AFCOM

2024 State of the Data Center Report

How Power Design and AI Demand Has Forever Changed the Industry

By Bill Kleyman

WHITEPAPER

Table of Contents

2024 State of the Data Center Report

How Power Design and AI Demand Has Forever Changed the Industry

A Look at the Evolution of Our Industry

8th Edition

Report compiled by:

Bill Kleyman

AFCOM, Data Center World Program Chair

Featured AFCOM Contributor

Data Center Knowledge, Contributing Editor

CEO, Apolo

Report Reviewed by:

Jen Steele - AFCOM

Senior Manager, Data Center Programs

Informa Tech

Jordan Sutlive - AFCOM

Content Manager, Data Center Programs

Informa Tech

Statistical Analysis by:

Kristin Letourneau, PhD

Director, Market Research

Informa Engage

Note from the Author

I recall writing this note the previous year, not fully realizing how much our industry was about to change. We published the report just as ChatGPT took the world by storm. Fast-forward to today, and we've seen an entire year of innovation, data center growth, and market acceleration. Our critical infrastructure facilities have never been more important than they are today. I should note none of this report was written by ChatGPT. (Just in case you were curious.)

While I don't want to make this paper focused on AI alone, it became clear that artificial intelligence is a significant driver in how we will be building facilities moving forward. Simply put, every data center will become an AI data center. It's critical to understand the significant shift that happened. To do so, I want to speak directly to you, the reader.

Over the past year, we have dynamically changed how we interact with data. The change happening isn't a technology trend; it's a foundational shift in how humans interact with information. Everyone reading this has used Google or Bing in the past hour, day, or week. That means every one of you is a user of Generative AI. We've been conditioned to type a question into our favorite search engine for years only to receive a blue link. Today, the first response is a GenAI response, followed by the blue links. This change happened so fast that many hardly noticed. But this change is here, and it will impact your facilities.

While attending a recent conference, I learned how drastically we as an industry are playing catch-up with this new demand. Since the second half of 2021, *over 100 megawatts of pipeline construction have been added every single month.*

United States Data Center Absorption and Construction

Source: JLL Research
*Includes markets with complete historical data from 2019-2023
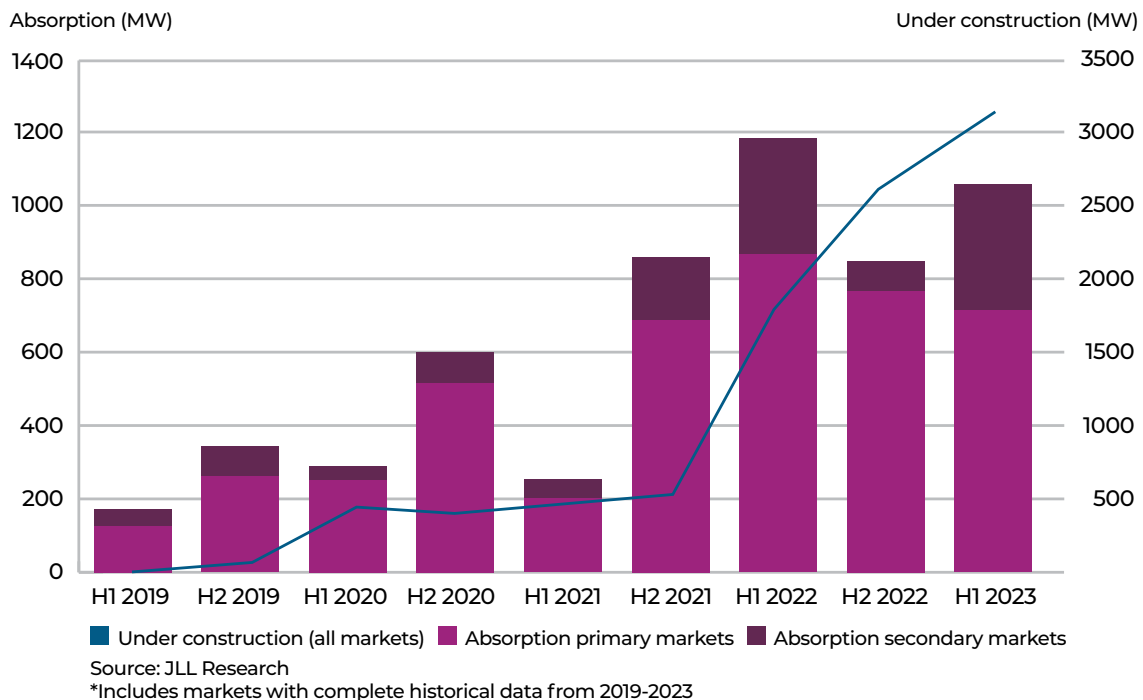
The large hyperscale cloud providers are increasingly accommodating new AI requirements and the need for more computing power. Rapid growth makes finding space and power for smaller market requirements challenging. Across the board, impacting practically every market and data center type, we have seen a significant surge in demand, with a mounting focus on capacity to meet higher-density data center requirements for AI development.

As AI requirements grow, data center operators must adapt their infrastructure to accommodate high-power-density server clusters. Language models dominate the AI conversation today with predictions that in the next five years, LLM-based applications will be as prevalent as web apps.

As you continue to absorb the data in this report, please note that this "trend" is not a fad or even a trend in some cases. The way we interact with data has experienced a human-level shift. We as a society will be interacting with data in ways we never thought possible. And the use cases will only continue to grow.

A year of non-stop innovation

As ChatGPT and Generative AI took off, we at AFCOM quickly took notice. The 2024 AFCOM State of the Data Center Report will reflect non-stop change and innovation in our industry. We'll bridge all new topics and showcase further questions based on the critical trends in our industry.

The 8th State of the Data Center Report: Section Overview

This report will look at some of the most impactful trends in our industry. The report and findings will shed new light on this growing digital industry with all-new sections.

