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Public Cloud vs Enterprise Datacenters — A Sustainability Comparison

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Executive Summary

Key Findings

- Datacenter energy consumption is predicted to record a compound annual growth rate (CAGR) of 23.5% from 397 terawatt hours (TWh) in 2024 to 915 TWh by 2028.
- With explosive growth in cloud spending and AI, implementing sustainable cloud solutions is imperative to add value and reduce risk.
- Cloud service providers (CSPs) are more sustainable than enterprise datacenters: specifically, 5x more carbon efficient, 1.9x more energy efficient, and up to 4.8x more water efficient.
- While minimizing the environmental footprint is important, IT and line-of-business (LOB) executives view cloud service providers and AI as important enablers for the organization's sustainability journey.

Recommendations

- Choose cloud providers that match your values and sustainability goals while offering the right solutions including CloudOps and containerization.
- Consider which workloads are best suited to be moved to cloud service providers while managing your hybrid cloud environment.
- Traditional metrics focus on facility efficiency, but additional sustainability benefits can achieved by optimizing environments through software and management.
- While implementing AI sustainably is important, it is only the first step. Build a strategy on using the cloud and AI to actively maximize the positive contributions of sustainable AI.

Implementing Sustainable Cloud Solutions

Implementing sustainable cloud solutions delivers business value by reducing operational costs through energy efficiency, enhancing brand reputation with eco-conscious consumers, and mitigating risks associated with future environmental regulations.

Footprint: The environmental impact of the cloud, including the facility, IT, and applications.

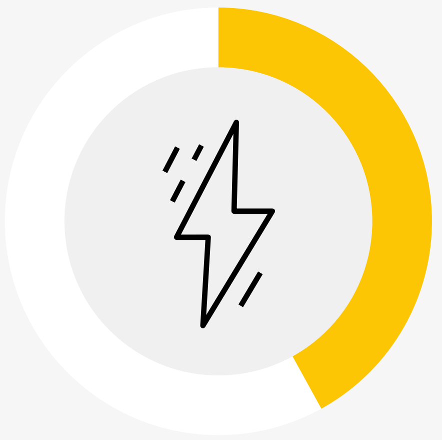
Handprint: The positive environmental impacts of actions, products, or services.

With the investment in datacenters and AI, there is pressure to implement and use resources responsibly.

Total cloud revenue CAGR, 2023-2027

18%

AI datacenter energy CAGR, 2023-2027



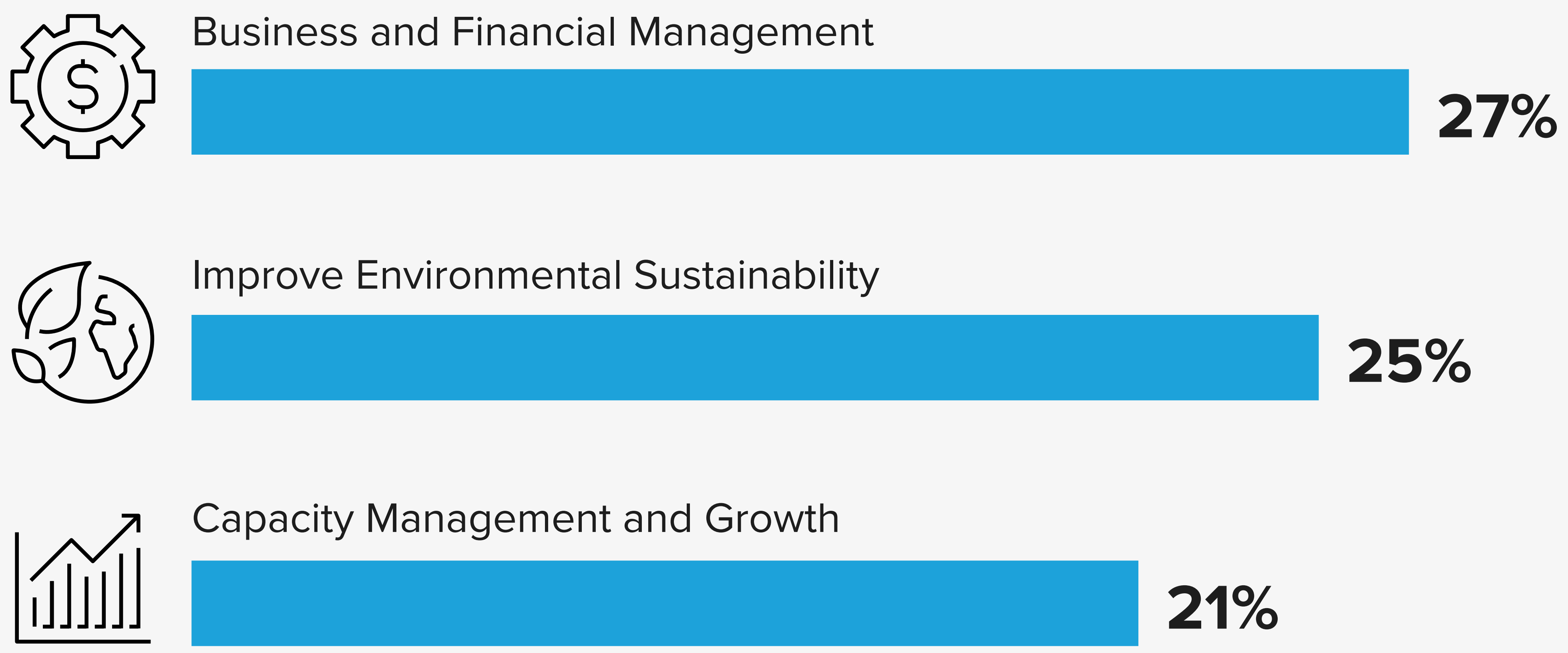
42%

Sources : IDC Worldwide Whole Cloud Forecast, 2025–2028; AI datacenter capacity, energy consumption, and carbon emission projections

Sustainability Is a Priority

In terms of footprint, sustainability remains a top priority, with market projections confirming its importance. This reflects a complex, structural challenge, lacking a short-term fix, especially as demand continues to grow.

Considering your company's priorities regarding datacenters, what are the top 3 initiatives currently?



Source: IDC *Datacenter Operations and Sustainable Survey*, March 2024 (Enterprise respondents)

Driven by AI and digitalization, datacenter energy use is projected to surge from **397 TWh in 2024 to 915 TWh by 2028 — a CAGR of 23.5%.**

