JLL®

Global | H1 2022

Research

H1 2022 Global Data Center Outlook

Data Center activity continues to swell as the world moves toward a more digital future

Emerging from the pandemic, it's clear the world of work is adapting to this digital environment, especially as hybrid becomes the new norm for most office workers. Roughly 55% of office workers globally are now working in a hybrid model. Moreover, there is unforeseen growth in personal usage of social media, online gaming and streaming applications. All these changes in the internet ecosystem demand more power capacities, innovative data storage solutions, and internet connectivity, adding to the ever-growing scale of data creation, mobility, and storage needs.

Enterprise organizations continue to invest in cloud infrastructure services, driving momentum within the data center development pipeline. Operators are forecasting their biggest year this year and at least for the next three years as demonstrated through preleasing activities on campuses that are not built yet. Macroeconomic challenges are likely to drive continued operational optimization at the enterprise level which will in turn drive cloud demand, further fueling data center growth.

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Data Center Research

Contents

Key trends to watch

for the second half of 2022:

1. New data center supply will be impeded by the availability of land and power in many major markets, driving expansion outside the traditional hubs.

- Driven by the historically high volume of preleasing activities U.S. market demand reached 1,087 MW in H1 2022, more than 95% of 2021's full-year demand.

2. Persistent supply chain delays will continue to cause delivery challenges for the next 24 months.

- These delays are resulting in 50+ week intervals for server hardware and labor shortages continue to persist throughout the global manufacturing landscape.

3. Enterprise demand for cloud is anticipated to grow exponentially as businesses move from owned assets to either full cloud or hybrid models.

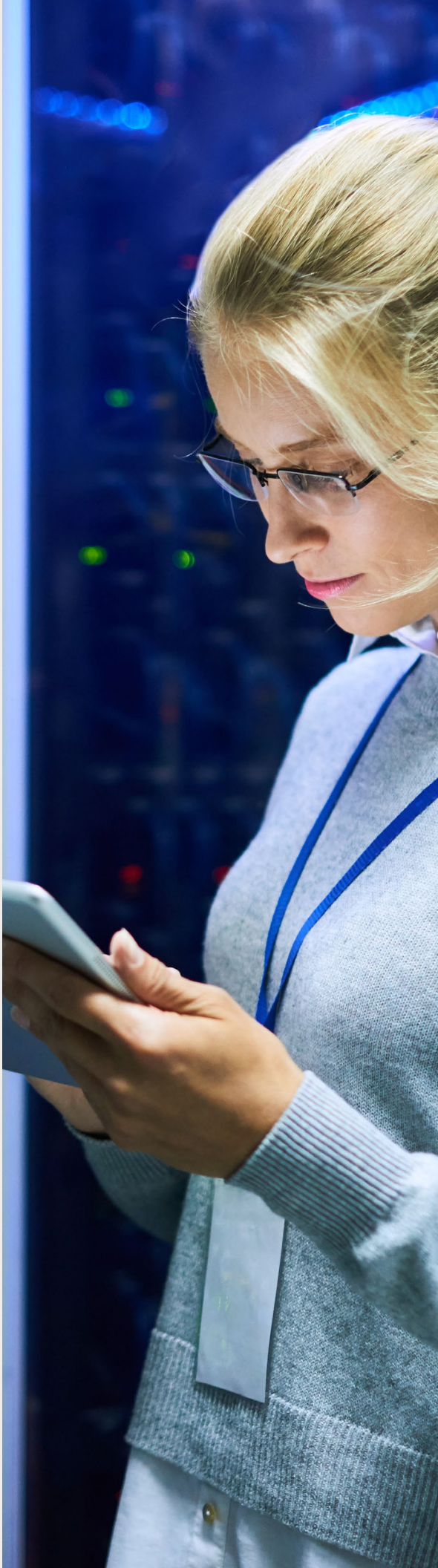
- Globally, annual spending on cloud services reached $178 billion in 2021 compared with $129.5 billion in 2020 and the cloud services sector in 2022 is expected to grow to $200 billion by the end of this year. This is leading to preleasing and increased competition between hyperscale users.

4. Sustainability will continue to be a key focus for the sector as net zero carbon mandates proliferate across the public sector.

- Global data center energy consumption reached 190.8 terawatt hours at the end of 2021. Since 2017, hyperscale data centers have nearly doubled their consumption to 87 terawatt hours while traditional data centers have more than halved their power consumption from 70 terawatt hours to 33 terawatt hours. Users of all types are starting to require providers to have a clear strategy around their energy usage and sustainability goals.

5. Capital will continue to flow into the sector through private equity and real estate investment.

- Despite interest rate hikes, M&A activity for H1 2022 totaled $24 billion while real estate investors poured more than $2.8 billion into acquisitions of existing assets as well as development sites.



1. Top global trends

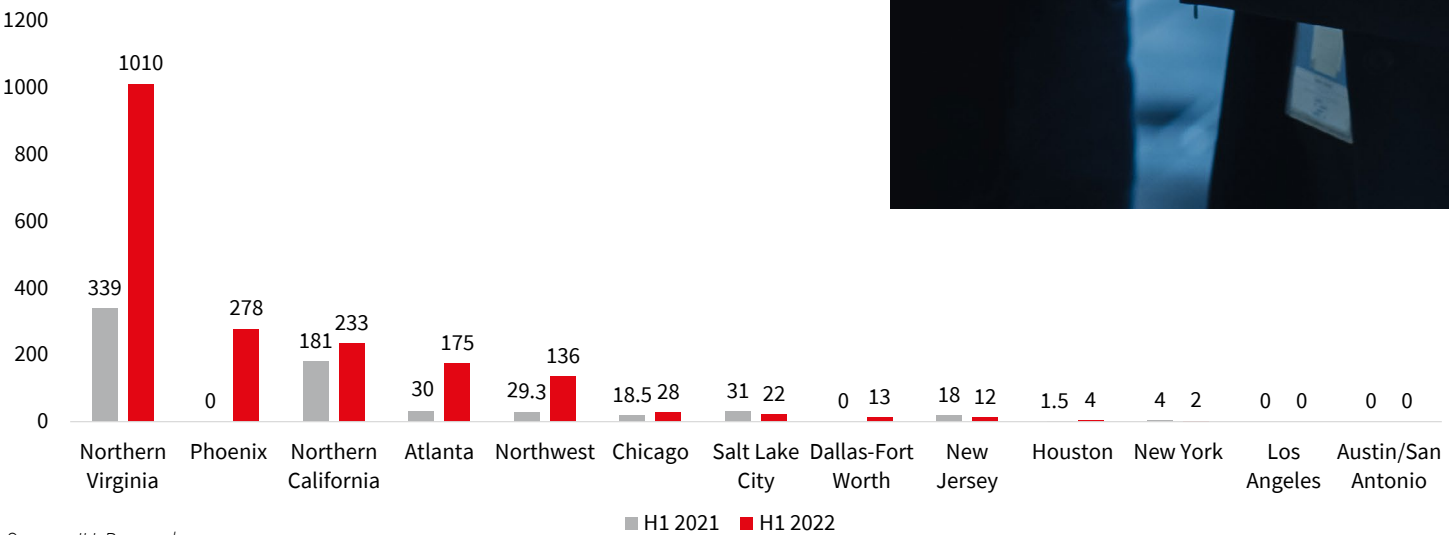
New data center supply will be impeded by the availability of land and power in many major markets, driving expansion outside the traditional hubs.

In the United States, leasing activity continued at an unprecedented pace through mid-year 2022, creating challenges for users and operators in an environment already colored by very tight supply conditions. The U.S. data center construction pipeline at the mid-point of 2022 totaled 1,913 MW, which exceeds last year's total, and has nearly grown by three times on a year-over-year basis.

Data center construction activity has escalated in APAC and EMEA, too, where key markets combined have an additional 2,000 MW of development underway at mid-year 2022. Operators are expanding to catch current and future market needs in the increasingly digital world. The biggest problem around the corner is how to generate enough power for these newly developed sites.

U.S. data center construction trends

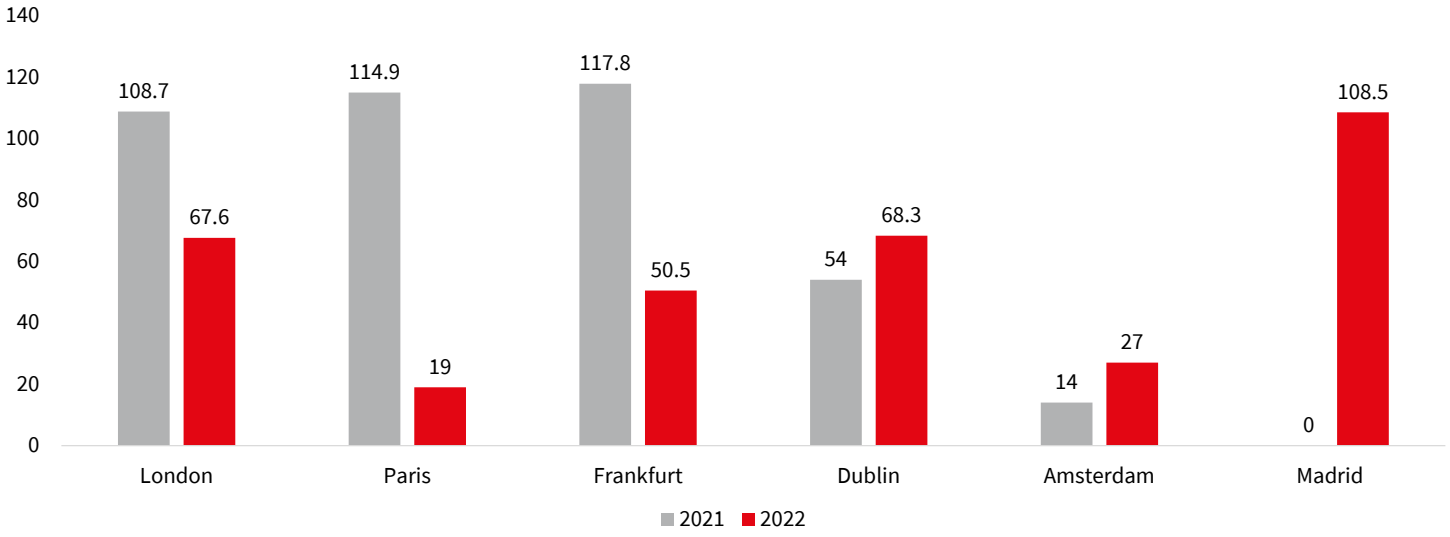
Under construction (MW) by U.S. Market, H1 2022 vs. H1 2021



Source: JLL Research

EMEA data center construction trends

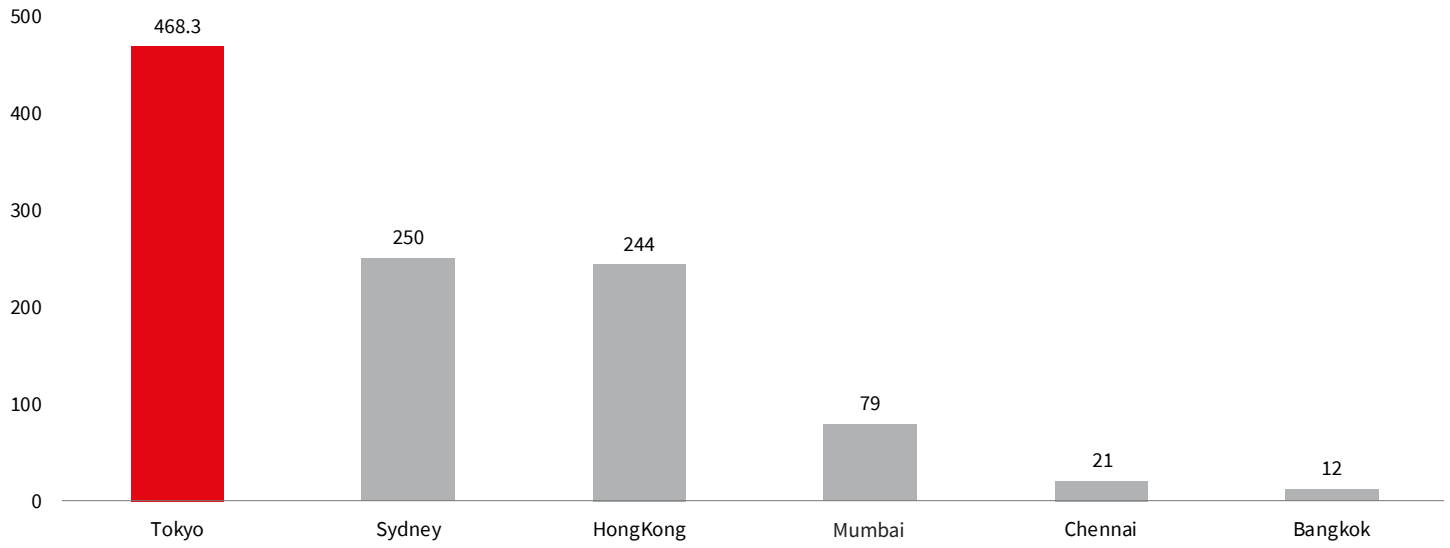
Under construction (MW) H1 2021 vs. H1 2022



Source: JLL Research

APAC data center construction trends

Under construction (MW) 1H 2022



Source: JLL Research

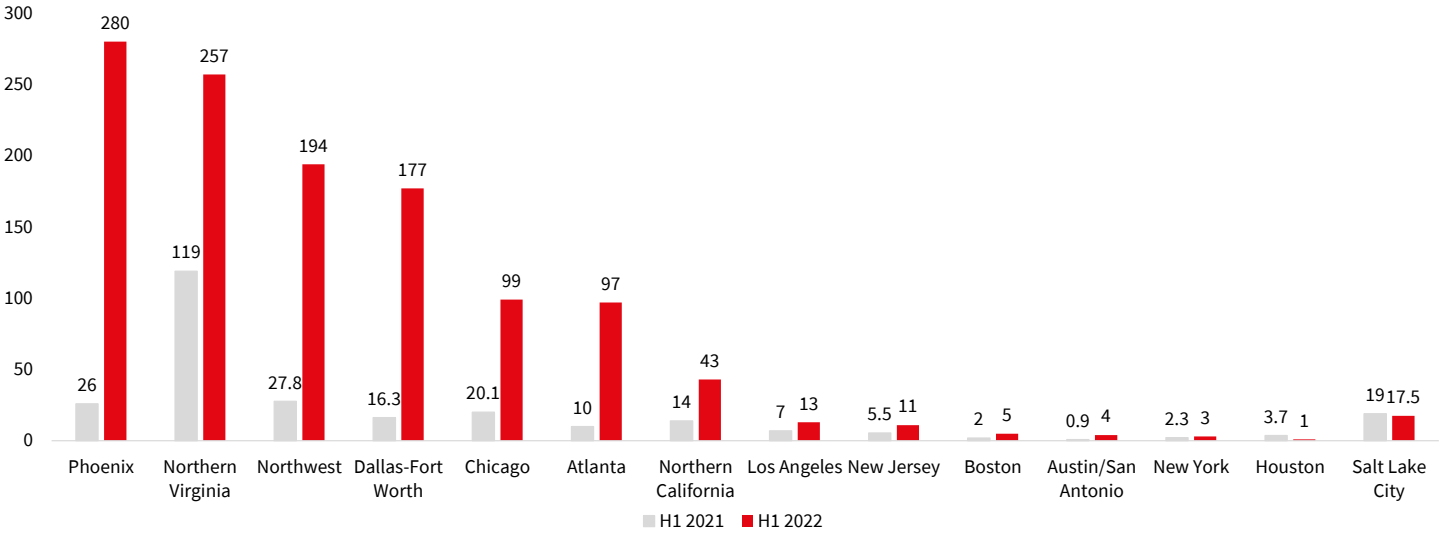
From 2019 through 2021, the data center infrastructure market continued its rapid growth, with public cloud service revenue surging from $160 billion to $230 billion. With the rise of new social media applications, growth in established platforms and implementation of AI, unprecedented hyperscale demand has absorbed significant load across all markets. The enterprise demand side of the market has remained marginally stagnant, generating an average of $100 billion in revenues annually, as more enterprise-level users are now migrating to cloud services to optimize their IT footprint, implement flexibility and increase speed to market within their business.