In the 2024 report, we will review the following:

▲ Key Market and Data Center Trends

▲ Data Center Build, Design, and Construction

▲ Security Threats

▲ Implementation Plans

▲ Supply Chain Challenges and Updates

▲ Cloud Migration

▲ Cooling, Water Conservation, and Renewables

▲ CAPEX/OPEX Updates

The 2024 AFCOM State of the Data Center Report: An Exploration of Our Data-Driven World

With the help of our amazing AFCOM team, our nationally-held Leaders Labs, and the tens of thousands of people who received this report, we gathered some absolutely amazing insight that we're excited to share with you. Reviewed under the watchful eye of Dr. Kristin Letourneau, Ph.D., Director of Market Research at Informa Engage, who oversaw our study methodology.

Our fantastic AFCOM team, alongside our AFCOM advisors and members, have collaboratively unearthed remarkable insights we're eager to share with you. Meticulously scrutinized by Dr. Kristin Letourneau, Ph.D., the Director of Market Research at Informa Engage, our research approach aligns with the highest marketing research methodologies and practices standards. This report offers a clear lens into the nuances of the data center market and our progressive digital landscape.

The insights presented in this report are designed to significantly expand your understanding of the data center market and its dynamic nature within the business world. Regardless of your role, embracing this report will be vital in integrating into our digital era. It encourages an openness to novel possibilities, cutting-edge technologies, and innovative solutions, all contributing to the growth of your business and its users. More importantly, this report guides you in becoming an informed and responsible participant in our digital-centric world.

The data center, pivotal to digital transformation, has established itself as a crucial element in creating and designing advanced digital solutions. I am confident that you will find this report as insightful and illuminating as I have.

Bill Kleyman
AFCOM, Data Center World Program Chair
Informa Tech - Featured Analyst, Speaker, and Contributor
CEO, Apolo
January 20, 2024

## Introduction: State of the Data Center Industry Report

We've taken your feedback to heart. And we've also closely followed the updates from our industry. This year's report has been refined to be more succinct, following in-depth reviews of pertinent subjects and engaging in industry dialogues. As a result, you'll notice new sections, additional queries, and deeper insights into burgeoning industry trends.

So, relax and join us as we delve into these exciting updates.

Section 1: Data Center Construction and DCIM Implementation

The Number of Data Centers is Growing

The latest S&P Global **study** indicates nearly 10,000 colocation and wholesale data center facilities across North America, EMEA, Asia-Pacific, and Latin America. However, as our data needs continue to grow, the number of facilities to support this demand will only increase.
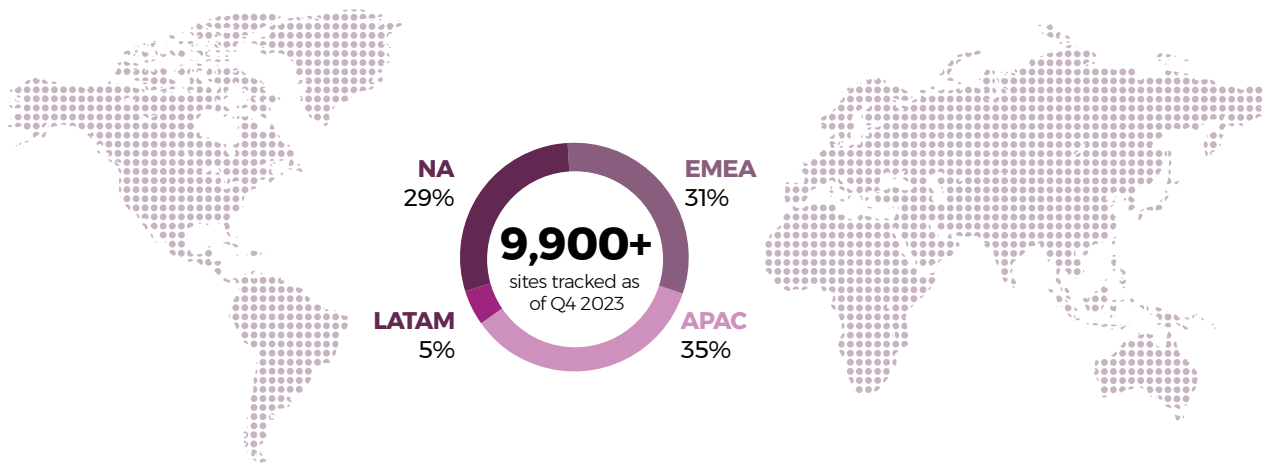
The recent study reveals promising, and not entirely surprising, trends in data center growth, as evidenced by two key metrics mentioned above:

1. **Expansion in Number of Data Centers:** There is a significant projected increase in data centers across various locations. Currently, the average number of facilities per respondent stands at 14. This figure is anticipated to rise notably, reaching an average of 22 facilities over the next three years, marking a considerable expansion in the data center infrastructure.

2. **Rise in Construction of New Data Centers:** Alongside the overall increase in facilities, there's a notable surge in the construction of new data centers. The current average of new data centers being built stands at one per respondent. However, this number is expected to multiply sixfold over the next three years, indicating a robust growth trajectory in creating new data center spaces.

These findings collectively suggest a robust and expanding landscape for data centers, reflecting these facilities' escalating demand and strategic importance in the digital era. The level of growth in the data center industry begs the following question: How will we support new construction and design efforts to support all these new facilities? With that question in mind, let's dive into some of the new questions from our survey.

New Data Center Builds and Prefabrication

The massive boom in infrastructure design and construction prompted us to ask a few new questions to better understand how our industry will keep up with the pace of demand.

The latest trends in data center construction for 2023-2024 highlight a dynamic and evolving landscape driven by various factors, including technological advancements and environmental considerations:

1. **AI-Driven Infrastructure:** The rise of artificial intelligence (AI) is significantly influencing data center design and infrastructure. Data centers are adapting to accommodate higher rack load requirements to support AI workloads and computational power demands. This change is driven by significant companies like Meta, Google, and Amazon, as well as AI-focused companies seeking more extensive power availability from a single location.