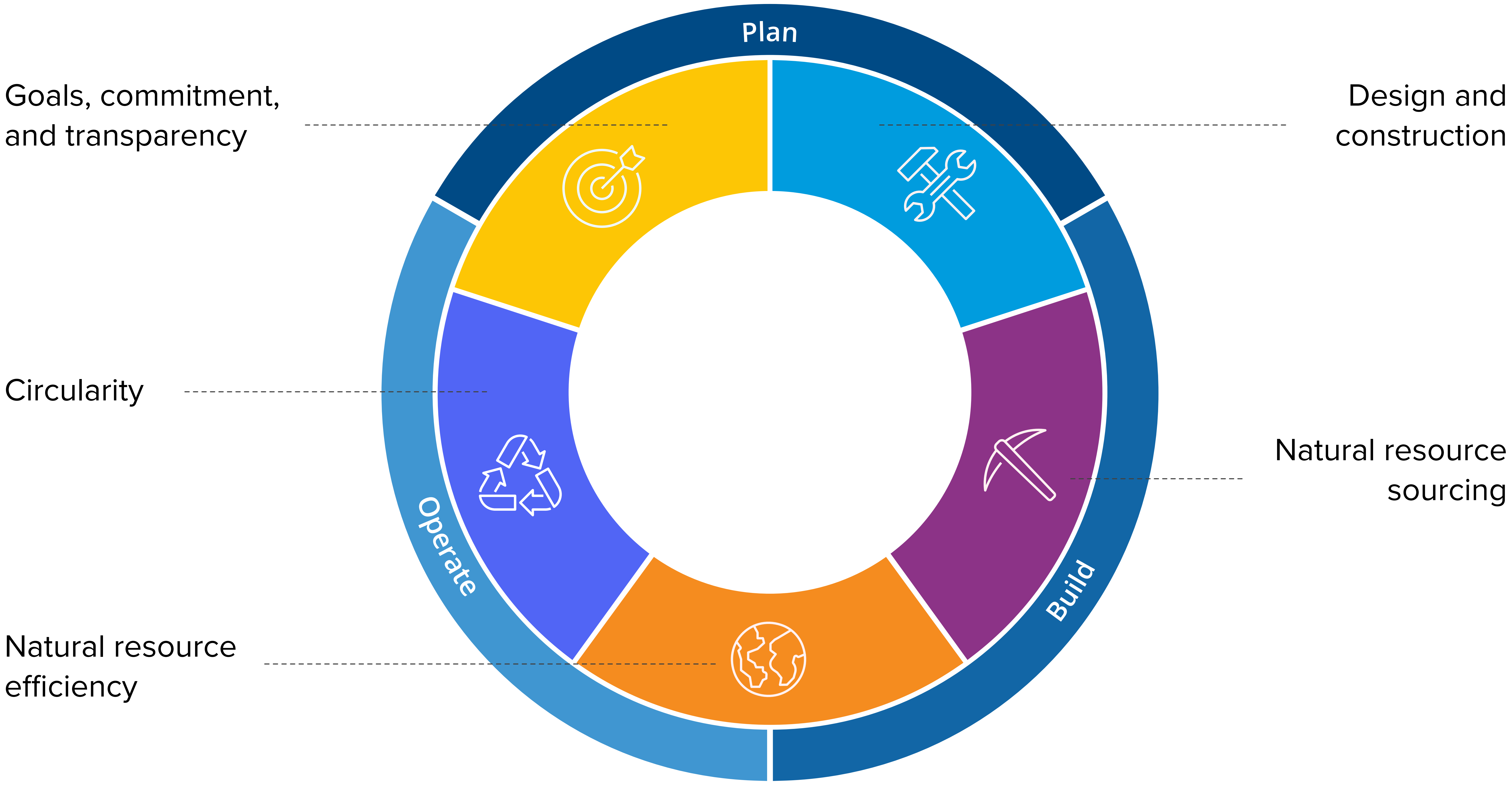
Net new datacenter power by 2028:

108 gigawatts

Source: *IDC, DC Trends: Sustainable Builds and Carbon Emissions*

Defining a Sustainable Cloud

A computing infrastructure and services that are designed, built, and operated with minimal environmental impact.



Recommendations

- **Goals, commitment, and transparency:** Setting clear targets for sustainability, demonstrating dedication, and openly sharing progress.
- **Design and construction:** Utilizing eco-friendly materials and methods in building datacenters and infrastructure.
- **Natural resource sourcing:** Responsibly obtaining materials with minimal environmental impact, namely clean energy.
- **Natural resource efficiency:** Optimizing energy and water usage within cloud operations
- **Circularity:** Adopting a closed-loop system to reduce waste and reuse resources.

Measuring the Sustainability of Cloud Solutions

Carbon usage effectiveness (CUE[1])

A metric used to measure the carbon emissions associated with operating a datacenter and calculated by dividing the carbon emissions (kgCO2) by IT equipment energy (KWh).

Energy efficiency (PUE[1])

A metric used to understand how much of a datacenter's power consumption is going towards computing and how much is being used for supporting infrastructure.

Water usage effectiveness (WUE[1])

A metric that measures the water efficiency of datacenters by determining how many liters are consumed by IT equipment energy.

Circularity

The practice of minimizing waste and maximizing resource utilization by extending equipment lifespan, recovering materials, and designing for sustainability to create a closed-loop system.

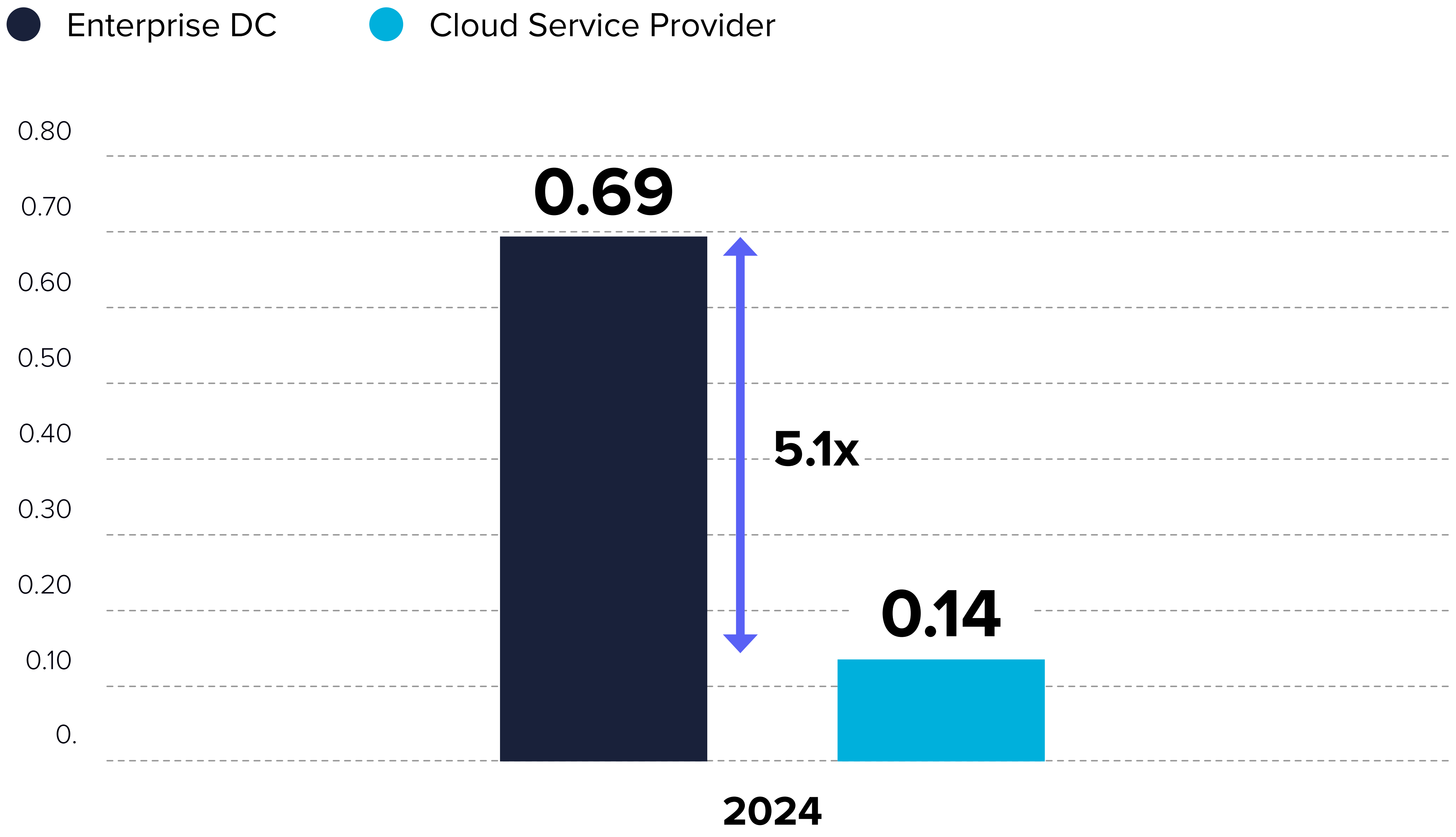
By measuring the key environmental impacts of a datacenter, organizations can make informed data-based decisions to improve their overall environmental footprint.

