The Montrose Group, LLC

TRANSFORMING YOUR WORLD

DATA CENTER MARKET OPPORTUNITIES:

A MONTROSE GROUP WHITE PAPER

FROM THE MONTROSE GROUP, LLC

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100 East Broad Street, Suite 1340, Columbus, Ohio 43215

MONTROSE GROUP'S CORPORATE SITE LOCATION PRACTICE DRIVEN BY MULTI-DISCIPLINARY TEAM

Utility Economic Developer | Public Sector Economic Developer | Economic Developer Author | Public Relations Leader | Tax Incentive Lawyer | Project Finance Advisor

Dave Robinson, JD, Principal and Founder
Dave Robinson serves clients based upon 25 years of experience as a corporate site location consultant, economic developpent lawyer, public relations executive and lobbyist before the federal, state and local governments. Mr. Robinson negotiated $200 M in economic development incentives, including $20 M in 2019-20, and co-authored 26 comprehensive economic development, site development, Downtown redevelopment and business incubator feasilibiltys plans. Mr. Robinson is a national economic development author with *The Energy Economy* and *Economic Development from the State & Local Perspective* both published by Palgrave-MacMillan.

Nate Green, MBA, Partner and Director of Economic Development
Nate Green serves customers based upon his 21 years as a corporate site location consultant and strategic consultant to economic development organizations. Mr. Green negotiated for $1.2B in economic development incentives, including $20M in 2019-20, and co-authored 26 comprehensive economic development strategies, site development, Downtown redevelopment and business inclubator feasibility plans. Mr. Green was on the start-up team for JobsOhio and served at the Cleveland-Cuyahoga County Port Authority, Ohio Department of Development and the Pickaway Progress Partnership.

Jamie Beier Grant, Manager of Economic and Workforce Development
Jamie Beier Grant provides corporate site location, economic development planning, site development and workforce development services based upon her 19 years of local, regional and state economic development experience, including for the Ohio Department of Development in the International Trade Division and Economic Development Division, Northwest Ohio's Regional Growth Partnership and for 16 years as Director of the Ottawa County Improvement Corporation.

Timothy L. Biggam, II, Director of Government Relations, Montrose Group
Tim Biggam provides Ohio lobbying services to clients before local, state, and federal government. Starting as an aide in the Ohio Senate, Mr. Biggam served as the Legislative Director for Governor John R. Kasich and was engaged in local government, healthcare and Medicaid policy, tax policy, budget, and regulatory matters. Mr. Biggam served on the Presidential campaign of Governor Kasich, at the Ohio Department of Natural Resources, Ohio Department of Transportation, Ohio Municipal League and Ohio Senate.

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Executive Summary

A data center is a physical facility that organizations use to house their critical computer applications and data. Several types of data centers operate including: enterprise data centers that a single company houses on corporate campus; managed services data centers run by third party providers; colocation data centers where a company rents space within another's data center; and cloud data centers where off-premises data and applications are hosted by a cloud services provider such as Amazon Web Services (AWS), Microsoft (Azure), or IBM Cloud or others. Data center capex will grow at a 6% CAGR to reach just over $200 B over the next five years.[1] State consumer data policy initiatives, being debate before 30 state governments, could slow the growth of the Internet and data centers, but the election of Joe Biden may break the federal privacy legislation logjam that can overcome damaging California laws. Leading regions for the location of data centers include New York City, Los Angeles, San Francisco, Dallas, Atlanta, Northern Virginia, and Seattle which may have more data centers than most other states.

Montrose Group Data Center Corporate Site Location Process

Site Development

- Protection from natural elements such as floods and earthquakes
- Adequate land
- Proximity to telecom central office
- Availability, reliability and rate of power
- Sustainability of power supply

Construction & Infrastructure

- Tier 1 single-capacity components and nonredundant distribution
- Tier 2 multiple-capacity components and nonredundant distribution
- Tier 3 redundant-capacity components and multiple independent distribution
- Tier 4 redundant-capacity components and multiple independent distribution enable concurrent maintainability
- Critical mechanical & electrical virtual construction approach

Land Use Entitlements & Economic Development Incentives

- Zoning and land use entitlements
- 24 states offer data center tax incentives
- Local property tax abatements & Tax Increment Financing for infrastructure
- Port authority construction materials sales tax exemptions

Utility Economic Development Riders offer critical discounted electric rates for energy-intensive data centers and 32 states offer some form of economic development incentives to reduce the property and sales tax burdens for these capital-intensive projects. Data center investments, even with economic development incentives produced a substantial Return on Investments for communities. According to a Pennsylvania study, by 2024, Pennsylvania's data center industry provides over 33,000 more total jobs, including 10,000 more jobs in the sector, over $6 B more in total output, over $2 B more in total wages; and $110 M more in net tax revenues in FY 24, even after the tax exemption.[2] Finally, data centers are dependent upon a small set of highly skilled computer software, information technology and data scientist workers that communities need to train and develop if they wish to successful retain and attract data centers to their market.

Data Centers drive the Internet. A data center is a physical facility that organizations use to house their critical applications and data. A traditional data center is specifically designed and constructed as a high security environment for the location of servers and similar equipment that hosts Internet Web sites. It

provides uninterrupted Internet access to customers' web pages and consists of computer system hardware, such as servers and routers, pre-written computer software, storage racks and cages for computer equipment, property necessary to maintain the appropriate climate-controlled environment, such as air-filtration equipment, air-conditioning equipment, and vapor barriers, and power generators and power conditioners. A data center could have raised flooring as well as building systems that are designed for an Internet data center, such as interior fiber optic and copper cables, fire control, such as fire suppression equipment and alarms; and maintaining a secure environment, such as protective barriers if the exempt property is placed or installed in the Internet data center for use there. Over 2000 data centers exist across the United States and they can be billion-dollar capital investments and are massive users of electricity and telecommunication services.

From a site development standpoint, a data center site plan is based off 2 - 10MW facilities with mechanical support on a 17.72 AC parcel. Typical standards include fire lane coverage and an emphasis on security. Security berms are along roads to prevent bomb-trucks from ramming the site, as well as 100-ft building setbacks from property lines for bomb truck damage reduction. Controlled access and checkpoints are needed at each site entrance. The site entrances typically are divided driveways to allow for double security gate operation efficiency. The driveways can be widened for security booths if needed. Utilities are typically located in duct corridors that run along the mechanical yards. An 8" fire protection loop is typical for a data center. The duct banks are typically 3' deep and run along the building. In sites with multiple data centers, mechanical yards and loading docks are typically facing each other to reduce pavement costs and utility costs. Typical parking ratios are 1 parking space per 5,000 sf of building area. This site plan shows 61 parking stalls. Overall, data centers do not generate high traffic volumes; the AM peak is 14 cars and the PM peak is 11 cars. Adjacent roads should be able to handle WB-67 truck traffic.

Data centers supports enterprise IT growth due to email, file sharing, productivity applications, CRMs, ERP databases, Big data, AI, machine learning, virtual desktops, communications, and collaboration services. Several types of data centers operate including:

- Enterprise data centers that a single company houses on corporate campus;
- Managed services data centers run by third party providers;
- Colocation data centers where a company rents space within another's data center; and
- Cloud data centers where off-premises data and applications are hosted by a cloud services provider such as Amazon Web Services (AWS), Microsoft (Azure), or IBM Cloud or others.

Changes in technology and how the Internet operates more efficiently are in the works as well that impact data center operation. Edge computing is computing that's done at or near the source of the data, instead of relying on the cloud at one of a dozen data centers to do all the work.[3] It doesn't mean the cloud will disappear, but the cloud maybe coming closer to you to address the latency or speed in which data travels between computers and potentially lowering the costs of traveling across global networks.[4] The growth of edge computing may well change the size and scale of data centers. As the above photo of a mini data center tied to edge computing, small data centers maybe popping up all over the United States. These small data centers may well need a local land use regulatory strategy if they wish to be in the public right of way but likely they will just appear in parking lots or behind buildings. The incentive for this new generation of data center are tied to the more efficient operation of the Internet as well as efforts to serve a broader population base in a faster and more cost-efficient manner.