This demand is driving capacity shortages, land availability issues and power delivery delays. Driven by the historically high volume of preleasing activities, U.S. market absorption reached 1,087 MW in H1 2022, more than 95% of total demand in 2021. This is driving accelerated demand in EMEA markets, where moratoriums on new development and energy regulations are limiting future supply, driving users to secure space while it's still available.

Globally, there is a pipeline of 314 new hyperscale sites, and at the end of 2024, the number of global hyperscale sites will pass the 1,000 mark from approximately 500 sites just five years ago. However, land and power is becoming a more pressing issue in core markets in EMEA and APAC. Amsterdam put a moratorium on new data center developments for two years and currently has strict requirements on new builds. Singapore also has a moratorium and Ireland announced a de facto moratorium on new developments as well. Power supply will be the greatest challenge for emerging markets, even with land in abundance.

U.S. data center absorption trends

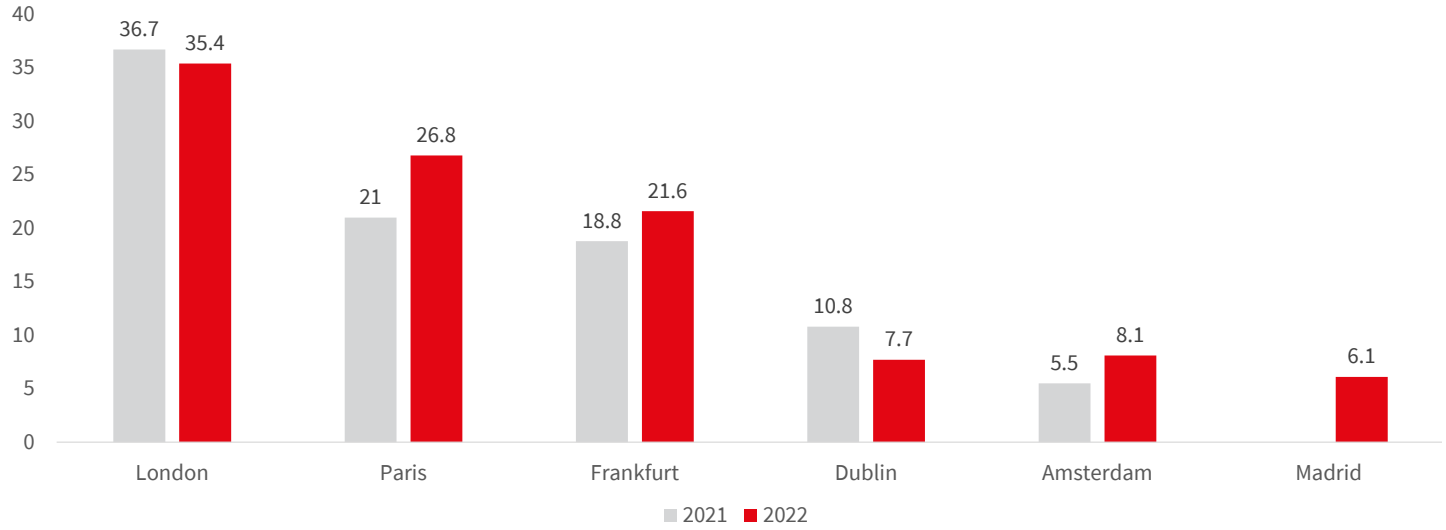
Absorption (MW) by U.S. Market, H1 2022 vs. H1 2021



Source: JLL Research

EMEA data center absorption trends

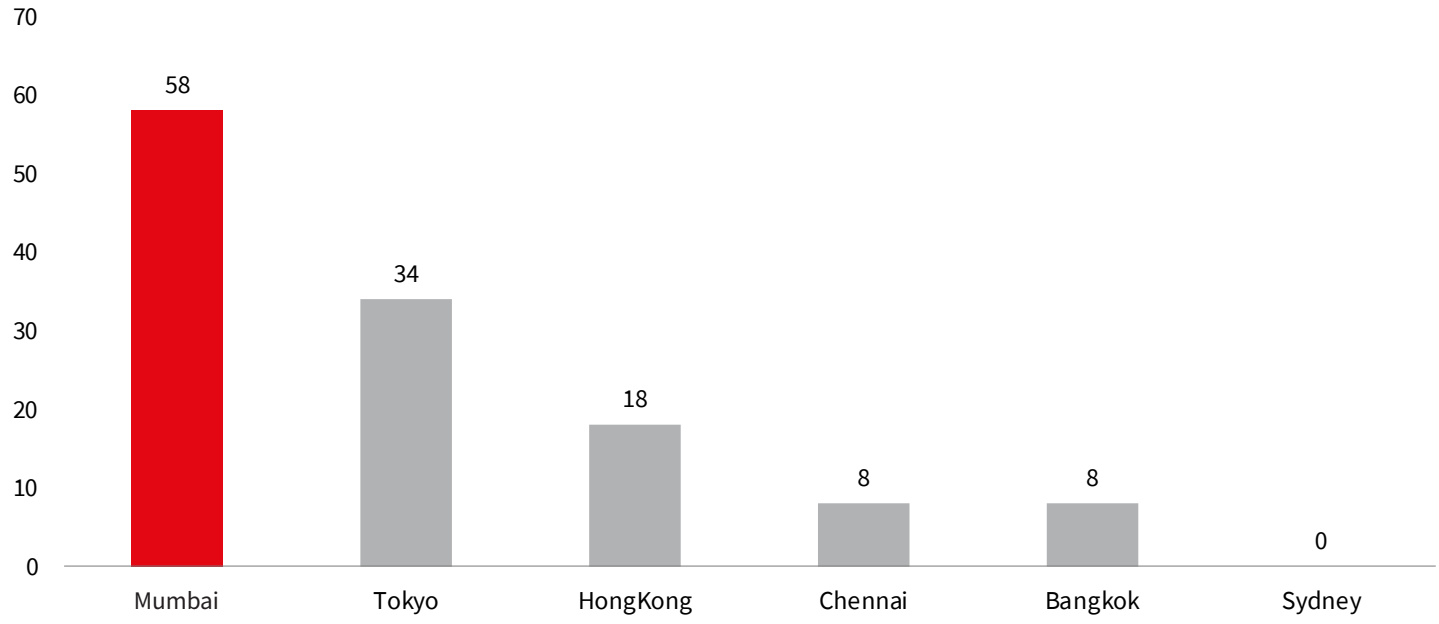
Net absorption (MW) H1 2021 vs. H1 2022



Source: JLL Research

APAC data center absorption trends

Net absorption (MW) 1H 2022



Source: JLL Research

A robust pipeline of multi-phase data center construction developments are taking place across the globe.

In the second half of 2022 we anticipate seeing more announcements of significant data center developments across the African continent, into Middle Eastern countries and new regions in APAC.

AMER

A 100 MW project is rolling out this year in Salt Lake City, Utah, by Aligned Data Centers.

Stack infrastructure has completed a 24 MW facility in Hillsborough, Oregon, which was powered by 100% renewable energy; this quarter only 12 MW is available due to the preleasing activity.

Quantum Loophole, Inc. is laying out 2,100-acre sites for data center infrastructure at Frederick, Maryland.

EMEA

More than 62 MW of capacity will be delivered by Equinix in Europe this year.

In Frankfurt, Germany, another 83 MW for five data centers named FRA18-22 project is under construction by DPR Construction for Digital Realty. By 2028, this project is expected to deliver 200 MW power capacity.

Madrid continues to be the largest data center hub in Spain. This year NTT Ltd. opened its first data center in the capital with 6.3MW power capacity deployed in phase 1.

Africa Data Centers is planning to build a 30MW facility in Accra, Ghana.

APAC

A Malaysian international multi-utility infrastructure group, YTL Data Center Holdings Pte. Ltd., is constructing a data center park in Johor, Malaysia, with 500 MW power capacity in total with equal solar power generation. The first phase will operate in 2024.

STACK Infrastructure is constructing a 72 MW colocation data center campus in Melbourne's western suburbs as well as expanding two hyperscale markets: 28 MW in Canberra and 24 MW in Perth.

Followed by the introduction of Data Center Policy in 2021, this year the state cabinet of India approved a non-financial incentive worth $1.24 billion to NIDP Developers Pvt Ltd. of Hiranandani Group. Under the policy, government agrees to provide a data center park (any facility more than 40 MW) with nonfinancial and financial incentives that cover interest, land, stamp duty, electricity supply, transmission and wheeling charges.

Top global trends

2.

Persistent supply chain delays will continue to cause delivery challenges for the next 24 months.

Streaming services (video, online gaming and emerging digital technologies) account for 87% of consumer internet traffic today. 4G and 5G networks together carry 83% of mobile traffic, underscoring the growing need for edge data centers to accommodate the changing nature of data transmission toward mobile-driven networks.

With the rising deployment of IoT services, edge data centers will become more essential to drive performance and handle larger data storage needs. As users require greater and better performance, modernized, high-density data center capacity will be needed to support the interconnected ecosystems across the major markets.

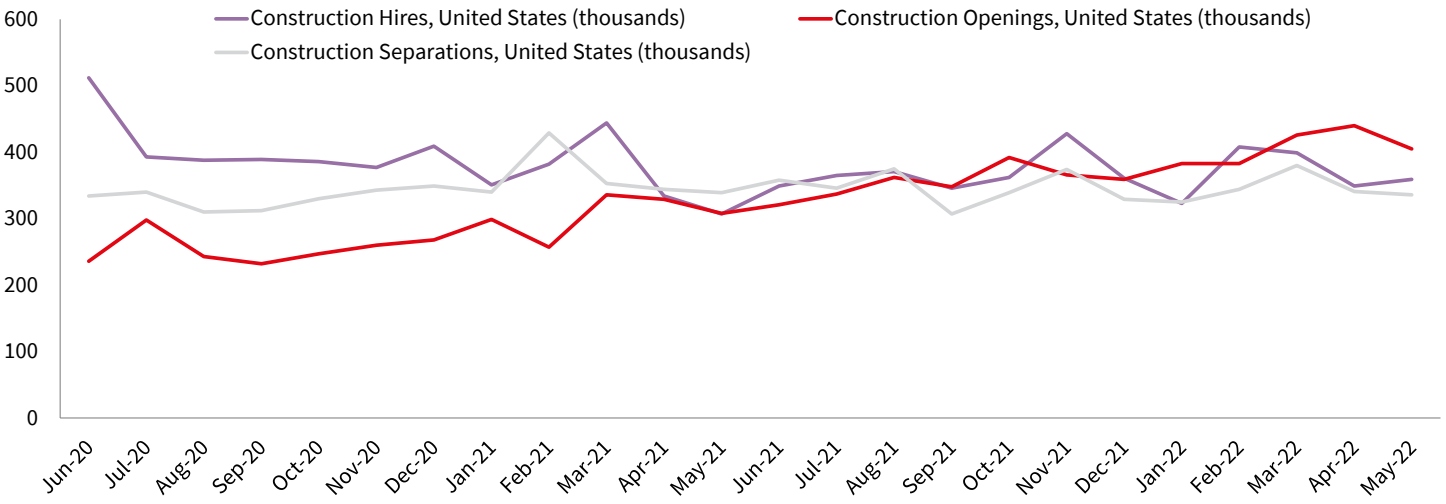
In recent years, massive construction material and equipment purchasing due to hyperscale data center expansion along with the impacts of the pandemic, have disrupted the construction supply chain. Construction suppliers with limited capacity amid an unpredictable market face challenges meeting the growing demand.

Additionally, the increasing demand for data centers exacerbates supply chain disruptions, including the surging price of raw materials, product assembly, and labor shortages.

In the United States, construction job openings have hovered between 300,000 to 400,000 each month, putting additional pressure on data center development timelines. One of the critical challenges for the construction sector is the lack of skilled workers, and this is even more pronounced for data centers due to their specialized design. Competing projects like new semiconductor plants put further strain on the same skilled workforce.

From the ongoing labor wage and material inflation challenges to construction supply chain disruptions, the current macroeconomic environment is transforming any user-oriented markets into provider-oriented markets. Many primary markets are now seeing power transmission delivery delays, moratoriums or pushback on development,and lack of available land sites. Because of this, vacancy is expected to decline, especially as development slowdowns persist and create scarcity in the market.

U.S. Construction job openings continue to outpace hiring



Source: BLS

3.

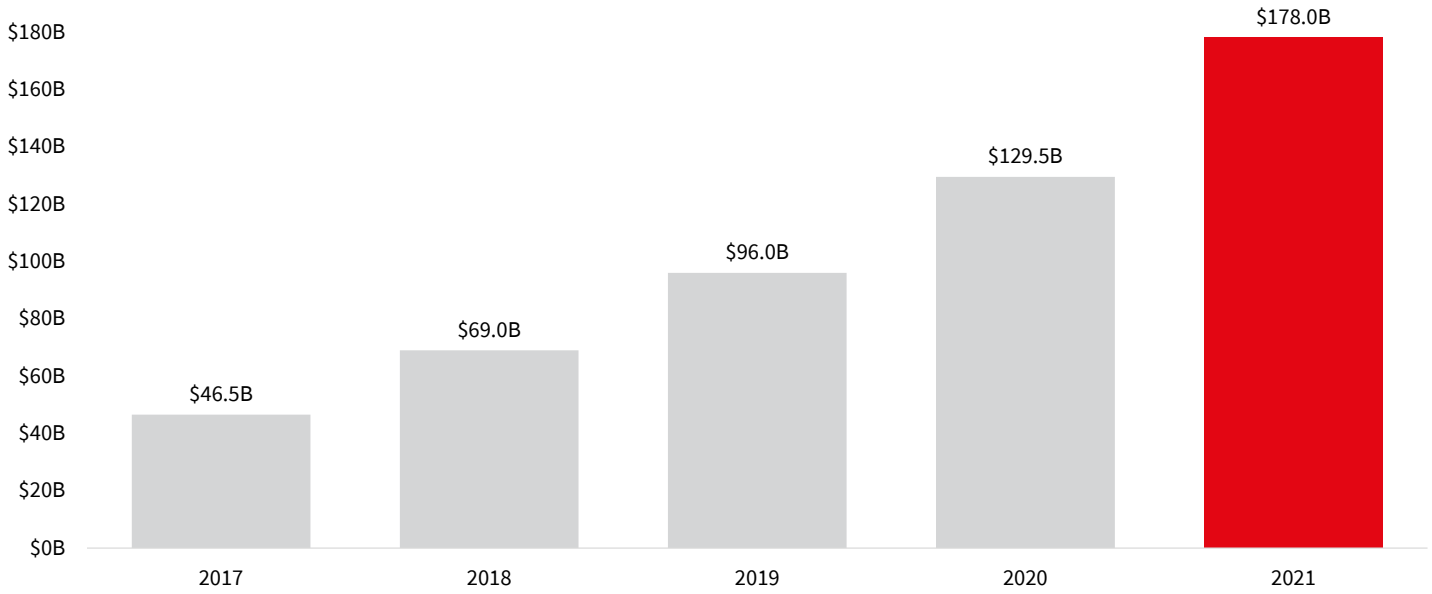
Enterprise demand for cloud is anticipated to grow exponentially as businesses move from owned assets to either full cloud or hybrid models.

Companies continue to maintain enterprise solutions, but hybrid and multi-cloud systems are becoming more mainstream. According to a recent Cisco survey of 2,500 IT decision makers, 82% have already deployed a hybrid cloud strategy to their business. Hybrid cloud systems can ensure organizations have full control and highest security over their core data.

Organizations spent $53 billion on cloud infrastructure services globally in the first quarter of 2022, reaching an all-time high and accounting for roughly 24% year-over-year growth compared to 2021. Hyperscalers accounted for 60% of this revenue share during the same period. Globally, annual spending on cloud services reached $178 billion in 2021 compared with $129.5 billion in 2020, and the cloud services sector in 2022 is expected to grow to $200 billion annually by the end of this year.

