VERTIV

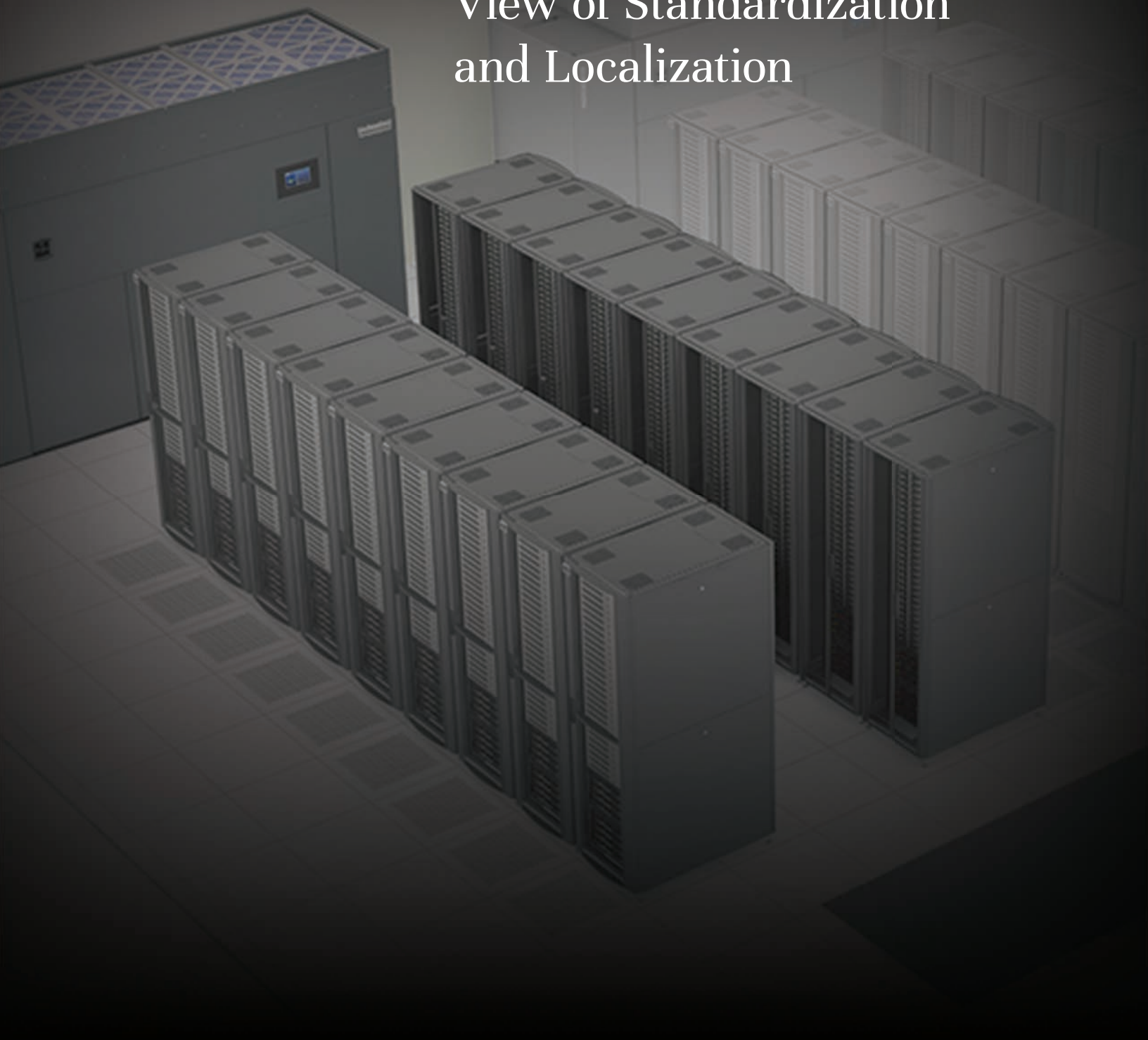# 2023 Hyperscale Data Center Design: A Global View of Standardization and Localization

As speed rules the landscape, hyperscale data centers are looking to maximize efficiency through standardization, where possible, and localization, where it is not.

