PGIM REAL ESTATE

GLOBAL DATA CENTERS

Americas Excerpt

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Executive Summary

- The COVID-19 pandemic has led to mass adoption of technologies, and the resulting increase in global internet traffic and data creation is without precedent, driving growth in demand for data centers.
- Data centers are best described as buildings designed specifically to house computer systems and network equipment. They differ from standard industrial buildings because of the more-complex technical specifications for the physical building and the fit-out, which comprises large amounts of electrical and mechanical hardware. Tenants usually sign long leases because of the high initial costs incurred. This provides resilient income streams.
- To date, supply growth has been focused in major cities, where economic and demographic drivers underpin strong demand. Key technical factors for the sector include the availability of cloud operations, power and fiber network cable connectivity, and land cost and government policies.
- Data centers are still viewed as a niche real estate asset class, but transparency and liquidity are improving as the sector grows. Including corporate acquisitions, total transaction activity averaged US$25 billion per annum from 2017 to 2019, showing notable growth in capital flows.
- Investors can invest via three main structures: a powered shell and core structure; with or without fit-out; or as fully owned operators. These are distinguished by several key investment options, and leasing profiles vary.
- Globally, unlevered returns for powered shell and core data centers are estimated at 11% per annum on average. The sector is expected to continue offering attractive returns in the coming years, with potential for further yield compression. Major investment risks include technological obsolescence and depreciation, a limited pool of operator-tenants and government policies.
- **The United States is the largest data center market in the world. Total capacity has grown 10% per annum over the past five years as the market continues to scale up, though the gradual vacancy uptrend has weighed on rents.**

INTRODUCTION

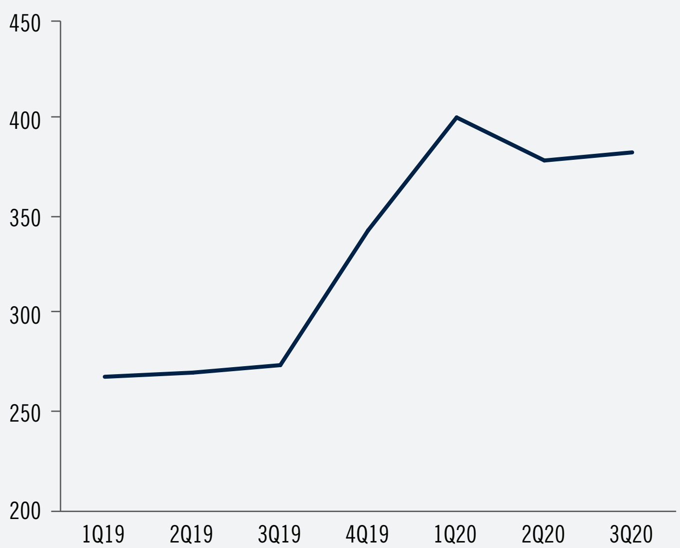
The COVID-19 pandemic has caused the largest economic shock in generations. Significant disruption across all segments of the economy has resulted in severe recessions globally. Government-imposed restrictions to contain the virus — such as those on travel and social distancing — have led to a significant increase in the mass adoption of advanced technologies. Technologies that enable remote working, distance learning and online shopping and entertainment, for example, have helped societies cope with and even overcome these new barriers to our ways of life.

The resulting increase in global internet traffic and data volume is without precedent. Examples include a ninefold increase in unique-user count on communication tools Microsoft Teams and Zoom,[1] a 40% annual increase in average monthly household broadband usage and a 35% increase in the average number of hours spent on mobile phone usage (exhibit 1). Although impressive, those numbers hide the reality that both the application of and advances in technology have been on a strong upward trend for several years.