In the first quarter of 2022, the public cloud ecosystem generated $126 billion in revenue, up 26% year-over-year compared with the same period in 2021. The public cloud markets are expected to grow by 10%–30% every year from 2020 to 2027. This highlights an increasing trend where organizations are moving away from enterprise-led data storage and management and evolving toward a cloud-based solution.

Cloud infrastructure services spending



Source: Synergy Research

Top global trends

4.

Sustainability will continue to be a key focus for the sector as net zero carbon mandates proliferate across the public sector.

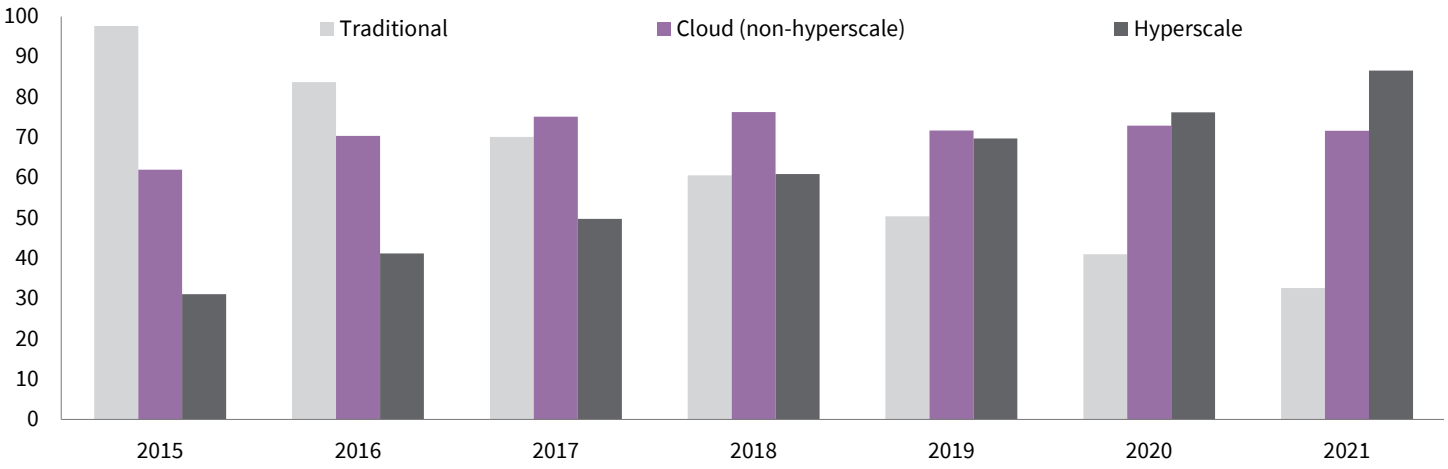
Meeting the challenges of building a more sustainable world will be a key focus within the data center sector for the foreseeable future. Collectively, these spaces in the U.S. account for approximately 2% of the total U.S. electricity use. As a high energy-consuming sector, the industry has been proactively working toward sustainable operations. Additionally, data centers are thirsty for water, requiring huge amounts of (often potable) water to cool equipment. For example, on an average annual basis, a medium-sized data center (15 MW) will use as much water as about three hospitals or two 18-hole golf courses. Environmental concerns combined with inflation, power constraints and the energy crisis have kept the focus firmly on energy usage. As a result, operators are moving away from designs that require heavy water usage.

Data center providers traditionally purchase PPAs (Power Purchase Agreements) and RECs (Renewable Energy Certifications) to offset their carbon emissions. Telecommunication companies and hyperscalers have contributed the most capacities to the PPA deals. For the first quarter of 2022, technology operations' PPAs reached 6 GW, which dropped 60% year-over-year from 2021. Inflation led to overpriced installations, and raw materials costs are direct influences.

In Europe, PPA offer prices grew by 10%–15% in the second quarter. In America, corporate and industrial clean power purchases declined by 23%. IEA predicted that the renewable electricity net capacity would reach 279.6 GW worldwide. This goal requires more effort than before, considering the current renewable energy market price is going up. Although PPAs can help with overall carbon emissions, this method cannot directly improve energy use efficiency. Because data demand continually grows despite limited renewable energy facilities in operation, the carbon emission related to this industry will soon exceed the purchasable clean power's capacity in the current market.

Global data center energy consumption reached 190.8 terawatt hours at the end of 2021. Since 2017, hyperscale data centers have nearly doubled their consumption to 87 terawatt hours while traditional data centers have more than halved their power consumption from 70 terawatt hours to 33 terawatt hours.

Energy demand in data centers worldwide from 2015 to 2021, by type (in terawatt hours)



Source: IEA

As an analogy, global data center energy consumption is equivalent to 20% of the total commercial electricity consumption (987 terawatt hours) in the U.S. While traditional data center energy consumption has declined three years in a row, hyperscaler energy consumption has surged in recent years due to the rapid expansion of these data center types and their enormous size.

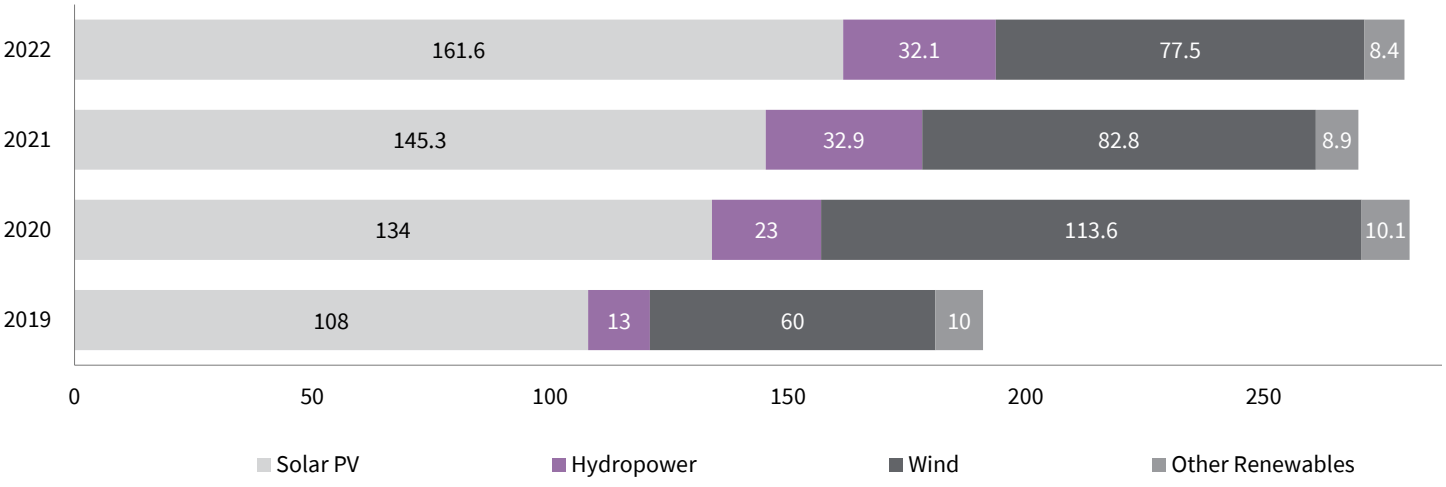
Data center infrastructure efficiency (DCIE) is a popular performance improvement metric to help calculate a data center's energy efficiency. DCIE is the percentage value of dividing information technology equipment power by total facility power. The average annual PUE (power usage effectiveness) for operators' largest data center in 2021 is 1.57 worldwide. Under the DCIE standard, energy consumption is considered efficient if a data center's DCIE is above 67% and PUE is below 1.5. When a data center's DCIE is below 40%, and PUE is above 2.5, the energy consumption is inefficient. Data center operators can install Data Center Infrastructure Management (DCIM) software to track the entire facility and IT equipment energy.

Improving the overall industry's energy consumption efficiency is the goal. To achieve a lower PUE or higher percentage of DCIE, data center operators often choose to have hardware upgraded. Chipmakers are equipping their newly designed servers with more features, capacity and processing power. As a result, the data center sector can benefit from better server performance and higher energy-efficiency.

However, new technology is not necessarily beneficial for all data centers. One condition for the newly designed server to improve the overall energy consumption is consolidating workloads to reach higher utilizations, which requires support from updated software applications. Enterprise data center users who run in light workloads would not benefit from this improvement. The cloud services, technology and heavy-computing users will continually widen the power efficiency gap between other data center consumers. To remain competitive in future markets, data center operators must achieve higher utilization.

The data center sector needs to work together on developing standardized sustainability goals to help the industry become more sustainable and measure success. Data center users often treat IT system power consumption as a scope 3 emission that is neglected in their offset energy portfolio for cost-saving. Data centers should also treat their water consumption more seriously and investigate how to consume water more efficiently. The data center sector faces more pressure from the commercial world to have a more transparent and standardized approach toward sustainability.

World renewable electricity net capacity additions by technology (GW)



Source: IEA, Renewable electricity net capacity

Top global trends

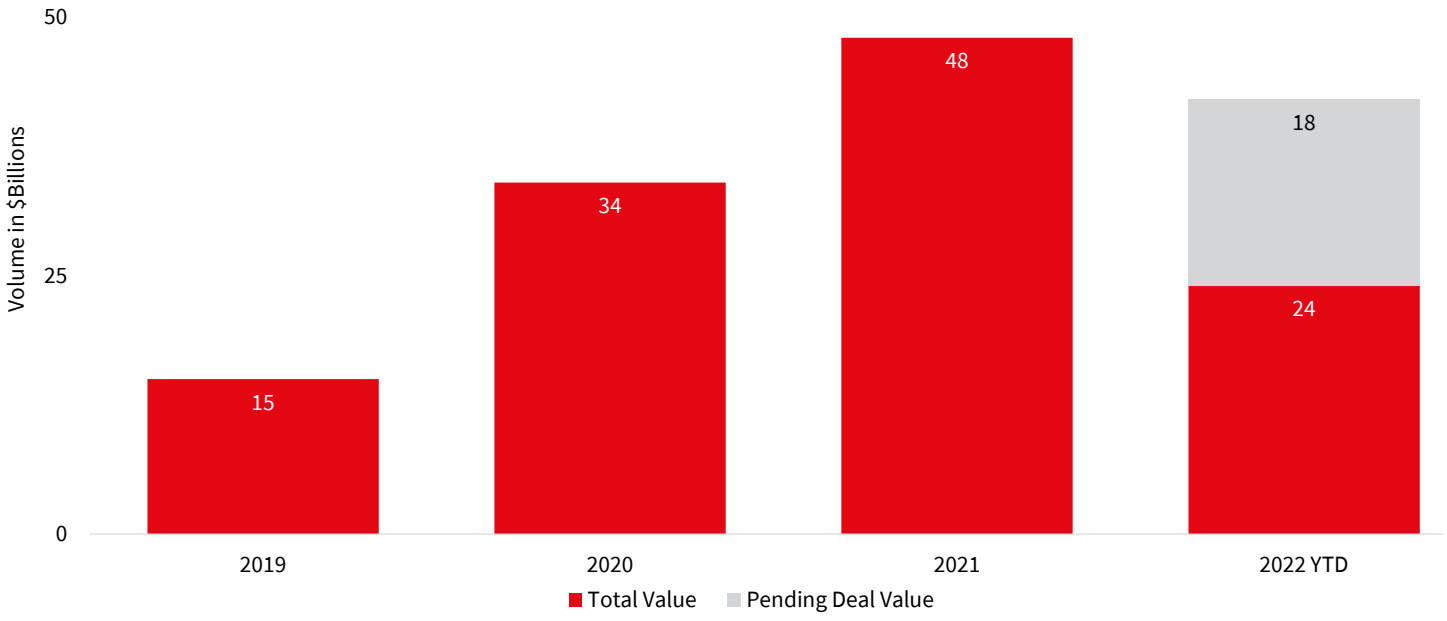
5.

Capital will continue to flow into the sector through private equity and real estate investment.

Due to significant hyperscale investment globally, an unprecedented amount of capital has been interested in investing in the space.Through the first half of this year, M&A activity continued at a steady clip with deals exceeding $24 billion. This amount is 50% of the M&A total deal volume closed in 2021, and 60% of that in 2019.The biggest deal was the acquisition of CyrusOne by KKR's Global Infrastructure Partners for $15 billion in an all-cash deal. After the $10 billion CoreSite acquisition last December, American Tower launched a $2.5 billion deal with a Stonepeak, a minority equity investment company focused on the company's U.S. data center business.

Real estate investors across the globe have been increasingly attracted to alternative asset classes, amounting to increased interest in data center assets among other alternatives such as life sciences, senior housing and student housing opportunities. In aggregate, alternative real estate investment activity in 2021 totaled nearly $80 billion in transactions across these four sectors, $8.2 billion of which was driven by data center acquisitions alone. In the 10 years through 2021, data center transaction volume grew at a compound annual rate of 15%, fifth across major real estate asset classes, and close behind living sectors and logistics. The limited scale of the market and investor caution amid economic uncertainty may govern more robust transaction activity in the near term.

M&A activity



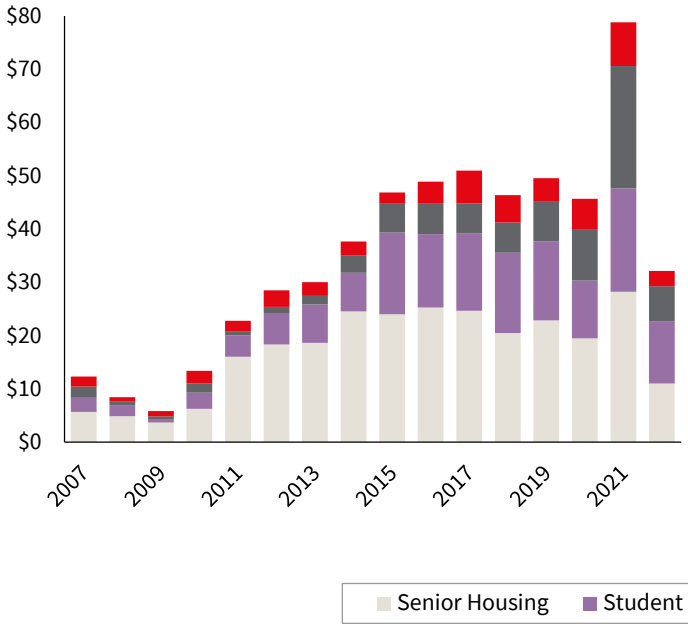
Source: Synergy Group

Given its increased scale, the U.S. accounts for a significant portion of transaction activity, at 50% of all deals, but other global markets are gaining share as those markets expand and provide more opportunities for investors to transact.

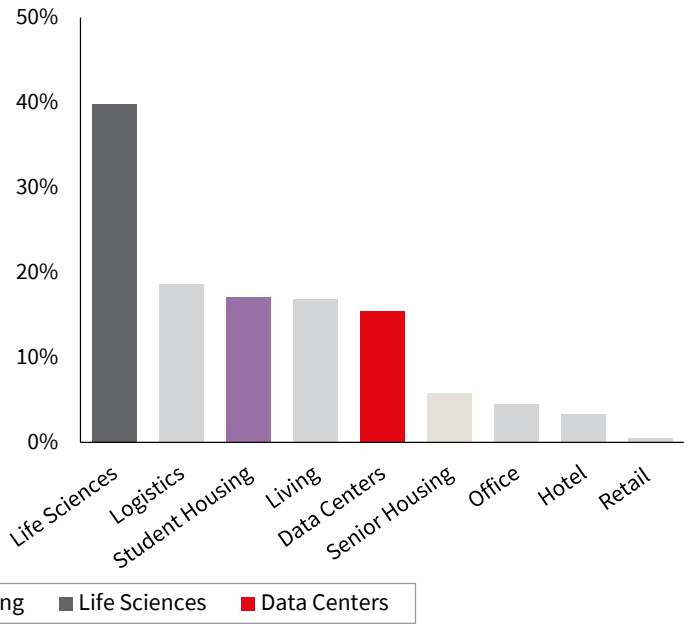
The long-term opportunity for investors remains attractive as the world's data needs continue to grow exponentially, limited only by power and land availability to scale further.