Source: https://www.lightreading.com/the-edge/edge-computing-mini-data-centers-are-rolling-out-for-real-whats-next/d/d-id/755493

Data center market growth prospects are extraordinary. Data Centers are a COVID 19 winner. Data center capex will grow at a 6% Compound Annual Growth Rate (CAGR) to reach just over $200 B over the next five years, and wholesale data centers in primary U.S. markets recorded 134.9 megawatts (MW) of net absorption and 373 MW of capacity was under construction across primary markets in H1 2020.[5] The U.S. data center construction market is expected to register a CAGR of approximately 9% during from 2020 - 2025. The data center colocation market was valued at USD 31.39 billion in 2019, and is expected to reach a value of USD 58.28 billion by 2025, at a CAGR of 10.92% over the forecast period (2020 – 2025).[6] It is estimated that there is an increase of 35% in data generated every year, globally, which has resulted in many organizations, doubling their on-premises storage over a three-year period interval."[7] Also, JLL suggests that, in 2019, increased investments from the REITs with five major companies accounting for 29% of the total returns are expected to drive the market based upon AI and 5G penetration driven demand.[8] COVID 19 has not slowed data center growth. While data centers' resiliency, reliability and manned operations have been tested during the pandemic, it is one of the few sectors that performed strongly in H1 2020.[9] In fact, data center REITs recorded the highest YTD returns in the FTSE Nareit US Real Estate Index Series in the first half of 2020, ahead of office, industrial, retail, hospitality and healthcare.[10] Three out of five data center REITs (CyrusOne, QTS, Digital Realty, Equinix, CoreSite) recorded at least 40 percent returns over the past year.[11]

Data privacy laws have the ability to slow the data center market. News reports that major American hospital systems shared patient data with tech giants like IBM, Microsoft and Amazon could be the feather that tips the scale to substantial consumer privacy discussions in Statehouses across the United States. These tech companies seem to have noble causes—primarily using patient data to bring the benefits of Big Data to the American health care system. However, the rising use of consumers data is likely to produce a backlash among populist politicians on the right and the left.

California's approach to consumer privacy may well prove to be the focus of other state governments. The California Consumer Privacy Act of 2018 was signed into law on June 28, 2018 to prevent passage of the law through a voter initiative.[12] The California Consumer Privacy Act gives California residents the right to know, through a general privacy policy and with more specifics available upon request, what personal information a business has collected about them, where it was sourced from, what it is being used for, whether it is being disclosed or sold, and to whom it is being disclosed or sold, the right to "opt out" of allowing a business to sell their personal information to third parties, the right to have a business delete their personal information, with some exceptions; and the right to receive equal service and pricing from a business, even if they exercise their privacy rights under the Act.[13]

California's law requires that companies make certain disclosures to consumers via their privacy policies, or otherwise at the time the personal data is collected, and companies that sell consumer data to third parties will need to disclose that practice and give consumers the ability to opt out of the sale.[14] Minors are given special protections under the law. The law also prohibits companies from discriminating against consumers who exercise their privacy rights' but companies may charge a different price for these consumers.[15] Personal information is defined as information that identifies, relates to, describes, is capable of being associated with, or could reasonably be linked, directly or indirectly, with a consumer or household but does not include information that is lawfully available from government sources.[16] Finally, the law applies to for-profit businesses that collect and control California residents' personal information, do business in the State of California, and have annual gross revenues of at least of $25 M or receive or disclose the personal information of 50,000 or more California residents, households or devices on an annual basis, or derive 50 percent or more of their annual revenues from selling California residents' personal information.[17]

California voters doubled down on data privacy through their vote of support for Proposition 24 in the November 2020 General Election. Proposition 24, also known as the California Privacy Rights and Enforcement Act of 2020, expanded and amended the provisions of the California Consumer Privacy Act of 2018 (CCPA), created the California Privacy Protection Agency, and removed the ability of businesses to fix violations before being penalized for violations.[18] The ballot initiative requires businesses to do the following:

- not share a consumer's personal information upon the consumer's request;
- provide consumers with an opt-out option for having their sensitive personal information, as defined in law, used, or disclosed for advertising or marketing;
- obtain permission before collecting data from consumers who are younger than 16;
- obtain permission from a parent or guardian before collecting data from consumers who are younger than 13; and
- correct a consumer's inaccurate personal information upon the consumer's request.[19]

California is not alone. The National Conference of State Legislators reports that 30 states are considering consumer data privacy legislation during 2020, including: Arizona, California, Connecticut, Florida, Hawaii, Idaho, Illinois, Kentucky, Louisiana, Maine, Massachusetts, Maryland, Michigan, Minnesota, Missouri, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Nevada, New Hampshire, New Jersey, New Mexico, New York, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, West Virginia and Puerto Rico have all debated consumer privacy legislation in the past year.[20]

The U.S. Business Roundtable points out the benefits for a national consumer privacy standard. The Business Roundtable suggests a national consumer privacy law should:

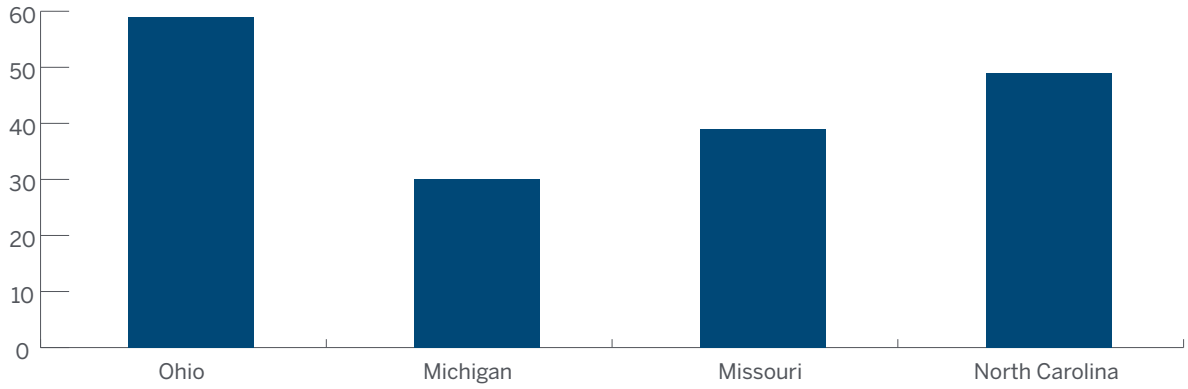
- Champion consumer privacy and promote accountability by including robust protections for personal data that enhance consumer trust and demonstrate U.S. leadership as a champion for privacy by including clear and comprehensive obligations regarding the collection, use, and sharing of personal data, and accountability measures to ensure that those obligations are met;
- Foster innovation and competitiveness by being technology neutral and taking a principles-based approach in order for organizations to adopt privacy protections that are appropriate to specific risks as

well as provide for continued innovation and economic competitiveness in a dynamic and constantly evolving technology landscape;
- Harmonize regulations by eliminating fragmentation of regulation in the United States by harmonizing approaches to consumer privacy across federal and state jurisdictions through a comprehensive national standard that ensures consistent privacy protections and avoids a state-by-state approach to regulating consumer privacy; and
- Achieve global interoperability by facilitating international transfers of personal data and electronic commerce and promote consumer privacy regimes that are interoperable, meaning it should support consumer privacy while also respecting and bridging differences between U.S. and foreign privacy regimes.[21]

Progress in Washington D.C. is always a challenge but until there is national action the California law will likely act as a national consumer privacy standard unless other states adopt more thereof own legislation. The election of President Joe Biden may help push negotiations on a national privacy law. Lawmakers on both sides of the political aisle have been progressing on draft proposals in the last 18 months, and action on federal privacy legislation progressed into this fall, with the U.S. Setting an American Framework to Ensure Data Access, Transparency, and Accountability Act, which represented a conglomeration of three previously introduced legislative proposals.[22] Federal privacy legislation was not necessarily a priority for the Trump administration.[23]

Data centers spread across the U.S. in primarily urban centers. Data centers are primarily located in or near major urban centers across the United States. The top markets for the corporate site location of data centers includes: Northern Virginia/ Washington DC, Santa Clara / San Jose / South Bay, Northern New Jersey, Chicago, Dallas / Fort Worth, New York City, Phoenix, Seattle, Los Angeles, and Atlanta.

Data Centers Comparison by Select States

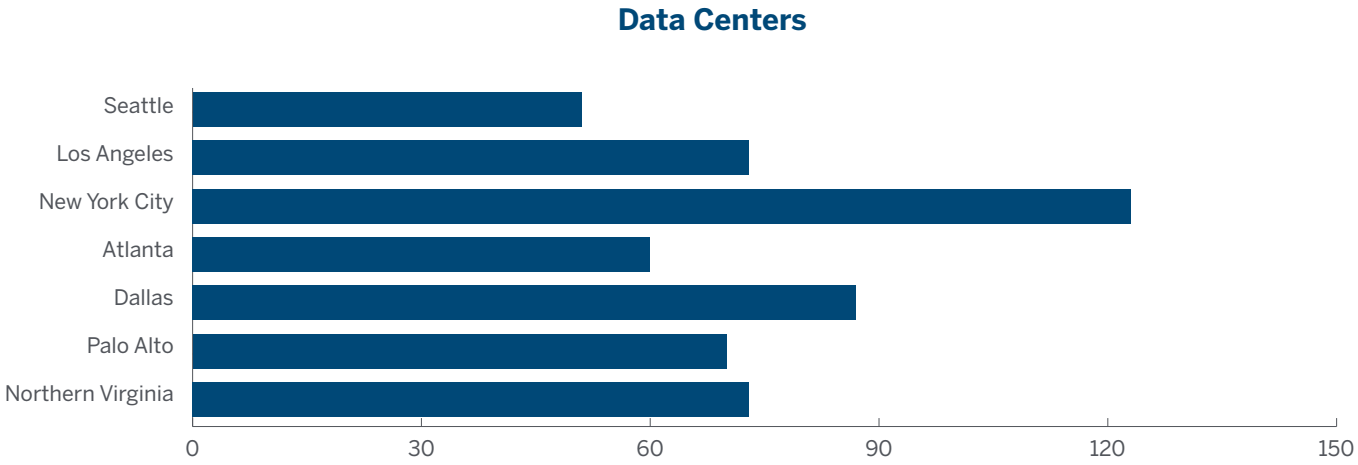


Source: https://cloudandcolocation.com/

Looking at a comparison of Michigan, Missouri, Ohio and North Carolina, the Buckeye State leads this state sample with nearly 60 data centers followed by North Carolina, then Missouri with Michigan last. Nearly all these data centers are in urban markets except for a handful of data centers in communities like Asheville, North Carolina. The complete list of data centers from these states can be found in Appendix B.