1. Measures aspects of build & design, natural resource sourcing, and natural resource efficiency in IDC's definition of a sustainable public cloud

Are Cloud Service Providers or Enterprise Datacenters More Environmentally Efficient?

According to IDC research in 2024, cloud service providers were over 5x more carbon efficient than enterprise datacenters.

Carbon usage effectiveness



Source: *IDC, DC Trends: Sustainable Builds and Carbon Emissions*

Reasons shared public cloud datacenters are more efficient:

Powered by clean energy sources — CSP datacenters increasingly rely on clean energy sources like solar, wind, hydroelectric, and nuclear power.

More efficient hardware and facilities — Modern shared public cloud datacenters are designed with efficiency in mind, utilizing advanced liquid cooling systems, optimized server layouts, and smart building technologies.

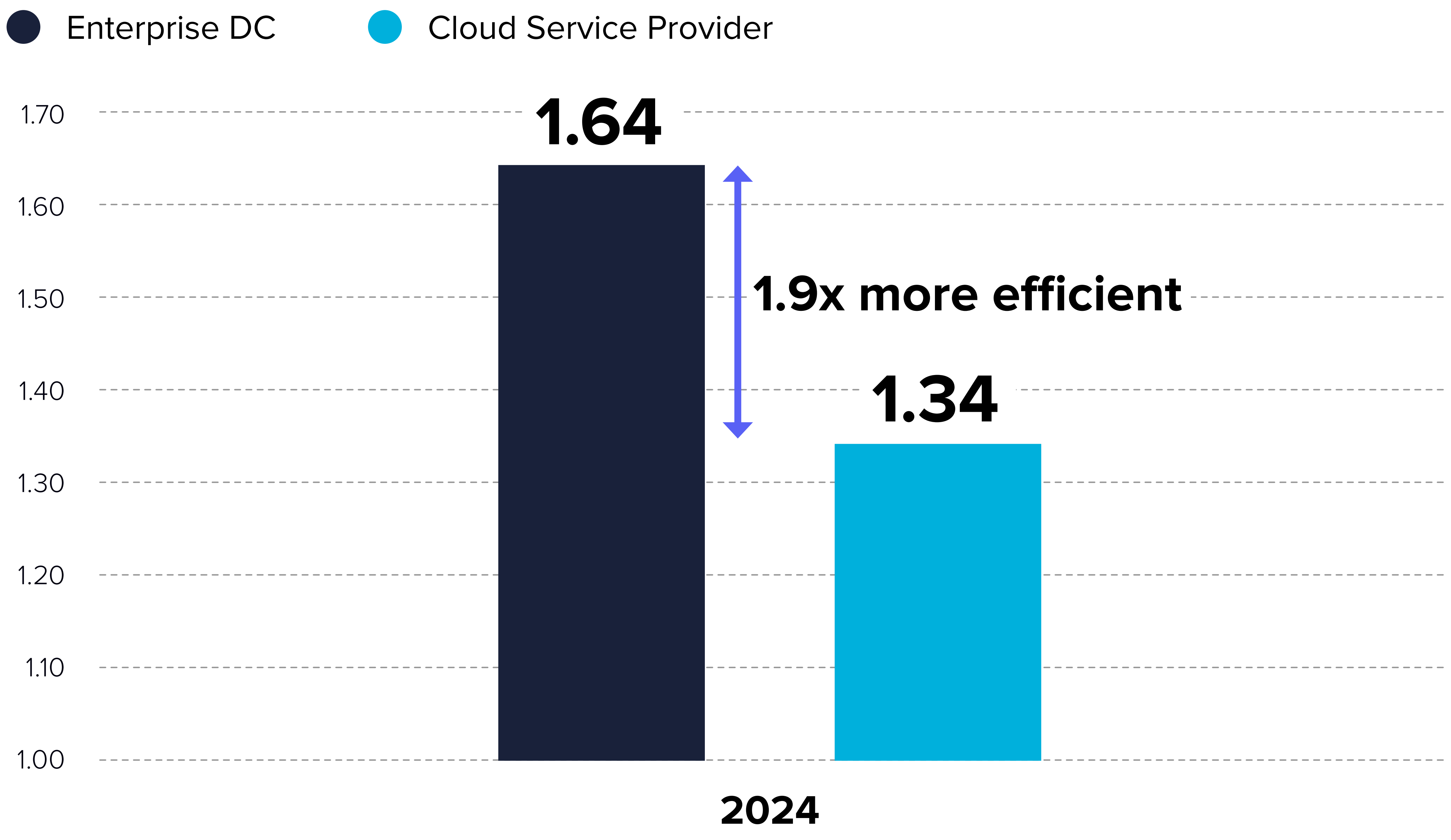
Improved utilization — Shared public cloud datacenters maximize resource utilization by leveraging virtualization and containerization technologies.

Container orchestration — Optimizing resource utilization enables better workload density and reduces wasted computing power.

Cloud Service Providers Build and Operate More Efficient Facilities

Cloud service providers use nearly 2x less energy to power datacenter facilities (non-IT consumption) than their enterprise counterparts.

Power usage effectiveness



Source: *IDC, DC Trends: Sustainable Builds and Carbon Emissions*

Annual energy savings for a 5-megawatt datacenter with 40% average IT utilization:

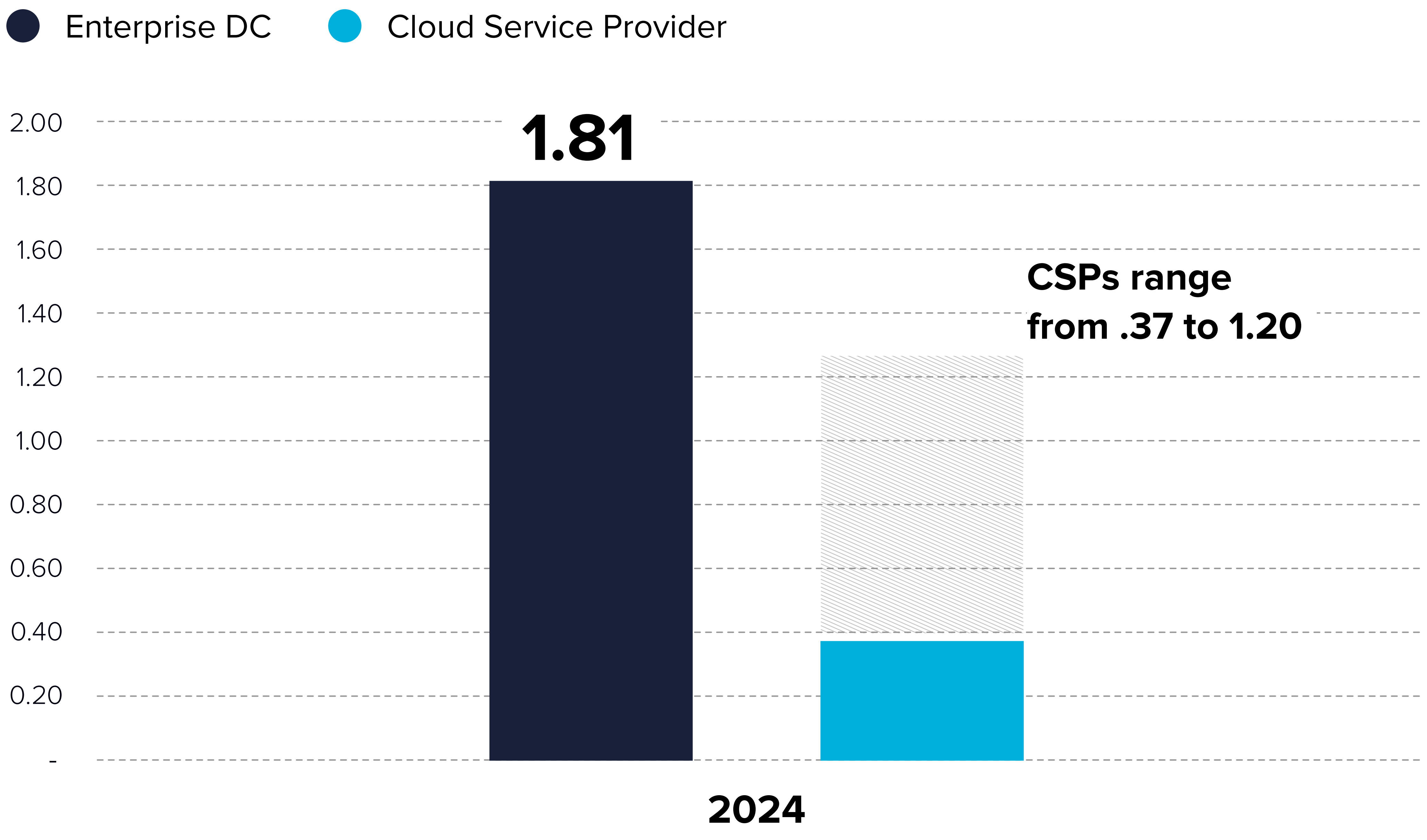
	Enterprise	Cloud Service Provider (worst case)
IT Energy	17,520,000 kwh	17,520,000 kwh
PUE	1.64	1.34
Total DC Energy	28,732,800 kwh	23,476,800 kwh