2. **Growth in Secondary Markets:** Data centers are expanding into secondary markets due to power shortages in primary markets. This includes developing submarkets around existing data center corridors and undertaking large projects in new areas with sufficient power and land resources.

3. **High-Density Colocation:** The demand for specialized high-density colocation services is increasing. This trend is driven by the need for facilities optimized for new processors and software frameworks tailored for generative AI and other advanced technologies.
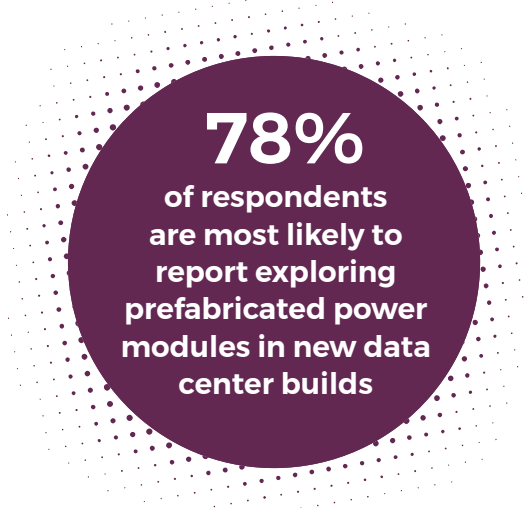
These trends reflect a sector rapidly adapting to technological innovations, environmental challenges, and market demands, emphasizing the importance of sustainable and efficient design in the future of data center construction.

To build towards a more efficient design and construction state, we asked our respondents what their approach to new data center builds would be.

Per our AFCOM report, the hybrid approach, a mix of traditional building and prefabricated modules, appears to be the most common approach to new data center builds over the next three years.

▲ 42% indicated that a hybrid approach to data center construction, using prefabricated modular facilities alongside traditional building techniques, is the best way to go.

Diving deeper into prefabricated data center designs, we were curious to learn which part would be prefabricated and delivered. Respondents planning to leverage prefabrication in new data center builds are most likely to report exploring prefabricated power modules (78%) and prefabricated cooling modules (72%).

78%
of respondents are most likely to report exploring prefabricated power modules in new data center builds

Prefabricated Data Center Models Being Explored

Model	Percentage
Power module (e.g., power supply, backup)	78%
Cooling module (e.g., chiller)	72%
IT module (e..g., an enclosure with multiple racks)	39%
Shell (used to encapsulate modules)	39%
Auxiliary (e.g., NOC rooms, corridors, meeting rooms)	28%
Physical security module	28%

Diving into power modules specifically, as it is the most popular prefabricated approach, we wanted to discover the features of a modular power design that were most interesting to our respondents. Th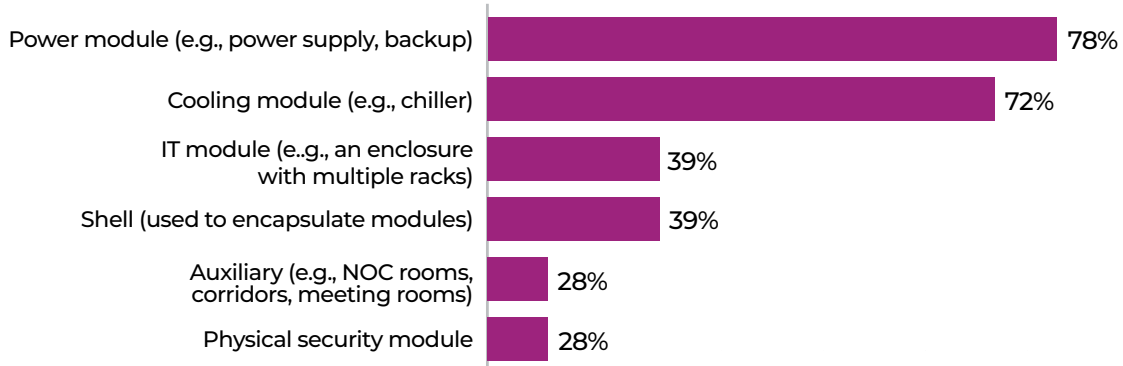e features that respondents look for most in prefabricated power models are power distribution equipment (92%) and uninterruptible power supply (92%). In a two-way tie for third, switchgear and transformer equipment (77%) were the next-most sought-after features.

DCIM Integration Initiatives

During the recent AFCOM Data Center World event in Austin, our DCIM class attracted a large audience. In a departure from our usual approach, we concentrated on illustrating the evolving perception of DCIM over the years. Our focus was on managing a data center's most vital and current operational aspects. We utilized cutting-edge technologies such as artificial intelligence, machine learning, and virtual reality to achieve this.

The point is that the evolution of digital twins, data modeling, and virtual reality has come a long way. And it's being applied in DCIM. To illustrate the growth, consider these metrics specifically around AR/VR and smart systems:

▲ In 2020, 16% stated that they already had some augmented or virtual reality solutions deployed as part of their DCIM strategy.

▲ In 2021, that number increased to 20% of those deploying the solution.

▲ In 2022, almost one in four (24%) actively deployed augmented or virtual reality systems.

▲ In 2023, 30% of respondents indicated they would deploy or work with AR/VR and smart system integration.

▲ In 2024, 58% stated that they have deployed or will be deploying AR/VR systems for their DCIM solution.

Over three years, the adoption of these advanced systems within DCIM has nearly tripled.

With that in mind, there are a few other significant changes in how data center leaders have evolved their DCIM Implementation Plans.

This year, we saw a shakeup in the top 5. For the first time since we released this report, security (both physical and logical) was at the top of the DCIM Implementation Planning list for data center leaders. This year, security tops the list again. Here's the breakdown:

▲ Security (physical and/or logical) – 59% currently implemented

▲ Power/energy/environment management - 56% currently implemented

▲ Cable management – 55% currently implemented

▲ Asset tracking/management – 50% currently implemented

▲ Integration with ITSM – 45% currently implemented

Unsurprisingly, security ranks high on the priority list, especially with the increasing worry over the physical security of critical infrastructure. Integrating more deeply with DCIM systems is a logical step, given their extensive insight into a wide range of operations within data centers.

