

JLL Research Report

Data Center Outlook



A photograph of two men looking at a book together. One man has a beard and is wearing glasses, while the other has short hair and is wearing a headband. They are both looking down at the book.

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Trends to watch in 2020

1.

Data center REITs closed 2019 with a strong performance and are poised for healthy 2020

Following a disappointing 2018, five data REITs—Digital Realty Trust, Equinix, CoreSite Realty, CyrusOne and QTS Realty Trust—yielded returns of 29 percent during the first half of 2019. This robust growth continued throughout 2019, with these five REITs yielding a 44.2 percent return for 2019, which outperformed retail and office REITs in the FTSE Nareit index.

Accelerated growth in consumer and commercial data usage and digital content continue to drive positive investor sentiment. REITs, including Digital Realty, continue to bolster their investment in Europe and Asia Pacific.

Snapshots:

- Digital Realty expanded its global presence by joining forces with Interxion, which has 53 data centers in 13 markets across Europe.
- CoreSite opened its data center campus in Reston, Virginia, in October 2019. Once fully built out, it will provide an estimated 100 MW of power on the 22-acre campus.
- In December 2019, QTS announced it will offer Megaport to seven locations in six U.S. markets—Atlanta, GA; Ashburn, VA; Piscataway, NJ; Miami, FL; Suwanee, GA; and Sacramento, CA. Megaport's Network-as-a-service (Naas) provides on-demand connectivity to cloud onramps that enhances scalability and is more cost efficient for its customers.

H2 2019 forecast vs. H2 2019 results

What we said:

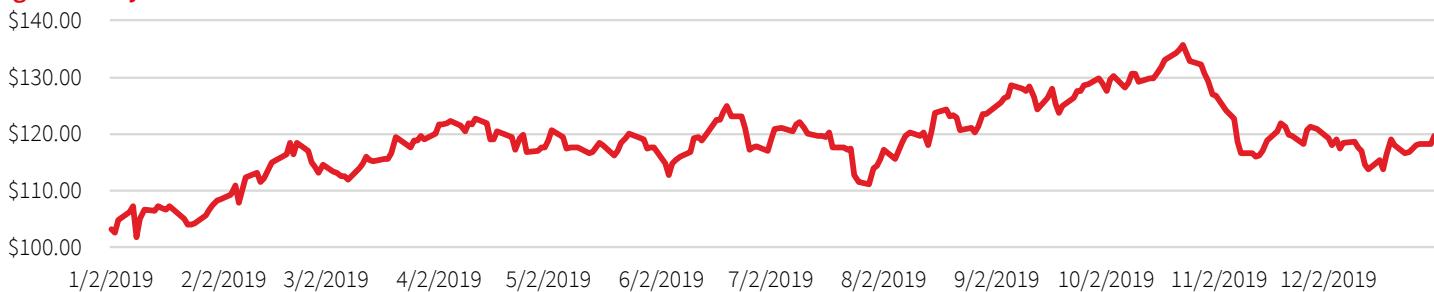
We expect data center investment to remain substantial throughout the year. Institutional investors and foreign capital are leading the way with aggressive investments, but infrastructure funds are a growing new source of data center capital.

What happened:

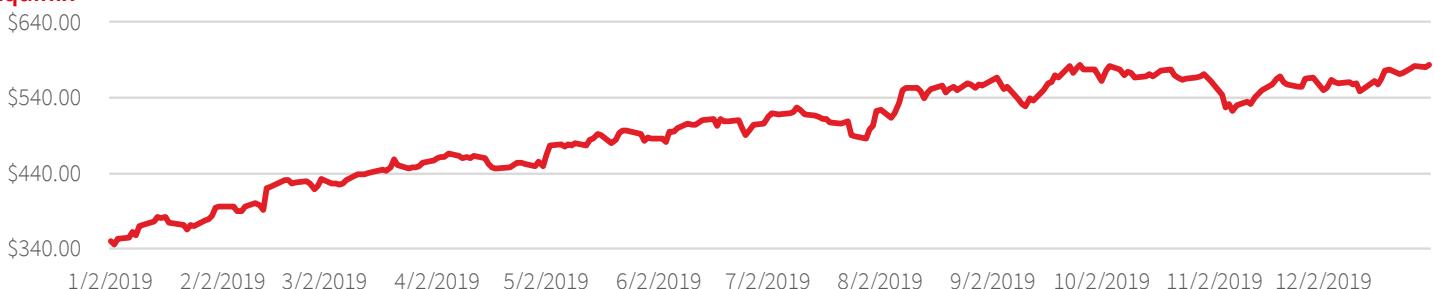
Data center REITs outperformed office and retail sectors with 44.2 percent returns in 2019. This strong performance happened despite a slight slowdown in global IT spending growth. According to Gartner, global IT spending grew by just 0.5 percent in 2019. However, it projects spending will grow by 3.4 percent in 2020.

5 REITs – closing stock prices in 2019

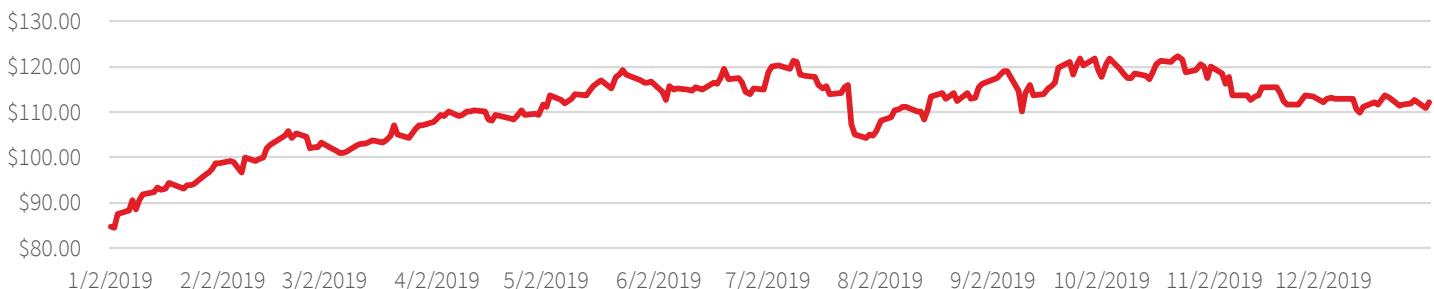
Digital Realty



Equinix



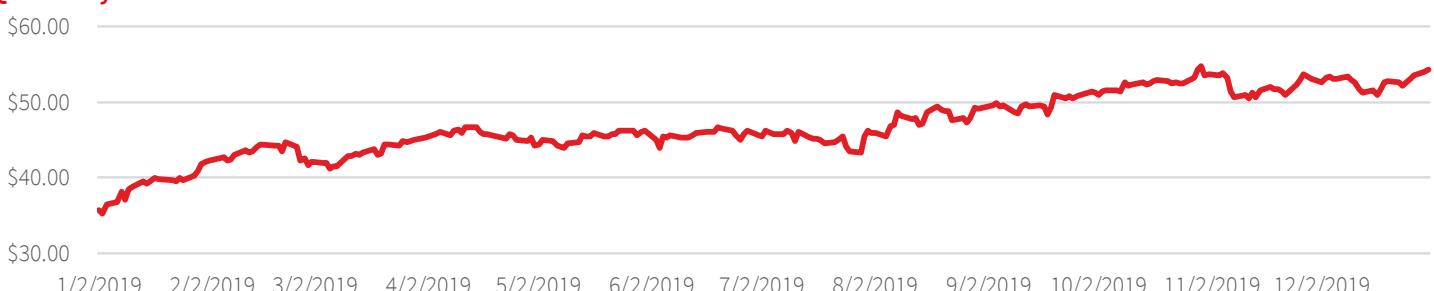
CoreSite



CyrusOne



QTS Realty Trust



2.

