



Research®  
Now a Part of

BLACK & WHITE PAPER

**S&P Global** Market Intelligence

# Multi-tenant Datacenters and Sustainability

Ambitions and Reality

COMMISSIONED BY



SEPTEMBER 2020

©COPYRIGHT 2020 451 RESEARCH.  
ALL RIGHTS RESERVED.

# About this paper

A Black & White paper is a study based on primary research survey data that assesses the market dynamics of a key enterprise technology segment through the lens of the “on the ground” experience and opinions of real practitioners — what they are doing, and why they are doing it.

## ABOUT THE AUTHOR



### DANIEL BIZO

PRINCIPAL ANALYST, DATACENTER SERVICES & INFRASTRUCTURE

Daniel Bizo is a Senior Analyst for Datacenters and Critical Infrastructure Channel at 451 Research. His research focuses on advanced datacenter design, build and operations, such as prefabricated modular datacenters, highly efficient cooling and integrated facilities and IT management to achieve superior economics. Daniel is also a regular contributor to 451 Research’s silicon and systems technology research in the Systems and Software Infrastructure Channel. Dan is also a member of 451 Research’s Center of Excellence for Quantum Technologies.

# Introduction

Colocation and wholesale services, collectively known as multi-tenant datacenters (MTDCs), form a key and growing part of the datacenter world, serving customers from a broad cross section of the global economy – from microbusinesses to large enterprises and regional IT services firms to global content and hyperscale infrastructure providers. The rapid growth in demand for MTDC services is a testament to the value that they offer regarding fast time to market, rich connectivity options and an asset-light leasing model.

Global MTDC capacity by available power grew 62.4% in the five years through 2019, a compound annual growth rate of nearly 10.2%, according to the 451 Research Datacenter KnowledgeBase. By 2024, 451 Research projects global MTDC capacity to expand by an additional 35.2%, when it will have exceeded 32 gigawatts of electrical power available to customer IT systems. This is comparable to the total electricity needs of a mid-sized country such as Spain or the average consumption of California.

The mushrooming of datacenters has attracted attention to the growth in their resource consumption, however. In recent years, both regulators and the public have become more curious about the environmental impact of popular online services such as streaming videos, browsing content-rich social media and playing online games. Although the world's largest technology companies invite the most scrutiny, general awareness of datacenters and their environmental impact is growing fast as a result, raising the environmental standards expected of MTDC partners.

In the coming years, major technology players and their datacenter providers will need to answer questions about their sustainability practices and demonstrate they do everything within their power to improve. IT vendors and cloud service providers are instrumental in bringing about a world economy that is gentler on the environment by improving efficiencies in virtually all industries, which includes enterprise IT.

Enterprise customers, too, have become much more aware of the higher expectations the public imposes upon them. In response, 86% of the companies in the S&P 500 Index published a sustainability report in 2018, up from only 20% in 2011, notes the Governance and Accountability Institute. With reporting comes comparison to peers, which incentivizes organizations to consider environmental factors in their decision-making. This is not purely about good optics, but a factor with growing influence on business partners, clients and investors. In fact, S&P Global Ratings<sup>1</sup> now marks environmentally beneficial investment opportunities (Green Evaluations), as well as socially responsible governance practices (environmental, social and governance, or ESG score).

---

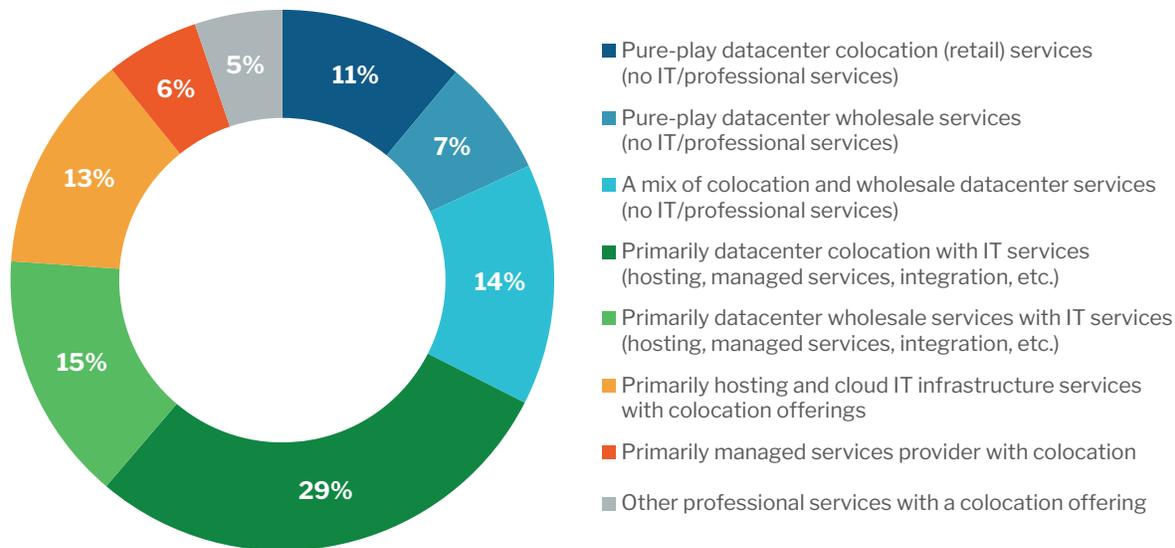
1. 451 Research is part of S&P Global Market Intelligence; S&P Global Ratings is a separately managed division of S&P Global.

To see how they view the importance of sustainability and how they go about instituting sustainability initiatives to achieve better results in their datacenter operations, Schneider Electric commissioned 451 Research, a technology market research and advisory firm, to conduct a study on MTDC operators. We surveyed more than 800 datacenter service providers globally in the sector, most of which offer a mix of IT and professional services, in addition to colocation or wholesale facilities – in fact, one in three providers offer purely facilities services. Participating firms operate datacenters across more than two dozen countries, dominated by the US, the UK, China, Germany, India, France, Australia and the Netherlands.

**Figure 1: Services offered by participating MTDC operators**

Source: 451 Research custom survey

Q: Which of the following best describes your organization's profile?



Nearly half of the survey participants had C-level titles with chief information officers (CIO) and chief information security officers (CISO) most prevalent, with an additional fifth with director-level or managerial titles in operations. The rest of the respondents were in mostly technical roles.