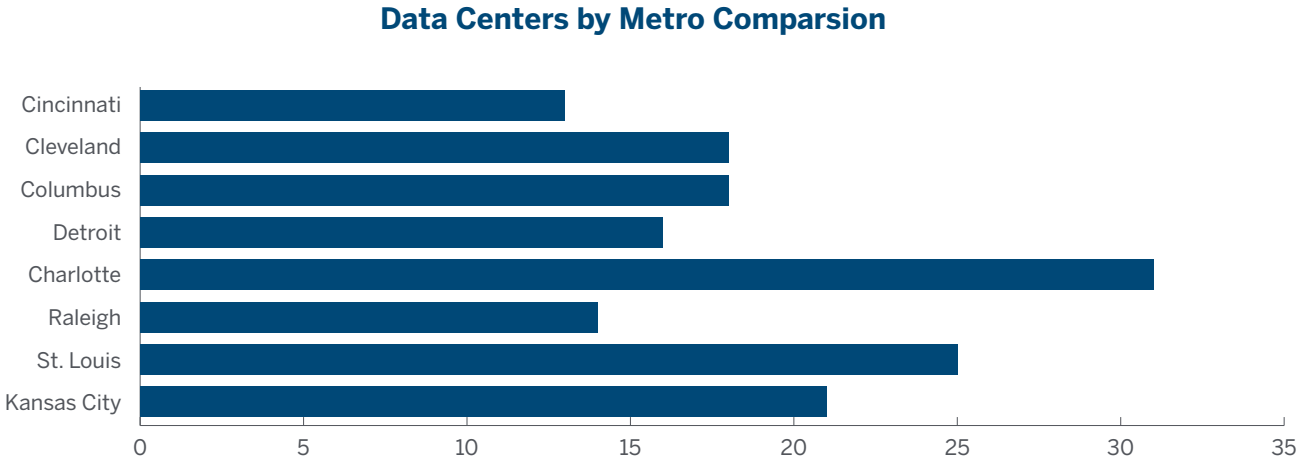
Comparing metro regions in these states is also of interest. As the table below illustrates, Charlotte in the same comparison states above has the largest number of data centers. Far more than high-tech Raleigh which also serves as the state capitol of North Carolina. In Missouri, St. Louis has slightly more data centers than Kansas City but this likely reflects the fact that overall economy of St. Louis is larger than Kansas City. The "Three C's" of Ohio, Cincinnati, Cleveland and Columbus have a relatively low number of data centers but this is likely the result of Ohio having three mid-sized urban centers while Michigan has one, and Missouri and North Carolina having two. Detroit has a very low number of data centers which could reflect the lack of

advanced services diversity in their economy but also a weak economic development incentive for data centers in the state of Michigan. It is worthy of note these mid-sized urban markets number of data centers pales in comparison to major data center markets like Northern Virginia, Palo Alto, Dallas, or Atlanta.[24]



Source: https://cloudandcolocation.com/

In fact, CBRE reports year-over-year e-commerce growth surged to 44.5 percent in the second quarter, from 14.8 percent in the first quarter, before the pandemic forced national shutdowns, and data centers will grow 13.8 % in 2021, and that the U.S. wholesale data center primary markets—Atlanta, Chicago, Dallas/Ft. Worth, New York Tri-State, Northern Virginia, Phoenix and Silicon Valley—accounted for more than 56% of the record annual absorption in 2018 with 60% of construction of data centers in 2019 at one point in Northern Virginia.[25] However, the exponential growth of data requirements in the country has been fueling data center construction, but a data center cost index 2019 study suggested that in the United States, Dallas, North Virginia, and Phoenix were the "overheated" markets for Data Center construction in 2019.



Source: https://cloudandcolocation.com/

JLL further reports data center demand remains robust in the first half of 2020, with eight out of the 14 markets in the United States showing a year-over-year increase.[26] Last year, these same domestic markets absorbed 171.2 MW, compared to 288.2 MW in H1 2020.[27] Total absorption reached 295.2 MW in the United States, including Salt Lake City's 7.0 MW figure, but, again, Northern Virginia leads the way in demand, as absorption increased from 76.1 MW in H1 2019 to 180.0 MW in H1 2020.[28] New Jersey and Northern California increased absorption by 11.8 MW and 10.2 MW, respectively, year-over-year.[29]

Data center corporate site location process focused on site, use and incentives. The data center corporate site location process is as much as about site development, construction, and infrastructure as it is about economic development incentives. Data centers cannot be located just anywhere. The site needs to be stable, protected from the elements and natural disasters as well as have reliable and affordable water, power, and broadband service. Not all data centers are built alike either. Generally, data centers are built along different tiers that go up in capacity and redundancy as well as cost. The largest data center operating item, ranging between 40% and 80% of total annual expenditures, is electricity, and the second largest operating item, including 24x7x365 security, operations, and IT staff.[30] Staffing expenditures account for 15% of annual operating expenditures.[31] Property taxes are estimated to be between 8.7% of total cost over 10 years and about 12% of annual operating spending, and other costs include administrative, maintenance, security, and landscaping. Repairs, replacement, and upgrade of IT equipment and infrastructure begin in year three of operation.[32]

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Locating data centers in rural versus an urban center is dependent upon five factors: availability, reliability, and cost of electric power; proximity factors; weather or natural disaster factors; infrastructure cost factors; and employee retention factors.[33]

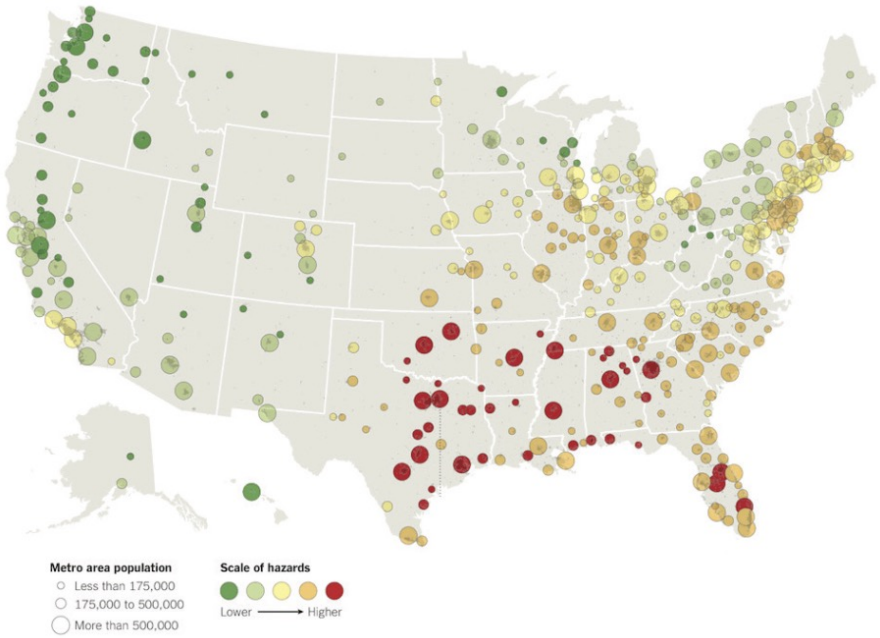
Rural v. Urban Data Center Location Factors

- **Energy availability, reliability and costs**
- **Proximity factor to major customers**
- **Managing natural disaster risk**
- **Broadband infrastructure costs**
- **IT employee attraction**

Data centers are massive consumers of electricity and rural regions need to have substantial electric utility infrastructure investments to compete with urban markets.[34] The redundancy of the electricity infrastructure is regarding as critical for many data centers. The largest challenge for most rural regions to serve as locations for data centers is, they are maybe some distance away from the data center's customers creating performance challenges for the operation of the center. Rural regions will need to have the best location when it comes to not just whether a natural disaster will hit the area but how prepared the region is to deal with hurricanes, floods, tornadoes, and earthquakes. The strongest argument for a rural data center is the cost of real estate and construction—which will almost always be lower than urban counterparts but these rural locations need to have the infrastructure in place the data center requires from a power, road, water, sewer and telecommunications standpoint to compete. Finally, rural data centers need a workforce development strategy to attract and retain computer software and data scientist occupations.