Over the past several years, the world has seen record-setting growth in data center construction with the major hyperscalers leading the way in their race to add capacity. According to **Structure Research**, the total global hyperscale self-build capacity of 13,652 megawatts (MW) is expected to be added over the next 5-10 years.

This is part of the ongoing bifurcation of the data center market with growth focused among hyperscalers and at the edge. Meanwhile, the traditional data center is changing, focusing on efficiency, acting as the hub of hybrid networks, and

increasingly embracing prefabricated modular data center solutions and designs. These solutions can be constructed and integrated under tightly controlled factory conditions by trained specialists, which helps shorten construction timelines when time and labor are at a premium. These solutions also help reduce certain project costs and improve the total cost of ownership (TCO) by shortening the time to revenue. Depending on the architecture of the data center, prefabricated modular data center designs can reduce the physical footprint of the systems they replace by as much as 40%.

Prefabricated modular data center solutions come in the form of smaller prefabricated components, such as integrated racks, rows, aisles or skids built in the factory and deployed with servers and infrastructure included. They also can be deployed as all-in-one modules featuring integrated IT, power and cooling. These fully integrated prefabricated modules resemble compact building blocks and can be used for new data center builds or added to existing facilities.

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Standardization Versus Localization: What's the Difference?

A majority of hyperscalers across the globe are using standardized prefabricated data center designs featuring off-site prefabricated, modular units and building blocks that allow organizations to design and engineer on the backend and build and repeat as needed — regardless of location. While this practice may be more acceptable in areas such as the United States or certain parts of Europe, Middle East, and Africa (EMEA) where there's a stronger level of cohesion across various industry practices and regulations, global organizations need to consider the requirements of each region before deploying a standardized solution.

The alternative is a localization approach, a small yet important distinction where a standardized design is slightly modified and customized to comply with all the local requirements. For some specific regions, once a solution has been localized, it helps simplify compliance with building codes, standards, and regulations that can prove difficult in traditional installations and slow deployment.

This global hyperscale data center design update features insights from Vertiv's global team of experts and examines trends regarding prefabricated modular data center adoption and how standardization and localization differs among the regions.

In North America, Speed, Cost, and Proximity Pave the Way for Widespread Adoption of Prefabricated Modular Solutions

Peter Panfil, Vice President of Global Power, North America

According to **CBRE's 2022 North American Data Center Trends Report**, a record 686.8 MW of net absorption of data center space was added in just the seven primary U.S. data center markets. What makes prefabricated modular data center solutions appealing to the major hyperscalers and colocation (colo) providers in North America is that their speed and ease of deployment helps stabilize construction schedules during a time in which organizations are trying to meet unprecedented capacity demand. In every installation, they can use the same designs as much as possible, using a hybrid design based on prefabricated building blocks.

For example, when hyperscale data centers and colo providers are looking to deploy prefabricated modules, one of the biggest benefits is reducing the amount of wiring and piping on site. A traditional data center is full of conduit and wires that need to be connected, whereas a prefabricated module built on a skid, is

assembled in a production environment with predesigned and configured conduit and wiring space ways. The prefabricated solutions also rely heavily on busway that bolts together instead of cabling that must be cut, lugged, laced, and terminated. This reduces both the amount of labor required on site and the space needed for the discreet point-to-point wiring that must go into a design. Reducing the number of parts in a solution also increases both its reliability and uniformity.

In North America, hyperscalers and colo providers have the advantage of proximity. All the major third-party integrators have a local presence with easy access to equipment providers, which allows these integrators to deliver these solutions to various parts of the region within a matter of days. Conversely, in regions like Asia, even with centralized deployments in countries like Singapore or Thailand, the logistics for a deployment are much more challenging.