# Executive Summary

Demand for more commercial, scientific and consumer application of IT spurred the development of the MTDC sector, which offers readily available mission-critical facilities across the globe – typically near metropolitan areas where businesses and consumers concentrate. 451 Research views the MTDC sector not only as a provider of key infrastructure to the IT and telecommunication systems underpinning those applications, but also as a catalyst to the digital economy.

The rich cross-connection options and proximity to businesses and consumers that the MTDC sector offers make for fertile ground for the development and growth of digital services. Today, for example, a software-as-a-service developer in Poland can easily serve its North American customers using multiple colocation datacenters across the US. This improves the responsiveness of the service, lowers bandwidth costs, and helps the developer comply with data protection regulations without having to build and operate a datacenter infrastructure in the country.

The MTDC sector will keep reaping rewards from the continued expansion of the digital economy, but it will come at the price of higher expectations. The bigger the sector grows, the more attention it will garner as a major consumer of electricity and water, as well as a major emitter of greenhouse gases. Even though MTDCs might see themselves as merely providers of back-end services – a middleman between enterprises, service providers and consumers – scrutiny is inescapable.

Our survey indicates that MTDC operators are aware of this attention and are taking action to become more sustainable. Of the surveyed providers, about 43% said they have a strategic sustainability initiative in place to improve their datacenter builds and operations in a comprehensive fashion. A similar number reported they are running sustainability programs that may be short of being comprehensive, but still aim to deliver major improvements to parts of the infrastructure and operational practices.

While there appears to be some correlation with company size, the difference among regions is great. EMEA-based operators on average are less strategic about efficiency and sustainability than their US-based peers (under 30% vs. 54%), but the Chinese MTDC providers stand out: 68% of them reported having comprehensive programs.

Figure 2: MTDC operators' approaches to resource efficiency and sustainability

Source: 451 Research custom survey

Q: Which of the following best characterizes your organization's approach to resource efficiency and sustainability?

Base: All respondents (n=825)



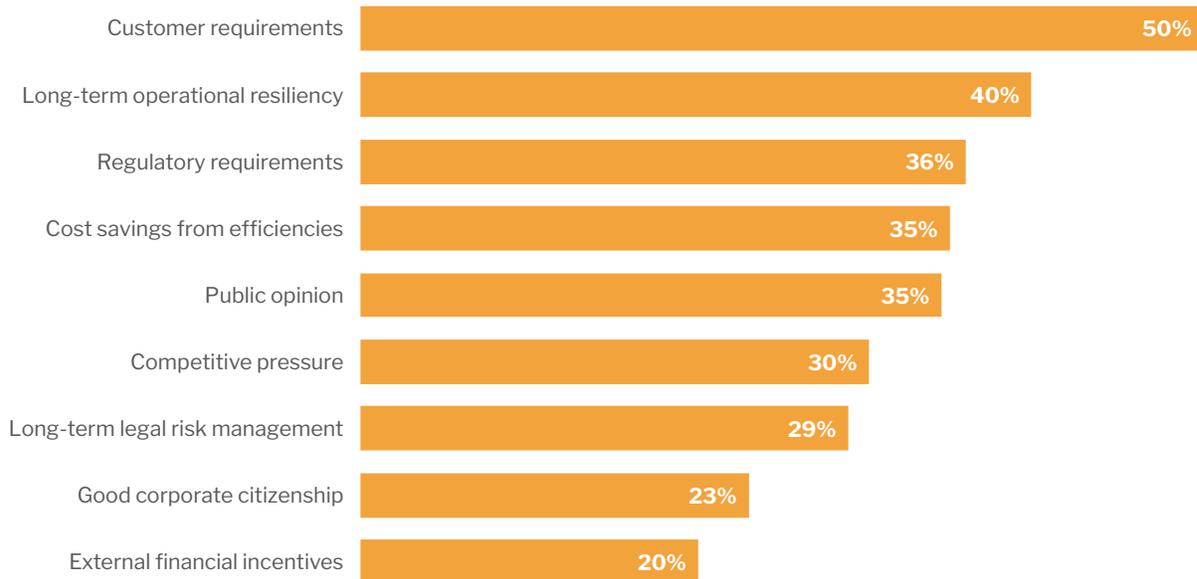
Importantly, cost is not a primary driver for such initiatives – only 10% of respondents named cost saving associated with efficiency gains as the foremost reason for undertaking sustainability programs – but neither is public opinion, long-term risk management or corporate value. Rather, **customer requirements have the strongest effect on the importance of sustainability**, with over a quarter of respondents naming it as the predominant driver for instituting a sustainability initiative, and half considered it to be in the top three drivers. On average, smaller MTDC providers scored this factor higher as a driving factor, likely because they depend on any single customer more than their larger, more diversified counterparts.

The second-strongest factor was long-term operational resiliency at 40%, which makes sense in an era of extreme weather and weather-related events such as high temperatures and humidity, floods and fires. Reduced use of resources such as electricity and water is not only good for the environment but also puts a datacenter in a better position to survive a major utilities outage longer on its energy and water reserves.

### Figure 3: Drivers of sustainability initiatives

Source: 451 Research custom survey

Q: Which of the following factors are most important in driving efficiency and sustainability initiatives within your organization currently? (Top three)