Migrating the same IT load to a cloud service provider can reduce annual energy consumption by 18.3%, saving 5.3 million kWh.

Cloud Service Providers Exceed Enterprise Datacenters for Water Efficiency

CSPs are driven to increase water efficiency by sustainability goals, cost reduction, and risk mitigation, leading them to adopt advanced cooling technologies and water recycling practices.

Water usage effectiveness



Annual water savings of a 5-megawatt datacenter with 40% average IT utilization:

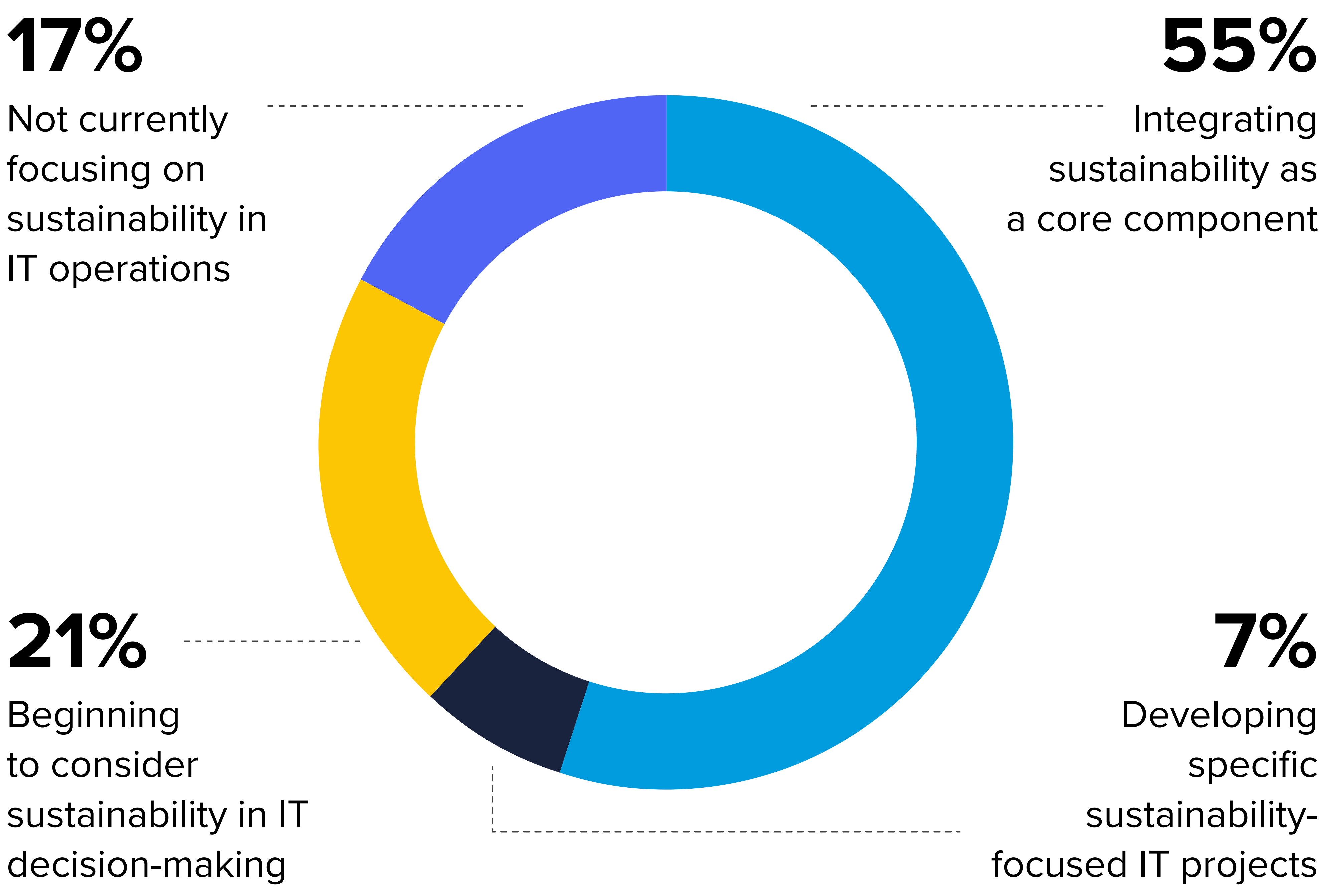
	Enterprise	Cloud Service Provider (best case)	Cloud Service Provider (worst case)
IT Energy	17,520,000 kwh	17,520,000 kwh	17,520,000 kwh
WUE	1.81	0.37	1.20
Liters of Water	37,711,200	6,482,400	21,024,000

Migrating the same IT load to a cloud service provider can reduce annual water consumption by 28.3% to 66.9%, translating to a savings of 10.7 to 25.2 million liters.

Moving Beyond Traditional Metrics

In addition to CUE, PUE, and WUE standard metrics, CIOs integrate other practices as core elements to further reduce environmental impact.

How is sustainability being incorporated into IT operations?



Green software development: Reducing the amount of electricity consumed by software applications.

Hardware efficiency: Optimizing software to use hardware resources effectively extends the lifespan of hardware and reduces the need for new manufacturing.

Grid aware: Software is designed that can adapt its behavior based on the carbon intensity of electricity grids; doing more work when clean energy is available and less when it is not.

Containerization: Core functionalities promote a more efficient and dynamic use of datacenter resources, leading to reduced energy consumption and a smaller environmental footprint.

Small language models: Reduced parameter count and simpler architecture result in lower computational demands, leading to faster processing and reduced energy consumption.

Cloud ops: Practices and technologies are used to manage, optimize, and automate cloud-based infrastructure and applications, ensuring their reliability, security, and efficiency.