However, standardized solutions do not always take into account the different wiring requirements between countries. For instance, prefabricated modular data center solution designs are not always standardized to accommodate CE or UL standards. When deploying prefabricated modular data center solutions, equipment providers need to work with hyperscalers to not only normalize their one-line diagrams, but also localize them to the proper power requirements. One aspect we see getting normalized is the distribution voltage running to the servers in the racks. Colo providers will have multiple outlets on the taps of their power distribution units so that they can support a variety of different customers.

2023 Global Data Center Market Size

Total Power (MW)

● Americas ● APAC ● EMEA
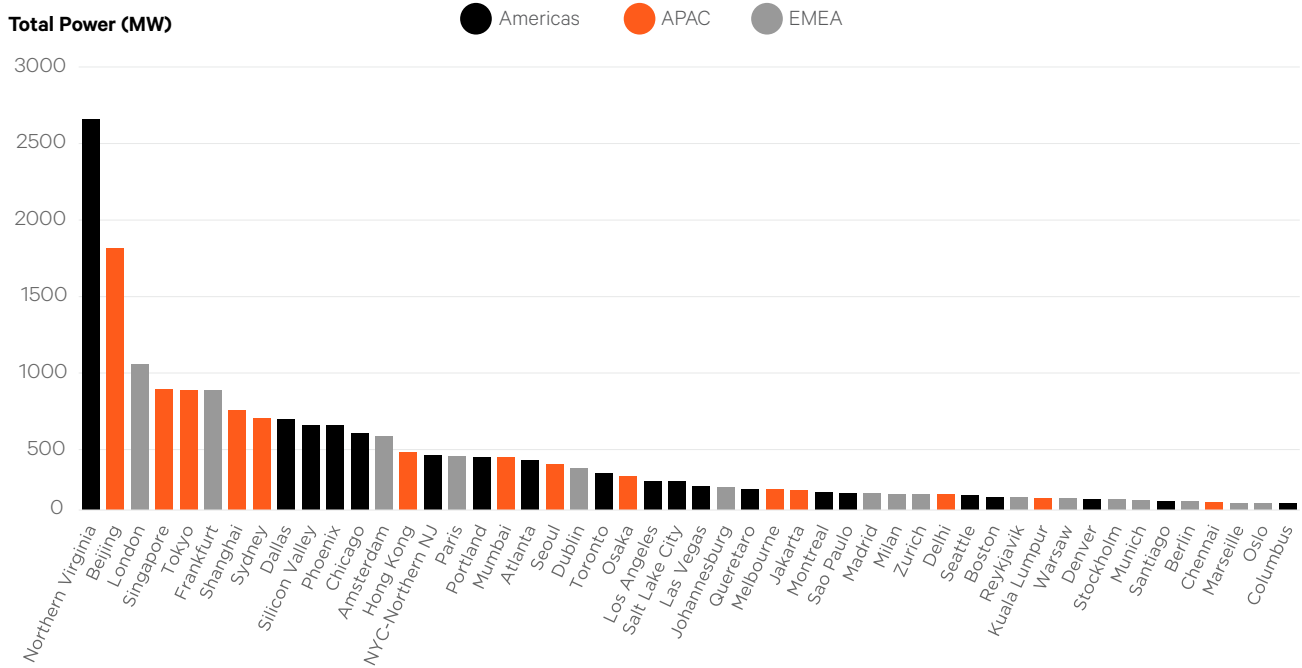
Per the [2023 Global Data Center Market Comparison report](#) from Cushman & Wakefield Research, the data center market continued its rapid growth with an estimated 7.4 GW online in 2023 as compared to 4.9 GW last year.