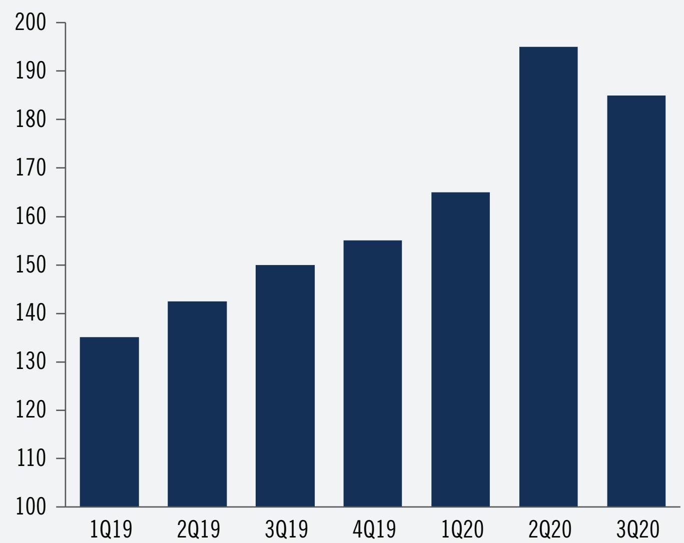
The sheer growth in the size of the information, communication and technology (ICT) sector provides a useful backdrop to how important technology has become to societies and with that, how significant the associated ICT infrastructure growth has been.[2] When it comes to real estate, the ICT sector is the underlying driver for demand for data centers — buildings built specifically to house computer systems and network equipment to support digital information processing — and based on current trends, this sector is set to grow significantly in the coming years.

Exhibit 1: Impact of COVID-19 on Technology and Internet Usage

Monthly Average Household Broadband Usage (Gigabytes)



Monthly Average Hours Spent on Mobile Applications (Billion hours)



Sources: Openvault, App Annie, PGIM Real Estate. As of January 2021.

[1] Comscore, May 2020.

[2] According to Economist Intelligence Unit data, from 1999 to 2019 the average annual real growth rate of the global ICT sector was almost twice that of real GDP (4.59% versus 2.72%).

UNITED STATES

Data Center Fundamentals

As noted earlier, the COVID-19 pandemic has accelerated many of the demand trends among data centers — most noticeably in the areas of remote working, social and entertainment streaming and e-commerce. In the United States, Green Street Advisors estimates[25] that e-commerce penetration will have risen from 11% in 2019 to 15% by the end of 2020, driven by stay-at-home orders that have converted many consumers to e-commerce.

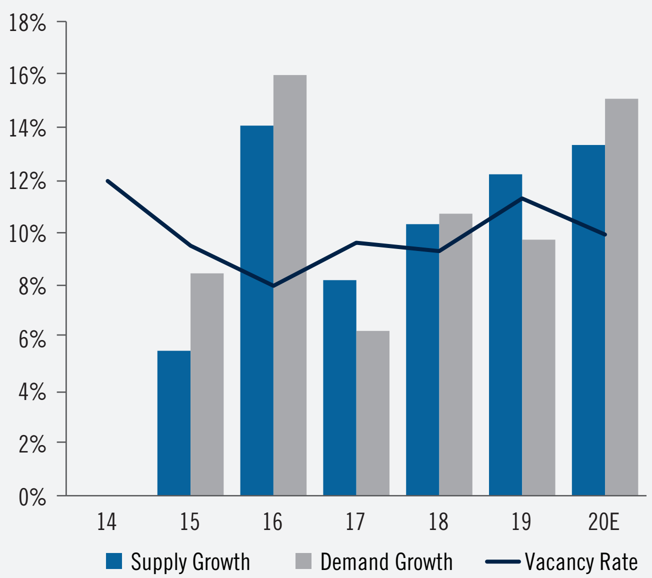
Three of the four largest cloud providers internationally, as well as several of the largest third-party data center operators, are headquartered in the United States. The companies have been at the forefront of driving data center demand globally and domestically and have played a key role in shaping the development of the U.S. data center market.