Section 2: Power, Cooling, Infrastructure, and Sustainability

Rack Density and Expected Changes

We continue to see an increase in rack density, closely following industry trends. In 2021, respondents reported an estimated mean rack density of 7 kW in their primary data centers. Last year, the average was 8.5 kW/rack. Today, the estimated average has jumped to 12 kW per rack. And most respondents (55%) expect a further increase in rack density over the next 12-36 months.

To that extent, most respondents (60%) are actively working to increase density in their racks today. They're accomplishing this with several methods. Most (58%) primarily focus on improving airflow, followed by containment (42%) and liquid cooling (40%). In a close fourth, respondents also leverage new sensors (31%) for improved visibility.

This information isn't surprising, yet the solutions needed to manage increased density present significant challenges. Many organizations are striving to maximize their operations within limited spaces.

Consequently, there's a shift towards investing in advanced cooling systems, enhanced power management, and improved capacity technologies to meet these demands effectively. On that note, let's dive into what keeps your data centers nice and cool.
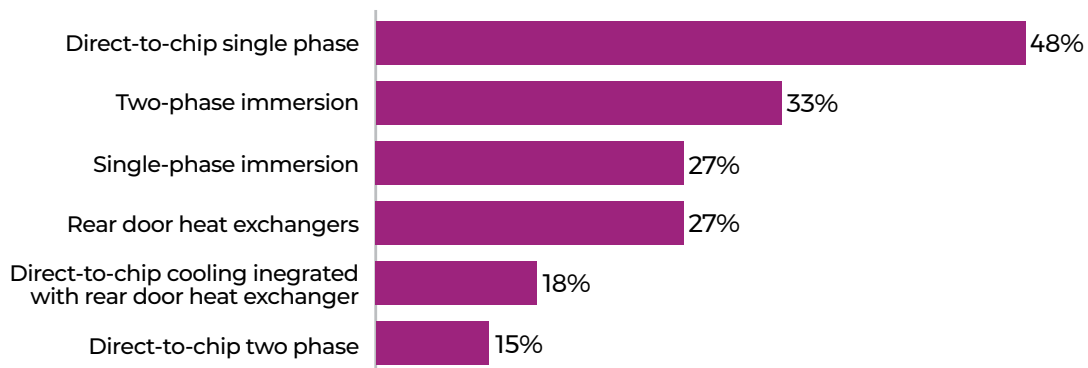
The State of Data Center Cooling

Last year, fewer than half (46%) of respondents reported their current cooling solutions meet all their requirements. 35% of respondents indicated they persistently run out of cooling capacity and must adjust.

Today, these metrics have improved as data center leaders shifted their cooling strategies to support more workloads, densities, and use cases. Still, over a third of respondents (38%) report their current cooling solutions are inadequate to meet their needs, including 20% actively looking into new systems for scalability.

Respondents are turning to liquid cooling for help to support emerging cooling requirements. Today, only 17% of respondents have adopted liquid cooling in their facility. However, an additional third (32%) plan to do so within 12-24 months.

Types of Liquid Cooling or Water-Cooled Solutions

Type	Percentage
Direct-to-chip single phase	48%
Two-phase immersion	33%
Single-phase immersion	27%
Rear door heat exchangers	27%
Direct-to-chip cooling inegrated with rear door heat exchanger	18%
Direct-to-chip two phase	15%

As an all-new question, we were curious about respondents' liquid cooling implementation plans. They will most likely have implemented direct-to-chip single phase (48%), followed by two-phase immersion (33%).

Regarding liquid cooling in data centers, there's been a remarkable uptick in innovative applications, such as integrating emerging solutions, novel liquid cooling techniques, and hybrid models to support new and evolving needs within the industry. Liquid cooling is expected to remain a focal point of discussion and development.

Investment in Renewable Energy, Nuclear Power, and Water Conservation

Our sector's expansion and critical role, along with its substantial energy needs, have necessitated a heightened emphasis on sustainable practices and the exploration of renewable energy sources.

From this year's report, three in four respondents (73%) plan to utilize renewable energy, including 27% who are currently doing so.

Respondents believe solar (59%) is gaining the most traction in data center operations, followed at a distance by wind (28%).

Let's bring up another important topic: nuclear power. Last year was the first time we asked the question of nuclear power as a renewable energy source. In 2023, 10% of respondents indicated that they are seeing traction around nuclear technologies, and this is where we may begin to see the rise of Small Modular Reactors (SMRs).

This year, that figure more than doubled, as 21% of respondents stated that they see nuclear technology as gaining traction in our industry. In fact, nuclear power came third on the list behind solar and wind.

According to the International Atomic Energy Agency, small modular reactors (SMRs) are advanced nuclear reactors with a power capacity of up to 300 MW(e) per unit, which is about one-third of the generating capacity of traditional nuclear power reactors.

59%

of respondents believe solar power is gaining the most traction in data center operations

While SMR vendors plan to launch commercially available SMRs sometime in the late 2020s to the early 2030s, many hurdles remain – from perfecting the technology and gaining regulatory approval to developing viable business models. Nevertheless, data center analysts say SMRs hold promise.

"There is a well-up of interest in nuclear as a potential solution for power-constrained markets that the data center industry has been challenged with," said Alan Howard, an Omdia principal analyst focusing on data centers and colocation services. "It's really clean energy. To get to a net-zero economy, nuclear is going to have to play a big role."

According to the IAEA, over 80 commercial SMR designs being developed worldwide target various outputs and applications, such as electricity, hybrid energy systems, heating, water desalinization, and steam for industrial applications.

As of this writing, further SMR developments in the USA have occurred. For example, The Nuclear Regulatory Commission (NRC) **approved** the first SMR design in the US: NuScale's advanced 'light-water' SMR, which can generate **77 MWe**. In October 2023, hosting provider Standard Power announced plans to use NuScale's SMRs to **build** two nuclear power plants in Ohio and Pennsylvania to provide nearly 2 GW of power to nearby data centers by 2029.