Investors turn to alternative sectors for growth and opportunities

Alternatives transaction volume ($US billions)



Compound annual growth rate (%)—2011–2021



Source:JLL Research; transactions above $5.0 million; excludes land/development and entity-level deals; Alternatives is inclusive of student housing, senior housing, life sciences, data centers, cold storage, transportation and other (education/self-storage/infrastructure)

Outlook

Pressure on supply

Just as we've seen in many areas of the economy during and as a result of the pandemic, the rapid acceleration of demand for data centers has put significant pressure on supply. Additionally, pressure to reduce carbon emissions will become an increasingly pressing challenge to solve within existing and future sites, especially as moratoriums on development have been focused on energy consumption. With concerns over the supply of energy available to Europe as a result of the Ukraine-Russia war, these concerns for energy consumption are only heightened. Data center operators continue to search in land and power constrained markets for the elusive next best data center location along with looking at new markets to which they are directed by their largest clients.

Definitions:

Data center infrastructure market: servers, storage, networking, security and software Cloud Infrastructure Service: Public and Private IaaS (Infrastructure as a Service), Public and Private PaaS (Platform as a Service)

Preleasing: The bulk of this absorption is due to the preleasing of space and power by one or a few companies in advance of construction. These data center buildings are designed and will be delivered over the next 12–18 months.
Inventory of multitenant data center square footage and power that's either leased (absorption), shell space planned for future development (planned), turnkey/conditioned available today (vacant) or currently being developed into turnkey/conditioned (under construction) all under one roof.

Planned: Represents development that has been announced, in process of entitlements and design. Total vacant space represents turnkey/fully conditioned data center space available for lease. Under construction represents data center space that has broken ground and has entitlements.

Absorption (Net): Represents the amount of new multitenant data center square footage and power leased less the total amount of square footage and power no longer occupied between the current and last measurement periods. Hyperscale data centers represent data centers with the ability to scale out from hundreds to thousands of servers owned and operated by one entity.

Multitenant data centers comprise facilities where an owner sells space and power to multiple tenants.

Data center typography
Enterprise: Built, owned and operated by companies for their own data services use

Edge: Smaller facilities that deliver cloud computing resource close to population served

Colocation: Building, equipment and bandwidth are available for rent by data center users

Hyperscale (Cloud): Industrial scale with large real estate footprint and software-focused resiliency

Data center space
White-space refers to the area containing IT equipment and infrastructure, including hot/cold aisles, racks, network gear and power distribution.

Gray-space references the area where back-end equipment (such as switch gear, UPS, transformers, chillers and generators) is located.

North America market insights

Atlanta

Hyperscalers shatter absorption records, elevating the Atlanta market

Market overview

Supply

Despite colocation operators expanding their operations, large blocks of space and power have diminished due to prebuild commitments. Operators and hyperscalers continue to compete with the industrial markets for land and buildings. Flexential, QTS & DataBank announcing third data center campuses.

Demand

Large enterprise users and hyperscalers continue to enter the Altanta market, leveraging the friendly business climate including low cost of energy. Technology, healthcare, and financial sectors are very active.

Market trends

Resource shortages, contractor-heavy workloads, and supply chain issues are impacting the delivery timelines of new space and power for many data center providers and users.

Outlook

for ***Users***

- Several quality colocation options for less than 3 MW users
- Large, new product deliveries forecasted in the next 12–18 months
- Inflation, rising energy costs, and supply may start to affect rates

for ***Providers***

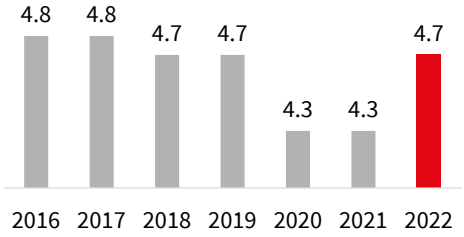
- Hyperscale absorption is at historic highs
- Power providers are challenged with meeting increasing power demand
- Expect future competition from new market entrants

Supply	s.f.	MW
Total inventory:	2,538,317	338.0
Total vacant:	199,500	34.0
Under Construction:	1,131,700	175.0
Planned:	1,578,860	302.0

Demand	MW
Net absorption:	97.0

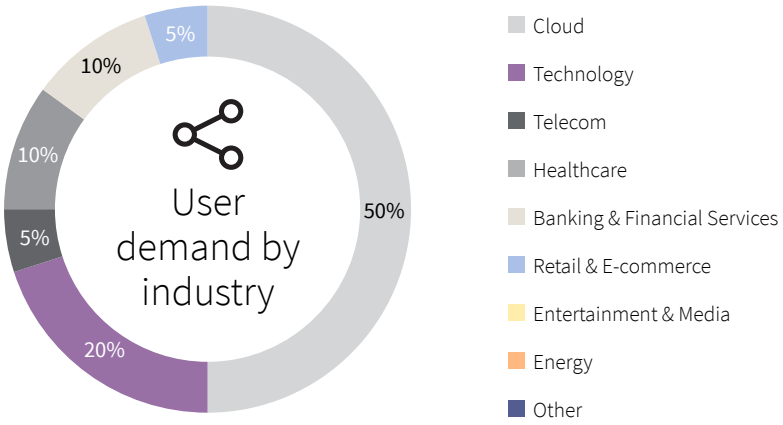
Rental rates	Low	High
(All-in) sub-250 kW	$115	$125
250 kW-1 MW	$95	$120
1-5 MW	$95	$110
5 MW plus	$80	$100

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



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Austin & San Antonio

Sabey enters the Austin market, San Antonio continues to develop for hyperscale and government users

Market overview

Supply

Austin sees a new entrant into the market, Sabey, marking its first foray into Texas. Switch Communications also announces and breaks ground on a large expansion. Both markets have limited available capacity for immediate requirements: however, with multiple projects in the works, there will be an increase overall for both markets once construction is complete.

Demand

Demand in San Antonio continues to be dominated by hyperscalers, public and government entities. Austin sees a mix of high technology users and traditional enterprise companies. While demand in Austin is low, new providers in the market bring the possibility of fresh interest to the state's capital.

Market trends

While both smaller markets, Austin and San Antonio possess unique attributes that make them appealing to specific users. San Antonio continues to attract hyperscale users looking to build a presence in Texas, while Austin operators look to attract technology users that have a large presence in tech-heavy cities in the region.

Outlook

*for **Users***

- As more supply comes online, users have more options in these markets
- New entrants will provide large wholesale availability in Austin
- Federal contracts will drive absorption in San Antonio

*for **Providers***

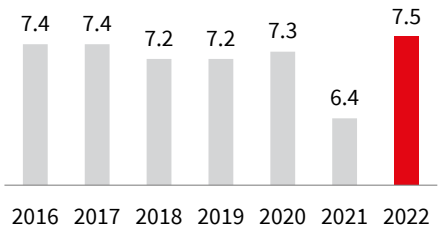
- New entrants to the market will increase competition for blue-chip clients
- Power constraints hinder existing facilities
- Competition for federal contracts will be fierce

Supply	s.f.	MW
Total inventory:	1,385,389	129.9
Total vacant:	4,600	1.0
Under Construction:	-	0.0
Planned:	441,000	86.0

Demand	MW
Net absorption:	4.43

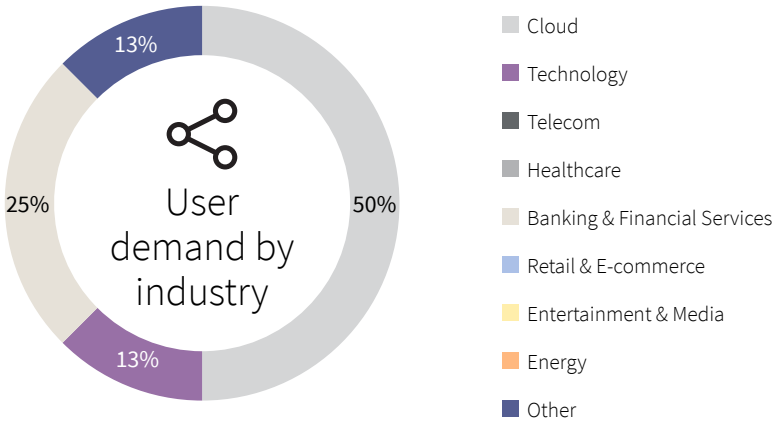
Rental rates	Low	High
(All-in) sub-250 kW	$220	$290
250 kW-1 MW	$85	$120
1-5 MW	$85	$105
5 MW plus	-	-

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



Authored by: Curt Holcomb

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Boston

Market continues to languish as high power rates and dated infrastructure drive local firms to other markets

Market overview

Supply

Space is available in all markets—City, 128 and 495. Absorption has been highest in City and 495 markets. The 128 market continues to be challenged by large vacancies at several facilities. Although these provide the potential for a wholesale deal, the market does not seem to be there.

Demand

Local demand remains modest with most, coming from healthcare, biopharm, and education, in that order. Tech firms do have requirements, but they are going to other markets.

Market trends

After several years of decomissioning facilities, that trend seems to have subsided, at least for the short term. Markley, Coresite, Equinix, and Cyxtera all are investing additional capital to improve the quality and positioning of their assets in the market.

Outlook

*for **Users***

- For moderate power users, pricing is competitive with other markets
- Improvement programs will increase efficiency and reduce price
- Network interconnection improving

*for **Providers***

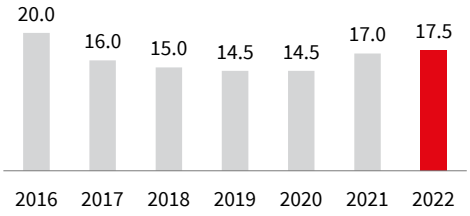
- Capital expenditure required to modernize facilities
- Working to improve energy story
- Nework interconnection improvements should support edge use cases

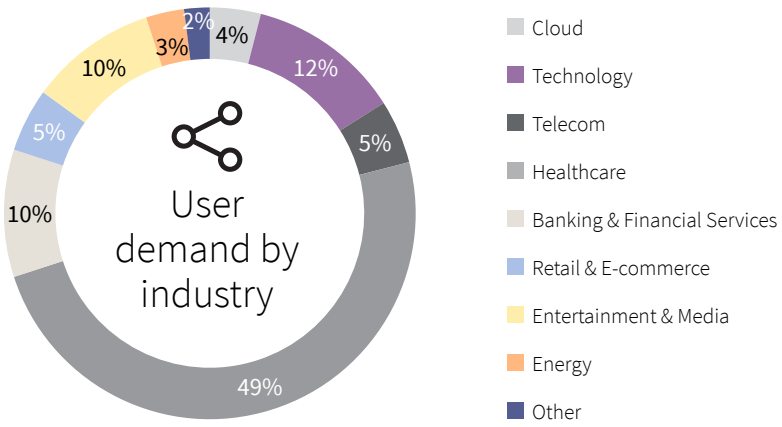
Supply	s.f.	MW
Total inventory:	1,200,000	160.0
Total vacant:	240,000	25.0
Under Construction:	-	0.0
Planned:	-	0.0

Demand	MW
Net absorption:	5.0

Rental rates	Low	High
($/kW+E) sub 250 kW	$225	$300
250 kW-1 MW	$110	$145
1-5 MW	$95	$130
5 MW plus	$85	$115

Average power rate (cents/kWh)





Data Center leverage

2020	*2021*	*2022*	*2023*	*2024*

User-favorable market
Neutral market
Provider-favorable market

Authored by: Gabe Cole

See page 46 of this document for contact information.

Chicago

Things are getting tight!

Market overview

Supply

Much of the available large block supply has been spoken for throughout the first part of 2022 due to three significant leases being signed across three suburban submarkets. 2023 may result in a complete sell-out of spaces above 1 MW in the suburbs. Look for leasing downtown given available capacity.

Demand

If the space and power is available, it is getting leased. There is an estimated 41 MW of precommitted or preleased capacity already completed for 2023. High-growth users are looking at strategies to accomodate long-term growth in a very tight market.

Market trends

The market continues to be lumpy, with large deals taking big blocks of space. With limited opportunities for bigger takedowns, we expect significant preleasing to occur. Pricing is expected to spike in 2023 with limited options available however; it should normalize in 2024 with several campuses delivering.

Outlook

for ***Users***

- Limited supply and pricing increases across all submarkets
- Less flexibility in terms, space and power takedowns
- Competition among tenants, especially larger users

for ***Providers***

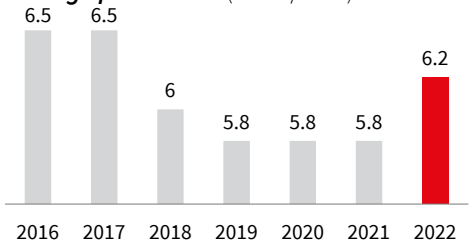
- Very limited capacity in market until 2024
- Severe power contraints and long lead delivery in key submarkets
- Limited expansion opportunities for new developments

Supply	s.f.	MW
Total inventory:	5,769,039	672.0
Total vacant:	560,000	41.8
Under Construction:	141,000	28.3
Planned:	351,000	70.3

Demand	MW
Net absorption:	98.6

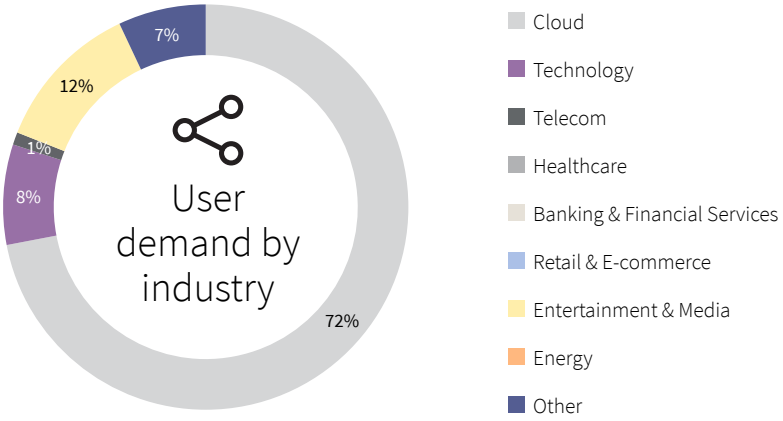
Rental rates	Low	High
($/kW+E) sub 250 kW	$200	$275
250 kW-1 MW	$100	$115
1-5 MW	$95	$110
5 MW plus	$82	$94

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



Authored by: Matt Carolan | Andy Cvengros | Sean Reynolds

See page 46 of this document for contact information.

Dallas/Fort Worth

Preleasing activity from hyperscale users leaves limited available supply, exacerbated by lengthy supply chain lead times

Market overview

Supply

Supply is constrained due to an influx of demand from hyperscale users leasing space from the major colocation operators. This is compounded due to the long lead times for infrastructure equipment. There are a handful of operators that are capable of leasing multi-megawatt contiguous data halls, furthering the squeeze on available supply.

Demand

Demand remains consistent in the enterprise sector, with natural expansions of existing leased space as well as net new requirements. Hyperscale demand increased to levels previously unseen, with multiple organizations leasing all available capacity, both current and future, from a number of providers. Non-hyperscale users vie for the limited available capacity.

Market trends

Preleasing space and capacity has hit the market. Tens of megawatts and thousands of square feet of floor are leased prior to construction. Operators search for green, and greyfield land to expand their campuses and operations to fulfill the demand. The search includes areas of the market previously unconsidered for data center use, particularly ouside the Eastern District.