Overall data center demand growth has been solid in recent years, keeping average vacancy rates in the United States at 8 to 12% since 2014. Driven by expectations of continued leasing demand from cloud service providers, supply completions have been increasing faster than demand, and vacancy has been on a gradual uptrend since 2017. This has weighed on rental rates, which have moderated in recent years to an average of US$126 per kW per month (exhibit AM1).

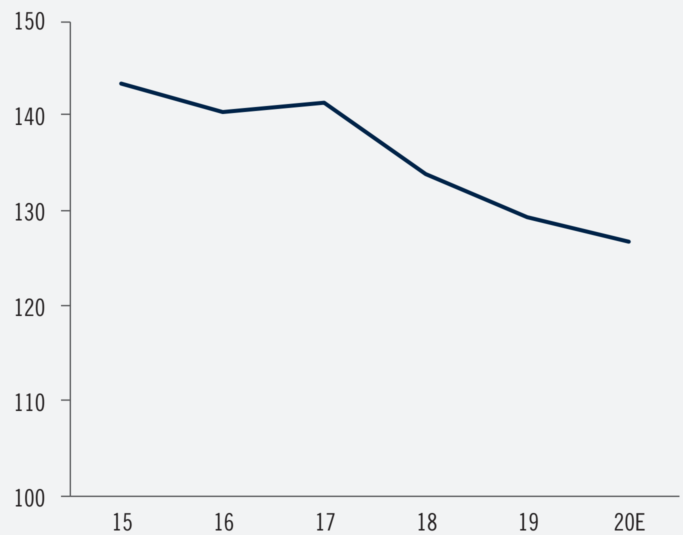
We expect fundamentals to improve and help rental rates stabilize, with data center demand being pushed upward by the COVID-19 pandemic. Furthermore, the supply pipeline remains moderate in most markets, with the only exception being Northern Virginia, where construction has picked up significantly.

Exhibit AM1: U.S. Data Center Market Fundamentals

Data Center Market Supply Growth, Demand Growth and Vacancy Rate



Data Center Rents (US$ per kW per month, >250kW)



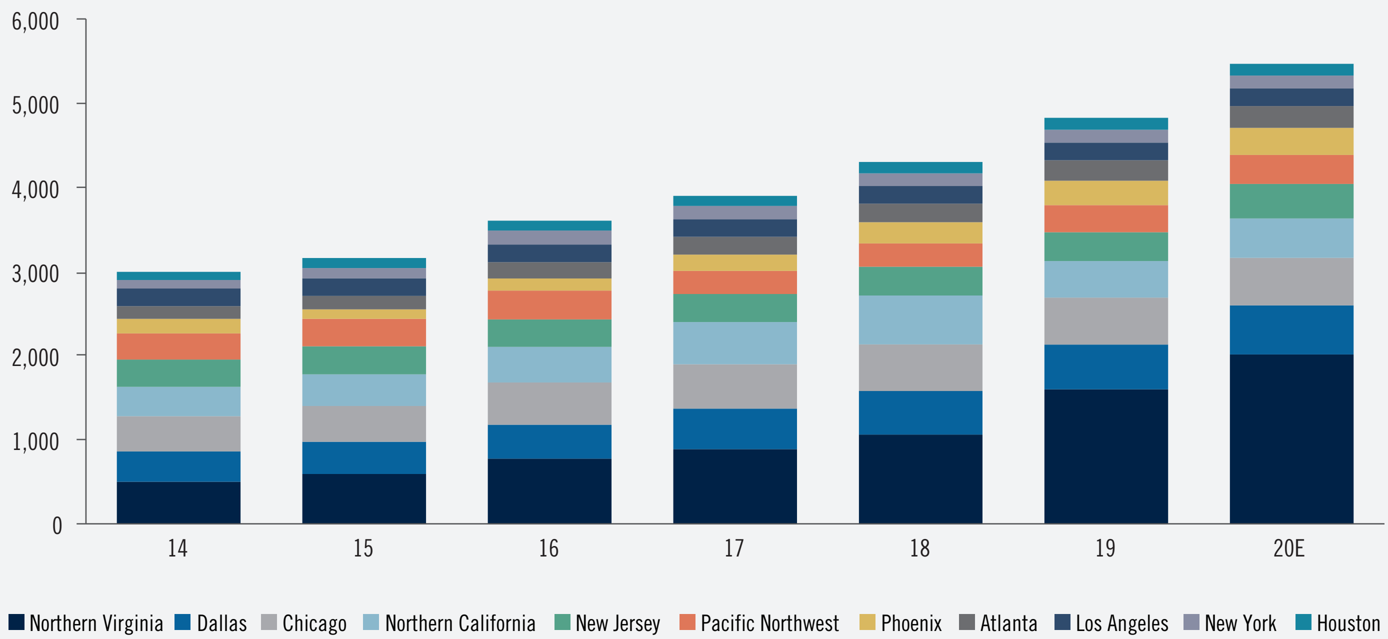
Sources: JLL, CBRE, PGIM Real Estate. As of January 2021.