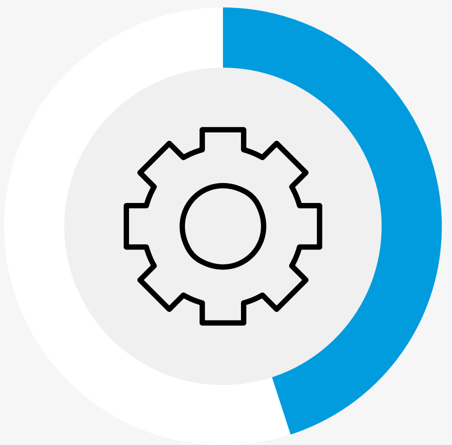
Source: IDC *CIO Sentiment Survey*, July 2024 (n = 395)

Enterprises Prioritize Dynamic Workload Management to Meet Their Sustainable IT Goals

Dynamic Workload Management (DWM) refers to the intelligent and automated allocation of computing resources to applications or workloads based on real-time demand, priorities, and system conditions, including energy availability and carbon intensity.

Which technologies/delivery models are/will be the most relevant to meet your objectives for sustainable IT (Top 3)?

45%

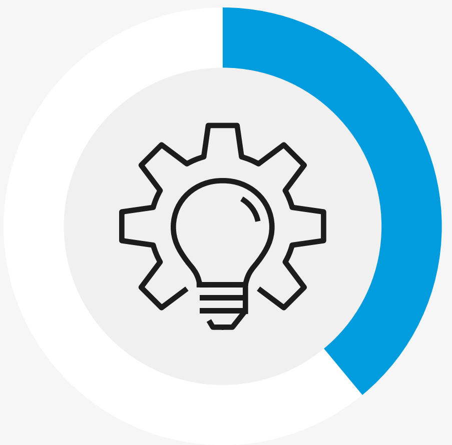


Dynamic workload management

41%

Circular economy - recycle, reuse, remanufacture (3Rs) mandating closed loop models

39%



Using smart utility solutions

- DWM delivers adaptability, automated resource allocation, and optimization.
- The result: By aligning resource usage with real-time demand, natural resource consumption is reduced and significant cost savings are achieved.

- Kubernetes provides the core platform for dynamic workload management by automating container orchestration, resource allocation, and scaling.
- Its ability to adapt to changing demands ensures application resilience and performance optimization.

Source: IDC *Sustainability Readiness Survey 2024* (B2B sample; N = 1,091; weighted using IT spending by country)

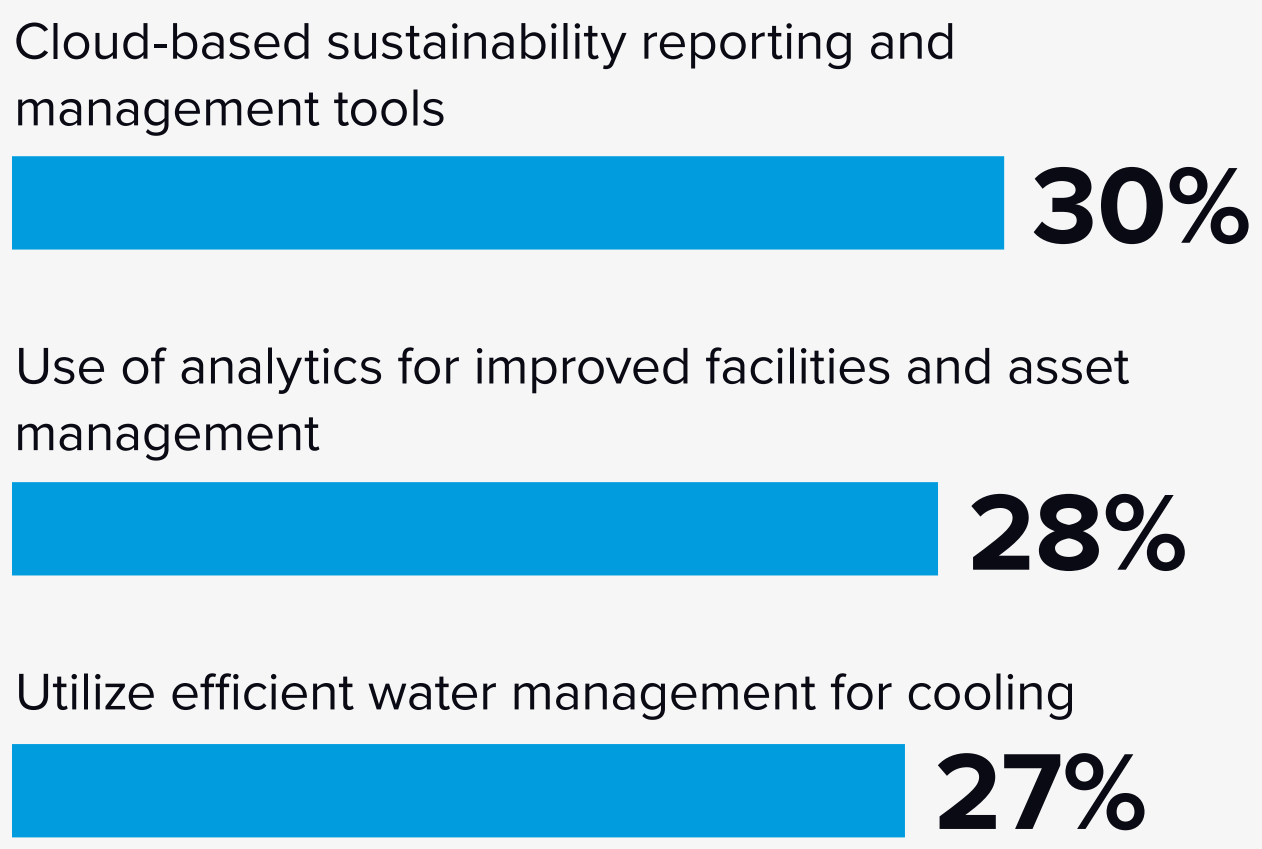
Resource Management Within the Cloud

The rebound effect: Increased efficiency and cost savings from technological advancements can inadvertently lead to higher overall consumption and demand.

- Leading cloud service providers deliver integrated CloudOps platforms to automate infrastructure provisioning, performance monitoring, and cost governance.
- Combined with API-driven workflows and container orchestration, these tools enable scalable, modular, and efficient cloud environments — ensuring operational consistency, rapid deployment, and full-stack observability.

1. **Implement resource optimization** strategies to ensure the most efficient use of resources, reducing waste and costs.
2. **Monitor and track cloud usage** closely to identify and eliminate unnecessary expenditures or overuse.
3. **Choose appropriate pricing models** that align with your usage patterns and budget to optimize spending.
4. **Develop clear policies for cloud resource allocation** and utilization to maintain control and prevent resource misuse or sprawl.

What are the most important factors when thinking about moving workloads to a sustainable public cloud? (Top 3)



Source: IDC's *Sustainable IT Infrastructure Survey 2023* (N = 1,640)

Circularity

Due to their scale, centralized operations, and resource management focus, CSPs can implement circularity more effectively than individual enterprises by designing for longevity, optimizing resource use, and preserving critical raw materials.