Outlook

*for **Users***

- Limited supply requires enterprise users to more rapidly execute agreements
- Requirements larger than 3 MW have 12+ month lead times for delivery
- Contracts have less flexibility in negotiation

*for **Providers***

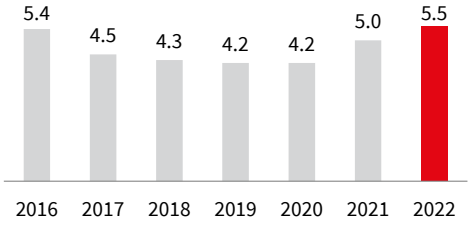
- Several providers are looking for the same land for expansion
- Providers focused on speed-to-market for expansions
- Rates will firm and increase due to the supply-constrained market

Supply	s.f.	MW
Total inventory:	4,180,456	531.0
Total vacant:	239,662	42.2
Under Construction:	38,108	12.5
Planned:	316,932	336.5

Demand	MW
Net absorption:	176.8

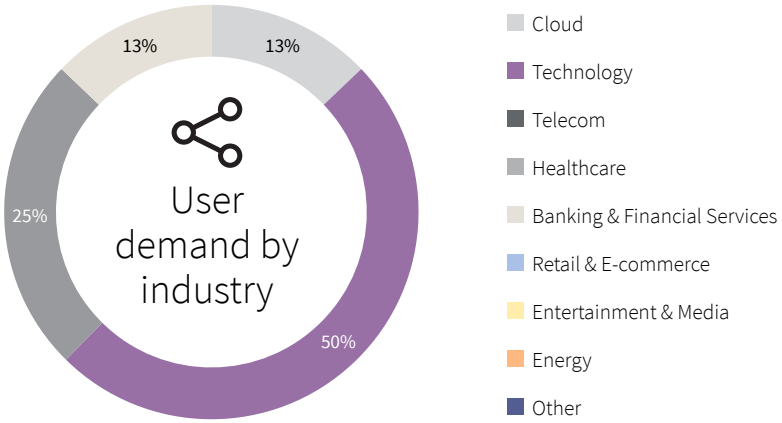
Rental rates	Low	High
(All-in) sub-250 kW	$120	$190
250 kW-1 MW	$95	$200
1-5 MW	$90	$110
5 MW plus	$85	$95

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



Authored by: Curt Holcomb

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Houston

DataBank acquires four former CyrusOne facilities, marking its entrance into a new Texas market

Market overview

Supply

Supply remains consistent from other quarters. There are multiple providers that can accommodate multi-megawatt deployments. Providers consider possible expansions to bring more supply online though little new construction.

Demand

Demand remains slow in Houston, with the majority of absoprtion stemming from small-footprint expansions in existing facilities. While demand is not as high as other Texas markets, it remains consistent with a few companies leasing additional space.

Market trends

The Houston market continues to be dominated by oil and gas companies, with a sprinkling of healthcare and technology organizations leasing space from providers. New provider entrants to the market potentially mark a refreshed focus on the area.

Outlook

*for **Users***

- Houston is a viable option for local users looking to expand data operations
- Limited number of providers makes Houston less attractive
- Rental rates remain competitive

*for **Providers***

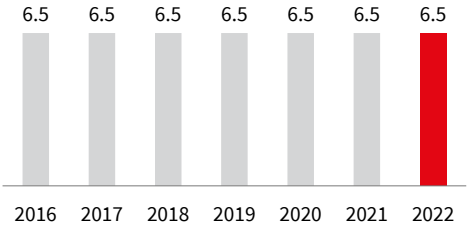
- Limited new customer entrants to the market focuses providers on organic growth
- Uptick in oil and gas industry may increase demand
- Providers are not focused on Houston for new market expansion

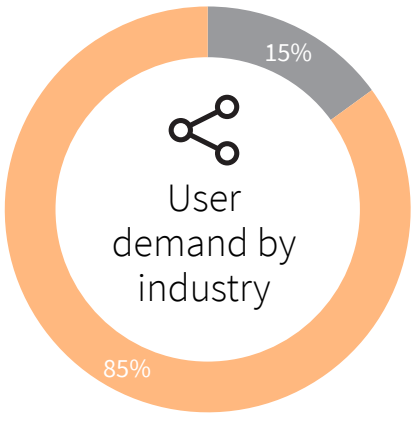
Supply	s.f.	MW
Total inventory:	1,491,107	110.5
Total vacant:	172,577	26.0
Under Construction:	-	3.5
Planned:	50,000	17.1

Demand	MW
Net absorption:	0.8

Rental rates	Low	High
(All-in) sub-250 kW	$170	$250
250 kW-1 MW	$80	$110
1-5 MW	$75	$95
5 MW plus	-	-

Average power rate (cents/kWh)





- Cloud
- Technology
- Telecom
- Healthcare
- Banking & Financial Services
- Retail & E-commerce
- Entertainment & Media
- Energy
- Other

Data Center leverage

User-favorable market
Neutral market
Provider-favorable market

Authored by: Curt Holcomb

See page 46 of this document for contact information.

Los Angeles

Southern California activity remains high as operators scramble to develop opportunities to satisfy the high demand from cloud providers

Market overview

Supply

Extremely limited inventory of high-end, turn-key data hauls. New development is limited by lack of land availability and competition for other uses, such as industrial or studio space.

Demand

Remains very strong as users within tech, media, and other digitally-driven enterprises take what available capacity exists in an extremely tight market.

Market trends

Record low vacancy and high land prices in the industrial market continue to apply pressure in the market by limiting the new development opportunities

Outlook

*for **Users***

- New developments will create options in 2024 and beyond
- Current inventory of quality space is low, thus minimizing tenant leverage
- Record tenant demand creates competition

*for **Providers***

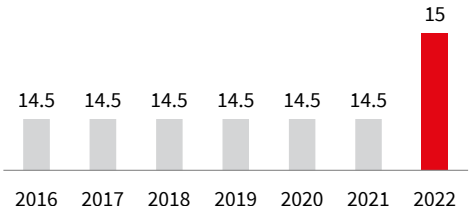
- Increased competition for quality tenants
- Time to market is essential
- Quality turn-key data hauls winning the deals

Supply	s.f.	MW
Total inventory:	2,500,000	265.0
Total vacant:	500,000	18.0
Under Construction:	0.0	0.0
Planned:	750,000	130.0

Demand	MW
Net absorption:	13.0

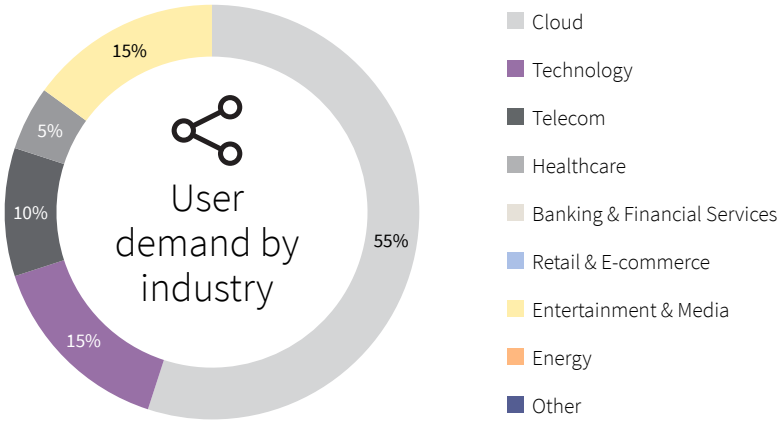
Rental rates	Low	High
($/kW+E) sub 250 kW	$125	$135
250 kW-1 MW	$115	$120
1-5 MW	$105	$115
5 MW plus	$90	$115

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



Authored by: Darren Eades

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New Jersey

Limited short-term supply as operators plan for 100+ MWs to support strong financial services and enterprise tenant base

Market overview

Supply

Consistent track record of 20+ MW last three years, has resulted in 17 MW of available capacity. Leading operators have planned expansions for over 100 MW coming online in 2H 2024. 12 MW scheduled to be available in mid-2023.

Demand

Financial services have a pipeline for over 20 MW of need in 2022. Cloud network edge nodes continue to emerge and compete with enterprise for market capacity. Orangeburg, NY, is competing with 6+ MW available now and 40+ MW planned in 2025.

Market trends

Supply chain delays have surfaced, stockpiling key infrastructure. Tenants are looking for flexible contiguous space and campus expansion as computing needs continue to grow. More all-in contracts are being set to protect from surge in power costs.

Outlook

for ***Users***

- Higher demand for Ramp and Rofo terms - to support computing needs
- Higher density fitouts being more common—10–17 kW rack densities
- Reserve capacity by early 2023, as expansions come online 2H 2024

for ***Providers***

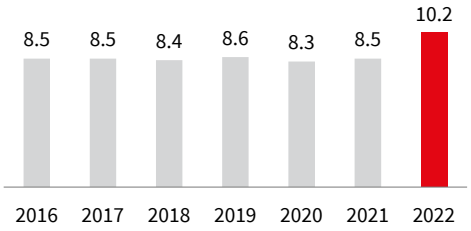
- Limited development sites with existing power
- Power substations have a three- to five-year lead time
- Renewable and on-site generation to offset rising power costs

Supply	s.f.	MW
Total inventory:	3,850,000	410.0
Total vacant:	120,000	17.0
Under Construction:	55,000	12.0
Planned:	810,000	102.0

Demand	MW
Net absorption:	11.0

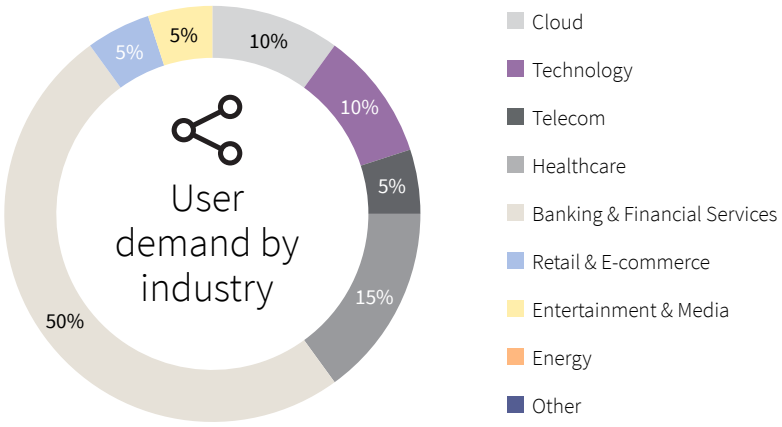
Rental rates	Low	High
($/kW+E) sub 250 kW	$225	$485
250 kW-1 MW	$125	$185
1-5 MW	$108	$145
5 MW plus	-	-

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



Authored by: Thomas Reilly | Jason Bell

See page 46 of this document for contact information.

New York

Limited retail capacity in NYC to support edge computing needs, and Orangeburg is growing as NY's wholesale choice

Market overview

Supply

Digital Realty, Coresite, Sabey, Telehouse and H5 support the retail needs with 3+ MW of capacity. Hudson Interxchange is NYC's wholesale option. Orangeburg - 1547 can support 8+ MW and has a 200 K expansion plan and Databank is planning a 30 MW/200 K DC - slated for the end of 2024.

Demand

NYC continues to see < 100 kW edge network deployments among retail operators. Orangeburg is starting to collect financial services' demand with tax incentives and limited NJ capacity.

Market trends

Investors continue to look for next carrier hotel and retail colocation options to replace excess office vacancies. Orange Renewable Energy options emerging to offset high electricity costs, and new IoT and AI/ML technologies are sought out to maximize utilization.

Outlook

*for **Users***

- Wholesale operators will offer flexbile expansion options
- Tightening NYC retail supply for carrier and network edge needs
- New expansions are expected to be delivered in 24 months

*for **Providers***

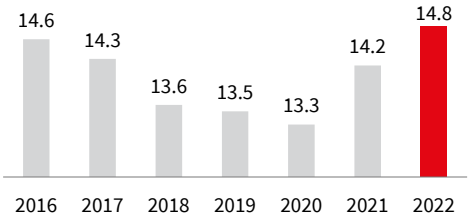
- Renewableenergy options emerging to offset high electricity costs
- Rockland County is attractive alternative to NJ with tax incentives
- Upstate development resurfacing as Crypto Moratorium creates opportunity

Supply	s.f.	MW
Total inventory:	1,020,000	152.0
Total vacant:	62,000	14.0
Under Construction:	6,500	2.0
Planned:	450,000	70.0

Demand	MW
Net absorption:	2.5

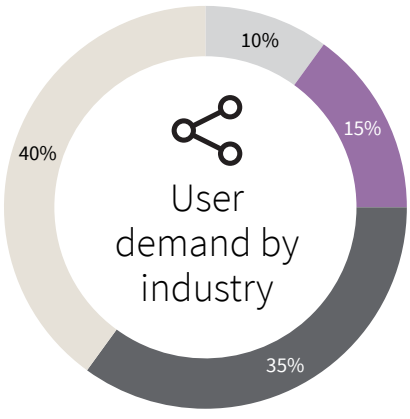
Rental rates	Low	High
(All-in) sub-250 kW	$325	$400
250 kW-1 MW	$150	$300
1-5 MW	$115	$165
5 MW plus	-	-

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



- Cloud
- Technology
- Telecom
- Healthcare
- Banking & Financial Services
- Retail & E-commerce
- Entertainment & Media
- Energy
- Other

Authored by: Jason Bell | James Quinn | Gary Youm

See page 46 of this document for contact information.

Northern California

Supply demand imbalance persists due to challenges bringing new supply online

Market overview

Supply

Available space and power continues to contract, with vacancy falling well below 5%. Expect low vacancy to persist as newly constructed product delivers largely preleased. Landlords continue to experience difficulties/ delays in procuring power, which slows the delivery of new supply. These delays will prevent the near-term alleviation of the supply-demand imbalance.

Demand

A select group of end users continues to drive demand. Despite limited available supply, NorCal is on track for record levels of absorption. End users are being forced to plan farther ahead and pre-lease under-construction sites to meet capacity needs and account for supply chain challenges. This has led to recently built projects averaging 70%+ preleased upon delivery.

Market trends

Interest from investors and end users remains strong despite high barriers to entry and scarcity of available space. This has resulted in increased momentum in secondary markets such as Sacramento. Issues with the supply chain and lengthy delays in the delivery of power have created challenges for both operators and end users.

Outlook

for ***Users***

- Low vacancy and rising construction costs will result in operators pushing pricing
- Scarcity of new product is driving competition between users
- Supply chain issues will continue to be a challenge

for ***Providers***

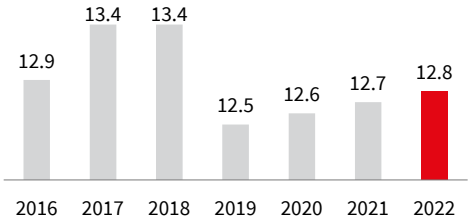
- Need to be mindful of competitive supply coming online
- Need to be realistic about timeline for procuring power
- Need to be mindful of development costs and supply chain challenges

Supply	s.f.	MW
Total inventory:	6,686,459	609.0
Total vacant:	264,299	35.0
Under Construction:	3,016,823	233.0
Planned:	3,489,634	629.0

Demand	MW
Net absorption:	43.1

Rental rates	Low	High
sub 250 (all-in)	$200	$350
250 – 1 MW (+E)	$145	$165
1-5 MW (+E)	$130	$160
5+ MW (+E)	$130	$160

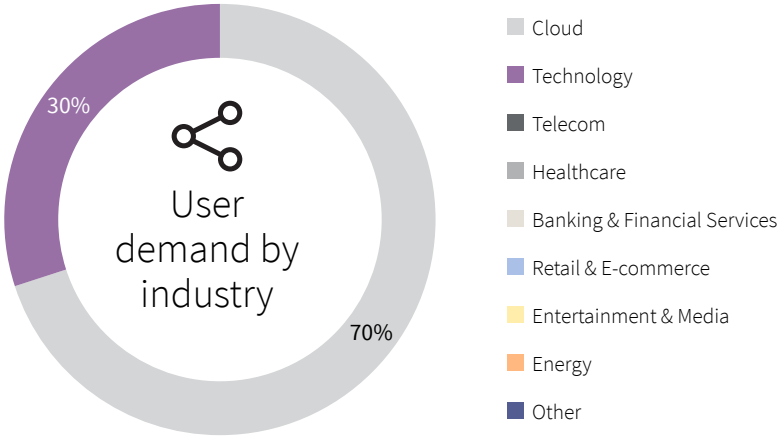
Average power rate (cents/kWh)



Data Center leverage

2020	***2021***	***2022***	***2023***	***2024***

User-favorable market
Neutral market
Provider-favorable market



Authored by: Patrick Murdock

See page 46 of this document for contact information. | **Northern California includes Silicon Valley/Santa Clara, San Jose, San Francisco, and Sacramento*
*** Please note rental rates are calculated on a weighted average which includes all NorCal submarkets*

Northern Virginia

First-half absorption in 2022 was more than double the first-half absorption of 2021

Market overview

Supply

2022 deliveries are on pace with 2020 and 2021. 103 MW were delivered in the first half of 2022. MTDC vacancy has reached an all-time low of 2.8%.