Natural disasters are bad news for data centers. Fire, floods, hurricanes, earthquakes, tornadoes, and any other natural disaster-prone region is not an ideal location for a data center. That does not mean data centers are in location where no natural disaster is possible. As the map below illustrates, regions that have a higher likelihood of having a natural disaster also house dozens of data centers. In fact, several these are major data center hubs. The data center design, redundant electrical and telecommunications systems, advanced fire suppression systems and planning and testing for natural disasters all can mitigate a location that may be prone to have a natural disaster.

Natural Disaster Risk U.S. Map



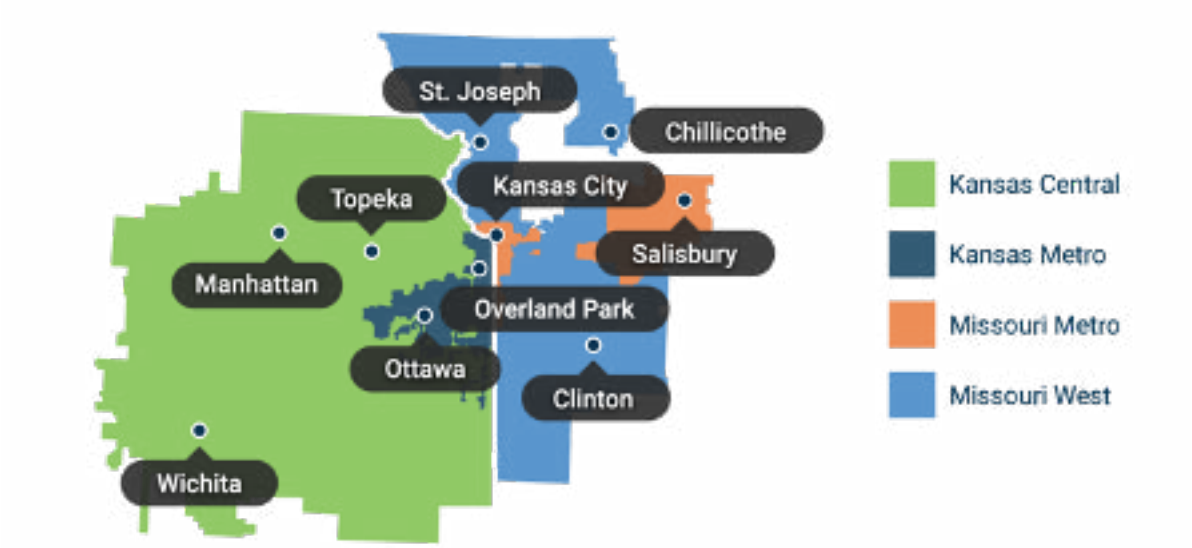
Source: By Matthew Ericson, Joe Burgess and Bill Marsh/The New York Times, Sperling's Best Places; National Oceanic and Atmospheric Administration (tornado map); University of Miami (hurricane map); U.S. Geological Survey (earthquake map)

Utility rate incentives can drive data center growth. Top Utility Economic Development Rate Riders. Many electric utilities offer an Economic Development Rate ("EDR") rider in addition to their standard base tariffs tied to energy intensive companies like data centers. The EDR ordinarily provides qualifying customers with a rate discount that is phased out over time, as an additional incentive for attraction or expansion. The main two key elements of an EDR are the size of the discount (as a percentage of the bill) and the duration of phase-out (in years). Regulated utilities offer EDRs as an approved tariff, for which each state regulator may establish different criteria to be met before approval. Unregulated utilities offer EDRs on a less formal and often unpublished / non-public basis. The following EDR offerings stand out among the published or otherwise public offerings.

- *AEP Data Center Program.* AEP's data center program provides confidential and complimentary site selection services, diverse location choices across our unmatched 11-state geographic footprint, strategic research and analysis on communities and sites, introductions to community and business leaders, development-ready properties, electrical service plan and rate design, and aftercare services and resources.[35] Depending on the size of the facility, AEP can provide distribution, sub-transmission or transmission service with redundant N+1 supply.[36] AEPs transmission planning criteria requires N-1-1 reliability.[37] AEPs data center customers can benefit from these programs and services: energy efficiency programs to reduce upfront capital costs, substation design, construction and maintenance services, energy services through our deregulated affiliate, AEP Energy, renewables options, and an assigned single point of contact for your national business, along with local account management.[38] AEP is focused on meeting the renewables needs of our customers and are transitioning from a historically coal heavy generation mix to a more balanced resource portfolio with the goal of gaining electricity from renewable sources for 40% of their portfolio by 2030.[39] Ohio operates in a deregulated electric market for investor owned utilities like AEP; thus, data center electricity rates are negotiated on a case by case basis.

- *Evergy Economic Development Rider (Evergy EDR).* Evergy, formerly KC Power & Light, serves the greater Kansas City marketplace in both Kansas and Missouri. The Evergy EDR is designed to offer discounted rates to encourage industrial and commercial growth through five distinct plans: Missouri Standard EDR Criteria; Missouri Limited Large Customer; Missouri Urban Core EDR Criteria; Kansas Central Standard EDR Criteria; and Kansas Metro Standard EDR Criteria.[40] As heavy energy users, data centers are likely eligible for the Missouri Limited Large Customer EDR. This EDR provides a discount over five (5) years equating to nearly two free years' worth of electricity: 40% discount year 1, 40% year 2, 40% year 3, 40% year 4 and 40% year 5.[41] Eligibility Criteria 1. The EDR is available only in conjunction with local, regional and state economic development activities where an incentive has been offered and accepted by the customer to locate a new facility, expand existing facilities, or retain existing facilities in the Evergy Missouri Service Territory.[42] If the project is an expansion of existing facilities, only the new/incremental electric load is eligible to receive the EDR, and a new facility is defined as a customer's facility that has not received electric service in Evergy's combined service area within the last twelve (12) months.[43] The annual load factor for the new or additional facility is reasonably projected to equal or exceed 55% within two years of receiving the EDR. The load factor must be maintained at or above 55% in years three through five, and the peak demand is reasonably projected to be at least three hundred (300) kW within two years and maintained at least 300 KW in years three (3) through five (5).[44] New/expanded load must be separately metered unless determined infeasible by Evergy, and revenues received from a customer must be greater than the applicable incremental cost to provide electric service as determined by Evergy.[45] The EDR is limited to industrial or commercial facilities whose product or service is not primarily sold directly to the local retail market and is not available in conjunction with any other special contract arrangements with Evergy.[46]

Evergy Service Territory



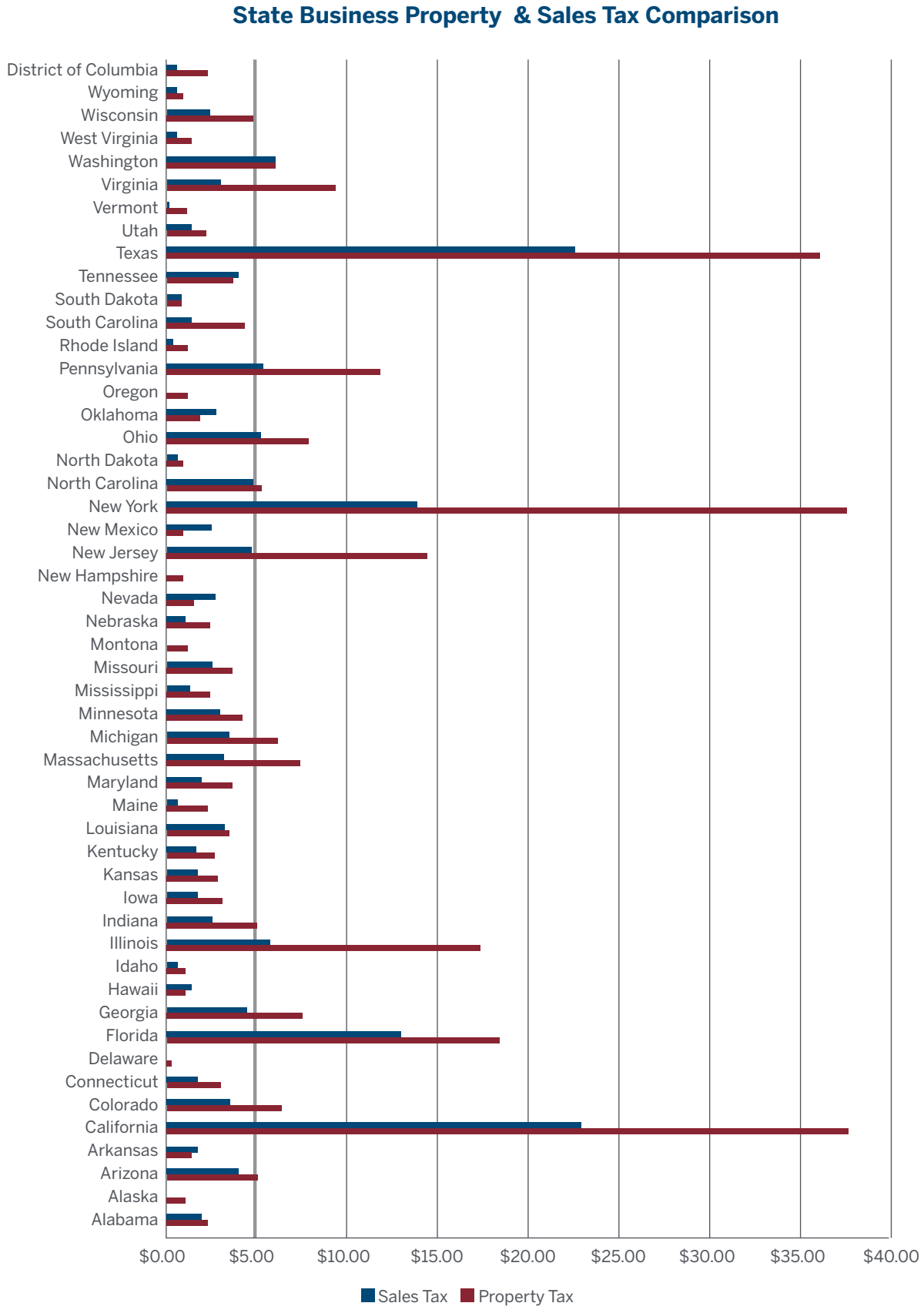
- *Ameren Missouri Smart Energy Plan.* Ameren Missouri offers a new Economic Development Incentive (EDI) that should substantially support job creation and capital investment in the region. The Ameren Missouri Smart Energy Plan economic development incentive (EDI) is a benefit offered to qualifying new and existing businesses seeking to locate or expand in Missouri. The Smart Energy Plan, which was developed with the passage of Missouri Senate Bill 564, is improving energy service for Ameren customers throughout the territory with upgrades, investment and new programs.[47] Lawmakers crafted the program to encourage new and existing businesses to invest in Missouri, adding jobs and spurring economic growth in local communities throughout the state.[48] The incentive will offer qualifying business customers an average 40 percent discount from base rates over an agreement term of five years.[49] Business eligibility is determined by specific criteria outlined in the rider EDI tariff, but, generally, these