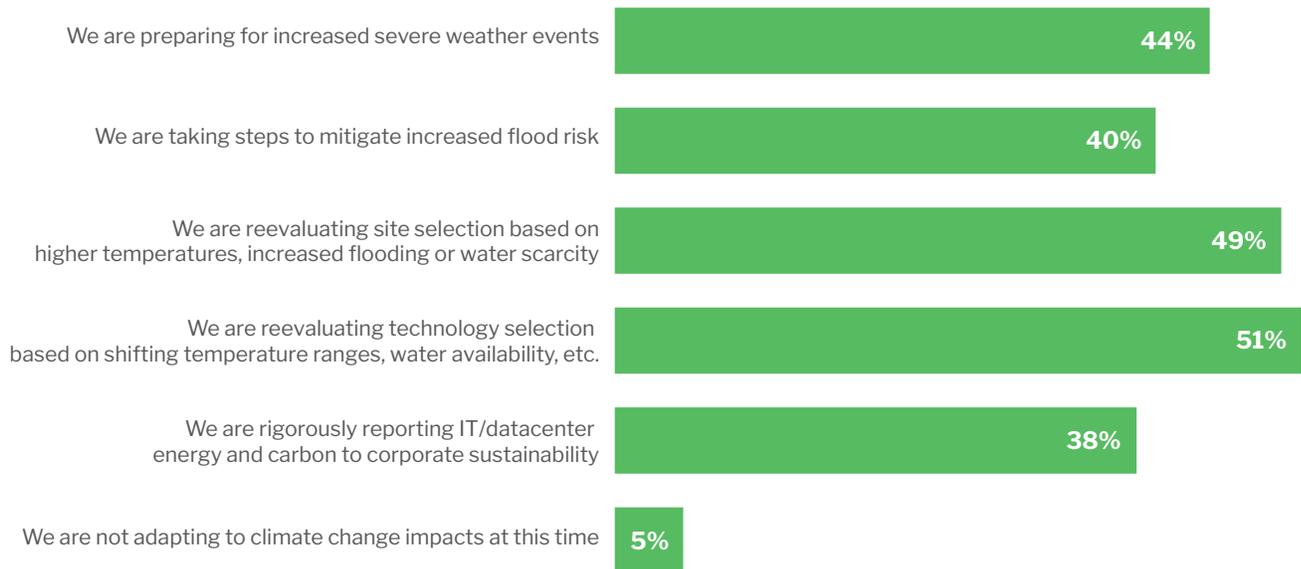
Operational resiliency is often overlooked in discussions about sustainability, which tend to focus on environmental impact rather than how the changing environment affects critical infrastructure. While the effects of climate change remain difficult to predict in detail even with the most advanced computer models, it is possible to mitigate risks via preparation of maintenance and operation protocols, different technology choices or a change in site-selection priorities.

Well-engineered datacenters are always cushioned by considerable safety margins in the sizing and resiliency of critical systems such as power, cooling and physical security, but climate change will likely breach some underlying assumptions for a growing number of locations, eroding such margins. Regulatory requirements and public opinion, alongside cost savings, were in a statistical tie for third place. On balance, the views of external stakeholders matter the most by a wide margin, followed by long-term survivability, and finally cost.

## Figure 4: Preparations for climate change

Source: 451 Research custom survey

Q: Which of the following initiatives is your organization currently undertaking in preparation for climate change?



Our survey suggests that MTDC players are much more mindful of climate change than the wider datacenter industry; about half of them are potentially making changes to what cooling systems they buy and where they build a site that may be operational 20 years from now. Traditionally, datacenter designers have looked at historical weather data for temperature and humidity peaks when specifying power and cooling equipment, but now they may need to take into account the likelihood of new extremes in the future, including not just temperature but the higher risk for grid outages and droughts in heatwaves. For existing sites, severe weather events and increased flood risks are also high on the list, and mitigation can prove costly.

The larger the organization is, the more likely it is to consider the adverse impacts that climate change may have on its datacenter fleet. Site selection is where the largest datacenter services providers consider climate change the most – which is prudent considering what is likely to be tens of millions of dollars in investment. Due to the inherent complexity of climatic modeling, geospatial risk assessment and their interplay with engineering decisions, siting is where datacenter operators will likely welcome support from technology vendors and consultants the most.

# Key Survey Findings

Our global survey of MTDC service providers takes a snapshot of a sector in transition. Ten years ago, the entire notion of efficiency and environmental sustainability was a complete novelty; most operators didn't even collect data or measure its operational performance against such metrics, let alone make different technology choices or consider renewable energy. Today, the picture couldn't be more different, and more changes are still to come.

That change in behavior occurred in the latter part of the decade, captured in the development of low-loss power distribution equipment, highly efficient cooling products, and the wide adoption of datacenter infrastructure management (DCIM) software. DCIM – tools that allow operators to collect, normalize, monitor and analyze data, including trending extrapolation – is foundational to running an efficient datacenter.

Half of the respondents said their firm has adopted DCIM, with 42% using commercial DCIM tools and 31% using homegrown DCIM code – most DCIM users have a combination of both. Also, a quarter of the surveyed professionals said their company uses custom reporting tools. As expected, larger operators are more likely to have commercial DCIM deployments in place – penetration is above 50% for MTDC firms with over 1,000 employees, compared to less than 33% for those with fewer than 250 staff. Geographically, adoption among EMEA-based and Japanese MTDC providers is significantly lower than in the US, China and India.

Interestingly, 45% reported having an energy and sustainability platform in place, a relatively newer product type that gained traction in the past five years and might have been conflated with widely used power management systems.

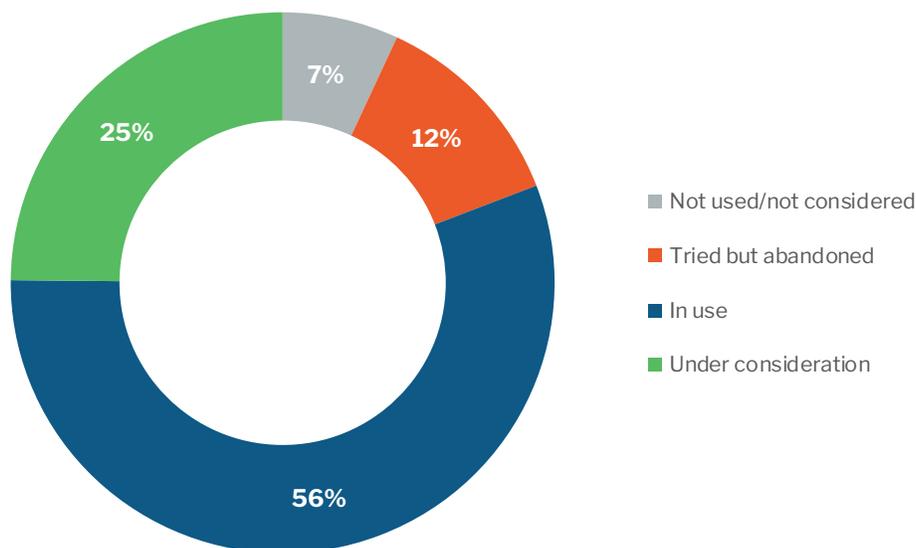
The most common use for datacenter management tools, beyond handling basic alerts, is the real-time monitoring of critical equipment that keeps the facility up and running: 58% of surveyed MTDC operators have adopted such a function. A close second (56%) is collecting data for reports on operational performance such as utilization, energy consumption and power usage effectiveness that are bound to be seen by senior managers.