Data centers going green

Sustainability and green initiatives are growing mandates for businesses across the globe and in commercial real estate, especially in data centers. While it is not intuitive to think about the carbon footprint of data, it lives in data center facilities where massive amounts of power are consumed. According to the Better Building Solutions Center of the U.S. Department of Energy, "data centers consume 70 billion kWh of electricity per year, close to 2% of all U.S. electricity use." A variety of sources produce this power: coal, wind, solar, nuclear and water.

The persistent growth of global IT spending and digital content consumption will not ease up on its demands from data centers and only promises that the digital era is here to stay. But this doesn't mean data centers cannot find ways to become more

efficient and sustainable. In fact, the Better Buildings Solutions Center estimates that if "data centers were 20% more efficient, we could save about 14 billion kWh by 2020 as a nation. That translates to roughly \$1.4 billion in cost savings." This isn't just a pipe dream. There are numerous ways data centers can become more efficient and sustainable.

According to Digital Realty's "Green Data Centers are Imperative for Enterprise Success" report, data centers can follow these practices to help reduce emissions:

1. Purchase green power (solar, wind, etc.) directly from utility providers.
2. Purchase renewable energy certificates (RECs) from a third party, who connects with renewable energy providers.
3. Buying directly from renewable energy providers in the form of power purchase agreements (PPAs). These

are attractive for customers who demand over 20 MW of power.

4. Invest in your own facilities by using solar panels, wind turbines and technology, such as AI and machine learning, to find new and effective ways to drive efficiency.

Finding sustainable solutions and methods to reduce carbon emissions is good for the planet and builds a better tomorrow. Not only do these practices have an impact on combatting climate change, but there are real cost savings to be achieved by optimizing utility use and equipment efficiency. Green initiatives also help convey the values and ethics of a company to consumers who are worried about energy use and carbon emissions.

There is still much work to be done when it comes to renewable energy use in data centers. But increasingly powerful technology and affordability will boost momentum moving forward.

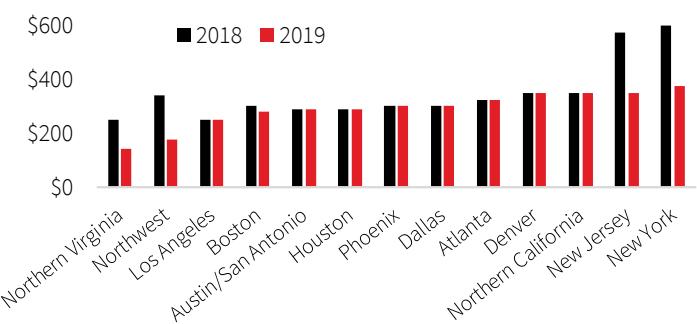
3.

Prices dip across markets in the United States

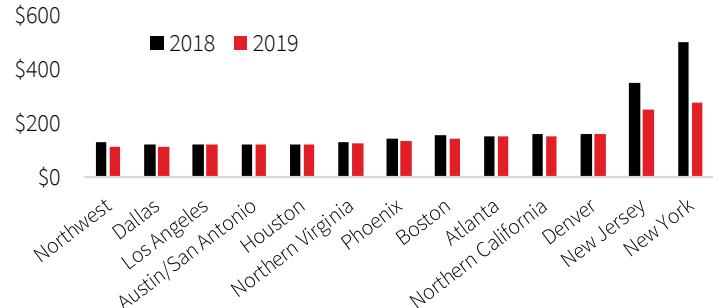
Prices compressed in markets across the United States in 2019. This trend was driven by more providers entering the markets, large megawatt deals executed at lower rates and robust supply pipelines. In Northern Virginia, second-generation inventory and a robust supply pipeline are driving downward pressure on rental rates. Rental rates for less than 250kW (all in) ranged from \$120 - \$140. In 2018, the rates ranged from \$175 - \$250. Northern California recorded a slight dip in rental rates for larger transactions. Rental rates for greater than 250kW (+E) ranged from \$120 - \$150 in 2019. Rental rates from the previous year ranged from \$125 - \$160. While prices have compressed, building and operating costs have remained virtually flat. This can add downward pressure on yields moving forward in 2020.

With plenty of megawatts under construction and much planned, we expect rates to continue its downward trend in the United States. The provider competition is driving conditions to be more favorable for the data center's end users.

Highest rental rates < 250 kW, 2018 vs. 2019



Highest rental rates > 250 kW, 2018 vs. 2019

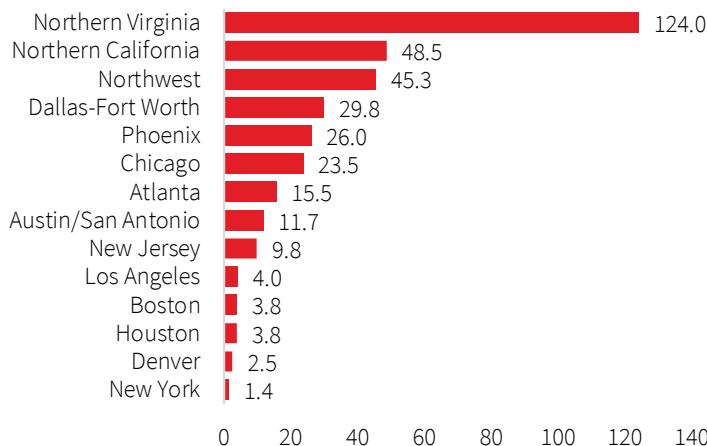


State of the industry

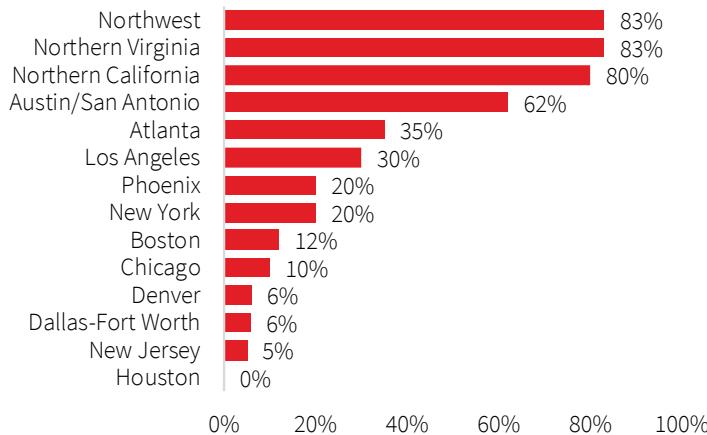
Demand remains healthy in the United States

Primary markets in the United States recorded healthy demand in 2019, although lower than the previous year. At year-end 2019, U.S. markets recorded 349.6 MW in net absorption, compared to 470.1 MW in 2018. Part of this decline can be attributed to Northern Virginia's record year in 2018 of 270 MW in net absorption versus 124.0 MW in 2019. While total net absorption was down year-over-year, some markets recorded significant increases in demand. Atlanta nearly tripled its net absorption due to expansions and consolidation of hyperscale and enterprise users. The Pacific Northwest had a record year in absorption reaching 45.3 MW, driven by technology companies headquartered on the West Coast.