It's important to note that while SMRs have a lower upfront capital cost per unit, their **economic competitiveness is still to be proven in practice once they are deployed.**

Outside of operating with renewable energy, leaders in the data center space also focus on water conservation efforts. Two in three respondents (63%) plan to employ activities and initiatives to decrease water usage, including 18% who are currently doing so.
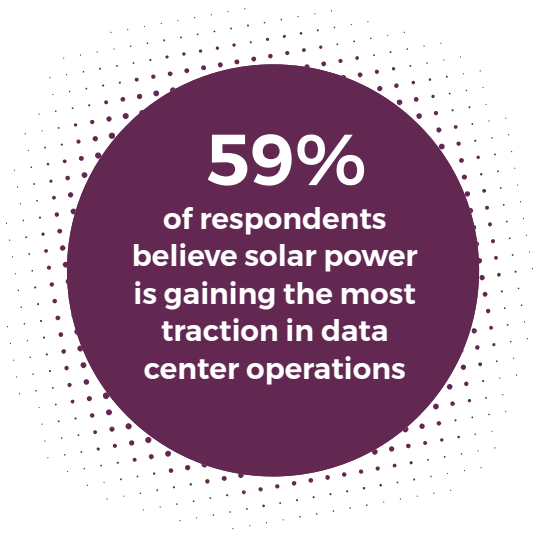
Concerning water conservation, respondents are most likely to employ or consider leveraging new cooling solutions that do not require water (45%), followed by eliminating evaporate cooling (37%).

Water Conservation Solutions Employed or Under Consideration

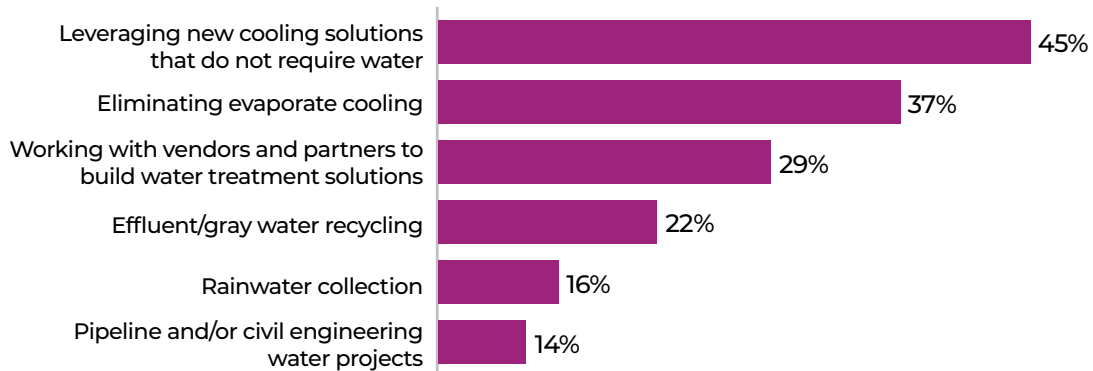| Solution	Percentage
Leveraging new cooling solutions that do not require water	45%
Eliminating evaporate cooling	37%
Working with vendors and partners to build water treatment solutions	29%
Effluent/gray water recycling	22%
Rainwater collection	16%
Pipeline and/or civil engineering water projects	14%

Section 3: Cloud Migration Trends and Deploying AI Solutions

Rebalancing Cloud Workloads

Cloud migration, specifically repatriation, has been a fascinating topic. Over the past few years, we have continued to see most respondents indicate that they are seeing some cloud repatriation happening. This year, we dove a bit deeper into the topic.

Concerns about the escalating costs of cloud computing remain significant. This issue has become so pressing that a specialized role has emerged, focusing on managing and reducing cloud-related expenses. Initially, shifting from capital expenditure (CapEx) to a subscription-based model in IT seemed cost-effective. However, the reality of increasing monthly charges, often for services with unclear usage patterns, quickly diminished these perceived savings. This challenge led to the creation of the FinOps discipline. Professionals in this field use innovative tools and methodologies to track, analyze, and control cloud costs, ensuring that the value derived from cloud services is optimized. And they've given us a good understanding of what lies ahead in the cloud:

"The dirty little secret of cloud spend is that the bill never really goes down," says J.R. Storment, executive director of the **FinOps Foundation**.

The positive development is the emergence of a more seasoned cloud and infrastructure deployment market. This maturity brings a heightened awareness among leaders about which elements need to be developed in the cloud and which are better suited for on-premise environments. Let's look at some cloud repatriation trends over the last three years.

- ▲ 2022: 59% of respondents saw the repatriation of workloads from cloud computing back to on-premise data centers or colocations.

- ▲ 2023: 83% of respondents saw the repatriation of workloads from cloud computing back to on-premise data centers or colocations.

- ▲ 2024: Most respondents (71%) have seen a migration of workloads from the cloud back to on-premise data centers or colocations.

Since we started asking this question, we have seen consecutive years of cloud workload migration into on-premise infrastructure. With that in mind, we asked a follow-up question. We were curious to see if there would be an impact on facilities once these workloads return on-premise. For those data center operators that saw repatriation, 71% have seen an increase in the power load demand, including 22% who report a significant impact.

Expanding on this topic, we also asked respondents which types of workloads they see being repatriated. The top ten workloads being repatriated include:

Types of Workloads Being Migrated from the Cloud

Workload	Percentage
ERP systems including supply chain management, human capital management, financial management	39%
Storage management including BDR, archiving, document management, general data storage	36%
Web applications	32%
IT Management solutions	32%
Commercially licensed databases	28%
Virtual desktops and/or virtual applications	27%
Custom applications (DevOps processes, services, Kubernetes)	26%
Service management solutions (ITSM, ITOM)	24%
Content management (enterprise content management and web content management)	23%
Financial management solutions	23%
AI workloads, like Large Language Model Training or Inference Training	21%

It was fascinating to see some workloads traditionally deployed in the cloud now being deployed within a colocation. Some of these trends will continue as end users calculate the actual cost of cloud computing. As a very important note: these metrics are not suggested that cloud computing is going away. We continue to see massive increased in new workloads and new use cases being deployed within the traditional hyperscale cloud ecosystem. However, with infrastructure and application maturity, many enterprise leaders have a better understanding of what should reside in the cloud and what should be colocated on premise. These metrics indicate a growing maturity in terms of how certain workloads are distributed.