## You Can't Manage What You Don't Measure

Measurement is essential when it comes to the efficiency and sustainability of a complex system like a datacenter. The flip side is that almost half of the respondents surveyed said their organizations don't generate reports on the operational metrics of their datacenters.

Figure 5: Reporting for senior management on key operational metrics (e.g., utilization, energy consumption, PUE, etc.)

Source: 451 Research custom survey

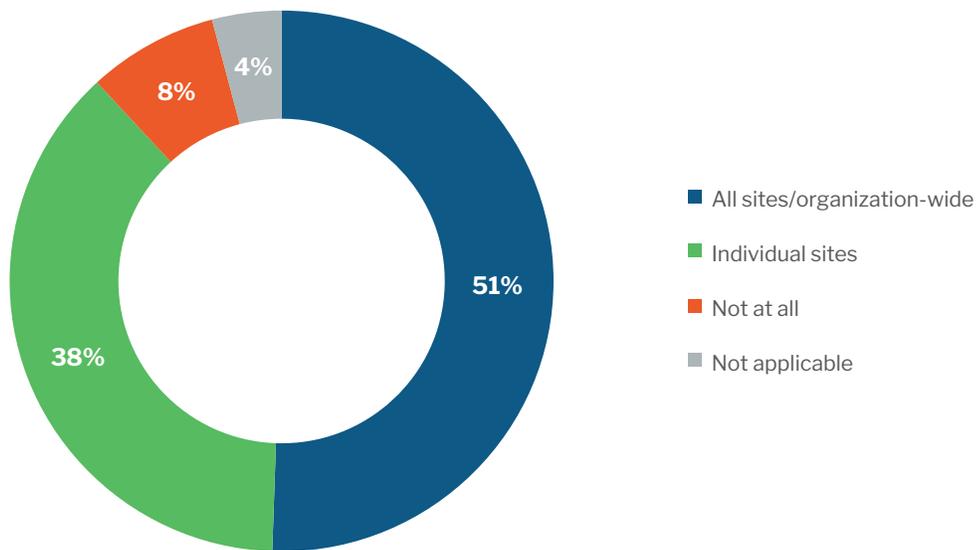


In general, our survey found that MTDC service providers track a wide array of metrics. For datacenter operations, energy consumption tends to be the single biggest expense line and therefore invites closer inspection from multiple angles: usage trends, efficiency, prices, energy sources, etc. Power usage effectiveness (PUE) is a metric MTDC providers track widely, even if not ubiquitously; half of the respondents said PUE is measured across their fleets and another 38% track PUE at some of their sites if not all – so almost 90% of respondents indicated they track PUE at some or all their sites.

PUE calculations help operators see how energy-efficient their datacenter facilities are compared with each other, as well as with the broader industry. Defined as the ratio of total datacenter power to the IT load supported, PUE captures the energy overhead associated with electrical distribution losses and cooling (and typically marginal ancillary functions such as lighting and security systems). While it does not consider the efficiency of IT systems, it can inform (when used correctly) investment decisions on efficiency improvements. Resource efficiency is at the heart of sustainability.

Figure 6: Power usage effectiveness tracking

Source: 451 Research custom survey

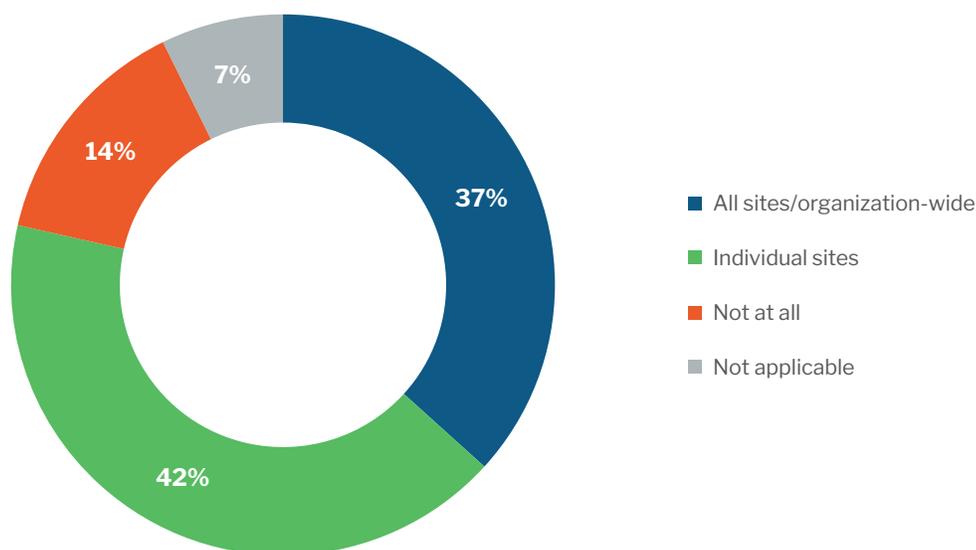


A similar number of MTDC providers keep an eye on IT utilization (two-thirds of our respondents offer a mix of facility and IT services), which is typically a good proxy for efficiency. Utilizing servers more strategically not only makes good business sense but can also dramatically improve the energy efficiency of the entire infrastructure.

Beyond the energy consumption of infrastructure, what matters is the way energy is generated – or to be more precise, the greenhouse gas emissions resulting from it. Carbon intensity (the amount of carbon dioxide and equivalent gases produced per kilowatt-hour electricity) of the power grid is essential in calculating the environmental impact. From that point of view, the fact that only 37% of respondents said they track carbon intensity across their entire organization perhaps seems low at first, but another 42% said they track it for some of their facilities, which brings the tally of those tracking carbon intensity to nearly 80%. It is worth noting that not all jurisdictions directly impose carbon emission regulations on datacenter operators as does, for example, the European Union’s Energy Efficiency Directive.