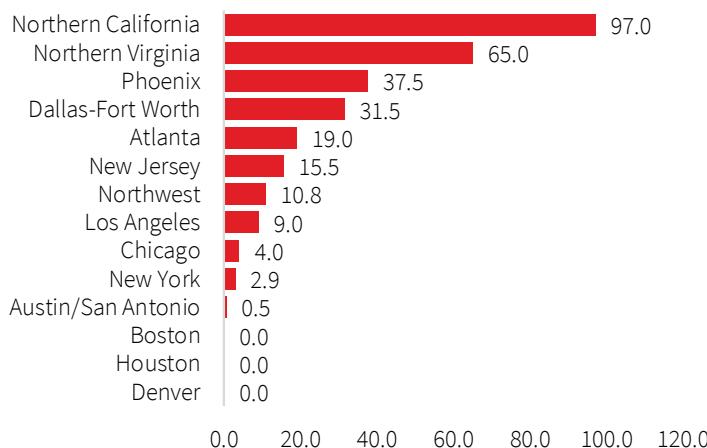
Absorption (MW) by market, YE 2019



Cloud as a percentage of absorption, YE 2019



Under construction (MW) by market, YE 2019



Demand for cloud won't let up

Cloud demand continues to dominate U.S. markets. The Northwest, Northern Virginia and Northern California recorded the largest share of cloud-driven absorption. They also represent the largest increases year-over-year. In 2018, only 42% of absorption was cloud driven in Northern Virginia; it now stands at 83%. Likewise, the share of cloud absorption increased from 50% to 80% in Northern California year-over-year. There will be more opportunities to work with cloud providers in Reno who want to be close to their customers who have existing space within a colocation. This has to do with the new Superloop, lower power cost and their 5 millisecond latency to the Bay Area.

The data center pipeline remains active

The supply pipeline for primary U.S. markets increased from 250.7 MW to 292.7 MW year-over-year. Digital Realty, CoreSite and Vantage are leading development in the Northern California market, which now has 97.0 MW under construction. The pipeline remains robust in Northern Virginia, which has the second largest pipeline, with 65.0 MW under construction. In Phoenix, Aligned, Compass, Stream and Microsoft account for the 37.5 MW under construction throughout the market. Elsewhere in the West, Switch accounts for over 85% of the available supply in Nevada and is the only operator with space under construction in both Las Vegas and Reno. The only other operator with available space is Flexential, and EdgeCore still owns land out in Reno. Atlanta marked one of the largest year-over-year increases in MW under construction, partly due to QTS Realty's Phase One construction of its mega campus.

Definitions:

Inventory of multi-tenant 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 roof.

Planned represents remaining square footage and power under roof to be developed in the future into turnkey or conditioned data center space.

Total vacant space represents turnkey/fully conditioned data center space available for lease.

Under construction represents data center space under roof that is actively being developed/constructed as turnkey/conditioned space.

Absorption (Net) represents the amount of new multi-tenant 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.

Multi-tenant data centers comprise facilities where an owner sells space and power to multiple tenants.

United States
local markets

Atlanta

Atlanta data center market shines with record supply and absorption

Market overview

Supply

Supply continues to increase in the second half of 2019 as Switch delivers new colocation product. QTS is under construction for Phase I of its mega campus expansion build of 72 MW; T5 is clearing its site starting a 13 MW build.

Demand

The majority of the demand was squarely driven by expansions and consolidations of hyperscale and enterprise users. QTS signed a 12 MW hyperscale deal elevating absorption numbers to a record high.

Market trends

Atlanta has been “rediscovered” as a viable and key data center location. After being early to the data center game in the 1990’s with enterprise data centers, Atlanta was moderately active with the advent of the colocation industry. Most recently Atlanta is thriving as a healthy and more mature data center market as new colocation operators steadily deliver new product.

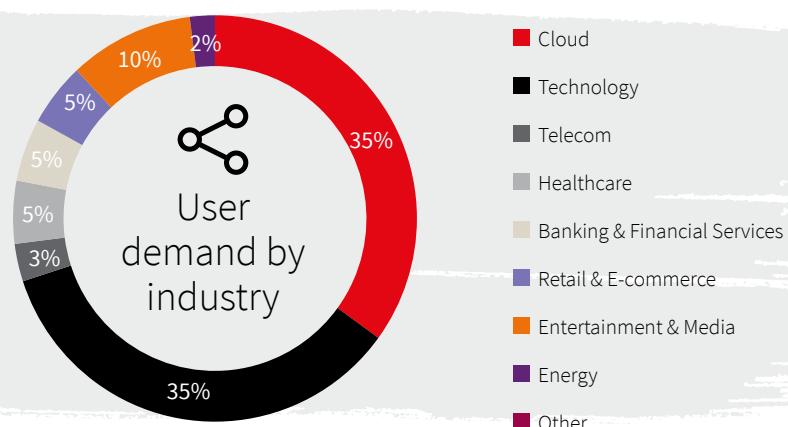
Outlook

for Users

- New options for efficient, purpose-built colocation product
- Influx of service providers brings favorable terms
- Increased supply is creating a competitive rate environment

for Providers

- Demand to remain steady throughout 2020
- Many colocation operators positioned to expand
- Enterprise users continue to migrate out of their owned data centers



Authored by: Mike Dolan | Ryan Fetz | Leigh Martin | Wendy McArthur

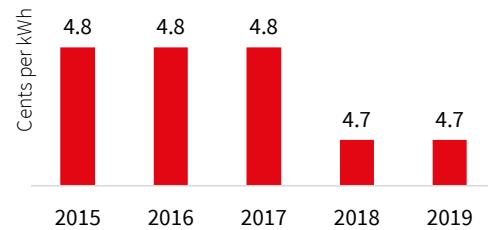
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Supply	s.f.	MW
Total inventory:	2,053,433	244.0
Total vacant:	381,000	95.0
Under construction:	195,000	19.0
Planned:	401,000	96.0

Demand	MW
Net absorption:	15.5

Rental rates	
<250kW:	\$185 - \$325/kW(all in)
>250kW:	\$95 - \$150/kW (+E)

Average power rate (cents/kWh)



Data Center leverage



2019 significant data center transactions

Tenant	Provider	Size (kW)
Hyperscale	QTS	12,000
Transportation Company	STACK	500
Cloud Services	EdgeConneX	300

Austin & San Antonio

Large anchor tenants drive new supply

Market overview

Supply

Supply in both Austin and San Antonio continues to be tight, with few providers with available capacity today. Large anchor tenants are driving providers to deliver new supply to accommodate. H5 entered the San Antonio market with the acquisition of 100 Taylor Street, and Lowe's San Antonio data center is currently being marketed for sale.

Demand

A balance of large enterprise and cloud provider activity represents the bulk of demand in Austin and San Antonio overall. Several multi-megawatt cloud and enterprise deals are actively in the market.

Market trends

With demand driven by large anchor tenants, providers in the Austin & San Antonio markets, while possessing healthy land positions, are not speculatively building turnkey space. Market supply constraints may potentially yield increased rental rates in the future. Expansive tech sector growth in Austin will drive new demand.

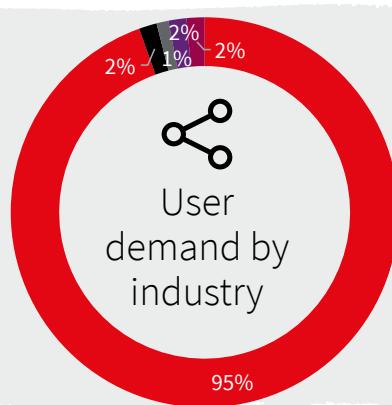
Outlook

for Users

- Lack of turnkey space requires longer-term capacity planning
- Consistent absorption of limited supply may drive rental rate increases
- Growth in tech sector employment may yield enhanced labor pool

for Providers

- Lack of turnkey space would suggest an opportunity for a provider to build on spec
- Upfront utility planning is key to timely delivery of new supply
- Scalable space is critical to meeting current and future hyperscale demand



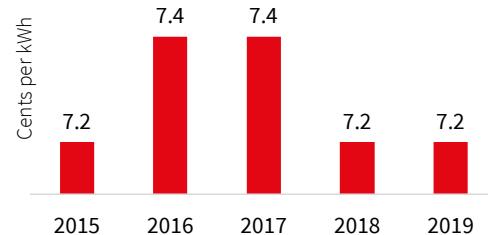
- Cloud
- Technology
- Telecom
- Healthcare
- Banking & Financial Services
- Retail & E-commerce
- Entertainment & Media
- Energy
- Other

