiency for the business and optimized datacenter efficiency for IT. Consolidating workloads onto modern, hybrid infrastructure with Azure Stack HCI can yield large savings in power costs and help reduce your environmental impact. With the sustainability and efficiency benefits of Azure hybrid cloud solutions, it's possible to do well by doing good.

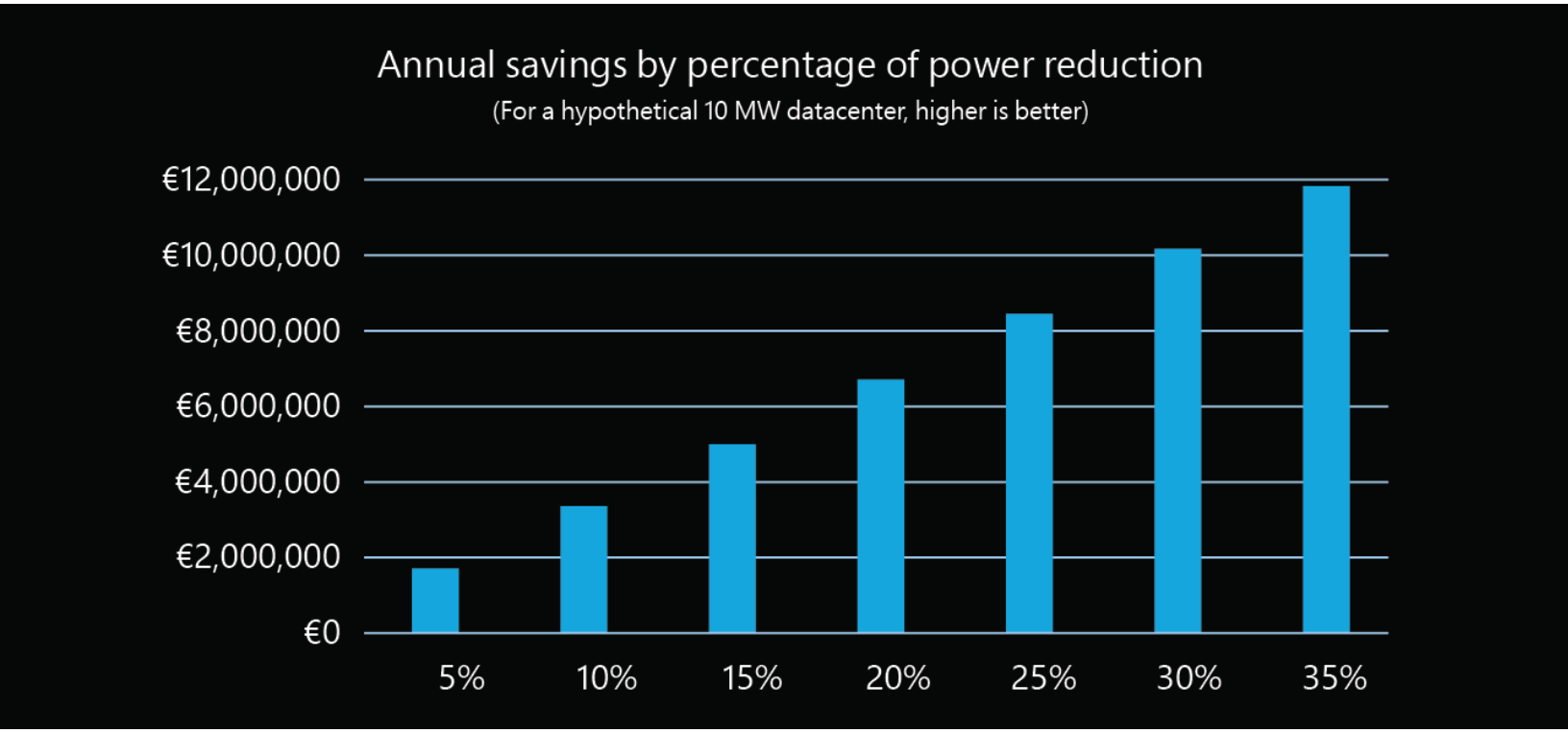
Learn more at
https://aka.ms/Azurehybridsustainability**.**