Demand

There were 257 MW absorbed in 1H 2022, setting up the NOVA market for a record-breaking year. Cloud and social media continue to drive demand.

Market trends

Most deals of scale have been preleased. Power constraints in Loudoun County have caused providers to explore alternative markets. Land prices in Prince William County have more than doubled in the last year.

Outlook

for ***Users***

- Lack of available options over 5 MW
- Rental rates are increasing with lack of availability

for ***Providers***

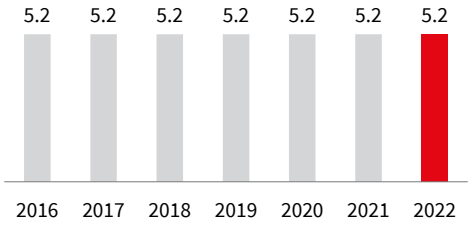
- Lack of land sites of scale have limited expansion opportunities
- Limited options have allowed providers to push rental rates
- Lead times for power commitments have become the number one issue

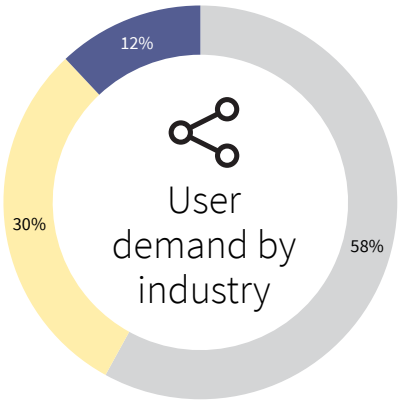
Supply	s.f.	MW
Total inventory:	41,904,859	3,249.0
Total vacant:	742,000	42.4
Under Construction:	17,675,000	1,010.0
Planned:	29,470,000	1,684.0

Demand	MW
Net absorption:	25.0

Rental rates	Low	High
($/kW+E) sub 250 kW	$120	$140
250 kW-1 MW	$117	$134
1-5 MW	$80	$90
5 MW plus	$75	$80

Average power rate (cents/kWh)





- Cloud
- Technology
- Telecom
- Healthcare
- Banking & Financial Services
- Retail & E-commerce
- Entertainment & Media
- Energy
- Other

Data Center leverage

2020	***2021***	***2022***	***2023***	***2024***

User-favorable market
Neutral market
Provider-favorable market

Authored by: Jeff Groh | Kelly Katz

See page 46 of this document for contact information.

Northwest

With Hillsboro leading the charge, absorption in just the first half exceeds previous year-end, record-setting 2021 totals by 79%

Market overview

Supply

Total supply has increased through construction by 32% over 2021, and available supply is at an all-time low with a 3% estimated vacancy. This is largely due to successful preleasing of entire facilities that were originally planned as multitenant projects.

Demand

Demand continues to be at an all-time high, primarily from technology tenants headquartered in the Western United States. Size ranges vary significantly, and deployments over 15 MW are increasingly more common and transactions below 1 MW are becoming rare. Note that the absorption calculation covers leased inventory; some of said absorption has not been built yet.

Market trends

Demand is expected to continue until supply is gone. Most of the leasing absorption is from a small group of companies. Demand will likely only slow if product is not developed on time. Overall, 87% of the absorption can be attributed to the Hillsboro submarket.

Outlook

*for **Users***

- There is very little commissioned supply left
- Tough negotiations for smaller users given the amount of large users
- Low vacancy/high build costs has not led to significantly higher rent

*for **Providers***

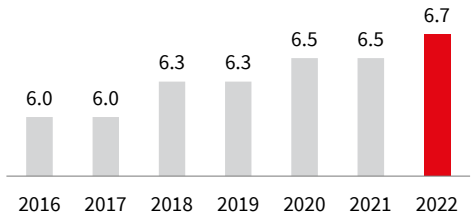
- There are very few development opportunities left in core markets
- Power procurement is challenging due to high demand
- Look to other markets for developable large-scale power sites

Supply	s.f.	MW
Total inventory:	3,544,294	563.7
Total vacant:	112,572	16.9
Under Construction:	818,339	136.1
Planned:	977,802	157.5

Demand	MW
Net absorption:	193.5

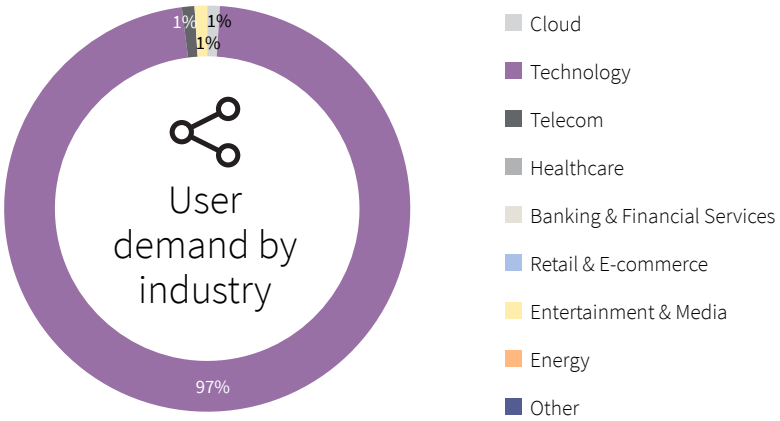
Rental rates	Low	High
($/kW+E) sub 250 kW	$185	$205
250 kW-1 MW	$95	$120
1-5 MW	$90	$110
5 MW plus	$80	$100

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



Authored by: Conan Lee

See page 46 of this document for contact information.

Phoenix

Providers take control of market

Market overview

Supply

Providers cannot build fast enough to support the ever-growing need for hyperscale/colocation space. Timelines on the delivery of power to sites are being extended as larger requirements come into the market. Critical IT equipment delivery dates continue to be pushed out.

Demand

The demand from 2021 has not slowed down but rather accelerated tremendously into 2022. Hyperscale tenants are grabbing up every piece of available space, which is forcing all other users to be more forward-thinking with their requirements.

Market trends

Preleasing commitments have become the norm for users that need to fulfill their requirements. We are currently seeing capacity demands from companies continue to grow. There has been continued expansion with existing and new hyperscale colocation operators.

Outlook

*for **Users***

- Plan for future capacity now and execute swiftly
- There will be less flexibility in leasing and ramps
- Less focus on economics, and more on on-time deliverability

*for **Providers***

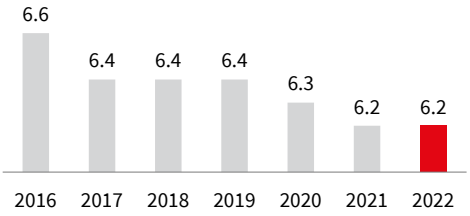
- Keep on bringing capacity to the market
- Stay focused on long-term campus growth with your customers
- Demonstrate low-water-usage and carbon-neutral initiatives

Supply	s.f.	MW
Total inventory:	6,312,120	544.7
Total vacant:	185,052	23.9
Under Construction:	1,076,700	278.0
Planned:	5,269,722	776.0

Demand	MW
Net absorption:	280.0

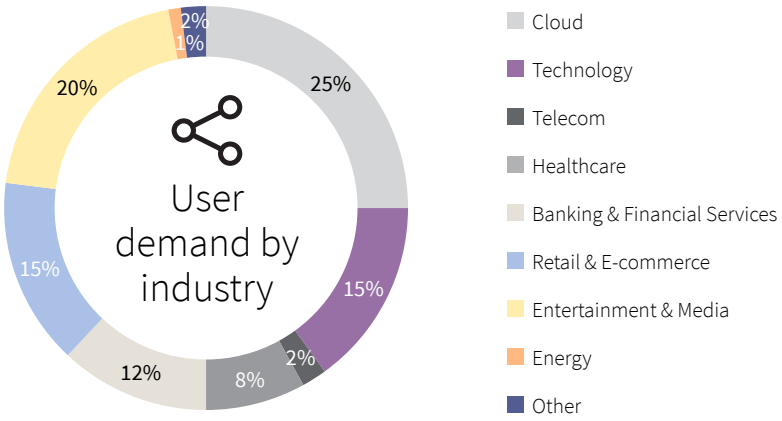
Rental rates	Low	High
(All-in) sub-250 kW	$200	$300
250 kW-1 MW	$100	$125
1-5 MW	$85	$95
5 MW plus	$80	$85

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



Authored by: Mark Bauer

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Salt Lake City

Salt Lake City remains a great alternative for NW and SW markets

Market overview

Supply

Supply in Salt Lake City keeps on growing by providers in the market getting power to their sites and pursuing additional expansion sites. Aligned with SLC04 being announced in West Valley City, Novva continues to bring power online to its campus, and DataBank grows its Bluffdale campus with SLC 6 nearing completion of its construction.

Demand

Hyperscale-cloud and social media companies continue to lead the demand, followed by financial service and e-commerce companies. Financial service companies continue their growth in this market with built-out and prelease committments.

Market trends

Existing and new providers continue to look toward Greater SLC for expanding their footprints. Preleasing commitments are becoming more prevelant in this market as capacity is not meeting the increasing demand.

Outlook

*for **Users***

- Less flexibility in leasing and ramps
- Future capacity needs are now current needs
- Focus less on economics and more on "on-time" deliveries

*for **Providers***

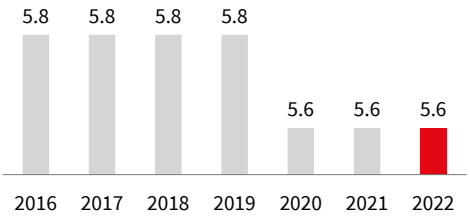
- Keep on bringing capacity to the market
- Focus on long-term campus growth with your customers
- Publicize your green initiatives

Supply	s.f.	MW
Total inventory:	1,215,920	157.4
Total vacant:	83,100	12.2
Under Construction:	100,000	22.0
Planned:	1,440,000	405.0

Demand	MW
Net absorption:	17.5

Rental rates	Low	High
(All-in) sub-250 kW	$225	$275
250 kW-1 MW	$120	$140
1-5 MW	$95	$115
5 MW plus	$85	$95

Average power rate (cents/kWh)



Data Center leverage

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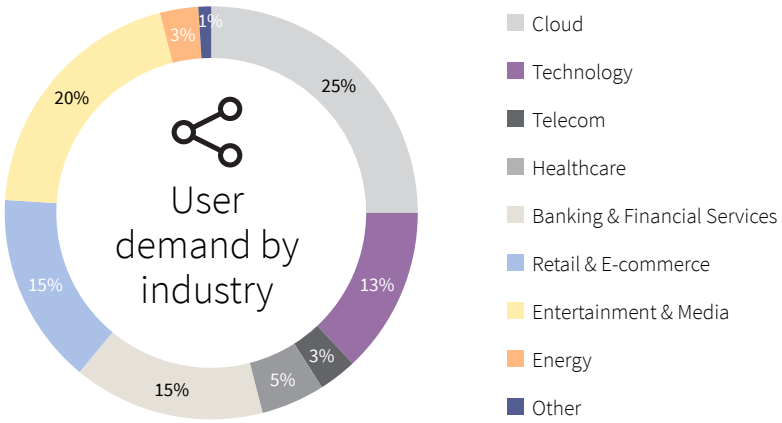
Neutral market
Provider-favorable market



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EMEA insights

- Demand is on track for another record-breaking year in terms of take-up and is on track to exceed the levels seen in 2021.
- Demand for capacity continues to outstrip the new supply being commissioned, leading to high levels of global preleasing activity, 266.9 MW in H1 2022 for the EMEA market.
- High levels of new supply forecast for 2022. Quite a few developments pushed over from 2021, and expect quite a few scheduled in H2 2022 to fall into 2023.
- Significant growth being seen in the secondary markets. Madrid is set to see 25 MW of new supply added in 2022, a 32% increase in supply. A lot in the development pipeline for Madrid, 108.5 MW in total under construction (44.4 MW of this for 2023) and 66.6 MW in planning.
- Sustainability is a major factor in Europe. De facto moratorium in Dublin and Climate Neutral Data Centre Pact says that new data centres must adhere to PUE rating of 1.3 & 1.4 (Cool and Warm target) by 2025. All data centres must be climate neutral by 2030.

London

London on course for continued growth

Market overview

Supply

London, the largest colocation market in Europe, now stands at 866 MW of total IT load. We anticipate 91 MW of new supply to be added in 2022. So far we have seen 50 MW of supply added in the first half of the year, with a further 41 MW due to come online later in the year.

Demand

London saw a strong start to 2022 with 35 MW of take-up in H1, marginally lower than the 37 MW seen at the same point last year. We forecast 76 MW of take-up throughout 2022, and London is currently on track to exceed this. Preleasing activity has been incredibly high, with 111 MW seen in H1.

Market trends

Despite London being the the most mature data centre hub in Europe, it continues to be one of the fastest growing. Last year saw just under 100 MW of new supply, a 13% growth in the total size of the market (the larget percentage increase out of the FLAP-D markets).

Outlook

*for **Users***

- Access to one of the world's top financial centres
- Most established data centre market in Europe
- Strong pipeline of new developments

*for **Providers***

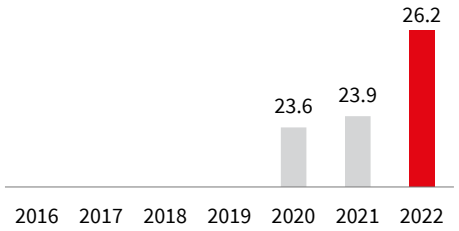
- Rising inflation, currently one of the highest in Europe
- Rise of hyperscaler presence in the market
- Competition for land is very high

Supply	s.f.	MW
Total inventory:	-	865.7
Total vacant:	-	176.0
Under Construction:	-	67.6
Planned:	-	304.3

Demand	MW
Net absorption:	35.4

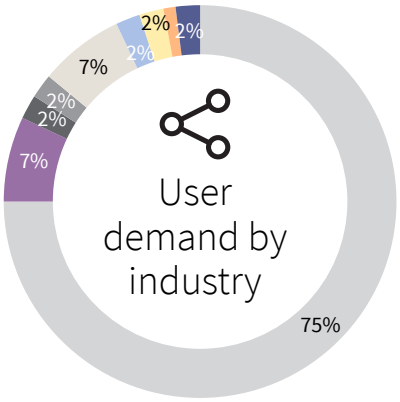
Rental rates	Low	High
sub 250 kW	-	-
250 kW-1 MW	$125	$155
1-5 MW	$100	$120
5 MW plus	$100	$115

2022 Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



- Cloud
- Technology
- Telecom
- Healthcare
- Banking & Financial Services
- Retail & E-commerce
- Entertainment & Media
- Energy
- Other

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Frankfurt

Triple-digit supply growth forecast for 2022

Market overview

Supply

The colocation market size of Frankfurt currently sits at 530 MW, the largest mainland Europe market. Last year saw 52 MW of new supply, a 13% increase in the total market size. The market shows no sign of slowing, with a record 129 MW of new supply forecast for 2022.

Demand

Frankfurt saw a strong start to 2022 with 21.6 MW of take-up in the first half (compared to the 19 MW seen at the same point in 2021). We do anticipate demand to pick up further in the second half of the year; we forecast the market to hit 95 MW of total take-up in 2022. Preleasing activity has been strong in H1 2022, with 98 MW seen so far.

Market trends

Frankfurt is the fastest growing colocation market in FLAP-D over the past five years, with the total supply growing by over 110%. This trend looks set to continue with a siginificant development pipeline. However, much of this pipeline is still in the planning stages, and if supply chain constraints continue we may see forecast developments fall in 2023.