Supply	s.f.	MW
Total inventory:	775,883	142.2
Total vacant:	32,373	8.6
Under construction:	2,750	0.5
Planned:	125,146	18.0

Demand	MW
Net absorption:	11.65

Rental rates	MW
<250kW:	\$220 - \$290/kW(all in)
>250kW:	\$100 - \$120/kW (+E)

Average power rate (cents/kWh)



Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
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User favorable market
Neutral market
Provider favorable market

2019 significant data center transactions

Tenant	Provider	Size (kW)
Cloud company	Stream	7,250
Technology company	CyrusOne	150
Energy company	CyrusOne	100

Boston

Slow growth as major providers upgrade facilities and target new customers

Market overview

Supply

Market supply remains healthy with next generation vacancy at 70 Innerbelt Rd (CoreSite), One Summer (Markley), Digital Realty in Needham, Cyxtera in Waltham, and Tierpoint in Marlboro.

Demand

Demand has picked up particularly amongst enterprise users as commercial rents have risen, making it less desirable to maintain data onsite in their offices. Demand is also driven by approaching turn down of TierPoint in Charlestown and Equinix in Waltham.

Market trends

Cloud migration continues across all classes of end users, but slowed somewhat as the year went on as enterprise customers began to show caution about new projects and skepticism over actual savings from cloud migration.

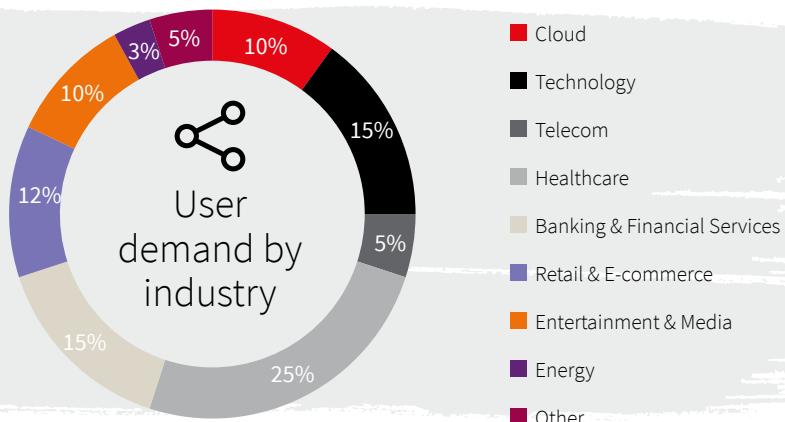
Outlook

for Users

- Prices are reaching a bottom point
- Next generation product offers better energy efficiency and lower cost
- There continues to be attractive out-of-market options

for Providers

- Prices will stabilize
- Next generation space will be more attractive to customers
- Need to renew efforts to reduce electricity cost and taxes



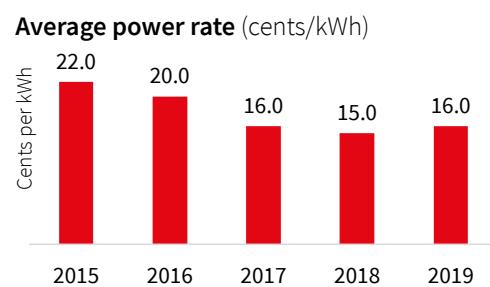
Authored by: Gabe Cole

See page 23 of this document for contact information.

Supply	s.f.	MW
Total inventory:	1,200,000	160.0
Total vacant:	255,000	30.0
Under construction:	-	-
Planned:	60,000	10.0

Demand	MW
Net absorption:	3.8

Rental rates	
<250kW:	\$115 - \$280/kW(all in)
>250kW:	\$85 - \$145/kW (+E)



Data Center leverage



2019 significant data center transactions

Tenant	Provider	Size (kW)
Technology company	Markley	500
Cloud service provider	Iron Mountain	250
Financial services	Cyxtera	500

Chicago

Slow and steady wins the race in 2019

Market overview

Supply

Supply remained stagnant during 2019 with limited new capacity being delivered without a lease in place. Operators who previously had projects on hold subsequently moved forward and expect to deliver capacity in 2020 including RagingWire, Stream and Digital Cross Roads.

Demand

Chicago saw a reduction in colocation demand by major cloud companies. However, the market continued to see steady organic growth of <1 MW users across all submarkets. 47% of the absorption can be attributed to two transactions, one being a retail colocation provider who will relet space to the market.

Market trends

Absorption slowed in the first half of 2019 considerably, however it picked back up in the second half. It is anticipated that an uptick in activity will occur in 2020 due to the recently established Illinois tax incentives and refreshed cloud demand.

Outlook

for Users

- Reduced demand and vacant capacity has led to rate compression
- Further flexibility in leases established
- Tax incentives make Chicago one of the cheapest markets nationally

for Providers

- Extremely limited land acquisition opportunities in key submarkets
- Continued aggressive deal metrics and pricing on all deal sizes
- Cloud companies looking at building greenfield rather than colocation

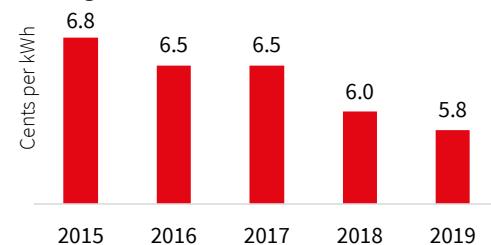
	s.f.	MW
Total inventory:	4,299,000	559.0
Total vacant:	268,000	31.2
Under construction:	350,000	4.0
Planned:	253,000	38.0

	MW
Net absorption:	23.5

Rental rates	
<250kW:	Confidential /kW(all in)

>250kW:	Confidential /kW (+E)
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Average power rate (cents/kWh)

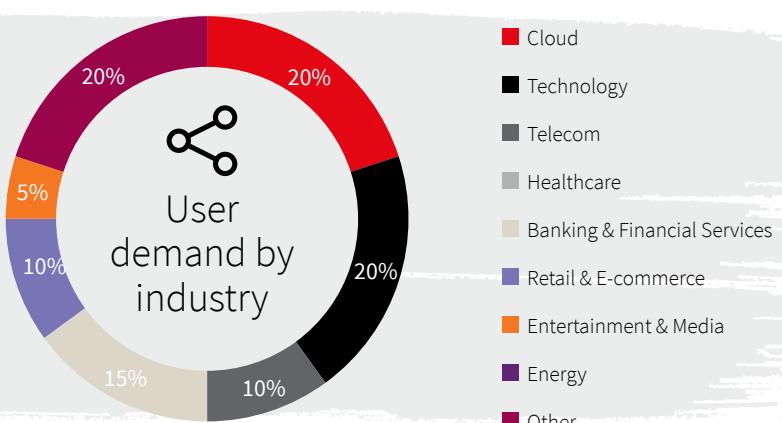


Data Center leverage



2019 significant data center transactions

Tenant	Provider	Size (kW)
Cyxtera	Stack	8MW
Confidential financial company	QTS	3MW
Trading Company	CyrusOne	900kW



Dallas/Fort Worth

Weaker demand shapes DFW market

Market overview

Supply

Supply in Dallas/Ft. Worth ("DFW") continues to be robust, with providers/enterprises completing shell construction on new builds in Q1-Q2. Stream is under construction in Garland, and Equinix has begun Phase I of a new, 4-story 40 MW build at INFOMART. Google has broken ground on its campus in nearby Midlothian, and Facebook has finished its last building in Ft. Worth.