Standardization Meets Customization to Help Hyperscalers Meet Efficiency Goals

Sam Bainborough, Sales Director EMEA-Strategic Segment Colocation and Hyperscale

In the EMEA region, the major hyperscalers (Amazon Web Services, Google, Meta, and Microsoft) are leading the market in terms of adopting prefabricated modular data center solutions. They are building in remote areas, and these wide-open spaces make it easier to deploy large, standardized modules.

Whether it's for individual products or full-on assemblies, hyperscalers are trying to standardize their data center designs as much as possible and then break those designs down into building blocks that can be built off site and skidded into place. The idea is that if you were to walk into a data center in Virginia or Dublin, both the operational teams and the teams on site would be working with the same visuals for the project.

In the years to come, we can expect standardization to become increasingly popular in the Middle East and Africa, where hyperscale cloud revenue will

increase from $1.1 billion in 2022 to $8 billion in 2027, according to Structure Research's "**Market Share Report: Hyperscale Cloud Q1 2022 Update.**" However, a lack of in-country contractors to provide the uniformity hyperscalers demand remains a challenge. While there are in-region codes and regulations that will require localization, using standardized solutions means having the same labor team working on the same production line, giving hyperscalers continuity, as well as a level of service and quality that comes with a factory build, which is not the quality they get with an on-site install. As education levels and skillsets in this region increase, we can expect to see an increase in the demand for more building block solutions, such as power and cooling modules or skids, rather than fully prefabricated modular data centers.

In Europe, there has been well-documented public pushback regarding data center resource consumption.

To help alleviate some of these energy-related concerns, hyperscalers in parts of the region have used customized elements of prefabricated modules to reclaim heat in the data center and provide district heating for local populations.

As efficiency and sustainability continue to be prominent topics across all regions within EMEA, hyperscalers are asking how data centers can benefit local communities. However, because of the nature of shipping these large blocks by sea, sustainability can be a balancing act. The more we can incorporate sustainable materials and manufacturing methods in prefabricated solutions, the easier it will be to balance these elements.

Successful Deployment of Localized Solutions in Africa Requires Greater Education and Training

Wojtek Piorko, Managing Director, Africa

Africa has experienced massive data center capacity growth in recent years, with expectations the region will expand to **675 MW by 2026, according to Xalam Analytics**. While still considered an emerging market, prefabricated modular data centers have been around in Africa since 2008. Prefabricated modular data center adoption in the region will continue to grow as African countries continue to pass various data privacy laws to protect personal data and allow more countries to manage their data within the continent.

The transition from 2G to 5G and the increased demand for data in African universities are also driving growth for hyperscalers and colo providers in the region. As far as the adoption of prefabricated modular data center solutions, most of the major players in the region prefer one of three options: a fully customized solution, a solution using standard components that are combined for specific customer specifications, or a pre-designed standard solution. Each of these options provide different levels of design customization, growth phasing/expansion capabilities, and deployment time to meet specific business requirements.

Prefabricated modular data center solutions have been a huge help in increasing the speed to market for hyperscalers and colo providers. As we see the market grow, organizations entering the region will need to familiarize themselves with the nuances of each country to ensure they're bringing in the right solutions, localizing that solution for each region, and adding capacity without disrupting existing infrastructure. These considerations include climate differences, local construction codes, certifications, standing contracts, and import duties between individual components versus a full solution.

Similar to other emerging regions, the challenge of finding skilled labor looms large across the continent. The plug-and-play nature of standardized prefabricated solutions has made them more popular for hyperscalers and colo providers in Africa. However, proper education is still needed to ensure successful deployments.

Organizations like Vertiv are working to establish more training centers in Africa to help educate the local population on all types of data center solutions. Vertiv has five training facilities in Africa with certification programs for technicians and salespeople. Once a prefabricated module is assembled and tested in the factory, equipment providers may also send engineers from the factory team to the build site so they can provide a factory-like presence while helping local engineers install complete solutions.