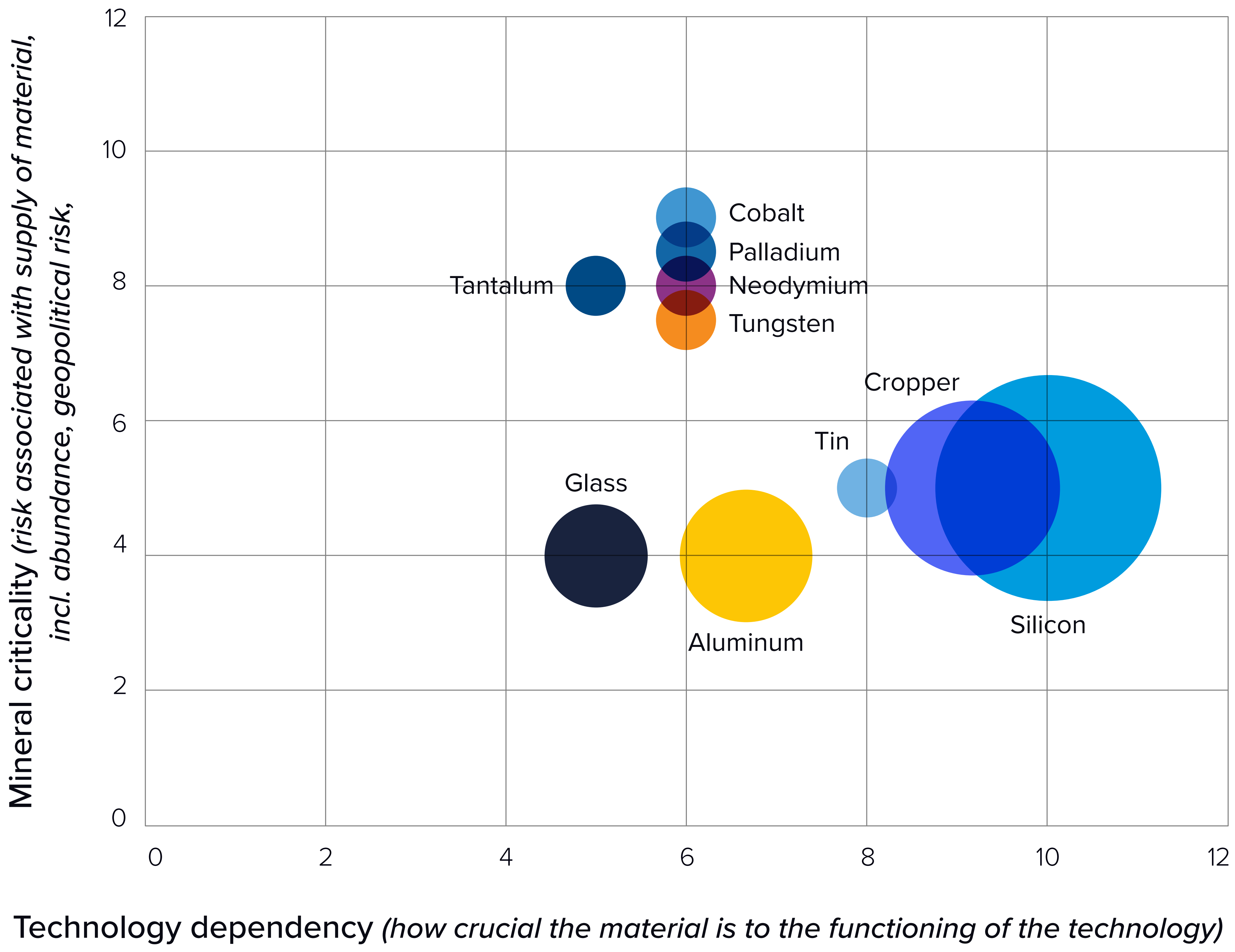
- Extending the lifespan and recycling initiatives that promote equipment reuse, combined with the shared infrastructure model of cloud services, significantly reduces the demand for critical raw materials and lowers embodied carbon — all while delivering the same IT workload.

34%

IDC expects the use of public cloud datacenters to result in 34–37% less embodied carbon, annually.

Critical raw materials in datacenters

(Combined selected technology evaluation: GPUs, HDDs/SSDs, and network cabling)

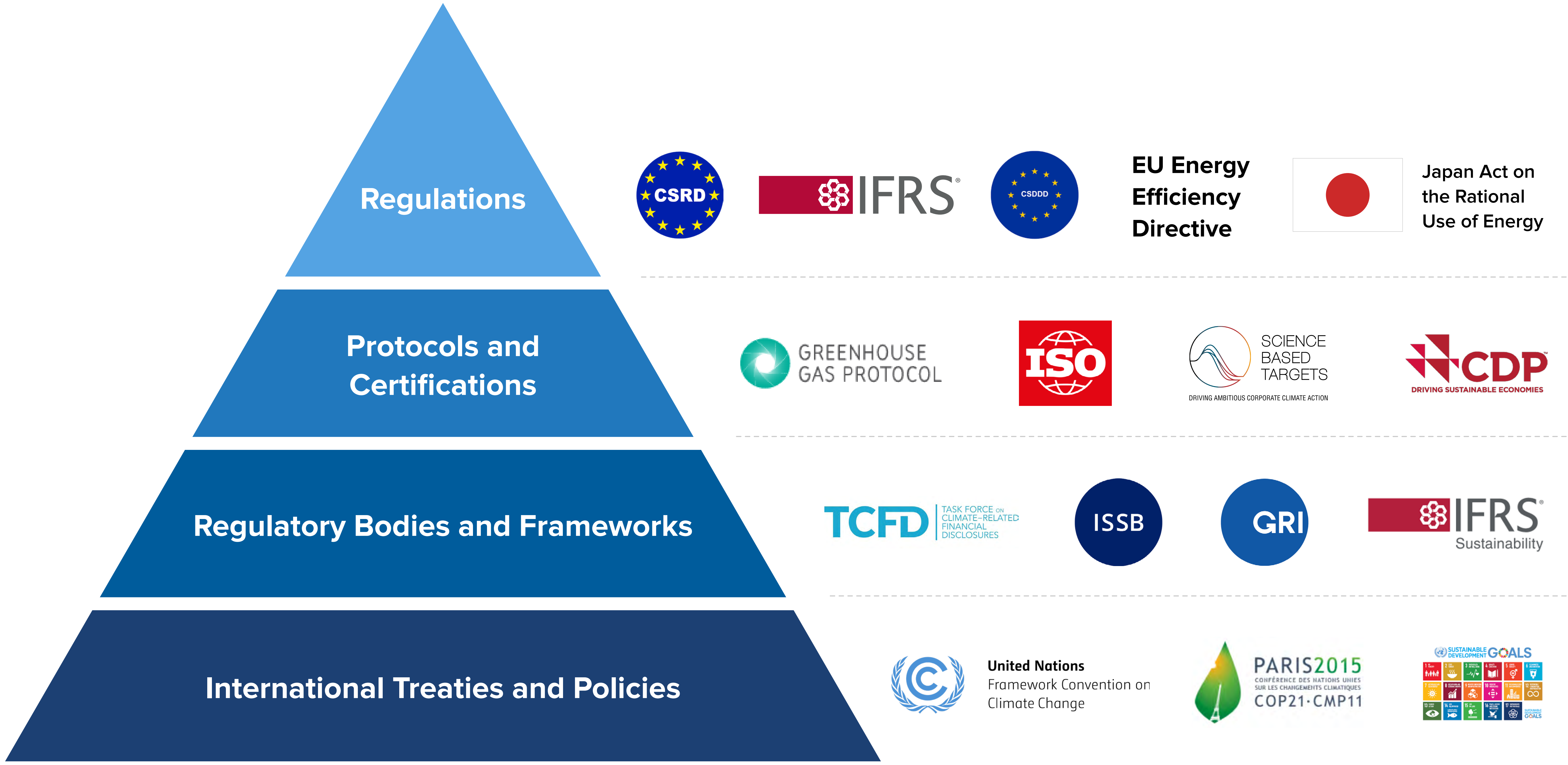


*Bubble size represents the relative amount of the material used in the technology. This number is not exact and reflects estimates from multiple sources.