[25] Green Street Advisors, Industrial Sector Update August 2020.

Data Center Market Scale

The United States is the largest regional data center market in the world, offering total third-party data center capacity of over 5,000 MW — more than half of global capacity (exhibit AM2) — and is also home to some of the largest data center markets by city, as shown in the global supply section earlier. With total inventory growing 10% per annum over the past five years, the U.S. market continues to scale up rapidly. Looking across national markets, there is a disproportionate share of data centers in Northern Virginia, where capacity is more than double the size of that in Northern California, the second-largest market. Other large markets are Dallas and Chicago. Outside those megamarkets, data center activity will continue to be concentrated in major metros that are home to technology and/or Fortune 500 companies because of their more-established infrastructure and security measures. Furthermore, major metros have higher population densities, and data centers located in these metros will be able to provide low-latency services for large consumer markets.

Exhibit AM2: U.S. Data Center Market Scale (Megawatts [MW])

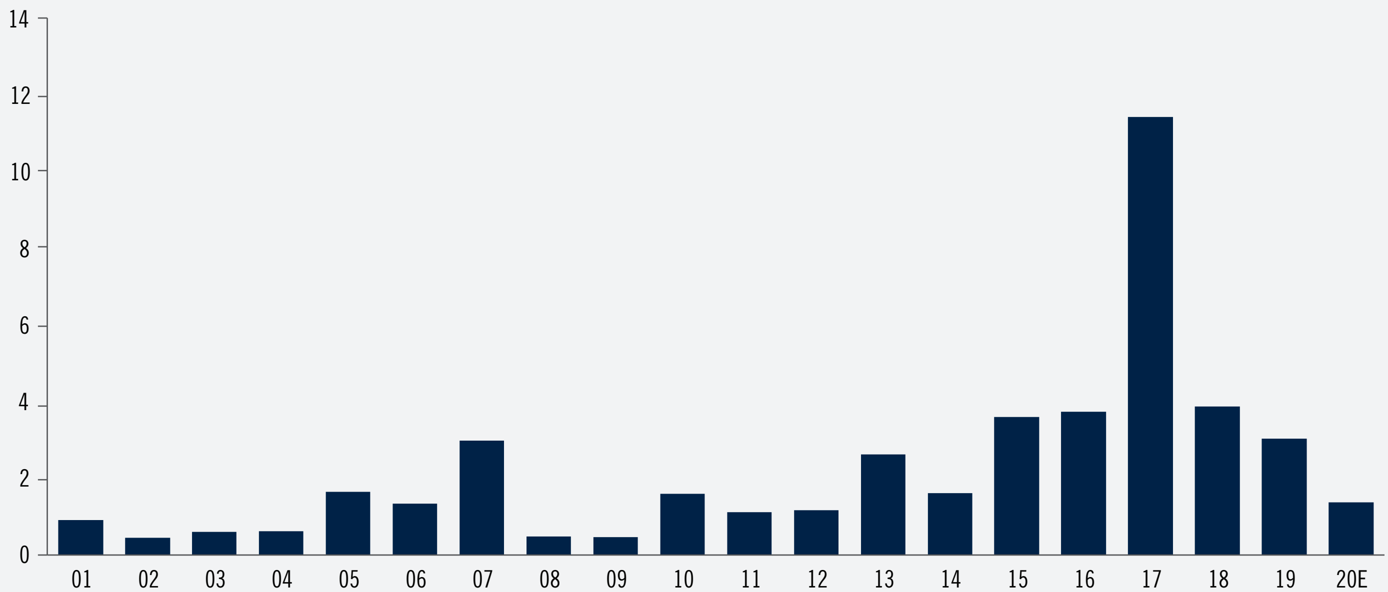


Sources: JLL, PGIM Real Estate. As of January 2021.

Capital Market Trends