Select Technology Implementation Plans

As an additional question, we were curious to learn about implementation plans for data center leaders. Specifically, we wanted to know which pieces of technology had the most impact on data center infrastructure planning. Not surprisingly, data center distribution has continued to fuel the edge data center market. And new requirements around AI, LLM, and generative AI have pushed data center leaders to look into GPU and other high-density compute solutions. Respondents are most likely to have currently implemented or plan to implement:

▲ On-premises cloud services

▲ Edge compute

▲ GPU/High-density compute hardware

Technology Implementation

■ Currently implement   ■ Will implement within 12 months   ■ Will implement within 3 years   ■ No plans to implement

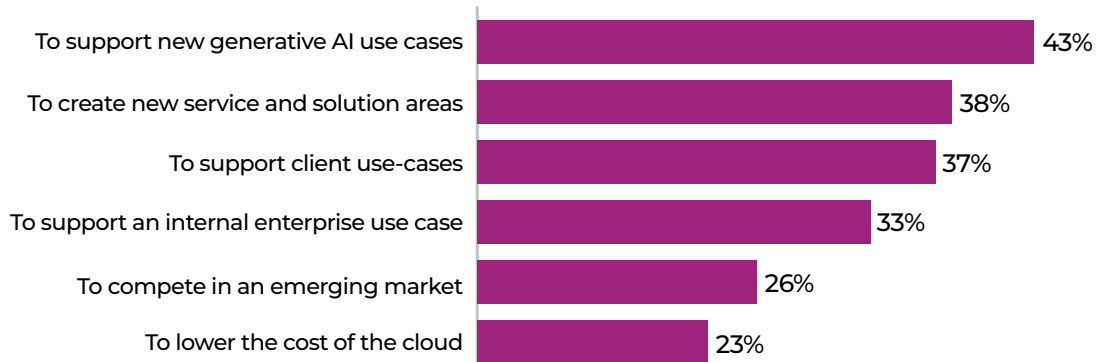| Technology	Currently implement	Will implement within 12 months	Will implement within 3 years	No plans to implement
On-premise cloud services	39%	19%	11%	38%
Edge compute	28%	20%	16%	36%
GPU/High-density computer hardware	26%	21%	15%	38%
Recycled servers or other IT hardware	30%	11%	11%	48%
OCP solutions, including DC-powered racks	18%	17%	16%	49%
White-box/commodity hardware	17%	17%	16%	51%
Immersion cooling	14%	16%	19%	51%
Direct-to-chip cooling	14%	14%	22%	49%

Interestingly, we saw Open Compute (OCP) platforms being positioned higher. 51% of respondents indicated that they are either already deploying OCP or will be doing so in the next 36 months.

Finally, tying back the cloud repatriation metrics, it was interesting to see on-premise cloud services take the top spot in this implementation list. It showcases an end-user market wanting to create deeper ties with its colocation partners outside hyperscale cloud solutions.

Deploying AI-Capable Solutions

Reasons for Deploying AI-Capable Solutions

Reason	Percentage
To support new generative AI use cases	43%
To create new service and solution areas	38%
To support client use-cases	37%
To support an internal enterprise use case	33%
To compete in an emerging market	26%
To lower the cost of the cloud	23%

As a new question on this year's survey, we were curious to see if our respondents were leveraging or deploying AI-capable infrastructure to support emerging demands. Throughout this report, you've witnessed metrics around GPUs and the growth of the data center industry. Regarding AI solutions, most respondents (56%) plan to deploy AI-capable solutions in their data centers, most commonly to support new generative AI use cases (43%).

Regarding AI in the data center, only 4% of respondents don't believe that AI workloads will increase capacity requirements. Most respondents (53%) believe new AI workloads (generative AI) will "definitely" increase capacity requirements for the colocation industry. Another 31% believe it will "probably" do so. These metrics indicate that AI-based workloads are here to stay and impact the traditional data center design approach.

Section 4: Infrastructure Threats and Supply Chain Challenges

Security and Infrastructure Threats

Ensuring that our infrastructures are up and running is no easy task. Emerging threats against physical infrastructure as it relates to physical and cybersecurity continue to exist.

According to the Uptime Institute's 2023 **Outage Analysis**, when outages occur, they are becoming more expensive, a trend likely to continue as dependency on digital services increases. With over two-thirds of all outages costing more than $100,000, the business case for investing more in resiliency — and training — is becoming stronger.