Outlook

*for **Users***

- Strong pipeline of new developments
- Vacancy rates compressed
- Home to the European Central Bank, and the largest financial centre in mainland Europe

*for **Providers***

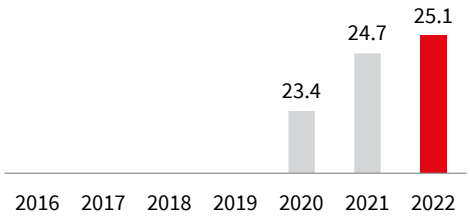
- Demand has regularly outstripped supply, leading to high levels of preleasing
- Regulation on new data centre developments proposed
- Home to the DE-CIX, the single largest exchange point worldwide in terms of traffic

Supply	s.f.	MW
Total inventory:	-	530.1
Total vacant:	-	65.0
Under Construction:	-	50.5
Planned:	-	238.4

Demand	MW
Net absorption:	21.6

Rental rates	Low	High
sub 250 kW	-	-
250 kW-1 MW	$130	$160
1-5 MW	$100	$120
5 MW plus	$85	$105

Average power rate (cents/kWh)



Data Center leverage

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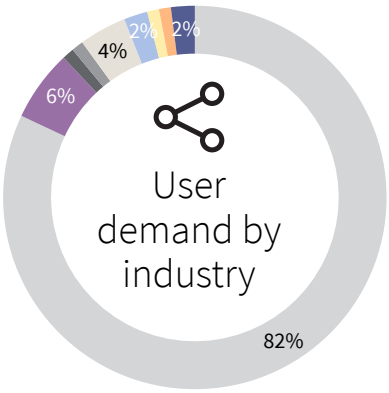
Neutral market
Provider-favorable market



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- Other

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Amsterdam

2022 will see the first new major data centre development since the moratorium was lifted two years ago

Market overview

Supply

Supply in Amsterdam is currently 434 MW IT load and we have yet to see any large amounts of new supply added since the moratorium on new data centre developments was lifted in July 2020. However, we do anticipate 23 MW of new supply to be added in 2022.

Demand

Take-up only saw 8 MW in the first half of the year, on par with 2020 and 2021. However, we forecast 21 MW of demand in 2022 with new developments due to come online in the second half of the year. The majority of demand in the market has historically been driven by smaller retail transactions.

Market trends

Data centre development in this market is still a political issue, despite the moratorium on new developments being lifted nearly two years ago. The Dutch Senate passed a motion to call on the government to temporarily block the construction of Meta's planned data centre until a national policy on new data centres has been developed.

Outlook

for ***Users***

- Major European business and technology hub
- New supply coming to the market for the first time in two years
- Demand has been subdued but outstrips new supply, keeping prices stable

for ***Providers***

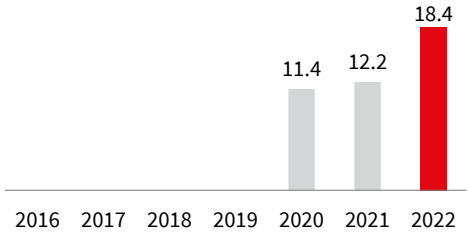
- Operators continue to struggle to secure planning for new developments
- Limitations on both available land and power
- Established data centre market, with strategic connectivity

Supply	s.f.	MW
Total inventory:	-	434.3
Total vacant:	-	105.0
Under Construction:	-	27.0
Planned:	-	74.4

Demand	MW
Net absorption:	8.1

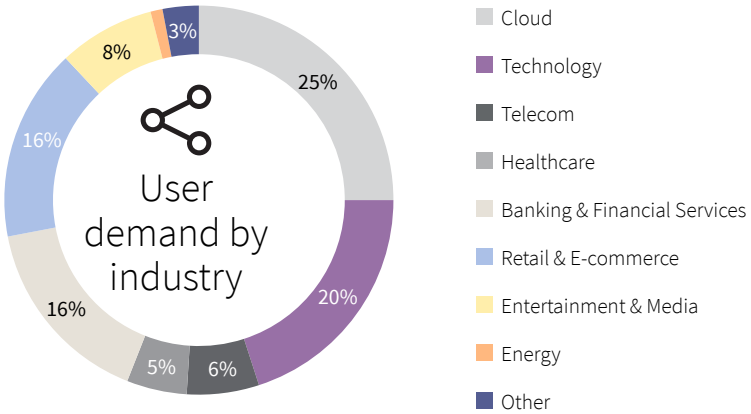
Rental rates	Low	High
sub 250 kW	-	-
250 kW-1 MW	$120	$150
1-5 MW	$105	$125
5 MW plus	$90	$95

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



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Paris

Strong forecasted supply and demand for 2022

Market overview

Supply

Supply currently stands at 318 MW after a busy 2021, which saw 31 MW of new supply added. We are forecasting a further 71 MW due to be delivered throughout the year, a 25% increase in total market size.

Demand

Take-up for the first half of the year reached 27 MW, a record H1 high for this market. Paris is on track to hit the forecasted 60 MW in total demand in 2022, which would be a considerable increase from the 43 MW seen in 2021.

Market trends

Competition for land in the market is very high, and this has contributed to a lack of growth in the market over the past couple of years (the lowest levels of percentage growth in FLAP-D over the last five years). However, we are now seeing large-scale developments come through, although some projects are now being pushed back into next year due to supply chain constraints.

Outlook

*for **Users***

- Demand regularly outstrips supply in the market
- Demand for space has led to new supply being preleased before completion
- A significant increase in the amount of new supply forecast for 2022

*for **Providers***

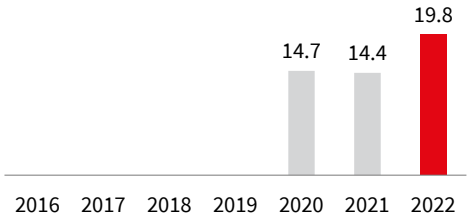
- Access to the Paris-Saclay Innovation Hub, one of the world's top technology clusters
- Competition for land and difficulties securing power
- Domestic tax on electricity consumption reduction for data centres that adhere to certain criteria

Supply	s.f.	MW
Total inventory:	-	317.6
Total vacant:	-	49.0
Under Construction:	-	19.0
Planned:	-	106.1

Demand	MW
Net absorption:	26.8

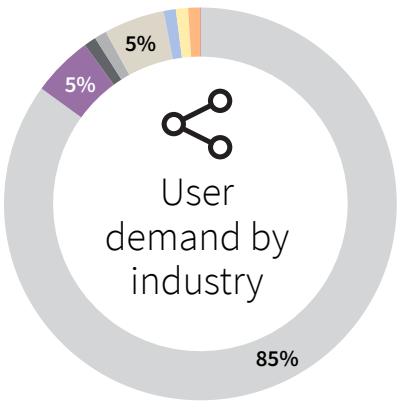
Rental rates	Low	High
sub 250 kW	-	-
250 kW-1 MW	$117	$147
1-5 MW	$102	$122
5 MW plus	$91.46	$101.63

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



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- Other

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Dublin

Huge growth anticipated in the colocation market

Market overview

Supply

Colocation supply in Dublin sits at 144 MW, the smallest colocation market in FLAP-D but the largest hyperscale centre. We are anticipating huge growth in 2022, with 83 MW, new supply forecast, a potential 58% growth in market size.

Demand

First-half take-up reached 7.7 MW, slightly down from the 11 MW seen at the same point last year. However, we forecast Dublin to see 40 MW of demand in 2022, with significant activity to be seen in the second half of the year. This is based on the large levels of preletting activity seen over the last two quarters, with 35 MW prelet.

Market trends

The uptick in new developments coming through in 2022 is after the sector coming under close scrutiny with a de facto moratorium on new data centre developments in Dublin. Ireland's state-owned power transmission operator EirGrid announced at the end of last year that it would not be providing any connections to new facilities in Dublin until at least 2028.

Outlook

*for **Users***

- Strong connectivity and access to major subsea cables connecting Ireland with the U.S.
- Huge levels of new supply currently under construction
- Currently the lowest vacancy rates in FLAP-D

*for **Providers***

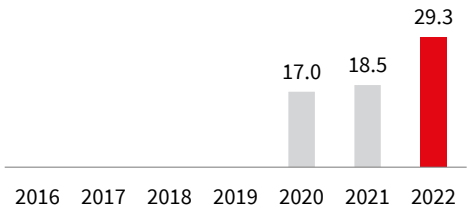
- De facto moratorium on new data centre development
- European headquarters for a large number of global tech companies
- Competition for land from hyperscalers

Supply	s.f.	MW
Total inventory:	-	144.0
Total vacant:	-	13.5
Under Construction:	-	68.3
Planned:	-	216.8

Demand	MW
Net absorption:	7.7

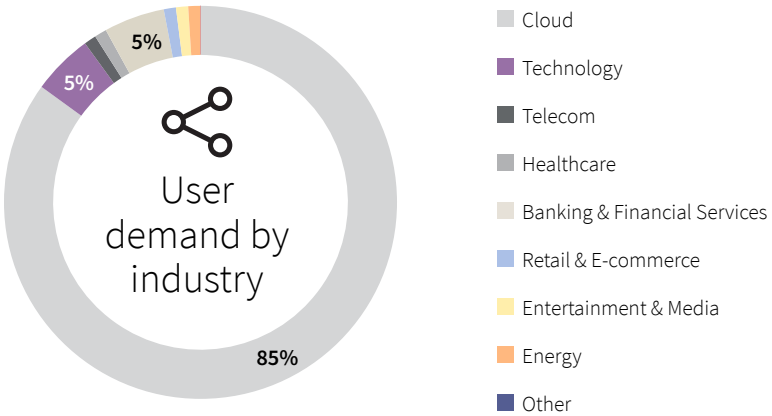
Rental rates	Low	High
sub 250 kW	-	-
250 kW-1 MW	$147	$178
1-5 MW	$117	$147
5 MW plus	$81.30	$101.63

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



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Madrid

Huge growth anticipated as hyperscalers launch new data centre regions in the country

Market overview

Supply

Current colocation supply currently stands at 86 MW, just over half of the size of the Dublin market. We are anticipating huge growth in the Madrid market this year, with 25 MW due to come online in 2022 and a considerable development pipeline for 2023.

Demand

We saw 6 MW of take-up in the first half of 2022, not too dissimilar to the levels of demand seen in Amsterdam and Dublin in H1 2022. We are forecasting 22 MW of total take-up in 2022, with demand picking up in the second half of the year.

Market trends

Madrid is set to see rapid growth with Meta, Interxion and Thor Equities looking to develop large-scale data centre developments. AWS and Microsoft are launching new data centre regions in the country to boost infrastructure and accelerate digital connectivity over the next couple of years.

Outlook

for ***Users***

- Access to excellent fibre-optic connectivity
- Brand-new supply coming to the market
- A new 360 MW data centre campus is planned in Madrid (Digital Valley Site)

for ***Providers***

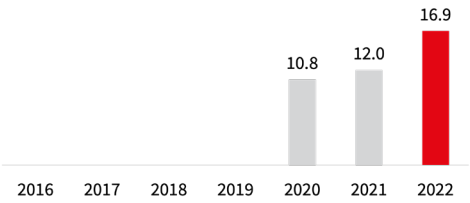
- Madrid is well placed to deliver data centre services to Southern Europe
- AWS and Microsoft launching new data centre regions in Spain
- Launch of Next Tech, a fund that will invest €4 billion into cloud services, big data and AI

Supply	s.f.	MW
Total inventory:	-	85.5
Total vacant:	-	12.0
Under Construction:	-	108.5
Planned:	-	66.6

Demand	MW
Net absorption:	6.1

Rental rates	Low	High
sub 250 kW	-	-
250 kW-1 MW	$125	$140
1-5 MW	$100	$130
5 MW plus	$90	$100

2022 Average power rate (cents/kWh)



Data Center leverage

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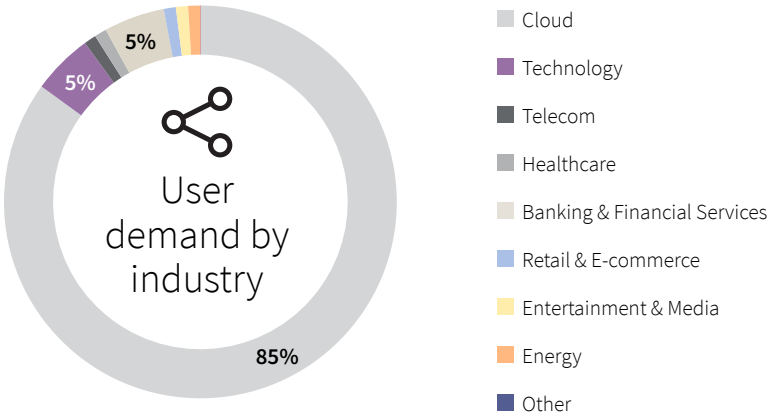
Neutral market
Provider-favorable market



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Asia Pacific insights

- Mature metros continue to see strong growth as colocation and cloud operators consolidate their positions in metros that have become new sub-regional hubs. Simultaneously, Singapore and Hong Kong's sub-regional hub status is being challenged by other markets.
- Maturing markets have become the focus of attention as investors and developers seek new opportunities in less crowded markets. Emerging metros across India and ASEAN are supporting the shift in data center infrastructure from core to edge. Jakarta and Mumbai in particular are attracting strong interest from colocation and cloud operators.
- Governments within the region have become more sensitive to the protection of their citizens' personal data, governmental data and the ability to physically control that data. Government regulation in many countries is moving toward greater mandatory storage and control of national data within sovereign borders.
- Governments have also become more sensitive to environmental impacts of large data centers and the country's climate change commitments. Data center operators through increased regulation are under pressure to use more sustainable energy and introduce further innovation into facility operations.
- For the period 2020–2025, data centre operators in Asia/Pacific are forecast to spend more than all years previously up until 2020, doubling from US$71 billion to US $175 billion cumulatively (IDC 2022).

Chennai

Cloud players increasing footprint as alternate DC hub

Market overview

Supply

Operators calibrated supply in line with cloud demand which has been picking up. Players have been scouting for Land parcels aggressively. Data centre regulations by the state government are expected to attract more operators.

Demand

Cloud players have been increasing their footprint with new pre-commitments being inked. Demand from enterprise and wholesale segments provided steady space offtake during the first half of the year. Chennai is emerging as an exchange hub for southern part of the country.

Market trends

The city has two DC hubs with more than 20 km of distance. Cloud players adopting three site strategy will lead to the emergence of new DC zone. New cable landing are expected to influence the growth of the DC hubs in the city. Low latency advantage due to connectivity with APAC hubs is expected to drive demand.

Outlook

*for **Users***

- Increased availability of colo options for IT industry
- New cloud regions to offer improved connectivity
- Lease rentals to remain stable

*for **Providers***

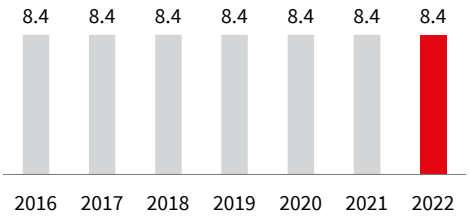
- Alternate availability zones to emerge
- E-commerce and media segment to increase space take-up
- Higher availability of renewable energy options

Supply	s.f.	MW
Total inventory:	1,377,800	76
Total vacant:	107,091	6
Under Construction:	960,000	96
Planned:	1,425,000	121

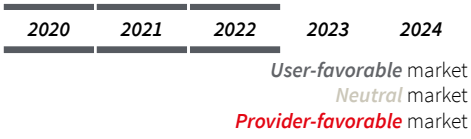
Demand	MW
Net absorption:	8.0

Rental rates	Low	High
sub 250 kW	$145	$150
250 kW-1 MW	$110	$130
1-5 MW	$95	$100
5 MW plus	$80	$85

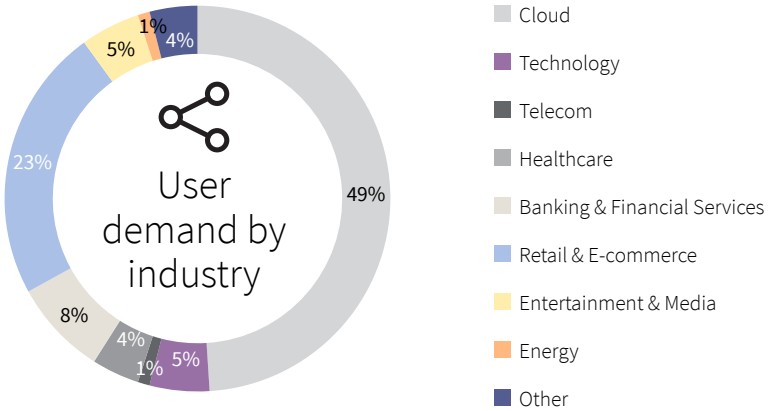
Average power rate (cents/kWh)



Data Center leverage



User-favorable market
Neutral market
Provider-favorable market



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Mumbai

2.5 x growth in absorption during first half of 2022

Market overview

Supply

Delivery of pre-commitments led to a sharp jump in the supply during H1 2022. DC operators continue to scale up supply in line with pre-commitments from cloud players. Hence the occupancy levels have been at higher levels. Apart from land banking, power and environment approvals have gained priority.