Figure 7: Grid carbon intensity tracking

Source: 451 Research custom survey



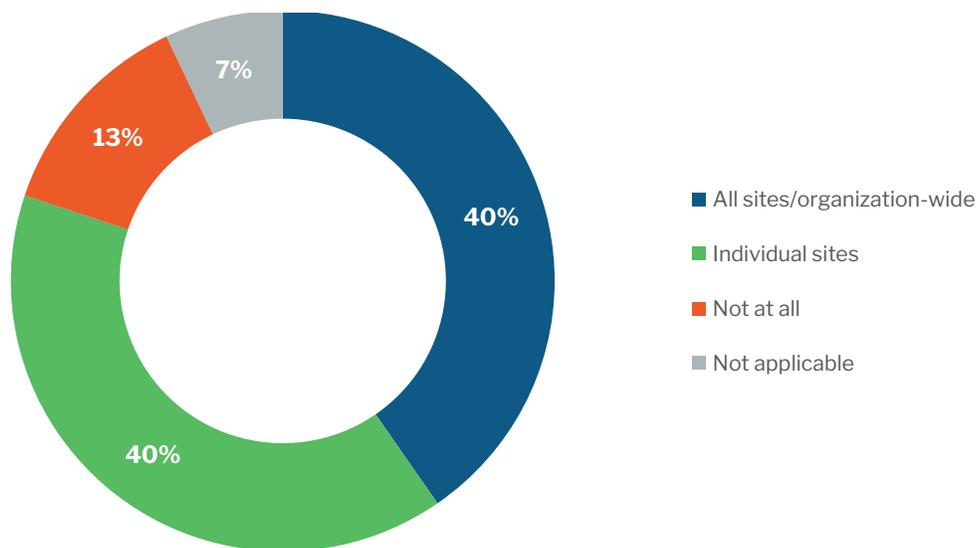
Even though it pales in comparison to indirect emissions using the electricity grid, the overwhelming majority of MTDC providers also keep a record of the direct emissions from their datacenter sites, chiefly from running the generators during tests and times of grid interruptions.

In addition to energy and carbon emissions, water management is an issue that 451 Research expects to become a highly sensitive topic in certain locations. While energy consumption relates to the causes of climate change, water use is contested in areas negatively affected by climate change. Water is going to become a more pressing topic in a greater number of locations as a result of droughts, but also because of increased consumption due to population growth in cities and by industries and farmlands supporting larger populations.

California, South Africa and India are prime examples where water shortages can be severe every year during a dry season. It is worthwhile to track water consumption and water usage effectiveness – defined as the ratio of water usage and electricity consumption of IT.

Figure 8: Water usage effectiveness tracking

Source: 451 Research custom survey

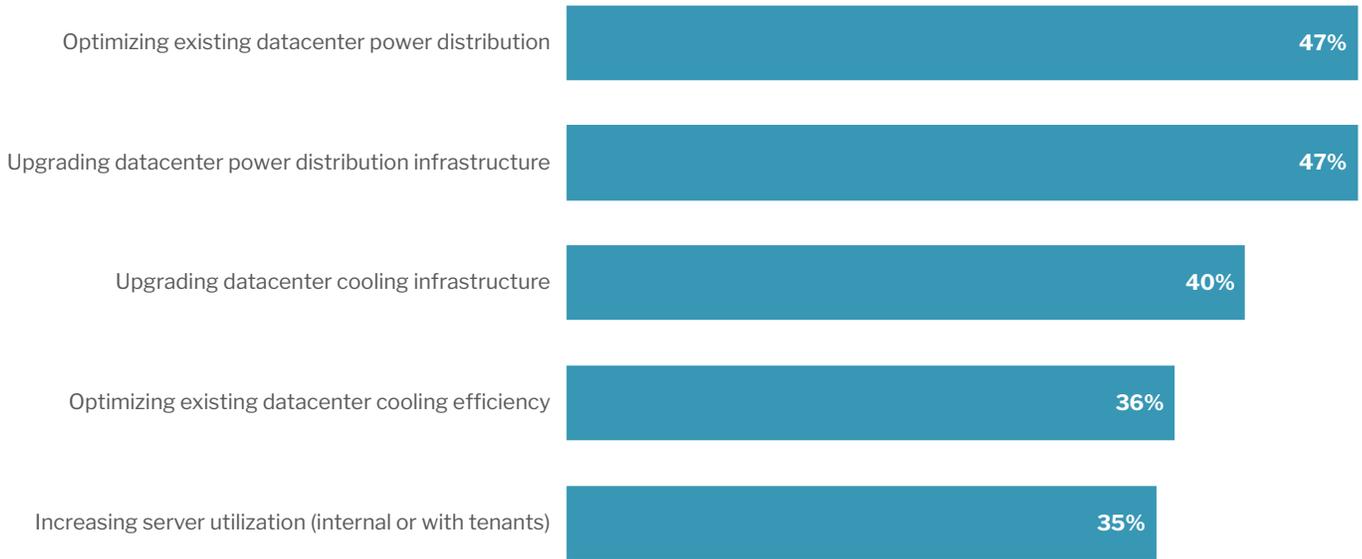


When it comes to improving infrastructure efficiency, power distribution was the most popular area. In recent years, power distribution has become highly efficient (above 90%) across the load curve, but older equipment tends to suffer from major degradation in efficiency once utilization drops below 50% – all too typical in many datacenters due to capacity overprovisioning practices. But power efficiency is not all about new equipment; it is also about balancing the load across power systems and reevaluating power capacity requirements based on actual load measurements, as opposed to taking nameplate (or arbitrarily dated nameplate) power of servers and storage systems. All these steps should free up stranded power, defer investments in new capacity and increase utilization over time. Larger operators are more likely to focus their attention on this area.

## Figure 9: Infrastructure efficiency and sustainability improvements

Source: 451 Research custom survey

Q: What efficiency and sustainability improvements is your organization actively considering within the next two years?



Cooling came in a close second to power, with upgrades to cooling systems edging out optimization. Datacenter cooling has been an area of significant innovation in the past 10 years because of its historically high demand for energy, driven by a habit of overcooling – fans and compressors working hard all the time. The MTDC sector has led much of the change with better-designed facilities and cooling architectures that require dramatically less energy through relaxed temperature settings, variable-speed fans and, crucially, reduced use of compressors.

Increased server utilization is the third most popular area for efficiency improvements for MTDC operators because most offer some form of IT services, too. The difference in efficiency (workload performance per watt) between low and high server utilization can be as much as factor of three, which also partly explains why hosting and cloud providers are willing to offer very aggressive spot pricing on light workloads and freely scheduled services running on shared infrastructure. The elimination of idle (or zombie) servers was also a relatively popular initiative with a little over quarter of surveyed MTDC providers pursuing it.