businesses must be non-retail in nature.[50] The new or expanding businesses must meet the following standards to be eligible for the Ameren Missouri Smart Energy Plan EDI: be receiving (or requesting) service from Ameren Missouri under Rate 3M – LGS, Rate 4M – SPS or Rate 11M – LPS, be an industrial and/or commercial facility not directly selling or providing goods and/or services to the general public; be receiving state, regional, or local economic development incentives in conjunction with its expansion/location project; must apply for the Ameren Missouri Smart Energy Plan EDI prior to a public announcement of the expansion/location project; have an average monthly demand increase of at least 300 kW and 55 percent load factor; discounted rates must be greater than Ameren Missouri's marginal cost.[51] Some of the most common industries eligible for the discount are manufacturing operations, data centers, research and development operations, large-scale agriculture processing facilities and wholesale warehouse/distribution centers.[52] The economic development incentive is part of Missouri's state energy law passed in 2018, and Ameren Missouri is currently authorized to provide five years of discounts for any agreement entered into prior to December 31, 2023.[53] Ameren Missouri's economic development incentive is a win-win for business and residential customers alike. That's because the additional energy requirements from a qualifying business customer ultimately helps enhance system efficiencies and distribute the fixed costs of generating and delivering electricity across a broader customer base, thus helping to keep rates lower for all customers.[54] Also, the attraction of new jobs and investment multiplies throughout the region in the form of increased spending in retail establishments, new housing starts and population growth.[55]

- *Duke Energy Economic Development Riders.* Duke Energy offers The Carolinas – Duke Energy Economic Development Rider that provides new large-qualified customers a discounted power rate for four years of operation (1,000-kilowatt (kW) minimum load). Duke Energy also offers an Economic Redevelopment Rider that provides new large-qualified customers who occupy an existing building a 50 percent discount on power for one year (500-kW minimum load). Finally, Duke Energy offers the Carolinas Investment Fund Special fund that can be used to supplement a county's incentive package for a project or to support site readiness and industrial park development.[56] These programs will be applicable to major data center projects.

Tax incentives have a major impact on the location of data centers. Over 30 states have data center tax incentives. However, how a state taxes data centers is critical. Property taxes are payable on IT equipment, furniture, or other equipment that is not bolted to the real estate and can be removed, and these taxes are paid each year based on original purchase price, depreciation, and the local effective tax rate. These taxes can be substantial for data centers that can include hundreds of millions of capital equipment. There are 11 states that automatically do not assess property taxes on equipment and furniture. These states include Delaware, Illinois, Iowa, Kansas, Minnesota, New Jersey, New York, North Dakota, Ohio, Pennsylvania, and South Dakota, and 19 states offer some form of property tax abatements data centers can attempt to gain through a corporate site location process.[57] In 2019, business property taxes increased for the ninth year in a row since 2010.[58] Almost half of the $14.8 billion in increased property tax revenue came from gains in four large states: Texas ($2.3 billion), California ($2.0 billion), New York ($1.4 billion) and Florida ($1.0 billion).[59] Nationally, business property tax revenue increased by an average of 4.9%, but for 33 states, this revenue grew at a slower rate.[60] Texas had the largest dollar increase in business property tax revenue, collecting 2.3 billion more than in 2018. Washington had the highest growth rate for business property tax revenue, increasing by 15.4%.[61] Sales tax is another substantial cost center for both the operation and construction of data centers, and many states offer aggressive economic development incentives to address their high sales tax costs which often provide revenue for local and state governments. From 2019 to 2020, the state with the largest gain in sales tax collections on business inputs was California, which saw an increase of over $3.6 billion.[62] Of the 45 states with a state sales tax, 42 experienced an increase in sales tax collections on business inputs.[63] Washington DC also experienced an increase in sales tax collections on business inputs.[64] As the table below illustrates, traditional high cost states like California, New York and Illinois have substantial sales and property taxes in place as well as every other tax government can think of. Texas and Florida's very high sales and property tax illustrates the downside of not having a state or local income tax. This business sales and property tax burden illustrates the needed for data center economic development incentives.

State Business Property & Sales Tax Comparison



Source: Council on State Taxation, 2020 State Business Burden Report

As most data centers are not "worker heavy" traditional state data center tax incentives generally are not focused on the job creation tax credits used for other industries but those credits may apply in some cases. The list below outlines the existing state data center tax incentive programs.

Survey of State Data Center Tax Incentives

Alabama data processing center projects are eligible for a tax abatement of all state and local non-educational sales and use taxes associated with constructing and equipping a project for an extended time period contingent upon the total capital investment in the project. For these projects, the maximum abatement period is: 10 years for projects that invest up to $200M within 10 years from the commencement of the project; 20 years for projects that invest over $200M but less than $400M within 10 years from the commencement of the project; 30 years for projects that invest over $200M within 10 years from the commencement of the project and exceed $400M within 20 years from the commencement of the project. [65]

Arizona offers data centers an exemption from the Transaction Privilege Tax and Use Tax exemptions at the state, county and local levels, on qualifying data center purchases for an owner, operator or qualified co-location tenant of a data center who may receive the exemptions provided by the incentive for up to ten full calendar years following the year certification of the data center is issued. If the data center qualifies as a Sustainable Redevelopment Project, the exemptions are available for up to 20 full calendar years following the year certification of the data center is issued. If the data center is located in either Maricopa or Pima County, a Capital Investment of at least $50 million is made within five years of the date of the Letter of data center Certification from the Arizona Commerce Authority, if the data center is located in any county other than Maricopa or Pima, a capital investment of at least $25 million is made within five years of the date of the Letter of data center certification from the Arizona Commerce Authority; or, in the case of an existing data center, regardless of location, a capital investment of at least $250 million was made during the period between September 1, 2007 and August 31, 2013.[66]

Arkansas does not offer a data center specific tax incentive but data centers meeting job creation and capital investment requirements may negotiate sales and use tax exemptions and rebates, tax credits and closing fund contributions.[67]

Georgia offers two possible ways for data centers to qualify for sales and use tax exemptions on qualifying purchases: New (signed into law May 2018): Co-located data centers and single-user data centers that invest $100 million to $250 million in a new facility may qualify for a full sales and use tax exemption on eligible expenses, which include equipment under current data center exemption and computers, emergency backup generators, air handling units, cooling towers, energy storage or energy efficiency technology and many other items and the minimum required investment in the new facility is tied to the population of the county in which the data center locates; and Georgia also has a full sales and use tax exemption on certain computer equipment purchased by high-tech companies that invest a minimum of $15 million in qualifying equipment. To be eligible, the company must be classified under certain relevant NAICS codes, which include single-user data centers (but not co-located data centers), software publishers, computer systems design, certain telecommunications firms, financial transaction processing facilities and R&D centers.[68]