Demand

Migration to colocation by BFSI and hyperscalers led to 58MW absorption in H1 2022, which is 2.5x of the same period of previous year. Hyperscale cloud players are looking at options only if land, power and fibre paths are secured by colo operators. Hyperscale demand from BFSI, fintech and financial intermediaries gained pace during the last six months.

Market trends

Colo operators have been increasing commitments and those with ability to deliver supply are gaining pace. Increase in scale and pace of pre-commitments from cloud players is leading to ambitious growth plans of operators. Cloud players are also exploring seif-build ambitions indicating strong potential demand.

Outlook

for ***Users***

- Limited supply conditions to prevail
- local storage need to be planned
- 5G spectrum to alter connectivity soon

for ***Providers***

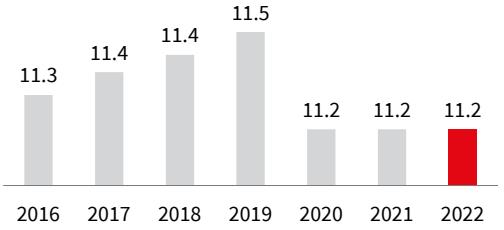
- Power and environmental approvals key to secure new clients
- New location to emerge as land costs rise
- Hyperscale self-build to impact colocation supply

Supply	s.f.	MW
Total inventory:	5,345,920	314
Total vacant:	98,622	6
Under Construction:	3,025,000	264
Planned:	1,770,000	175

Demand	MW
Net absorption:	58

Rental rates	Low	High
sub 250 kW	$120	$150
250 kW-1 MW	$90	$125
1-5 MW	$80	$105
5 MW plus	$75	$100

Average power rate (cents/kWh)



Data Center leverage

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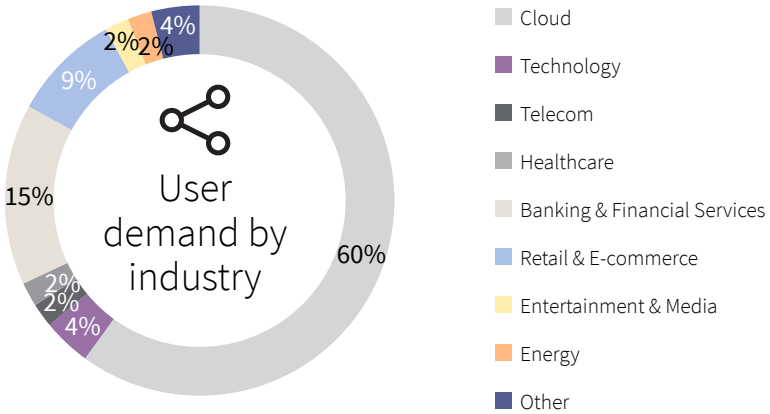

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Hong Kong

Concentration of DCs expanding to Kwai Chung from Tseung Kwan O

Market overview

Supply

2022 forecast new supply to total 69 MW, up 17% on 2021. Two data centres are slated for completion in 2022, one by iAdvantage and the other by GDS, the first centre developed by the operator in Hong Kong.

Demand

The trend of increasingly intensive data usage, 5G applications and rapid growth in online businesses are the main drivers of demand. Users are also increasingly shifting to cloud storage that drives demand for hyperscale centres.

Market trends

The growing reliance on digital technology such as metaverse, cryptocurrencies and online shopping platforms has driven the demand for data centre. In addition, the adoption of cloud service is becoming more common in both public and private sectors, bolstering the demand for data centres.

Outlook

for ***Users***

- Higher supply in coming years to provide more options for users
- Supply pipeline in New Territories may give rise to subdued pricing opportunities
- MEGA-iAdvantage–HK Island and Equinix's facilities lead in interconnectivity.

for ***Providers***

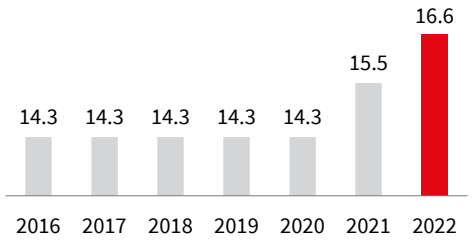
- Higher supply in coming years to provide more options for users
- Supply pipeline in New Territories may give rise to subdued pricing opportunities
- MEGA-iAdvantage - HK Island and Equinix's facilities lead in interconnectivity.

Supply	s.f.	MW
Total inventory:	6,333,876	403
Total vacant:	1,272,210	81
Under Construction:	3,188,600	244
Planned:	2,982,187	153

Demand	MW
Net absorption:	18

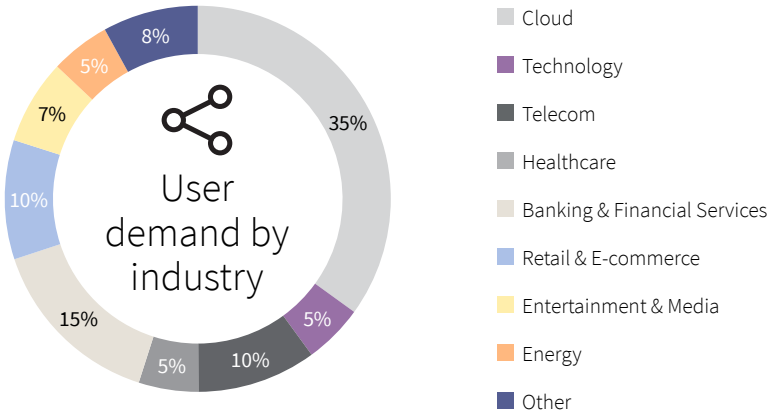
Rental rates	Low	High
sub 250 kW	$290	$430
250 kW-1 MW	$180	$280
1-5 MW	$160	$170
5 MW plus	$120	$150

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



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Tokyo

Hyperscalers expand operations with rising cloud adoption by enterprises

Market overview

Supply

Operators have announced hyperscale capacity additions as cloud players have been increasing their commitments in the region. A real estate developer plans to build data centre by converting its old office building signaling a new trend.

Demand

Rise in cloud adoption by enterprises continued, which has led to growth in hyperscale operations to meet demand. Government's digital initiative is also driving demand for cloud services. The use of online financial services has witnessed a steady rise.

Market trends

Supply additions are being hampered by a shortage of IT hardware and power permissions. Power prices have increased due to supply disruptions and rising input costs. Strong demand has forced players to absorb the increase in cost.

Outlook

for ***Users***

- Rents might see a revision due to rise in input costs
- Options in new regions could provide cost-effective options
- Faster adoption of cloud service to propel business growth

for ***Providers***

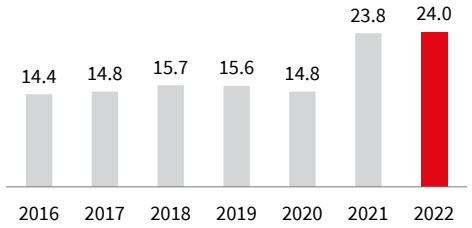
- Managing supply issues will be a key challenge
- Rising input costs are likely to keep margins under pressure
- Supply delivery might get postponed

Supply	s.f.	MW
Total inventory:	6,343,750	875.0
Total vacant:	1,326,750	183.0
Under Construction:	3,395,175	468.3
Planned:	1,745,800	240.8

Demand	MW
Net absorption:	34.0

Rental rates	Low	High
sub 250 kW	$500	$600
250 kW-1 MW	$550	$700
1-5 MW	$132	$165
5 MW plus	-	-

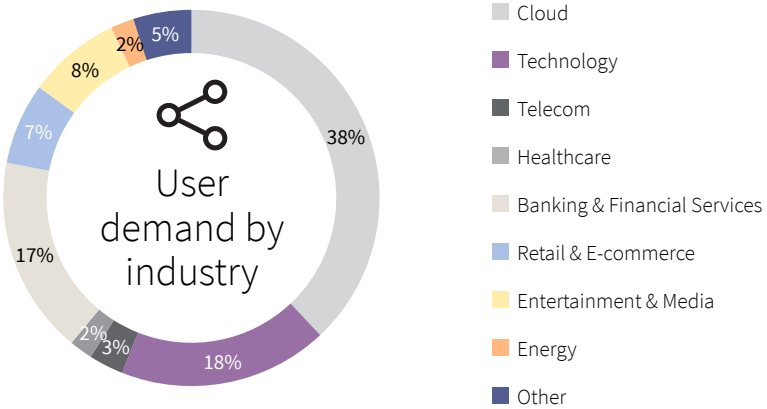
Average power rate (cents/kWh)



Data Center leverage

2020	*2021*	*2022*	*2023*	*2024*

User-favorable market
Neutral market
Provider-favorable market



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Singapore

Singapore's data centre market to remain constrained in medium term, risking Southeast Asia regional hub status

Market overview

Supply

No new retail colocation supply has come online since Airtrunk SGP1 in 2020 and Digital Loyang II, STT Loyang and Equinix SG5 in 2021. The only new supply on the horizon is with hyperscalers (Facebook) and cloud service providers (AWS). Supply will be severely limited in the medium term.

Demand

Demand for retail colocation, hyperscale applications and cloud services continues unabated. This demand is from traditional sources across all industries but particularly banks. It also continues from all regions; however, there is strong interest from Hong Kong.

Market trends

The Singapore data centre moratorium, which has been in force since 2019, was partially lifted in Q2 2022. 60 MW is now available yearly to operators through competitive tender. Pandemic-driven digital industries are exploding, changing the way enterprises and consumers work and play.

Outlook

*for **Users***

- Expect to pay premium rents for any retail colocation space found
- Consider taking space in other Southeast Asian countries with availability
- Continue to virtualise workloads to the cloud for ease of portability globally

*for **Providers***

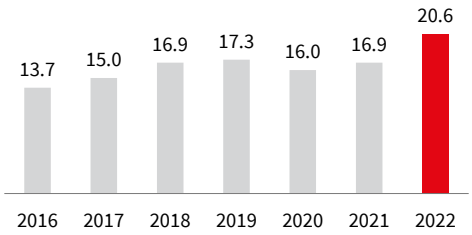
- De facto moratorium on new data centre development
- European headquarters for a large number of global tech companies
- Competition for land from hyperscalers

Supply	s.f.	MW
Total inventory:	7,250,000	1,000.0
Total vacant:	-	0.0
Under Construction:	-	0.0
Planned:	120,513	30.0

Demand	MW
Net absorption:	0.0

Rental rates	Low	High
sub 250 kW	$450	$850
250 kW-1 MW	$350	$800
1-5 MW	$450	$850
5 MW plus	-	-

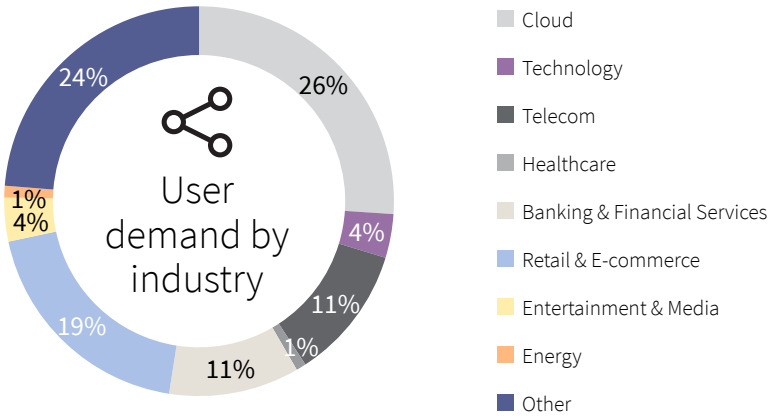
Average power rate (cents/kWh)



Data Center leverage

2020	*2021*	*2022*	*2023*	*2024*

User-favorable market
Neutral market
Provider-favorable market



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Sydney

High levels of projected supply to be met with robust demand primarily driven by both private-and public-sector cloud outsourcing over next few years

Market overview

Supply

There is a significant amount of stock under construction (equal to 42% of current built-out capacity). Recent completions include Macquarie Data Centres Intellicentre 3 East in Macquarie Park and Equinix XScale site in Rosehill. Operational stocks remains weighted toward the Western Sydney sub-region, which currently accounts for around 40% of operational data center capacity.

Demand

Strong levels of supply continue to be met with robust demand. High levels of cloud adoption as a result of government initiatives and corporate-sector outsourcing continue to support activity alongside rising underlying technology adoption such as hybrid-working, AI and other intensive data-analytic tools across a number of sectors.

Market trends

Data sovereignty remains an important issue. Three key government departments (ASIC, ACMA and Home Affairs) have left Global Switch's Sydney facility to meet the July 2022 deadline for sensitive data storage outlined by the Federal DTA (Digital Transformation Agency). Major corporate users are anticipated to increasingly consider security implications with providers.

Outlook

for ***Users***

- Corporates showing preference for storage in DTA-certified facilities
- Public-sector usage is anticipated to grow due to both state and federal initiatives
- More offshore content and digital media companies are considering local storage

for ***Providers***

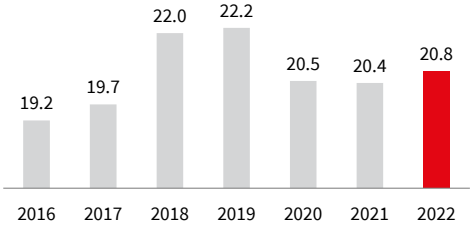
- Competition to secure key blue-chip corporates and major government contracts to rise
- Tech innovation to rise—Macquarie Telecom has recently invested in Submer cooling
- Cloud groups focusing on acquiring their own development sites

Supply	s.f.	MW
Total inventory:	3,100,000	470
Total vacant:	806,603	90
Under Construction:	1,004,500	250
Planned:	3,127,370	867

Demand	MW
Net absorption:	n/a

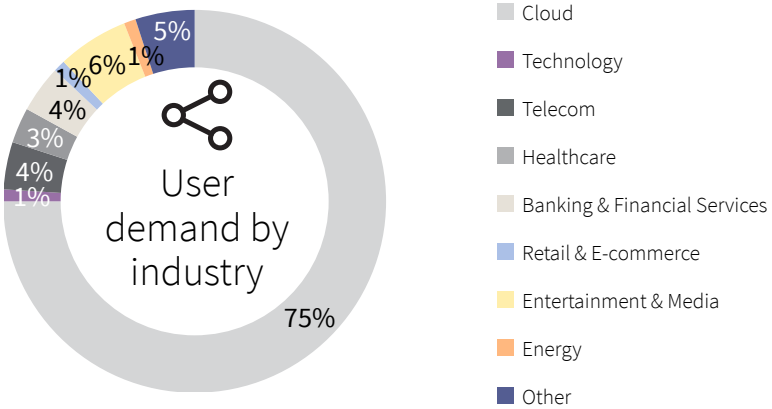
Rental rates	Low	High
sub 250 kW	$1,800.00	$2,500.00
250 kW-1 MW	$250.00	$500.00
1-5 MW	$160.00	$220.00
5 MW plus	$130.00	$170.00

Average power rate (cents/kWh)



Data Center leverage

User-favorable market
Neutral market
Provider-favorable market



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