Prefabricated Modular Data Center Challenges and Opportunities for Latin America

Marc Stewart, Global Sales Director

Image of Parque de las Ciencias in Canelones

With **Google purchasing 30 hectares of land for a data center in Uruguay in 2021** and Scala Data Centers launching the **largest vertical data center in the region last year**, Latin America (LATAM) is establishing itself as an emerging market for prefabricated modular data center solutions. This is mainly because hyperscalers realize that a fleet comprised of mostly bespoke solutions is too costly to maintain and scale over time.

Additionally, the costs and risks associated with more traditional stick-built data centers and changing regional markets have made the scalability of prefabricated modular solutions more appealing. If these organizations can get a standard solution with plug-and-play functionality, that will reduce overhead and help make their services much more profitable. While organizations moving into LATAM want to standardize as much as possible, they must understand the various codes and jurisdictions and correctly localize these solutions for successful deployment.

As with other developing regions, logistical hurdles related to shipping prefabricated modules and difficulties securing the proper government-related land permits have slowed growth in LATAM. Workforce development is also a challenge for the region. While prefabricated modular data centers can help address labor shortages during the installation process, there are ongoing needs in LATAM for more training and education to perform warranty and post-warranty services on these data centers once they are deployed.

To address this need, we are seeing more equipment providers sending factory-trained personnel to help bring local technicians up to speed so that these prefabricated solutions can be deployed successfully and in a way that abides by the local requirements.

Largest vertical data center in the region (Scala)

Adoption of Prefabricated Solutions Remains in Its Infancy in the Asia-Pacific Region

Tony Gaunt, Vice President, Colocation and Hyperscale, ANZ, SEA & India

Rather than self-built data centers by hyperscalers, colocation continues to be the most important data center sector in the Asia-Pacific region. One major reason for this is that hyperscalers often do not have access to in-country staff to build data centers. Instead, they leverage established colocation data centers with a local presence, expertise, and cable connectivity to meet demand. Even so, the region still faces the challenge of having enough data center builders in each country to keep up with demand.

While this lack of skilled labor on site would make a strong case for organizations to look into adopting more standardized solutions, there are several reasons why prefabricated modular data center adoption in the Asia-Pacific region is still in its relative infancy compared to the rest of the world. The first challenge is

that much of the local expertise lies in traditional brick-and-mortar data center builds. Many data center builders in the Asia-Pacific region also prefer the look and feel of traditional data centers, rather than the container-like appearance of a prefabricated modular data center.

Perhaps the greatest barriers for adoption are the logistical challenges related to shipping prefabricated modules. Much of the supply chain woes that have hampered the region since the pandemic persist today. The current lead times to ship these prefabricated solutions can minimize the speed-to-deployment benefits that these solutions provide once they arrive.

One area of opportunity for prefabricated modular data center solutions in the Asia-Pacific region is in cable landing stations in countries where you need standardized

solutions to accommodate the lack of engineering expertise within the local economy. By next year, there will be seven trans-Pacific subsea cables connecting the Philippines to the United States, including Asia-America Gateway (AAG), Guam-Philippines, SEA-US, Jupiter, PLCN, CAP-1, and Bifrost. Should there be opportunities for prefabricated modular data center solutions, there are several factors to consider beyond basic knowledge of the domestic environment. To successfully deploy a normalized solution, an organization needs to understand design compliance, price, lead time, the commissioning, and the warrantying of the solution, and which vendors to choose.

Conclusion

In a recent **Omdia global survey** of 228 companies that operate their own data center, 52% of respondents already had prefabricated modular data center (PMDC) technology in operation. A surprising 99% said PMDC would be a part of their future data center strategy. While each corner of the world may differ slightly in how these solutions are adopted and localized, the evidence is clear: traditional data centers continue to fade into the background as prefabricated, modular buildings and components become the norm for most hyperscalers and colo providers.

Visit the Vertiv website for more information about prefabricated modular data center solutions.