Demand

Though enterprise demand continues to dominate in DFW, large social media players have been quietly absorbing space in the market at scale. Organic growth from existing customer base expansions remains a consistent driver of absorption in the market.

Market trends

As providers, such as Stream, QTS, CyrusOne, and Digital Realty complete construction on their latest builds, supply in the market remains well-positioned to meet user demand. Absorption by traditional enterprises and major social media players in the market signal opportunity for providers.

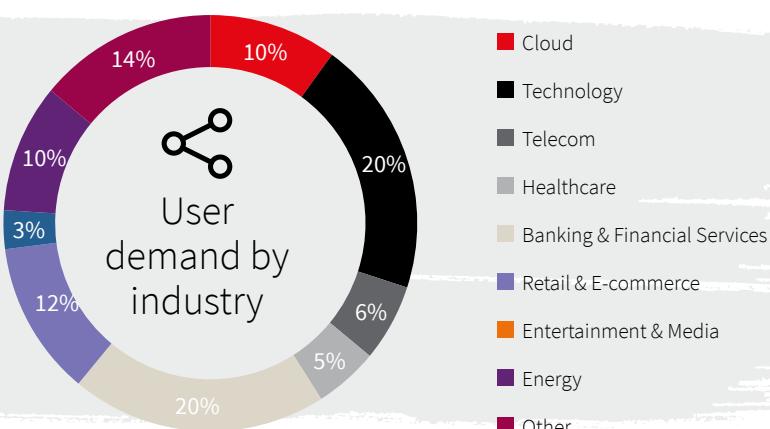
Outlook

for Users

- Attractive rental rates obtainable on expiring colo contracts
- Users locking in lower rates and more flexible terms
- Extremely competitive rates for new, credit-worthy logos

for Providers

- Organic growth from existing customers feeling expansion
- Users are valuing higher density infrastructure
- Cloud access and services are key differentiator



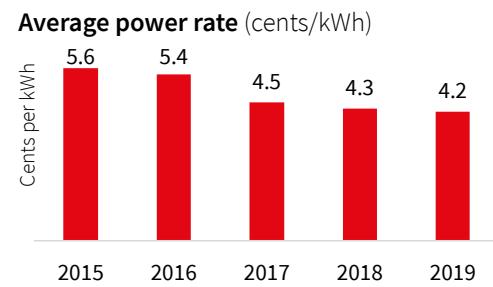
Authored by: Curt Holcomb

See page 23 of this document for contact information.

Supply	s.f.	MW
Total inventory:	3,734,649	530.4
Total vacant:	500,623	82.9
Under construction:	156,200	31.5
Planned:	1,214,030	206.0

Demand	MW
Net absorption:	29.8

Rental rates	
<250kW:	\$190 - \$300 /kW(all in)
>250kW:	\$95 - \$115 /kW (+E)



Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
User favorable market Neutral market Provider favorable market				

2019 significant data center transactions

Tenant	Provider	Size (kW)
Transportation company	CyrusOne	3,500
Technology company	QTS	3,000
Transportation company	Cyxtera	750

Denver

Denver remains a competitive secondary market; continues to find ways to bring in more business to the state

Market overview

Supply

Flexential, followed by Zayo, Iron Mountain, and Cyxtera, currently have the most available space in the market. At the moment, there is no future supply currently under construction.

Demand

The demand trend in Denver hasn't changed. Most of the demand is coming from smaller retail-sized deals with expansion options for a couple mega-watts. There were no major deals exceeding 1 MW seen in Denver. Most of the customers taking space are looking at 1 to 40 racks.

Market trends

Denver continues to stay stable and attract retail type customers with little to no deals exceeding 1 MW. Most of the deals have been in the 500kW range. Denver has started to find better ways to incentivize clients to enter their market, such as their new power bill. The bill allows the public utilities to charge economic development rates. Details to be finalized in 2020.

Outlook

for Users

- Continue cloud strategy pressures from the C-Suite
- Colorado continues to push for data center tax incentives

for Providers

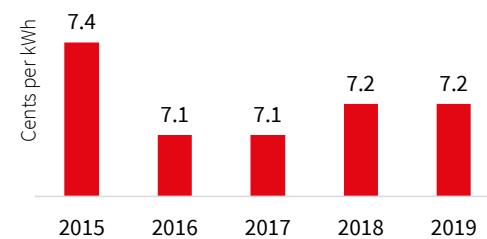
- Continue to provide quality managed service offerings to the end users
- Start strategizing to leverage new power bill and lower rates
- Be prepared to deliver space and services within 90-180 days notice to win business

Supply	s.f.	MW
Total inventory:	873,926	101.6
Total vacant:	232,000	23.0
Under construction:	-	-
Planned:	176,301	23.3

Demand	MW
Net absorption:	2.5

Rental rates	MW
<250kW:	\$260 - \$350/kW(all in)
>250kW:	\$118 - \$160/kW (+E)

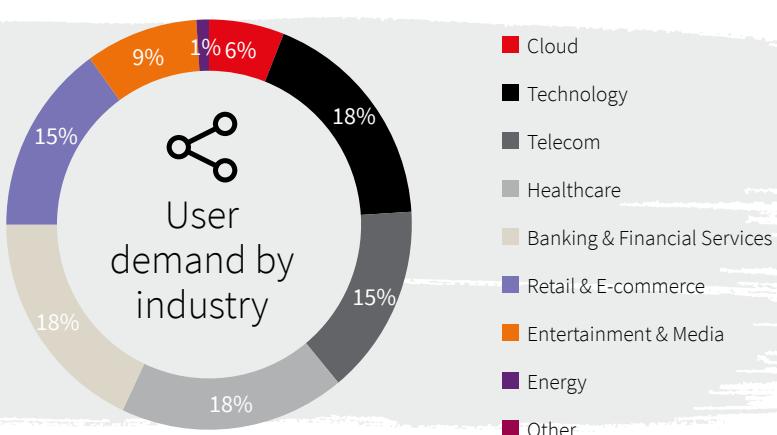
Average power rate (cents/kWh)



Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
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User favorable market
Neutral market
Provider favorable market



Authored by: Mark Bauer

See page 23 of this document for contact information.

Houston

New construction and supply comes to a halt

Market overview

Supply

Supply has stabilized in Houston, with no new construction delivered in the first or second half of 2019. This trend may not continue in 2020 as two providers have announced modest expansions of inventory.

Demand

Demand increased slightly but was hampered by some providers experiencing negative absorption. The energy industry historically has driven data center demand in Houston and that has not changed.

Market trends

The Houston market will improve with little supply coming to the market. If the energy industry improves we could see a shortage of supply in a short period of time with a stabilization and potential increase in rents.