Enterprise Outage Math

Cost of an Outage

$100,000/Incident
Uptime Institute

$5,600/Minute
Gartner

High-Profile Outages

$100,000
Facebook's lost revenue from an outage in 2021

$34,000,000
Amazon's lost revenue during 2021 outage

~$1,000,000,000
Alibaba's lost revenue during Singles Day outage in 2021
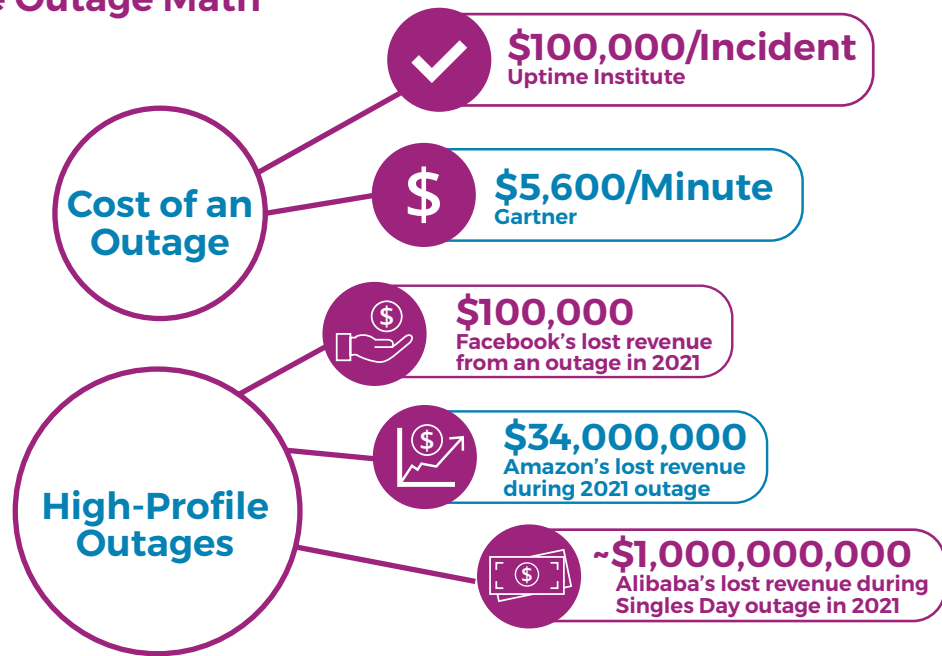
Source: Data Center Knowledge
https://www.datacenterknowledge.com/security/time-double-check-those-data-center-deadbolts-security-review-2023

For the 8th year in a row, and not surprisingly, ransomware hit the top of the list. When asked to indicate the top five security and infrastructure threats to their companies, respondents were by far most likely to mention:

- ▲ Ransomware: 54%

- ▲ Advanced persistent threats – threat of IT and corporate data: 48%

- ▲ Inside threats (human): 40%

- ▲ Outside threats (human): 39%

- ▲ Loss of PII: 37%

While DDoS slipped down in the list, human and physical threats against infrastructure continue to grow. Leaders in our industry aren't the only ones monitoring physical infrastructure threats; Federal regulators have also noticed. In January 2023, the Federal Energy Regulatory Commission (FERC) and the Department of Energy's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) held a joint technical conference discussing supply chain risk management in light of increasing threats to the Bulk Power System.

The result of this meeting was felt quickly. A few days after the meeting, FERC directed the North American Electric Reliability Corporation (NERC) to re-examine its Physical Security Reliability Standard, CIP-014-1.

This is an excellent reminder to all of you to review your physical infrastructure security and ensure it is up to date.

Let's shift our focus back to ransomware for a minute. In a recent 2023 **article** on Data Center Knowledge, we covered a ransomware attack against a data center that, quite literally, cost the company everything. The attackers succeeded in encrypting all servers' disks and the primary and secondary backup systems, whereby all machines crashed and lost access to all data.

While it's unclear exactly how the ransomware attack happened, the company stated that it was amplified by moving infected systems from one data center to another that was unfortunately wired to access their internal network to manage all of the facility's servers.

Please take note of these incidents, and be sure to review your cybersecurity approach, especially as it relates to ransomware.

Supply Chain Challenges

Once again, the conversation around supply chains continues to be one of the hottest topics.

According to Simon Ellis, Program Vice President of Global Supply Chain Strategies at IDC:

"Disruption has been front and center again and has largely validated the supply chain transformation journey that so many companies are on. In fact, companies that have aggressively pursued business transformation are outperforming those that have not. The supply chain will continue, must continue, on its journey of almost unparalleled levels of change with digital transformation at the center of efforts to both improve efficiency and effectiveness and be resilient to further, inevitable disruption."
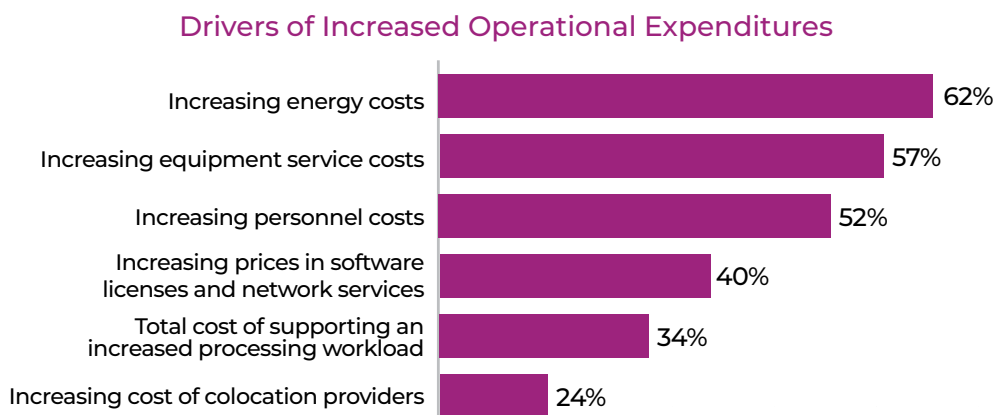
Like last year, this year's report indicated that 93% of respondents have had at least some supply chain challenges. Interestingly, about one in four (21%) of respondents experienced equipment outages due to supply chain constraints.

Expanding on the supply chain question, we were curious to learn more about where constraints are experienced. Respondents are most likely to have seen supply chain constraints with power systems (58%), IT equipment (54%), and cooling systems (49%).

Section 5: Budget and Personnel Trends

Shifting Budget and Spending Trends

Most respondents report increased operational expenditures in 2023 (54%). The top drivers of OPEX increases are increasing energy costs (62%), increasing equipment service costs (57%), and increasing personnel costs (52%).