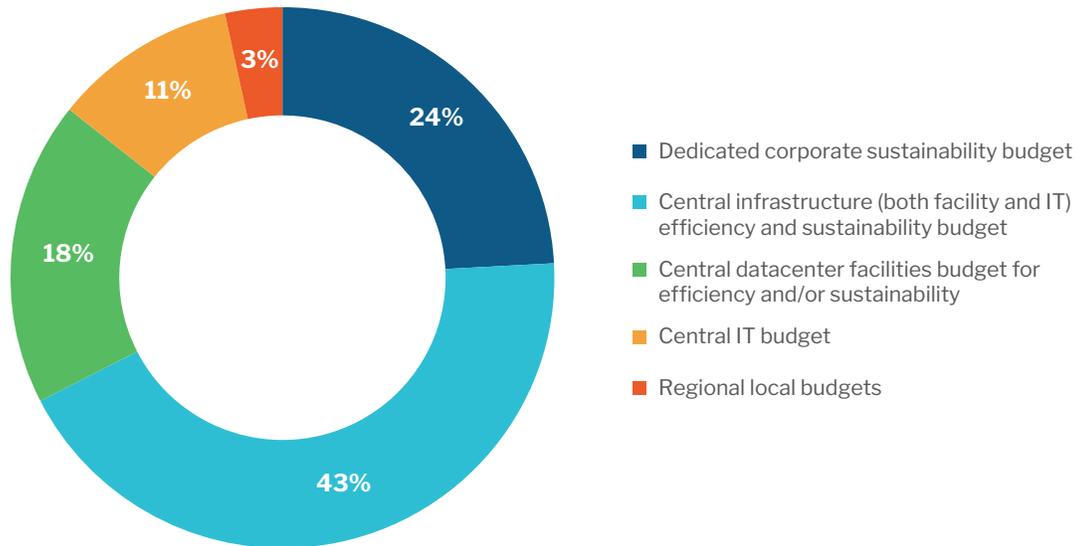
Where the funding for these programs comes from largely defines their ambition. Access technology upgrade budgets are a common challenge for enterprise datacenter facility operations. Even when critical to the customer-facing services and internal processes, running infrastructure is not typically at the core function of most businesses, and efficiency as a sustainability imperative takes a back seat. This limitation yields efficiency initiatives that address only parts of the infrastructure, typically improving existing assets rather than implementing major overhauls.

However, running datacenter infrastructure is the very business of MTDC providers, and it shows in the funding picture. Nearly a quarter of respondents said their organization had a dedicated corporate budget for sustainability, which should enable strategic thinking beyond the scope of the infrastructure, such as renewable energy purchases and tracking of supply chain carbon. Another 43% reported having central infrastructure efficiency and sustainability budgets, which promotes a comprehensive approach to the way infrastructure is designed, built and operated.

Figure 10: Funding for sustainability programs

Source: 451 Research custom survey

Q: In your organization, where do the funds for efficiency and sustainability programs primarily come from?



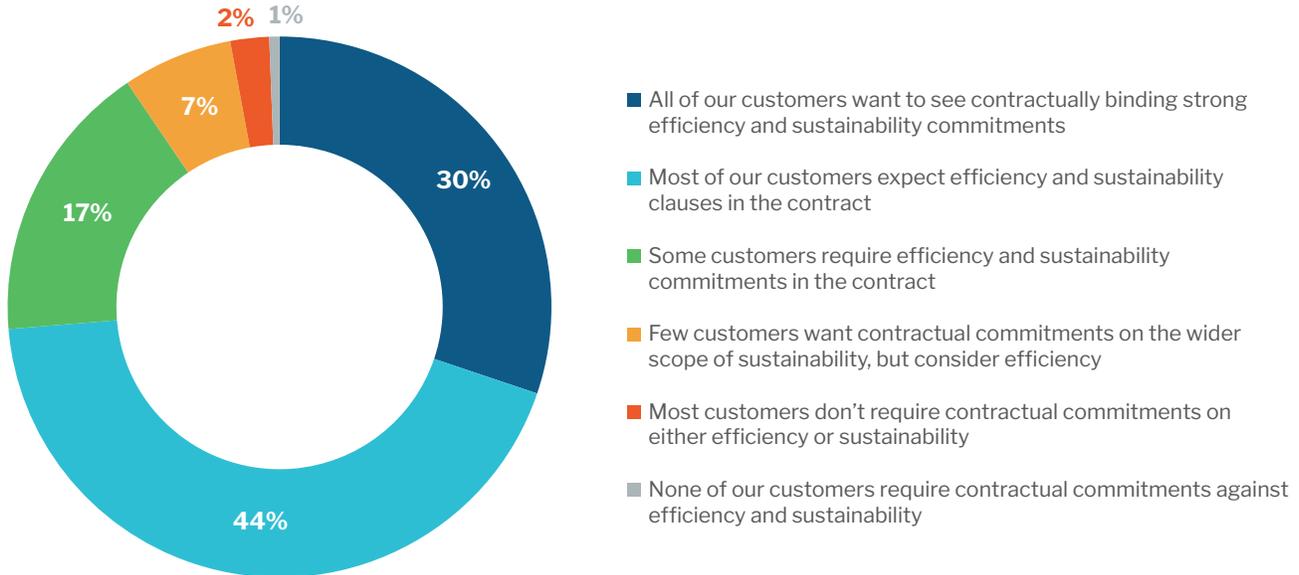
## Sustainability is Good Business – and Looks Good

What drives these investments is, perhaps unsurprisingly, the desire to win customers over with state-of-the-art infrastructure operations. Almost a third of MTDC representatives said all their customers want contractually binding commitments to efficiency and sustainability, while another 44% said it is true for most of their customers. Major enterprises and IT service providers (particularly larger cloud firms) typically have stringent infrastructure efficiency demands because it filters through to their own respective sustainability reports. Simply put: they cannot afford to use MTDC providers that do not prioritize high efficiency and sustainability standards.

Figure 11: Importance of efficiency/sustainability to customers

Source: 451 Research custom survey

Q: Which of the following best characterizes how important efficiency and sustainability is today for your customers?