Outlook

for Users

- Lack of new supply will soften price compression
- Quality space available at competitive pricing
- Users leveraging market to renegotiate terms

for Providers

- Providers connecting Houston facilities with their other markets
- Access to cloud providers and services key
- Providers focusing on retaining tenants

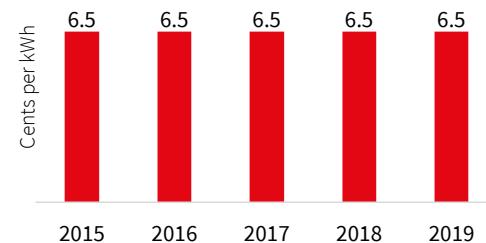
	s.f.	MW
Total inventory:	1,105,411	142.7
Total vacant:	217,085	21.1
Under construction:	-	-
Planned:	582,413	87.2

	MW
Net absorption:	3.8

Rental rates

<250kW:	\$220 - \$290/kW(all in)
>250kW:	\$95 - \$120/kW (+E)

Average power rate (cents/kWh)



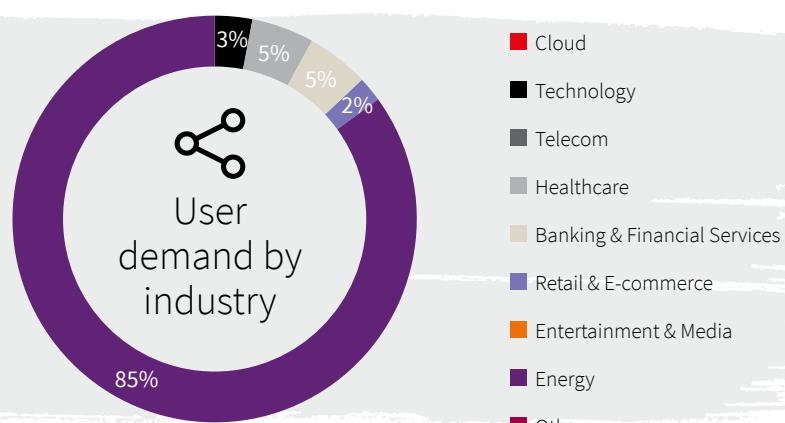
Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
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User favorable market
Neutral market
Provider favorable market

2019 significant data center transactions

Tenant	Provider	Size (kW)
Energy company	CyrusOne	1,500
Service provider	Digital Realty	800



Authored by: Curt Holcomb

See page 23 of this document for contact information.

Los Angeles

Los Angeles interest continues as several large players grow in the market

Market overview

Supply

Several major cloud providers finalized transactions to further tighten the market, but new construction will soon change this.

Demand

Overall, the market has remained flat as the market consistently produces small sub-25kW transactions to support local users and new overseas demand, however larger cloud deals will land.

Market trends

The demand from CSPs continue to be the only positive news in the market.

Outlook

for Users

- New inventory to come on line
- Continued rate compression amongst colocation providers
- More options in market to further reduce rates

for Providers

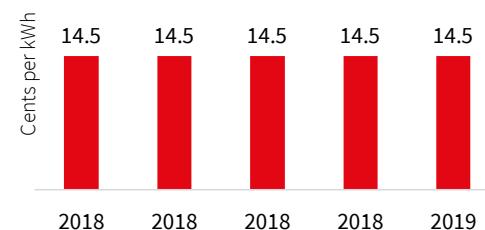
- Providers need to upgrade infrastructure
- Expect more efficient environments to combat high energy rates
- Higher return from investments in critical infrastructure from higher level clients

Supply	s.f.	MW
Total inventory:	2,300,000	210.0
Total vacant:	320,000	12.0
Under construction:	100,000	9.0
Planned:	120,000	9.0

Demand	MW
Net absorption:	4.0

Rental rates
<250kW: \$190 - \$250/kW(all in)
>250kW: \$90 - \$120/kW (+E)

Average power rate (cents/kWh)



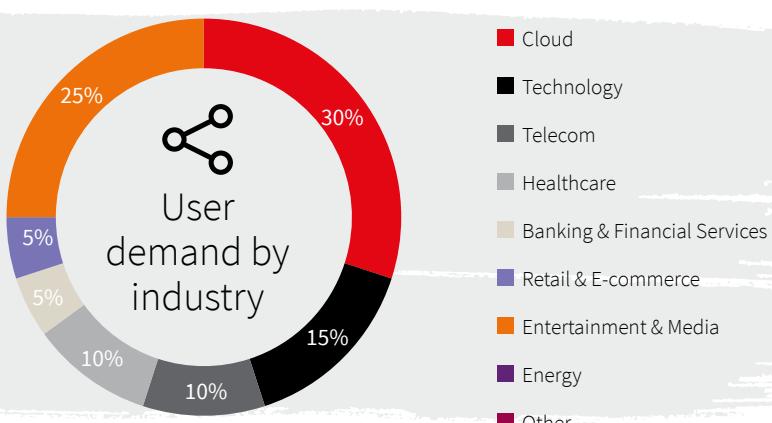
Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
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User favorable market
Neutral market
Provider favorable market

2019 significant data center transactions

Tenant	Provider	Size (kW)
Cloud provider	Coresite	4,000
Zayo	One Wilshire	3,000
Dedipath	Internap	1,500



Authored by: Darren Eades

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New Jersey

The New Jersey market had a strong year-end finish with absorption levels significantly higher than recent years

Market overview

Supply

Digital Realty, CyrusOne, QTS, Coresite and Equinix had healthy absorption rates in 2019 in available turnkey space. In 2020, Digital Realty has a new campus in Totowa in development and QTS, CyrusOne and Coresite are expanding onsite shell space to replenish supply.

Demand

The NJ market had a strong year as financial services continued to lead, with expanded footprints in close proximity to headquarters and local operations. Several enterprise level wholesale deployments ranged from 300 kW- 1.5 MW.

Market trends

Tenants are requiring flexible contracts. Service and location portability, power expansion and reduction on demand are being offered to attract users to stay locally. More managed services are entering the NJ market to support hybrid cloud workloads. Carrier Edge Deployments are surfacing in Northern NJ to support carrier's 5G network deployments.

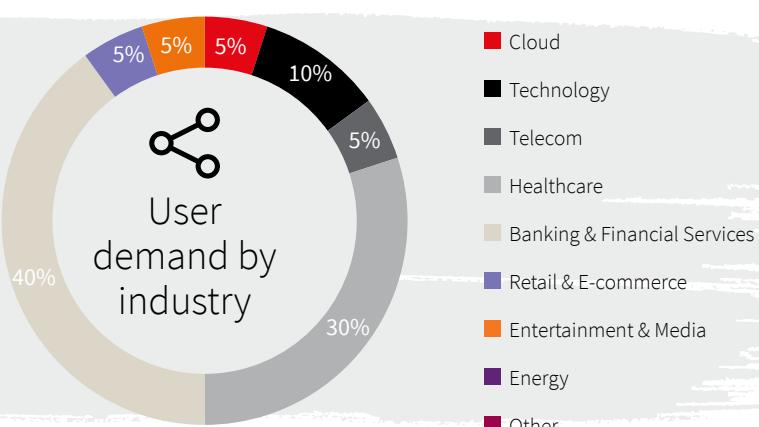
Outlook

for Users

- Competitive market that will offer flexible terms to expand and contract
- Energy sustainability will gain traction as tenants require 100% renewable energy
- Improved utilization and portal capabilities for improved service and reporting

for Providers

- Shell to turnkey conversion delivery intervals will be priority in early 2020
- New greenfield developments in Northern NJ are emerging
- Carrier and edge deployments are getting momentum in network-centric areas



Authored by: Thomas Reilly

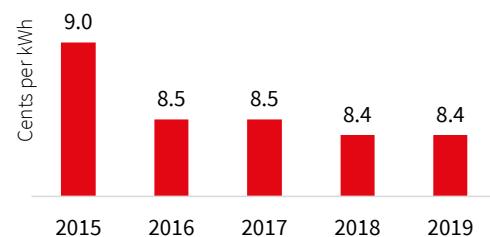
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Supply	s.f.	MW
Total inventory:	3,200,000	342.0
Total vacant:	260,000	42.0
Under construction:	85,000	15.5
Planned:	699,500	79.0

Demand	MW
Net absorption:	9.8

Rental rates	
<250kW:	\$225 - \$350/kW(all in)
>250kW:	\$109 - \$250/kW (+E)

Average power rate (cents/kWh)



Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
User favorable market	Neutral market	Provider favorable market		

2019 significant data center transactions

Tenant	Provider	Size (kW)
Financial services company	Digital Realty	1,200
Financial services company	QTS	1,000
Higher education	Coresite	1,500

New York

As carriers accelerate NYC 5G network deployments, NYC is emerging as a leading edge market

Market overview

Supply

The leading carrier hotels and colocation points continue to position network colocation deployments as fixed line and tier 1 wireless carriers ramp up for NYC 5G, CBRS and small cell roll-outs. 1547 Data Centers continues to be the leading Wholesale provider with powered shell capability. WebAir and NYI continue to see small growth from the SMB needs for managed services.