Idaho offers new data centers a potential sales tax exemption on server equipment as well as construction materials used in the construction of the data center facility for companies that create and maintain at least 30 new jobs in Idaho within the first two years after beginning operations, paying an average wage that is at or above the county average for the county in which the data center is located and make a capital investment of at least $250,000,000 within 5 years after construction begins and be solely devoted to the purpose of providing the data center, or have a separately operated segment of a business solely devoted to the purpose of providing the data center.[69]

Illinois' data centers investment program provides data center owners and operators with a tax credit of 20% of wages paid for construction workers for projects located in underserved areas with new and existing data centers and their tenants collectively making a capital investment of at least $250 million over a 60-month period for a term of 20 years, the data center owner/operator and its tenants create at least twenty (20) full-time or full-time equivalent new jobs associated with the operation or maintenance of the data center, total compensation for these jobs must be equal or exceed 120% of the median wage paid to full-time employees in the county where the data center is located, the data center must also be carbon neutral or attain certification under one or more green building standards and located in an underserved area.[70]

Indiana Data Center Gross Retail and Use Tax Exemption provides a sales and use tax exemption on purchases of qualifying data center equipment and energy to operators of a qualified data center for a period not to exceed 25 years for data center investments of less than $750 million. If the investment exceeds $750 million, the IEDC may award an exemption for up to 50 years. Indiana local governments may also provide a personal property tax exemption on qualified enterprise information technology equipment to owners of a data center who invest at least $25 million in real and personal property in the facility.[71]

Iowa data centers may be eligible for 50 or 100 percent refund on sales and use tax for: electricity purchased for use in data centers; power infrastructure equipment; computer purchases; temperature control equipment; cool tower equipment; racking systems, including cabling.[72]

Kentucky offers a sales tax refund for computer equipment for data centers investing $100 M.[73]

Florida offers a data center property tax exemption for a data center's owners and tenants with a $150 million capital investment, critical IT load of 15 megawatts and a critical IT load of 1 megawatt or higher dedicated to each individual owner or tenant within the data center met within 5 years of construction.[74]

Michigan offers data centers a potential sales tax exemption for data center equipment at qualified data centers and for qualified data centers operating in designated renaissance zones may gain both real and personal property tax exemptions.[75]

Maryland data centers that for a 10-year consecutive benefit period create five jobs over three years paying 150% of state minimum wage and make a minimum investment of at least $2 million in qualified data center personal property for a business located within a Tier 1 Area, and at least $5 million in qualified data center personal property for a business located in any other area of the State, and the benefit period expands to 20 years, subject to annual renewal, if the business invests at least $250 million in qualified data center personal property within the first ten years after submitting an application.[76]

Minnesota companies that build data or network operation centers of at least 25,000 square feet and invest at least $30 million within 48 months may qualify for a sales tax exemptions for up to 20 years on: computers and servers; cooling and energy equipment; energy use; software; and pay no personal property tax, and Minnesota does not tax: personal property, inventories, utilities, internet access, information services, and custom-created software, and companies that substantially refurbish a data or network operations center of at least 25,000 square feet and invest at least $50 million within 24 months may qualify for the Data Center Sales Tax incentives.[77]

Mississippi provides data centers with a sale and use tax exemption for all new and replacement computing equipment and software. Data centers must invest at least $20 million and must create at least 20 new jobs paying 125 percent of the average state wage to qualify for this program.[78]

Missouri offers a data center company or a consortium of eligible companies who plan to locate at a new or existing data center facility with at least 5 new full time jobs with average wages at 150% of county average wage within 24 months and $5 million dollars in new investment within 12 months of the project approval, or at least 10 new full time jobs with average wages at or above 150% of county average wage and $25 million dollars in new investment within 36 months of the project approval, for an existing facility, an exemption on state and local sales and use taxes used for expanding operations for a specified maximum amount for each year for 10 years or, for new facilities an exemption of 100% of the state and local sales and use taxes for a specified maximum amount for each year for 15 years applied to construction or rehab materials; machinery and equipment purchases; and utility costs over a designated term at the facility, and projects maybe eligible for a local government property tax abatement through the Chapter 100 Bond program.[79]

Montana offers Qualified Data Centers with at least 25,000 square feet of new or expanded area, where the total cost of land, improvements, personal property, and software is at least $50 million invested during a 48-month period with construction commencing after January 1, 2019 a property tax abatement of 75% or 50% of their taxable value in the first five years after a construction permit is issued, with each year thereafter, the percentage must increase by equal percentages until the full taxable value is attained in the tenth year, approved by the corresponding county jurisdiction.

Nebraska offers Tier 2 data centers valued at $200 million in new investment and 30 new full-time jobs a full refund of the sales tax paid for qualified capital purchases at the project, the full sliding scale wage credit of 3%, 4%, 5%, or 6% depending on wage level, and a 10% investment tax credit.[80]

Nevada offers a sales and use tax abatement reducing the rate to 2% for 10 or 20 years and requires the Governor's Office of Economic Development Board to approve a reduction to 2% by a two-thirds vote, and if this is not approved, the abatement will be reduced to 4.6%, and a 10 year and a 20 year tax abatement program: 10 year abatements: requires within 5 years creation of 10 jobs for Nevada residents paying 100% of the statewide average wage making $25 million in capital expenditures; and 20 year abatements: requires within 5 years creation of 50 jobs for Nevada residents paying 100% of the statewide average wage making $100 million capital expenditures. Co-located tenants must enter into a minimum two-year agreement with the applicant to use or occupy space at the data center, and obtain a business license issued by the Secretary of State; and data centers must maintain the business in Nevada for 10 years, register pursuant to the laws of Nevada, offer medical insurance plan and pay at least 65% of the plans premium costs, and ensure that 50% or more of all workers engaged in construction of the data center are Nevada residents.[81]

New York for an Internet data center operator who operates a data center specifically designed and constructed as a high security environment for the location of servers and similar equipment that hosts Internet Web sites; and provides uninterrupted Internet access to customers' Web pages exempts the payment of sales tax on the purchase or use of machinery, equipment, and certain other tangible personal property that includes: computer system hardware, such as servers and routers; pre-written computer software; storage racks and cages for computer equipment; property necessary to maintain the appropriate climate-controlled environment, such as air-filtration equipment, air-conditioning equipment, and vapor barriers; power generators and power conditioners; property that will constitute raised flooring when installed; and other similar equipment, as well as building systems that are designed for an Internet data center, such as interior fiber optic and copper cables; fire control, such as fire suppression equipment and alarms; and maintaining a secure environment, such as protective barriers if the exempt property is placed or installed in the Internet data center for use there; and required for and directly related to providing Internet Web site services for sale, and Internet data center operators may purchase the following services exempt from tax when the services are provided directly to or in relation to exempt Internet data center property: installing, maintaining, servicing, and repairing qualified tangible personal property; maintaining, servicing, and repairing qualified real property; and protective and detective services.[82]

North Carolina provides three sales and use tax exemptions for purchase of electricity and support equipment providing service or function included in the business of an owner, user or tenant of the data center, the generation, transformation, transmission, distribution or management of electricity, including exterior substations, generators, transformers, unit substations, uninterruptible power supply systems, batteries, power distribution units, remote power panels and other capital equipment for these purposes; HVAC and mechanical systems, including chillers, cooling towers, air handlers, pumps and other capital equipment used for these purposes; and hardware and software for distributed and mainframe computers and servers, data storage devices, network connectivity equipment and peripheral components and equipment, or providing related computer engineering or computer science research purchased for a "Qualifying Data Center investing $75 M within 5 years paying the county wage standard and providing health insurance, certain business property purchased for an "Eligible Internet Data Center" in Tier 1or 2 North Carolina counties for projects investing $250M within 5 years focused on software publishing; and computer software, defined as a set of coded instructions designed to cause a computer or automatic data-processing equipment to perform a task, at a "Data Center" that is defined as a facility that provides infrastructure for hosting or data-processing services and is concurrently maintainable, the power and cooling systems serving the computer equipment must include redundant capacity components and multiple distribution paths, and, although the facility must have multiple distribution paths serving the computer equipment, a single distribution path may serve the computer equipment at any one time.[83]

Ohio provides a sales-tax exemption on the purchase of eligible data center equipment including equipment cooling systems to manage the performance of computer data center equipment, to generate, transform, transmit, distribute, or manage electricity necessary to operate the tangible personal property used or to be used in conducting a computer data center business, and building and construction materials sold to construction contractors for incorporation into a computer data center with $100M investment and $1.5M in payroll, and data centers are eligible for property tax abatements negotiated at the local government level.[84]

North Dakota owners, operators, and tenants of a qualified, 16,000 square foot data center may be granted a sales tax exemption on information technology equipment and computer software, including replacement equipment and software, purchased between January 1, 2015, and December 31, 2020. The exemption is limited to the first four qualified data centers approved by the Tax Commissioner and 4 data centers have been awarded the incentive. To qualify, a data center must be a newly constructed or substantially refurbished facility of at least sixteen thousand square feet located in North Dakota.[85]