Aside from directly meeting customer requirements, operators keep a close eye on what the competition offers so they don't fall behind. The majority of our respondents, 57%, think efficiency and sustainability will be highly important competitive differentiators in three years, up from the current reading of 26%. This only makes sense: More often than not, decisions are based not only on pure technical merits and price, but the overall impression and, ultimately, trust that a MTDC provider manages to develop. Strong efficiency and sustainability commitments can be perceived as good stewardship of the infrastructure. Complexity inherent in datacenter lifecycle management from design to supply chains and operations to decommissioning creates ample room for differentiation.

The last major component to winning customers is good publicity – cutting-edge datacenter builds that achieve extreme efficiencies, use of renewable energy, or anything that makes the datacenter less of a burden on the environment makes for a good headline. Even relatively small MTDC providers may find that the local and trade media will get interested in their individual operations in a metropolitan area for various reasons – job creation, investments or simple curiosity about where online services live. Both customers and the public like to see tangible steps in environmental responsibility, such as buying low-carbon energy and reducing water losses.

Still, only about one in five MTDCs are considering low-carbon electricity (in the form of switching utilities, power-purchase agreements or renewable energy credits) or actively reducing water usage in the next 12 months. This rises to about one in three when the time frame is within the next two years.

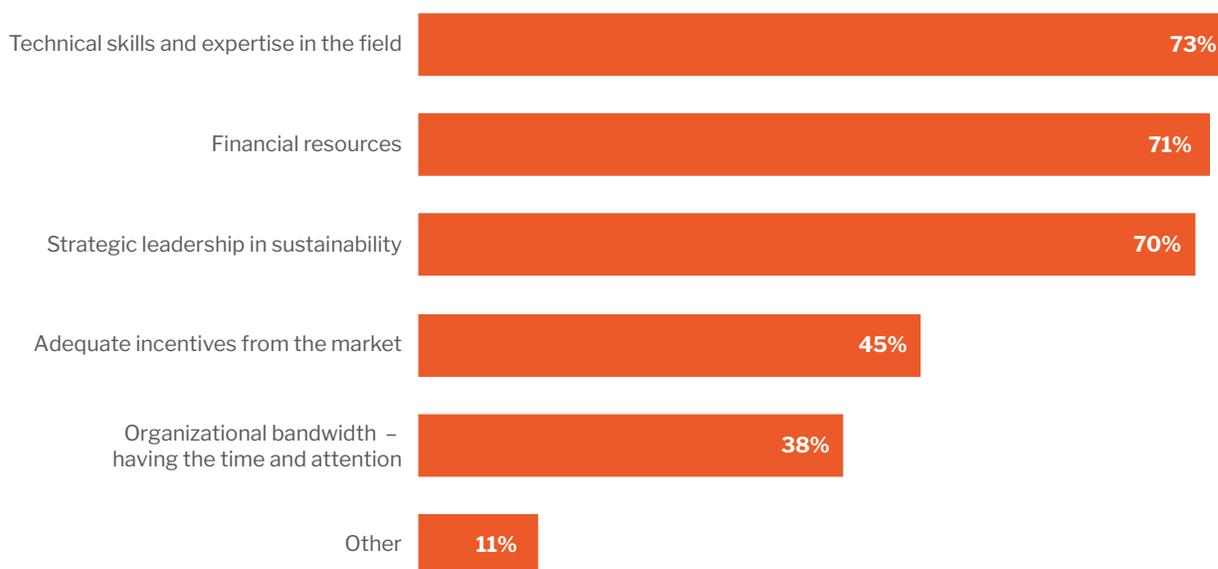
## Hurdles Remain

MTDC operators consider technical skills and expertise, closely followed by financial resources and strategic leadership the most important ingredients to make efficiency and sustainability programs a success. Technical expertise is all the more important to smaller MTDC operators, likely because they have fewer engineers compared to major datacenter services providers.

Figure 12: Factors that create successful sustainability programs

Source: 451 Research custom survey

Q: In your view, what are the most significant factors that make sustainability programs successful?



Regionally, there is little difference among MTDCs, with some exceptions. Respondents in India, China, Singapore and the Middle East tend to value technical expertise higher as key to a successful sustainability project. In Western Europe, MTDC providers deem financial resources the single most important ingredient and view, on average, strategic leadership as being less important than their counterparts in the US or other parts of the world. Instead, they view market incentives as more important on average than organizations in other regions. This may suggest that operators in Western Europe find it harder to fund major efficiency and sustainability projects adequately, hence the focus on financial firepower and a link to revenue streams (winning customers) or improvement to the bottom line (cost savings, rebates, etc.).

# Conclusions

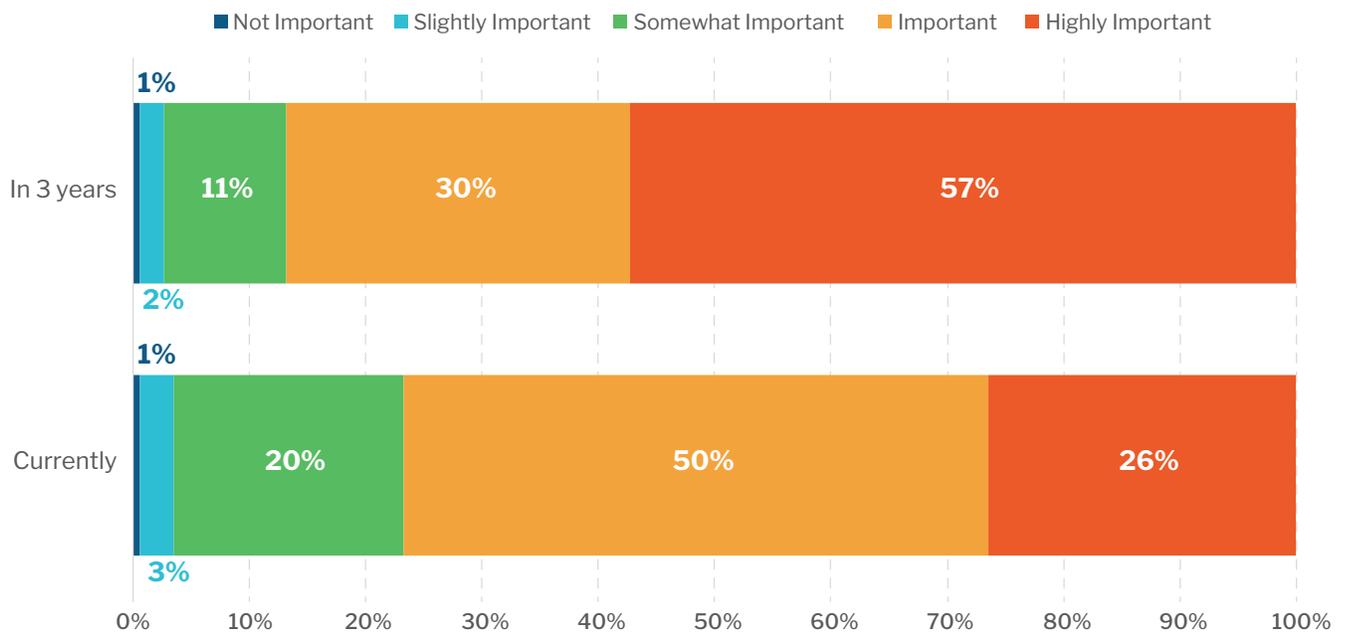
Datacenter efficiency and sustainability is already a major topic in the datacenter sector, and our survey shows it is high on the priority list for MTDC service providers worldwide. Ultimately, expectations from customers, regulators and the public at large will only become more pressing as the effects of climate change become more pronounced. As global datacenter infrastructure grows in response to higher demand for digital services, so does interest in its considerable environmental impact.