In the investment market, the United States typically accounts for 50% of completed-asset transactions globally. Prior to 2020, transaction activity had been broadly stable — at around US$4 billion per annum (exhibit AM3), with 2017 being exceptionally high due to a few portfolio transactions, including a US$3.6-billion portfolio acquisition. However, transaction activity of completed assets slowed in 2020. Nevertheless, the U.S. market continues to attract strong interest from international investors — especially in Asia — with cross-border and private investors making up nearly 80% of net buyers.

Exhibit AM3: U.S. Data Center Transaction Volume (US$ Billion)



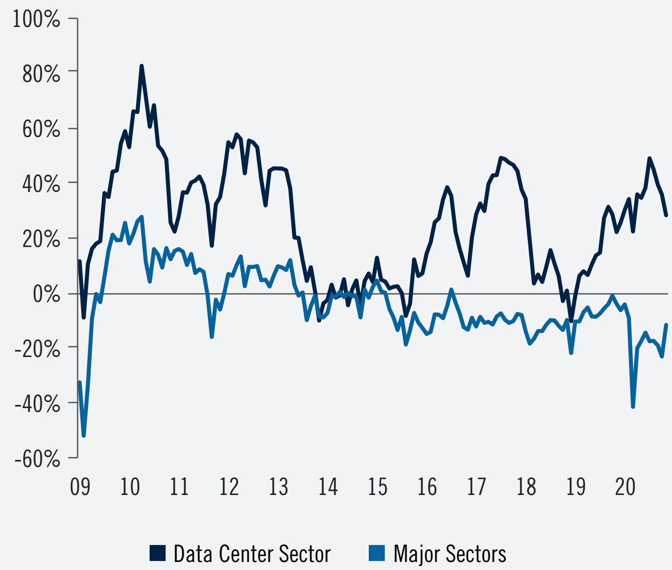
Sources: Real Capital Analytics, PGIM Real Estate. As of January 2021.

The U.S. data center market is the most transparent compared with Europe and Asia Pacific, given the relative maturity of the market and availability of data on leasing fundamentals and pricing. Data center yields, currently at 5.8% according to Green Street Advisors, have been compressing over the past two years while maintaining an attractive spread over major commercial real estate sectors except retail (exhibit AM4). Listed data center REITs have performed well relative to other real estate sectors throughout the COVID-19 pandemic market volatility, suggesting market confidence in longer-term structural drivers that the data center sector offers. With data center REITs' net asset value premiums averaging 40% in the second half of 2020 compared with a 17% discount for other major real estate sectors over the same period, the public market seems to believe that there could be an upside for data center asset valuations (exhibit AM4).