Drivers of Increased Operational Expenditures

Driver	Percentage
Increasing energy costs	62%
Increasing equipment service costs	57%
Increasing personnel costs	52%
Increasing prices in software licenses and network services	40%
Total cost of supporting an increased processing workload	34%
Increasing cost of colocation providers	24%

Regarding CapEx, half of the respondents (50%) reported increased capital expenditures in 2023. The top drivers of CapEx increases include investment in existing facilities infrastructure (52%) and expansion of new facilities (47%).
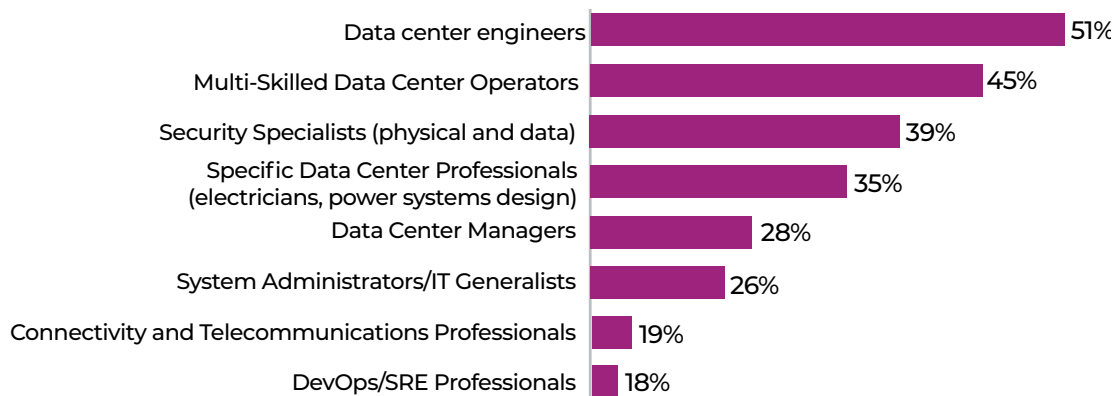
Drivers of Increased Capital Expenditures

Driver	Percentage
Investment in existing facilities infrastructure	52%
Investment in existing facilities expansion	47%
Investment in IT refresh, over and above annual refresh targets	43%
Investment in new facilities construction	43%
Supply chain challenges	43%
Acquisition of new applications	19%
Acquisition of a new company	14%
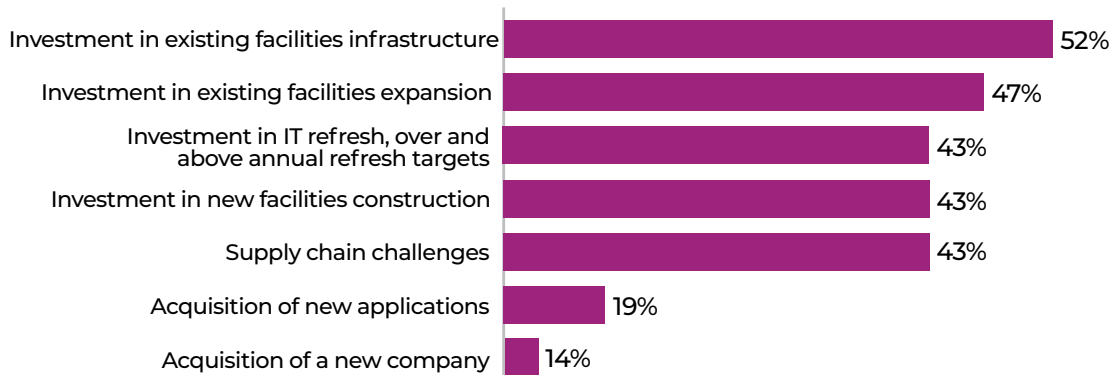
Working in the Data Center Industry

The data center industry remains a dynamic and enticing career option. This year, similar to the last, we observed consistent trends in the types of roles that were most sought after.

The personnel types posted for the most growth in recruiting include Data Center Engineers (51%), Multi-Skilled Data Center Operators (45%), and Security Specialists (39%).

Here are the top staffing opportunities within digital infrastructure:

Personnel Types Poised for Most Growth in Recruiting

Personnel Type	Percentage
Data center engineers	51%
Multi-Skilled Data Center Operators	45%
Security Specialists (physical and data)	39%
Specific Data Center Professionals (electricians, power systems design)	35%
Data Center Managers	28%
System Administrators/IT Generalists	26%
Connectivity and Telecommunications Professionals	19%
DevOps/SRE Professionals	18%

One important note regarding demographics. The data center industry continues to be in dire need of young talent and diversity. 85% of our respondents were male. Of all the respondents, 70% are 45 or older.

Final Thoughts: A Look to The Future

We are at the cusp of crafting a digital era like no other. In our world of unceasing connectivity, the reliance on data center operations is skyrocketing, magnifying the indispensability of the resources they provide every moment. With the advent of generative AI, groundbreaking applications in large language models, and an insatiable demand for digital infrastructure, the significance of our data centers has reached unprecedented heights.

In this journey, challenges are inevitable, and barriers are meant to be broken. The true mark of visionary leaders in this realm is their ability to achieve more through collective effort. The data center industry is a melting pot of innovators, visionaries, and intellects, all driving our technological use and experience. In this rapidly evolving landscape, there is very little tolerance for complacency. Embrace experimentation with new technologies; they could revolutionize your business and user experience.

Envision a future woven with ceaseless connectivity, encompassing everything from cars to cities, businesses to individuals. A future brimming with IoT devices, intelligent systems, and life-enhancing technology. This industry is a kaleidoscope of fascinating facts and figures, sometimes overwhelming, yet always exhilarating. To truly make a mark, it's essential to delve deeper into your business and technology ecosystem, not just to follow but to set the trends. Look beyond the apparent and position yourself as a trendsetter in a world and industry that thrives on change.

> **"We are at the cusp of crafting a digital era like no other. In our world of unceasing connectivity, the reliance on data center operations is skyrocketing, magnifying the indispensability of the resources they provide every moment."**
>
> **-Bill Kleyman**

DATA CENTER WORLD®
AFCOM

April 15-18, 2024 | Washington, D.C.

Being an AFCOM member has its benefits!

Active AFCOM members can enjoy special discounts and rates when they register for Data Center World.