Source: *IDC Digital Economy Strategies, 2025*

Goals, Commitment, and Transparency

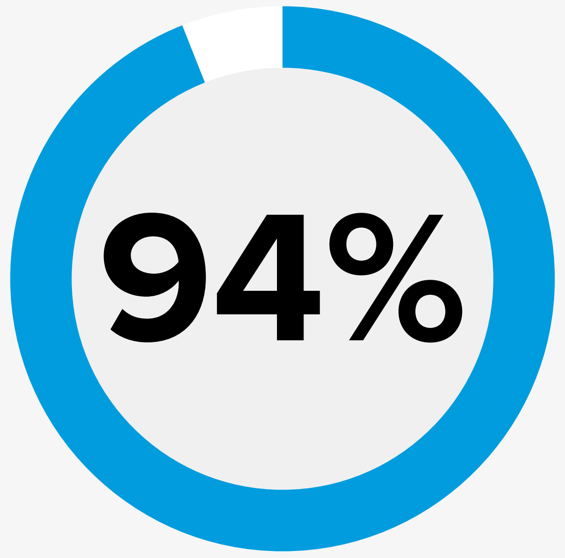
By setting ambitious yet achievable sustainability targets, complying with all regulations, and openly sharing efficiency, consumption, and environmental impact data, datacenters can align with broader climate objectives while meeting the growing demand for digital infrastructure.



Source: IDC, *Sustainability Regulations 101*

Sustainability regulations drive environmental protection by reducing pollution and conserving resources, while simultaneously providing businesses with benefits like enhanced reputation, cost savings, and increased competitiveness.

% of vendors that **only** or **mostly work** with vendors that meet certain criteria

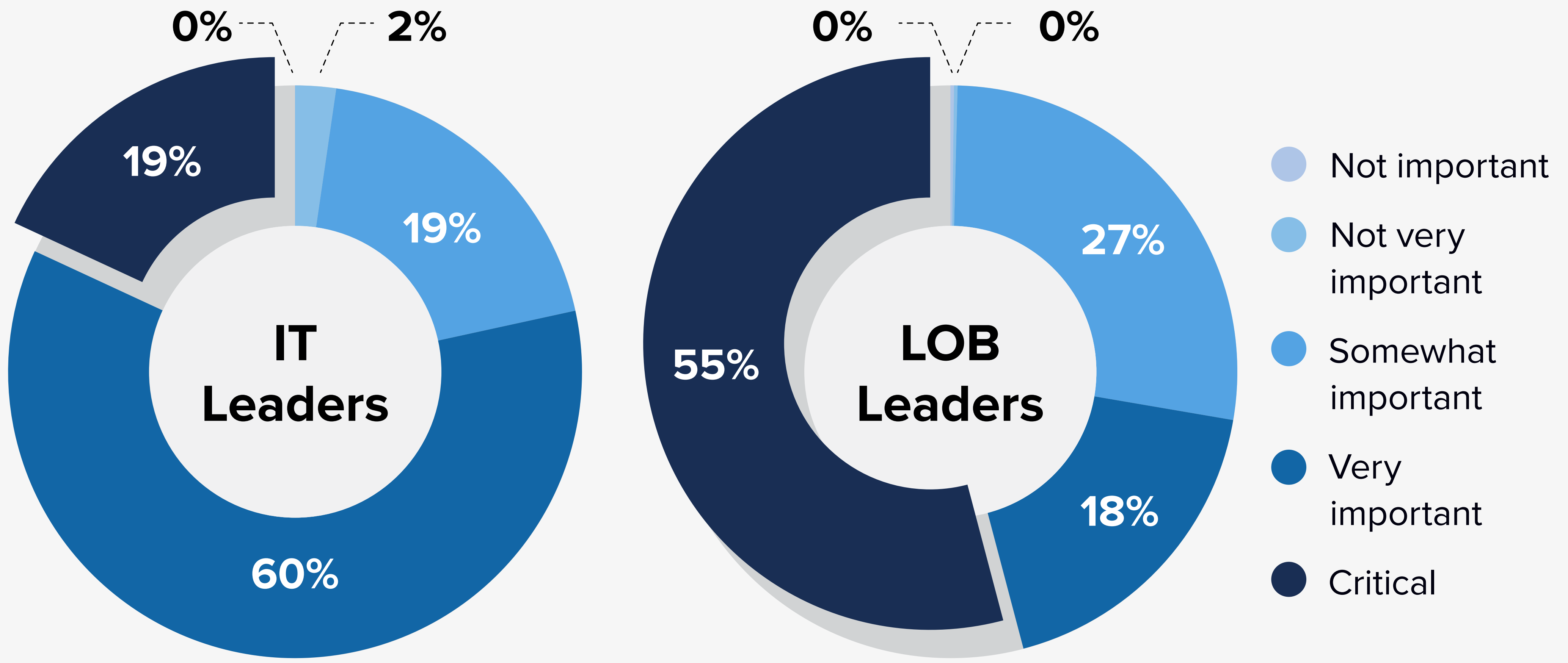


Source: IDC *AI, and Sustainability Survey*, February 2024 (N = 1,390)

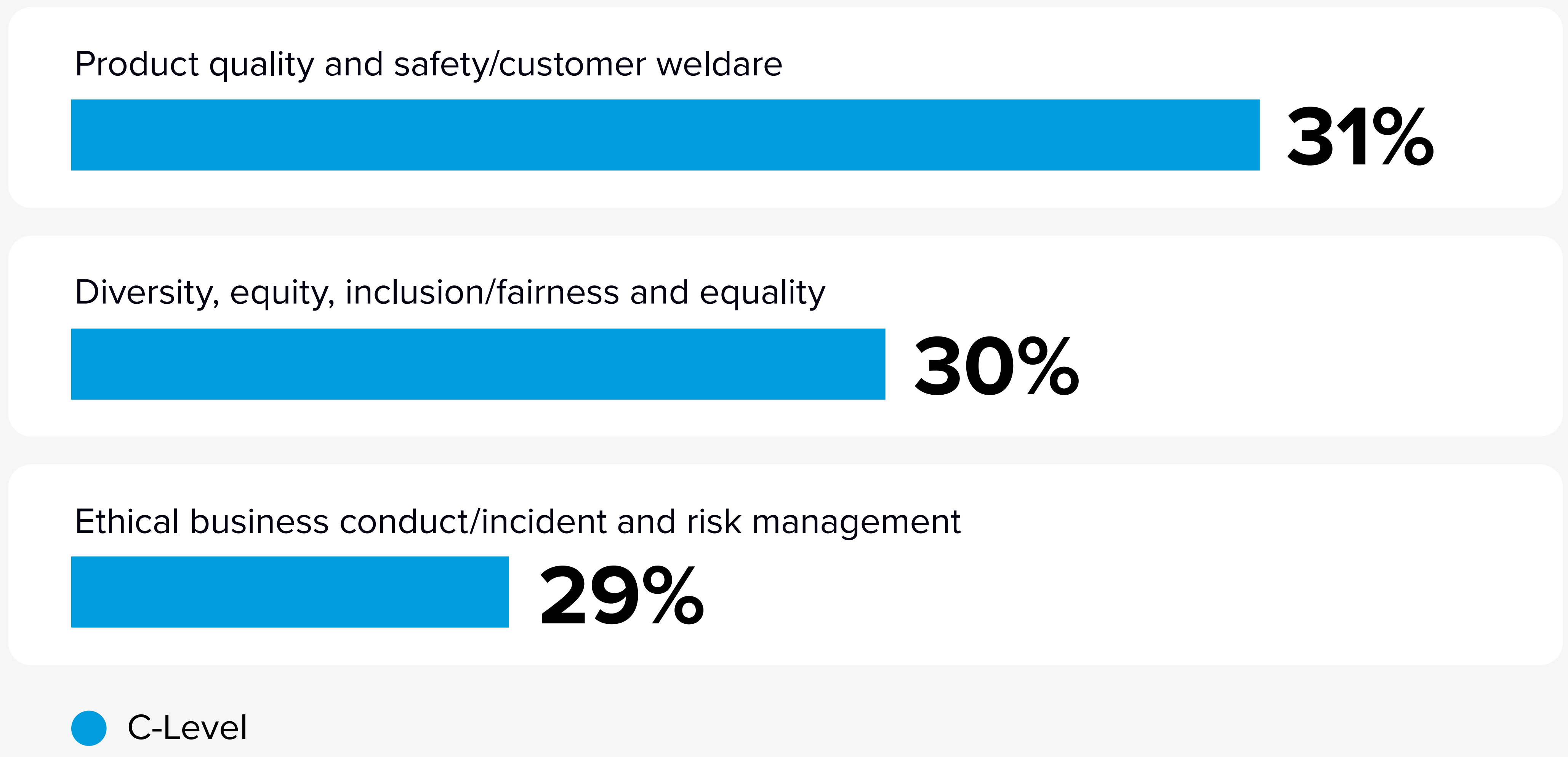
Cloud and AI for Sustainability

Current discussions often prioritize the cloud's environmental impact or footprint. However, cloud and AI's transformative power extends to their handprint — i.e., their ability to optimize all business operations.