Oklahoma computer services and data processing facilities in NAICS codes Numbers 5112 and 5415 may be eligible for a 5 year exemption from Ad Valorem Tax if they derive at least 50% of their annual gross revenues from the sale of a product or service to an out of state customer or buyer, invest $250,000 or more in construction, acquisition or expansion cost of the manufacturing facility and; have a net increase in annualized payroll of at least $250,000 if the facility is located in a county with a population of fewer than 75,000, or at least $ 1 million dollars if the facility is located in a county with a population of 75,000 or more in the initial application year. Establishments in NAICS codes 5142 must meet the following qualifications: 80% of annual gross revenues from the sale of a product or service to an out of state customer or buyer; invest $7 million dollars or more in capital improvements and; have a net increase in annualized payroll of at least $250,000 if the facility is located in a county with a population of fewer than 75,000, or at least $1 million dollars if the facility is located in a county with a population of 75,000 or more in the initial application year.[86]

Oregon data centers may gain an enterprise zone property tax abatement on the new plant and equipment for 3-5 years in rural communities.[87]

Pennsylvania provides up to a $5M tax refund on sales and use taxes for data center equipment.[88]

South Carolina may exempt from some sales and use taxes when a data center is expanding and/ or new facility is certified by the South Carolina Department of Commerce as a qualifying datacenter and invests at least $50 million (or a combined $75 million with one or more other companies) in real or personal property at a single facility over a five-year period, create at least 25 new jobs within a five-year period with an average wage that is at least 150% of the state or county per capita wage, whichever is lower, and maintain the 25 jobs for at least three years. The items that may be exempt from sales and use tax are computer equipment, software and electricity directly used in datacenter operations, and once qualified for this exemption, all future computer equipment purchases are exempt.[89]

Tennessee offers data centers a sales tax exemption for certain hardware and software purchased for a qualified data center with a minimum capital investment of $100M and 15 new full-time positions paying at least 150% of the state's avg. occupational wage; investment must be made during a 3 yr. period, but can be extended to 5 yrs. for investments under $1B or 7 yrs. for investments exceeding $1B with the state's permission.[90]

Texas offers data centers with 100,000 sq. ft. creating 20 and $200M in capital investment over a 5-year period that are constructed or refurbished for use primarily as a facility to house servers and related equipment and support staff in the processing, storage and distribution of data, have, or will have, an uninterruptible power source, generator backup power, a sophisticated fire suppression and prevention system, and enhanced physical security that includes restricted access, video surveillance and electronic systems, not be used primarily by a telecommunications provider to deliver telecommunications services; and not be subject to an agreement limiting the appraised value of the data center's property can qualify for a 100% exemption on sales and use tax.[91]

Virginia offers data centers equipment sales tax exemption for projects with $150M investment creating 50 jobs paying 150% of average wage or 25 jobs in underserved markets in Virginia Enterprise Zones and permits end users at the data centers to gain access to the incentive.[92]

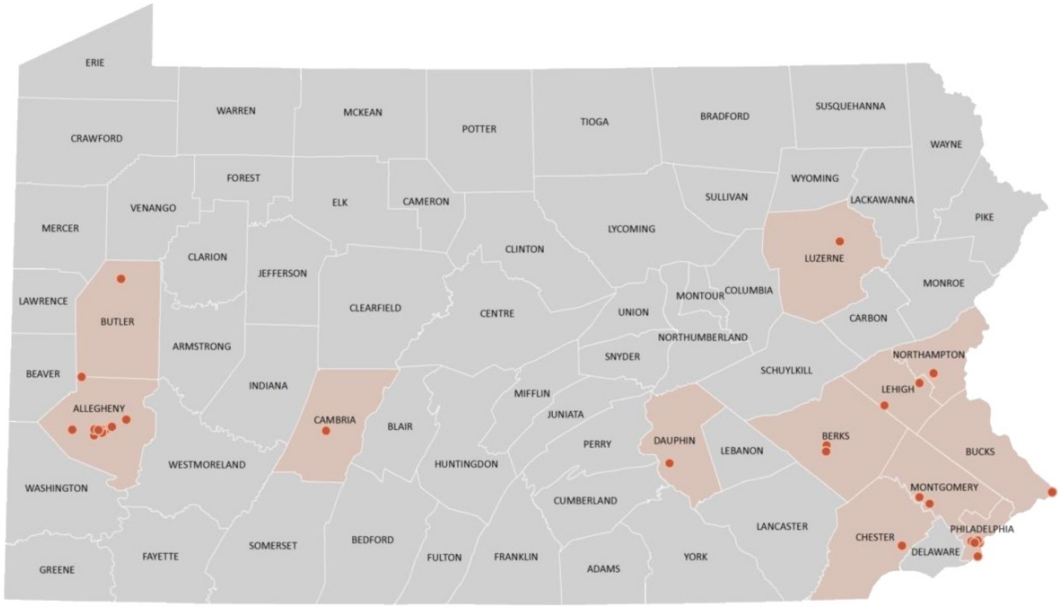
Washington offers data centers a retail-sales and use tax exemption for purchases and labor installation costs for eligible server equipment and power infrastructure.[93]

West Virginia values tangible personal property, including servers, directly used in a high-technology business or in an Internet advertising business, for property tax purposes at 5% of the original cost of the property, and eliminates the sales tax from all purchases of prewritten computer software, computers, computer hardware, servers, building materials and tangible personal property for direct use in a high-technology business or internet advertising business.[94]

Wyoming offers several data center incentives including a $2.25M max grant for Managed Data Center Cost Reduction Grant Program Is a $2.25 Million to reimburse accrued utility expenses for power or broadband over 3 years and for each grant the business must create a match of at least 125% of the grant amount in payroll and capital expenditure with the caveat that 50% of the match will be in payroll creation, and have a payroll must be greater than 150% of the county's median wage, a Data Center Permit Exemption for a mega-data center project which exceeds $178.3 Million in capital investment, would be exempt from the requirement of applying for an Industrial Siting Permit through the Wyoming Department of Environmental Quality providing a cost savings of approximately $500,000 associated with permit application preparation, wildlife studies, economic analyses, public meetings, permit hearings, attorney fees, etc., a Data Center Sales Tax Exemption that requires a $5 Million investment in capital infrastructure (building, walls, engineering, dirt work, etc) in a Wyoming location in addition to a $2 Million or larger investment in data center equipment (servers, peripheral equipment and data center containers) and software purchases, and the Wyoming Legislature approved a $15,000,000 appropriation to assist Wyoming cities, towns and counties to build necessary public infrastructure for the recruitment and operation of data centers.[95]

Pennsylvania offers an interesting case study about the role of economic development incentives in the attraction of data centers. Pennsylvania has been steadily losing its share of national employment in the data center industry.[96] The Pennsylvania data center industry has nearly 10,000 jobs, with $789 million in 2018 wages and expected annual employment growth to 2026 of 1.2% and a total data center square footage of 3.5 million sq. ft.[97] Pennsylvania's share of national jobs has dropped from 3.8% in 2008 to 2.8% in 2018.[98] This loss of Pennsylvania data center jobs is also during a time when the industry is growing dramatically across the United States and the globe. In 2018, Pennsylvania had 35 facilities as outlined below with the largest is 401 N Broad in Philadelphia with 1.3 million square feet with the majority of the locations in urban or suburban sites in the Philadelphia region in the eastern half of the state and Pittsburgh in the western portion of Pennsylvania.[99]

Pennsylvania Data Centers



Source: DataCenterMap.com (2019), Various Data Center Websites (2019)

The employment share in other states, like Arizona, North Carolina, and Washington, all of which have incentives in place to attract data centers, has been rising.[100] The success of these states is not an accident but is driven by economic development incentives. North Carolina offered tax abatements for data centers at a high investment threshold, but, in 2015, North Carolina lowered its investment threshold and expanded its exemption to include tax on electricity.[101] In 2007, North Carolina had around the same share of national employment as PA, but its share has risen steadily since then while PA's has fallen.[102] In reaction to the loss of a major Microsoft data center to Iowa after eliminating its data center tax incentive, the state of Washington extended its tax incentives and has seen substantial growth in data center developments.[103] Finally, Arizona passed sales and use tax exemptions for data center owners and operators in 2013 that brought a jump in national employment share which the state has retained since and the state is considering additional data center legislation to continue their growth in this high-tech market.[104]

Data Centers offer a substantial value proposition. Data center corporate site location projects offer a substantial Return on Investment (ROI) for the community. Addressing the ROI is the most effective strategy for explaining community value a data center can bring to industry outsiders. ROIs are a critical step in negotiating economic development incentive. ROIs are developed based upon a formula defines net benefits as the expected increased local and state revenue over the term and after the term of the economic development incentive considering incentive costs.[105] The ROI captures a broader set of economic costs and benefits in addition to fiscal impact to include: increases in state and local tax revenue, gains in worker earnings due to both increases in the employment-to-population ratio and increases in real wages, and gains in property values.[106] Costs included in the ROI analysis includes: increases in public spending to accommodate population change, effects on local firms that face higher costs due to increased wages and

property costs, and effects of financing the incentive are among the costs.[107] The critical ROI aspect of the analysis is to measure the economic and tax benefits beyond the term of the economic development incentive term. .