MTDC professionals concur in their outlook. Well over half (57%) of them expect it to be highly important for competitive differentiation in three years, up from the current reading of 26%. In a positive development, only an insignificant number of MTDC operators thought efficiency and sustainability unimportant.

Figure 13: Sustainability's impact on competitive differentiation

Source: 451 Research custom survey

Q: How would you rate the importance of efficiency and sustainability to your organization's competitive differentiation, currently and in three years?



Perhaps contrary to the tone of public policies in the respective regions, US organizations rated the current competitive importance of sustainability high in much greater numbers than Western European providers, 34% compared to only 19%. This difference doesn't change much with future expectations: nearly two-thirds of US operators think the matter will be highly important to their competitiveness compared to a little under half of those across the Atlantic. Encouragingly, providers in China and India, the two most populous countries in the world, view efficiency and sustainability as becoming critical: 75% of Chinese and 68% of Indian datacenter services providers believe it will be highly important in three years, up from the current reading of 33% and 46%, respectively.

Our survey shows that MTDC service providers are already doing a lot to improve the efficiency of their infrastructure and to make it more sustainable. The primary motivation behind their initiatives is to meet customers' requirements, most of which expect contractual commitments. 451 Research believes this factor will become even more powerful as large technology companies and major enterprises, which together command large swaths of datacenter demand, mount pressure on their MTDC providers in their pursuit of reducing carbon and water footprints under growing regulatory and public scrutiny. MTDC operators will have no choice but to comply or risk losing valuable business.

The current status of the MTDC sector is encouraging. On average, MTDC operators are much more aware of these challenges than general datacenter operators, perhaps largely because running datacenter facilities and the multitude of services wrapped around them is their core business. **Operators are giving more consideration to operational resiliency not only because customers are asking for higher efficiency and sustainability standards, but to prepare for the many potential effects of climate change.** Long-term survivability of their mission-critical digital infrastructure is a blind spot to many enterprise operations teams that lack funding and strategic thinking compared to commercial datacenter service providers.

Yet, most MTDC operators still have ample room for improvement. While there has been promising progress in the adoption of advanced management tools and more efficient power and cooling equipment, many MTDC facilities still have only covered the basics. About half of MTDCs have yet to roll out a DCIM suite, which is foundational not just for data collection but also for analysis and optimization. More sophisticated tenants, such as cloud and web services providers, will want real-time facilities data readily available for their consumption so they can, in turn, monitor the health of the infrastructure and optimize their IT.

Another area for improvement for MTDC providers of all sizes and in any geography is with low-carbon electricity purchases. A little over a third of surveyed operators said they did anything to lower the carbon intensity of the electricity sourced – such as switching utilities, buying renewable energy credits and contracting power-purchase agreements for low-carbon generation. Low-carbon electricity along with emerging ultra-high-efficiency technologies such as direct liquid cooling and dynamic power optimization give MTDC service providers options to reduce their environmental impact dramatically in the coming years.

## Methodology

Our study focused on MTDC service providers' views concerning sustainability and energy efficiency in the datacenter. Our analysis is based on primary research that included a field survey of datacenter professionals at MTDC providers with a sample size of 825 worldwide from 19 countries, our existing data from past surveys, and our interviews with technology vendors and customers as part of our standard research.



Now a Part of

## S&P Global Market Intelligence

### About 451 Research

451 Research is a leading information technology research and advisory company focusing on technology innovation and market disruption. More than 100 analysts and consultants provide essential insight to more than 1,000 client organizations globally through a combination of syndicated research and data, advisory and go-to-market services, and live events. Founded in 2000, 451 Research is a part of S&P Global Market Intelligence.

© 2020 451 Research, LLC and/or its Affiliates. All Rights Reserved. Reproduction and distribution of this publication, in whole or in part, in any form without prior written permission is forbidden. The terms of use regarding distribution, both internally and externally, shall be governed by the terms laid out in your Service Agreement with 451 Research and/or its Affiliates. The information contained herein has been obtained from sources believed to be reliable. 451 Research disclaims all warranties as to the accuracy, completeness or adequacy of such information. Although 451 Research may discuss legal issues related to the information technology business, 451 Research does not provide legal advice or services and their research should not be construed or used as such.

451 Research shall have no liability for errors, omissions or inadequacies in the information contained herein or for interpretations thereof. The reader assumes sole responsibility for the selection of these materials to achieve its intended results. The opinions expressed herein are subject to change without notice.



#### NEW YORK

55 Water Street  
New York, NY 10041  
+1 212 505 3030



#### SAN FRANCISCO

One California Street, 31st Floor  
San Francisco, CA 94111  
+1 212 505 3030



#### LONDON

20 Canada Square  
Canary Wharf  
London E14 5LH, UK  
+44 (0) 203 929 5700



#### BOSTON

75-101 Federal Street  
Boston, MA 02110  
+1 617 598 7200