Appendix: Hypothetical energy-savings calculations for Azure Stack HCI

This appendix illustrates how adopting Azure Stack HCI could potentially save money and reduce the power consumption of a hypothetical European datacenter providing 10 MW of IT power with a power-usage effectiveness (PUE) of 2.1,[12] the ratio of the total amount of power needed to operate the datacenter (including cooling and lights) and the power used solely to run computer equipment.

This illustration assumes a non-household electricity price of €0.1833 per kWh,[13] which yields a savings of €337,199 per year per percentage point of reduction in energy consumption.[14]



[1] Accenture and United Nations Global Compact. "Reimagining the Agenda: Unlocking the Global Pathways to Resilience, Growth, and Sustainability for 2030." www.accenture.com/us-en/insights/sustainability/ungc.
[2] Forrester. "The State Of Environmental Sustainability In The Fortune Global 200, 2022." October 2022. www.forrester.com/report/the-state-of-environmental-sustainability-in-the-fortune-global-200-2022/RES178120.
[3] Microsoft. "Microsoft CEO Satya Nadella on Microsoft's Commitment to Become Carbon Negative by 2030." January 2020. www.youtube.com/watch?v=LeQxTI-s48A.
[4] 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
[5] Microsoft. "Transportation, driven by data: Transport for Greater Manchester keeps its millions of residents on the go." June 2022. https://customers.microsoft.com/en-us/story/1505711025888306180-transport-for-greater-manchester-government-azure-stack-hci.
[6] Microsoft. "Performance benchmark of Azure Arc-enabled SQL Managed Instance." June 2022. https://techcommunity.microsoft.com/t5/azure-arc-blog/performance-benchmark-of-azure-arc-enabled-sql-managed-instance/ba-p/3507010.
[7] Microsoft. "SSP unifies its hybrid infrastructure with Azure Stack HCI and saves more than 100,000 kilowatt hours." February 2023. https://customers.microsoft.com/en-us/story/1605636596879000415-ssp-group-retailers-azure-stack-hci.
[8] Microsoft. "Royal Mosa reduces carbon footprint and enhances performance with centralized, cloud-native management through Azure Arc–enabled Azure Stack HCI." December 2022. https://customers.microsoft.com/en-us/story/1580186360678778121-royal-mosa-manufacturing-azure.
[9] Microsoft. "Outokumpu: A sustainable stainless steel giant with a data-driven mindset." June 2020. https://customers.microsoft.com/en-us/story/

818687-outokumpu-azure-manufacturing-finland-en.

[10] Microsoft. "Exxaro unites on-premises and cloud infrastructure into a single monitoring solution with Azure Arc." December 2022. https://customers.microsoft.com/en-us/story/1514037136829768161-exxaro-energy-azure-arc.

[11] Microsoft. "Taoyuan Builds Smart City with Microsoft Hybrid Cloud." January 2023. https://customers.microsoft.com/en-us/story/1597030753468723113-taoyuancitygovernment-azurearc.

[12] European enterprises surveyed by S&P Global Market Intelligence reported an average PUE of 2.1. Source: S&P Global Market Intelligence. "Improving datacenter efficiency in Europe – the role of PUE." 2022. www.spglobal.com/marketintelligence/en/news-insights/research/improving-datacenter-efficiency-in-europe-the-role-of-pue.

[13] Eurostat. "Electricity prices for non-household consumers." 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_price_statistics#Electricity_prices_for_non-household_consumers.

[14] 10,000 kW * 2.1 (PUE) * 8,760 hours/year * €0.1833/kWh * 1% = €337,199/percentage point/year.