How important is AI as an enabler for your organization's sustainability transformation?



Which of the following sustainability/ESG areas is your organization primarily tackling through its AI for sustainability deployments? (Top 3)



- Both IT and business leaders see AI as important to their sustainability transformation journey, with LOB leaders seeing it as more critical.
- C-level priorities for applying AI for sustainability/ESG indicate a comprehensive focus of ethics, social equity, and safety that is aligned to modern approaches.

Recommendations

Choose the right provider

Choose cloud providers that match your values and sustainability goals, as well as offering the right solutions (e.g., CloudOps and containerization).

Strategic workload allocation in cloud

Consider which workloads are best suited to be moved to cloud service providers while managing your hybrid cloud environment.

Look beyond the facility

Traditional metrics focus on facility efficiency, but additional sustainability benefits can be achieved by optimizing environments through software and management (i.e., green software development, small language models).

AI for sustainability

While implementing AI sustainably is important, it is only the first step. Build a strategy on using the cloud and AI to actively maximize their positive contributions.

By focusing on these key areas, organizations can sustainably expand the digital infrastructure required to implement AI and compete in the digital economy.

Message from the Sponsor

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OUTSCALE, a Dassault Systèmes brand, is the first sovereign and sustainable operator of Experiences as a Service. Using an innovative virtual twin approach, organizations can modernize their operations through three types of experience: Cloud Experience, Business Process and Virtual Twin Experiences.

By placing sovereignty at the heart of its solutions, OUTSCALE enables institutions and regulated industries to take full control of their strategic information while benefiting from full cyber governance.

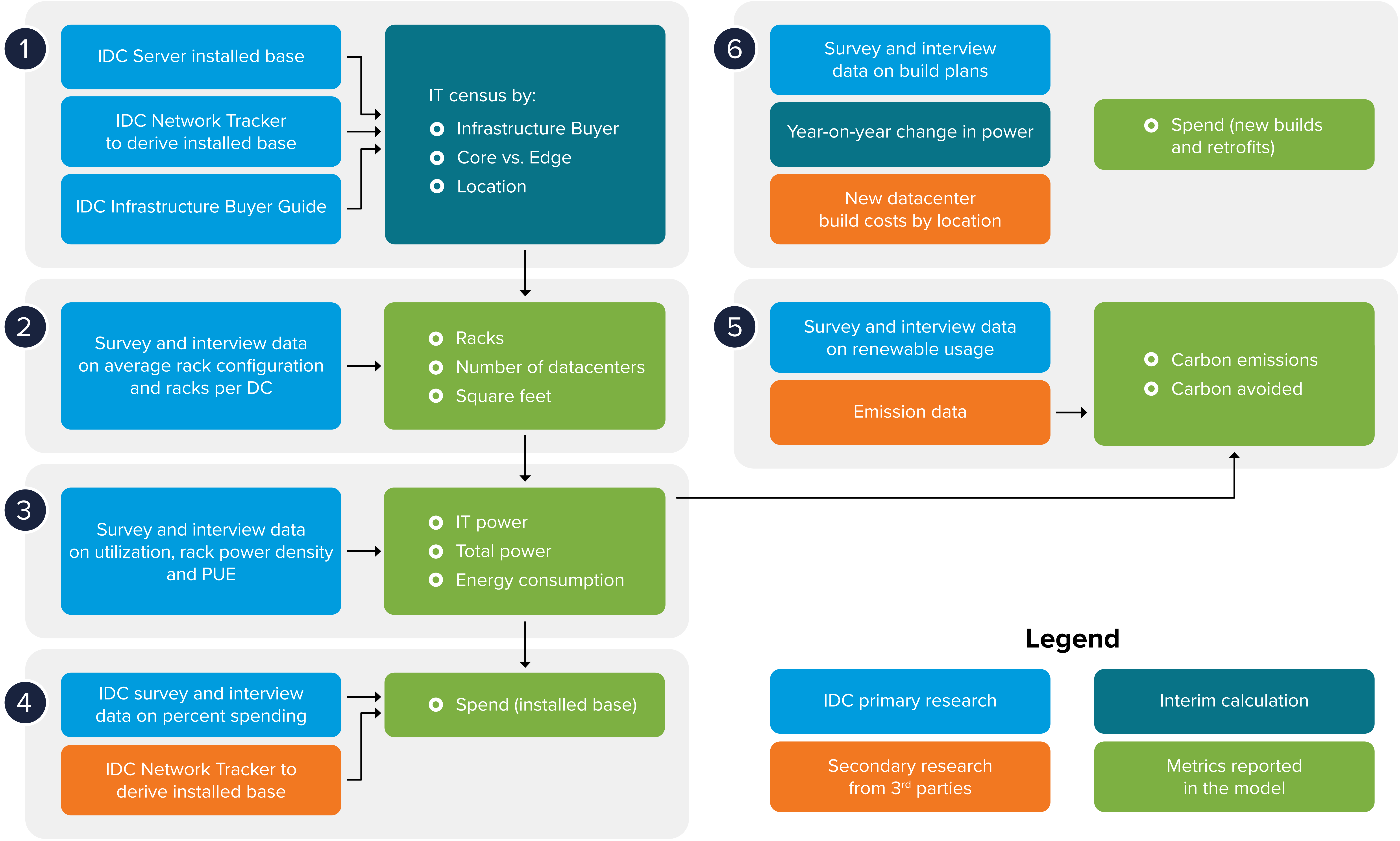
Commitment to sustainability

OUTSCALE is a purpose-driven company, redefining progress and innovation with a focus on balance and impact. Its mission is to harmonize product, nature, and life, ensuring that value is created responsibly, while considering what it gives back to the planet.

This philosophy of sustainable innovation guides OUTSCALE in delivering solutions that empower industries while safeguarding the environment. Committed to responsible innovation, OUTSCALE optimizes the energy efficiency of its infrastructures and guides its customers towards sustainable digital practices for a more sustainable future.

Learn more

IDC Methodology/Datacenter Trends: Sustainable Builds and Carbon Emissions



1. IDC infrastructure data is applied to the *IDC Infrastructure Buying Guide* to arrive at a census of IT Infrastructure by buyer type, core vs. edge, and location.
2. Using survey data and interviews with large providers, we develop a model of "the average rack configuration, racks per square foot and number of racks per DC" by buyer/core vs. edge/ location breakout.
3. Using IDC Infrastructure Tracker data for wattage draw, survey data, and interviews with large providers, we develop a model for total and IT power and energy consumption.
4. The operational cost to run a datacenter is modeled on survey data, publicly available energy price data, and calculated energy consumption.
5. Based on the energy data calculated in step three, primary and secondary research is used to calculate carbon emissions and carbon avoided.
6. Year-on-year power growth from step 3 is used as an input of how much new DC capacity is needed by year, with the distribution being guided by surveys and interviews. The price of construction is guided by 3rd party data.

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