Demand

Carriers, mobile virtual network operators, third-party wireless and WiFi operators are increasing the demand for sub-50 kW deployments at strategic locations to centralize headend space to support optimal Wireless Spectrum Coverage among users and building portfolios.

Market trends

Tenants are requiring flexible contracts. Service and location portability, power expansion and reduction on demand are being offered to attract users to stay locally. More managed services are entering the NJ market to support hybrid cloud workloads. Carrier edge deployments are surfacing in Northern NJ to support carriers' 5G network deployments.

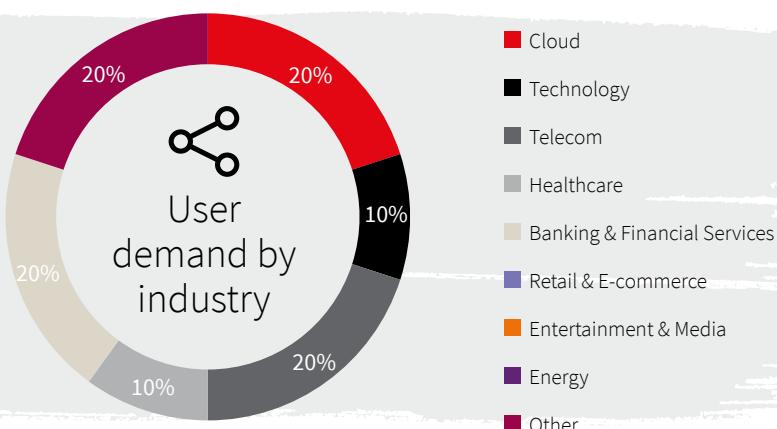
Outlook

for Users

- Small new footprints are being developed to support wireless carrier headend space
- Abundance of managed cloud services are readily available for hybrid strategies
- Local tax incentives and discounted power in suburbs

for Providers

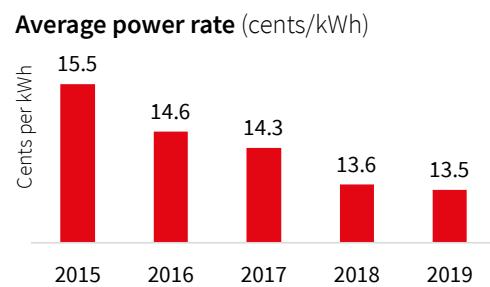
- Wireless carriers will be developing centralized headend space to support 5G density
- Commercial office growth in NYC is accelerating sublease & excess space conversions
- Enterprise clients are requiring connectivity to AWS & Azure access points in NYC



Supply	s.f.	MW
Total inventory:	1,020,000	152.0
Total vacant:	88,000	12.0
Under construction:	27,000	2.9
Planned:	180,000	25.0

Demand	MW
Net absorption:	1.4

Rental rates	
<250kW:	\$275 - \$375/kW(all in)
>250kW:	\$175 - \$275/kW (+E)



Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
User favorable market Neutral market Provider favorable market				

2019 significant data center transactions

Tenant	Provider	Size (kW)
Technology company	325 Hudson	50
Cloud provider	Digital Realty	100
Cloud provider	Coresite	150

Northern California

Fundamentals still the strongest in the U.S. Major uptick in absorption

Market overview

Supply

Nearly every major existing operator is building, has purchased, or is looking for a new site. Vantage, Digital Realty, and CoreSite are leading the way with new product being delivered in the next eight quarters. A significant block of rollover space is affecting supply.

Demand

Two hyperscale cloud operators account for the vast majority of absorption. Nearly all absorption was taken in new product which was delivered in 2019.

Market trends

There is a healthy amount of supply coming online over the next eight quarters. Given the reliance on several users for the vast majority of absorption, a supply/demand imbalance could occur should one or more of these users slow their growth plans. Users vacating the market for markets with lower TCO remains a risk.

Outlook

for Users

- Scarce options for larger deployment means fewer concessions
- Expect pricing to remain stable in the short term
- If overdevelopment occurs, leverage could shift to users

for Providers

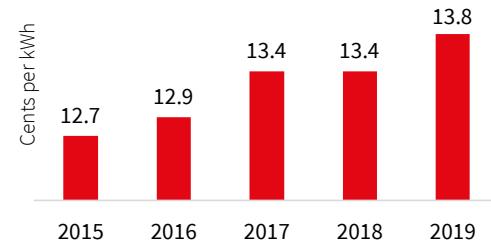
- Need to be mindful of competitive supply coming online
- Need to determine how much supply to bring online and why
- Need to be realistic about development costs and timelines

Supply	s.f.	MW
Total inventory:	5,852,508	436.0
Total vacant:	411,869	58.0
Under construction:	926,136	97.0
Planned:	4,079,145	518.0

Demand	MW
Net absorption:	48.5

Rental rates
<250kW: \$200 - \$350/kW(all in)
>250kW: \$120 - \$150/kW (+E)

Average power rate (cents/kWh)

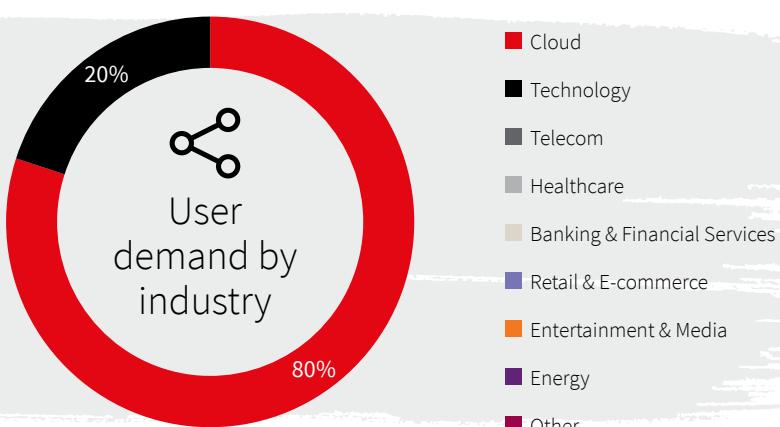


Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
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User favorable market
Neutral market
Provider favorable market

*Northern California includes Silicon Valley/Santa Clara, San Jose, San Francisco, and Sacramento



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

Authored by: Raul Saavedra

See page 23 of this document for contact information.

Northern Virginia

As more providers enter market, rents continue on a modest downward trend, making for very favorable occupier conditions

Market overview

Supply

Supply of available and under construction product exceeds 180 MW, or approximately 1.5 years of net absorption at 2019 levels.

Demand

There was 124 MW of net absorption in 2019, down from a historic 2018, but still in line with 2016-2017. Hyperscale deployments accounted for much of the absorption, as there were three deals signed greater than 15 MW.

Market trends

Large scale deployments, build-to-suit activity, 2nd generation inventory and new market competitors backed by aggressive capital, have placed downward pressure on rents and increased concessions creating an unprecedented opportunity for end users.