Exhibit AM4: Data Center Yields and Listed Data Center REIT NAV Premiums

Data Center Yields

Average Data Center REIT NAV Premiums

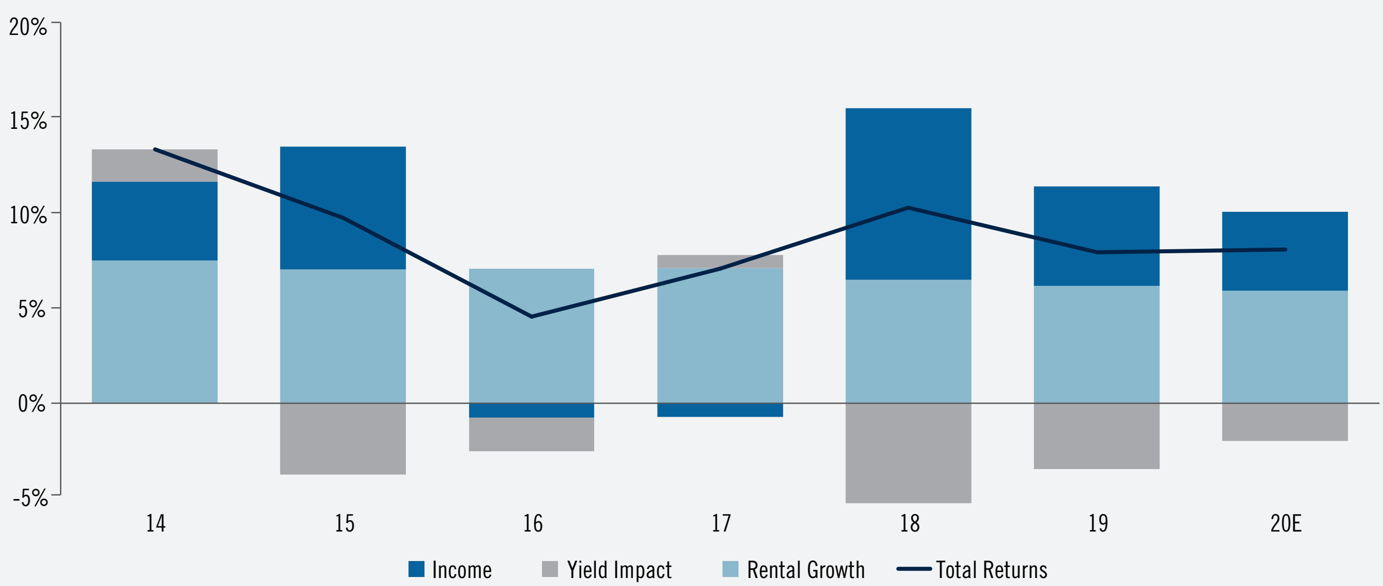


Sources: Green Street Advisors, PGIM Real Estate. As of January 2021.

Since 2014, unlevered total returns for powered shell and core data centers have averaged 9% per annum (exhibit AM5). Yield compression has been a key driver of returns, though partially offset by modest rental growth. However, we expect rents to stabilize in the medium term due to strong demand and moderating supply. Keen interest from global investors in U.S. data centers could potentially compress yields further, keeping prospects positive for the overall market.

Exhibit AM5: U.S. Data Center Total Returns

Estimated Total Returns (Unlevered, Powered Shell and Core Assets)



Sources: Green Street Advisors, PGIM Real Estate. As of January 2021.

CONCLUSION

Data centers are buildings designed to house computer systems and network equipment that support the collection, storage, computing and distribution of data. And although the growth in data center demand has been on an upward trend due to innovations and the adoption of new technology, the COVID-19 pandemic has accelerated demand due to growth in both internet traffic and data creation.

Based on current trends, the global data center market is set to grow significantly in the coming years, potentially leading to a further decrease in risk premium and providing investors with relatively attractive returns. However, deal sourcing is difficult as this is still only a small sector. Moreover, an associated lack of liquidity and transparency — especially around pricing for different ownership and leasing structures, as well as the potential for technological obsolescence — raises the risk profile relative to more-traditional commercial real estate sectors. The sector is set to grow significantly, however, leading to a further decrease in the risk premium and providing investors with relatively attractive returns across the world.

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