Outlook

for Users

- Historically aggressive rates/concessions from world-class facilities
- Requiring greater flexibility as options increase
- Stronger focus on service offerings and public cloud on-ramps

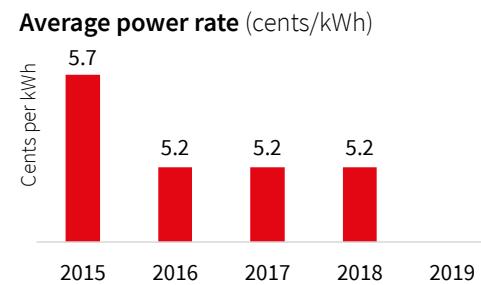
for Providers

- Margins decreasing for providers due to aggressive new competitors
- Still the top market for hyperscale "elephant hunting"
- Must be more flexible, offer more services and highlight "on-ramps"

Supply	s.f.	MW
Total inventory:	13,700,196	1,599.0
Total vacant:	1,210,000	121.0
Under construction:	650,000	65.0
Planned:	3,671,000	367.1

Demand	MW
Net absorption:	124.0

Rental rates	
<250kW:	\$120 - \$140/kW(all in)
>250kW:	\$80 - \$125/kW (+E)



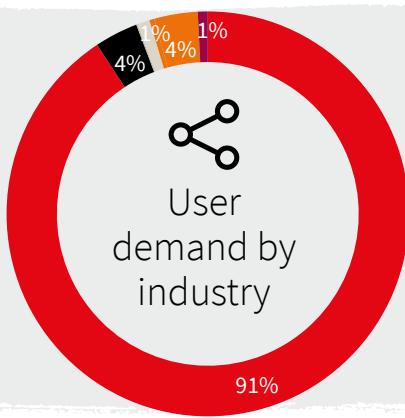
Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
---------	---------	---------	---------	---------

User favorable market
Neutral market
Provider favorable market

2019 significant data center transactions

Tenant	Provider	Size (kW)
Technology Company	Sentinel	25,000
Software Company	Cloud HQ	21,000
Enterprise User	QTS	10,000



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

Northwest

Major West Coast technology tenant leasing leads to highest annual absorption ever recorded

Market overview

Supply

The major increase in supply can be found in Hillsboro, where three major operators are under construction on new builds – NTT, QTS, and DLR. All other major operators in the region have commissioned availability.

Demand

Demand is driven by fewer tenants with larger requirements. Nearly every significant end user is a U.S. West Coast-headquartered technology company.

Market trends

Market rental rates are continuing to drop as multi-megawatt transactions proceed to lease at low rates and spike the averages downward. The Northwest has a high amount of speculative construction underway driven by aggressive, global colocation operators new to the Northwest.

Outlook

for Users

- The cost differential between small and large scale deployments is diminishing
- Many more national/global operators to consider
- Operator competition has never been higher

for Providers

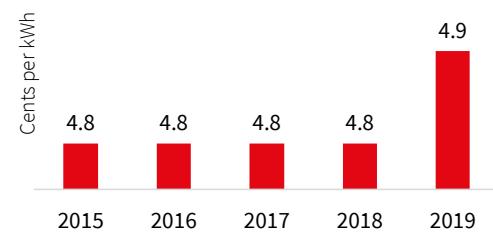
- Having ready product has increased demand in the Northwest
- Look for more managed hosting providers leasing colocation product
- Markets are land and power constrained limiting new entrants

Supply	s.f.	MW
Total inventory:	2,054,056	322.8
Total vacant:	152,733	22.9
Under construction:	72,133	10.8
Planned:	541,400	81.2

Demand	MW
Net absorption:	45.32

Rental rates	MW
<250kW:	\$145 - \$175/kW(all in)
>250kW:	\$85 - \$115/kW (+E)

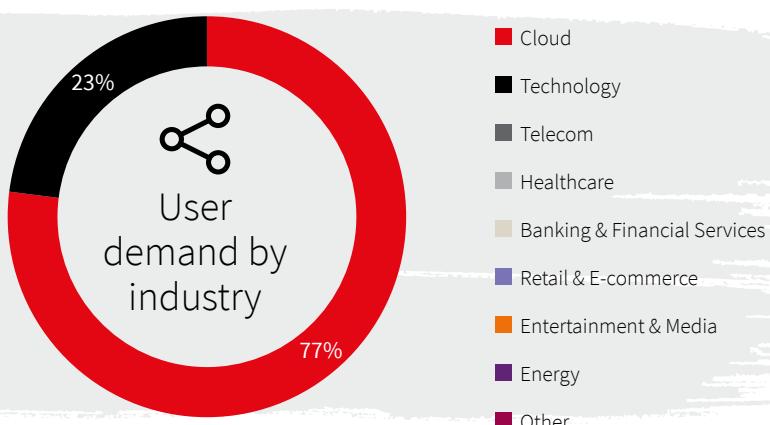
Average power rate (cents/kWh)



Data Center leverage

H2 2017	H1 2018	H2 2018	H1 2019	H2 2019
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User favorable market
Neutral market
Provider favorable market



Authored by: Conan Lee

See page 23 of this document for contact information.

Phoenix

Major construction projects from multiple operators/cloud providers has Phoenix ready for hyperscale deployments for 2020

Market overview

Supply

Iron Mountain and Aligned Energy brought new space online in the third quarter. Compass and Stream, in the West Valley, are the only companies building out new space. Aligned continues to build out their existing building, with 30 MW under construction. Microsoft is building out all three of their sites in the West Valley and Google is getting their permits for their site.

Demand

Although hyperscale deployments have slowed down, there are still smaller deals in the pipeline that continue to take space. These retail-sized deals will continue to be in demand to operators in Phoenix. Since there is more supply available now than there was last year, we should see an increase in activity and absorption in 2020.

Market trends

The way cloud has been changing the data center industry has been a major conversation. Many enterprises and smaller companies are evaluating or have decided to move to the cloud instead of on-premises. Companies such as Microsoft, Google, and Oracle, as well as other public and hybrid cloud companies, are looking to take space in Phoenix for their deployments.

Outlook

for Users

- Several options to consider with new supply coming online
- Cloud developments will provide better latency and service options for enterprises
- Continue cloud strategy pressures from the C-Suite

for Providers

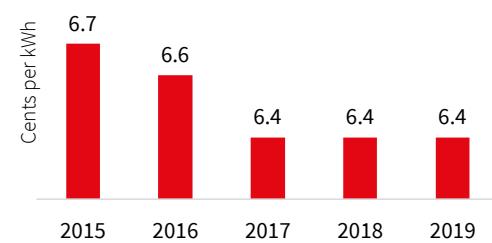
- Let's go; you've got one of the lowest TCO's in the US to deliver to your customers
- You got this; be positioned to deliver within 90-180 days
- Bring it on; look beyond the cloud providers to anchor your deployments

Supply	s.f.	MW
Total inventory:	2,126,241	288.6
Total vacant:	454,394	46.7
Under construction:	120,965	37.5
Planned:	689,897	208.0

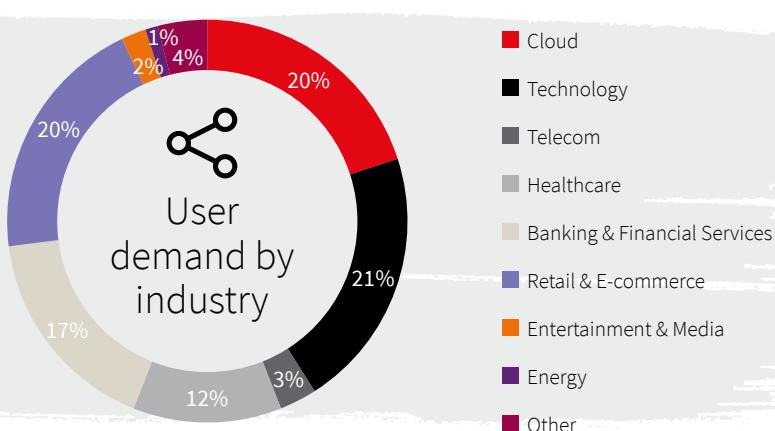
Demand	MW
Net absorption:	26.0

Rental rates	
<250kW:	\$175 - \$300/kW(all in)
>250kW:	\$90 - \$133/kW (+E)

Average power rate (cents/kWh)



Data Center leverage



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