Data centers are low on jobs but high on capital investment. Capital investment in a data center could be $50 million on the low end and up to $1 billion on the high end depending on the type of facility.[108] The capital investment includes new buildings, purchases of computer servers, and the consumption of a substantial amount of electricity. Revenue at the state level include: sales taxes on construction materials; sales/use taxes on equipment purchases; sales taxes or franchise fees on power consumption; personal income taxes from construction and permanent jobs; and unemployment taxes from construction and permanent.[109] Revenue at the community level includes: sales taxes on construction materials; sales/use taxes on equipment purchases; sales taxes or franchise fees on power consumption; local income taxes from construction and permanent jobs; real estate taxes on a newly constructed or renovated building; and personal property taxes on computer servers and furniture.[110] CBRE conducted an ROI analysis on a hypothetical $1 billion data center development.[111] Based on a typical state/community's tax structure, economic and demographic characteristics, a $1 billion data center could generate upward of $200 million in total tax revenues over a 10-year period of time, including the one-time construction phase and ongoing operations.[112] According to CBRE, this $200 million ROI is equivalent to a corporate headquarters creating 1,700 jobs with a $130,000 average salary and making a $40 million capital investment.[113]

The Pennsylvania legislature conducted a study of the fiscal impact of the current data center program and legislation under consideration at the time that illustrates substantial ROI for the development of data centers in the Keystone State. Pennsylvania provides a limited sales tax refund for computer data center equipment requiring a minimum payroll of $1 million per year or, within first 4 years of certification, capital investments of $25 to $50 M (depending on county size), with a cap of $5 million allocated pro-rated for eligible applicants.[114] The Pennsylvania legislature was considering legislation to create a standard exemption for computer data center equipment for eligible centers and their tenants.[115] Eligibility for the exemption requires a minimum payroll of $1 million per year, and within first 4 years of certification, capital investments of $35 to $60 M (depending on county size) with no cap on the exemption, so exemptions would be applied through a standard exemption certificate.[116] According the Pennsylvania study, by 2024, under Pennsylvania would gain:

- Over 33,000 more total jobs, including 10,000 more jobs in the sector;
- Over $6 billion more in total output;
- Over $2 billion more in total wages; and
- $110 million more in net tax revenues in FY 24, even after the tax exemption.[117]

Virginia offers another case study for the economic impact and ROI of data centers. Northern Virginia is the leading data center market in the United States. A recent study conducted for the Northern Virginia Technology Council found that in 2018 the data center industry in Virginia directly provided approximately: 14,644 full-time-equivalent jobs with an average annual pay of $126,000, $1.9 billion in associated pay and benefits, and $4.5 billion in economic output.[118] Taking into account the economic ripple effects that direct investment generated, the report estimated that the total impact on Virginia from the data center industry in 2018 was approximately 45,290 full-time-equivalent jobs, $3.5 billion in associated pay and benefits, and $10.1 billion in economic output.[119] The report noted that data centers pay millions of dollars in state and local taxes in Virginia, even though Virginia has a sales and use tax exemption on some equipment for data centers that are large enough to qualify for the exemption.[120] In addition to the taxes paid directly by data centers, local governments and the Commonwealth of Virginia collect tax revenue from the secondary indirect and induced economic activity that data centers generate.[121] The report found that in 2018, data centers were directly and indirectly responsible for generating $600.1 million in state and local tax revenue in Virginia.[122] At the local level data centers provide far more in county or city tax revenue than they and their employees demand in local government services.[123] The report estimated that for every dollar in county expenditures that the data center industry caused in 2018, it generated: $8.60 in local tax revenue in Henrico County, and property taxes there would have had to rise by 1 percent without the data center induced tax revenue; $15.10 in local tax revenue in Loudoun County, and property taxes there would have had to rise by 21 percent without the data center induced tax revenue; and $17.80 in tax revenue in Prince William County, and property taxes there would have had to rise by 7 percent without the data center induced tax revenue.[124]

Data center workforce challenges create an opportunity as well as a challenge. Data centers, while not typically large employment centers, do require a smaller number of highly skilled workers.[125] According to the U.S. Department of Energy, there are 3 million data centers scattered across urban and rural areas in the U.S.[126] More than 90% of the servers are, however, housed in data centers and owned or leased by small- and medium-size businesses. Less than 10% of servers located in large data centers are owned by major cloud providers and national supercomputer centers.[127]

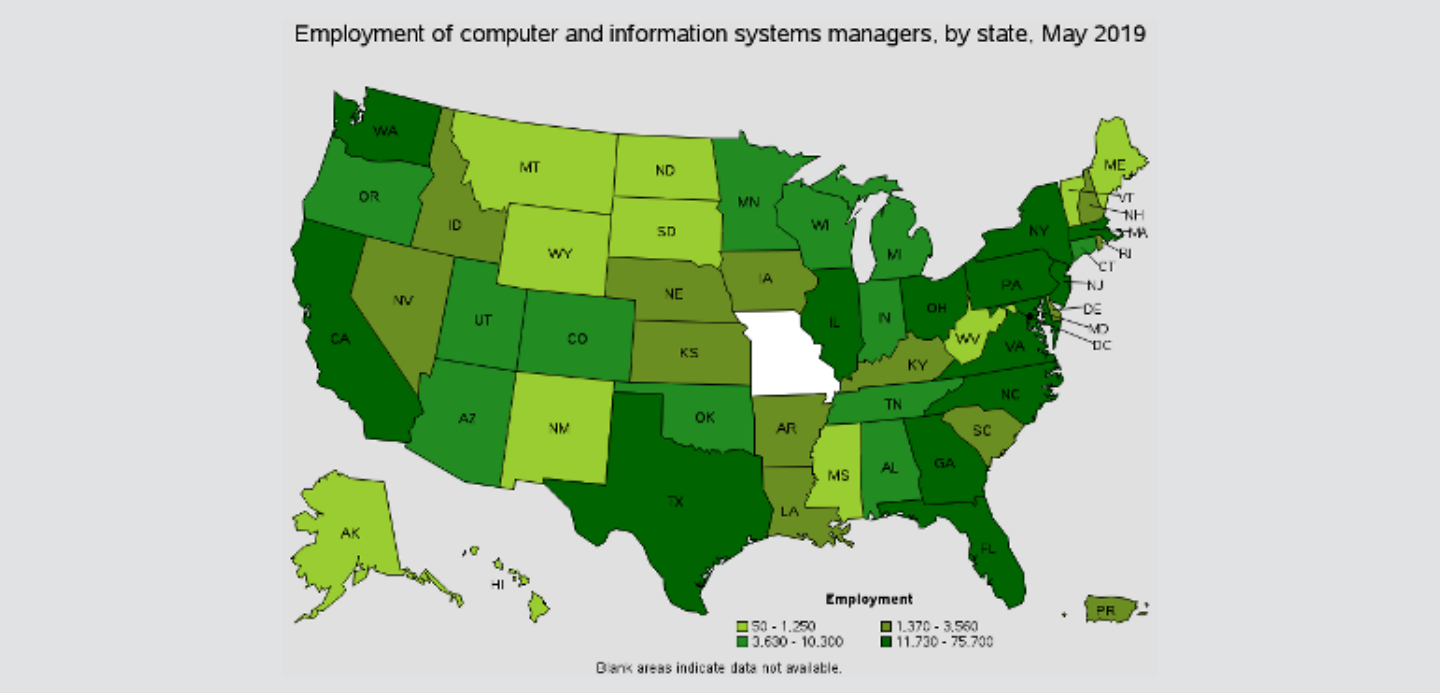
A range of occupations are included in the "computer and information technology" occupations based upon federal BLS data as listed in the table below.

Computer and Information Technology Occupations

JOB SUMMARY	ENTRY-LEVEL EDUCATION		2019 MEDIAN PAY
Computer and Information Research Scientists	Computer and information research scientists invent and design new approaches to computing technology and find innovative uses for existing technology.	Master's degree	$122,840
Computer Network Architects	Computer network architects design and build data communication networks, including local area networks (LANs), wide area networks (WANs), and Intranets.	Bachelor's degree	$112,690
Computer Programmers	Computer programmers write and test code that allows computer applications and software programs to function properly.	Bachelor's degree	$86,550
Computer Support Specialists	Computer support specialists provide help and advice to computer users and organizations.	See How to Become One	$54,760
Computer Systems Analysts	Computer systems analysts study an organization's current computer systems and find a solution that is more efficient and effective.	Bachelor's degree	$90,920
Database Administrators	Database administrators (DBAs) use specialized software to store and organize data.	Bachelor's degree	$93,750
Information Security Analysts	Information security analysts plan and carry out security measures to protect an organization's computer networks and systems.	Bachelor's degree	$99,730
Network and Computer Systems Administrators	Network and computer systems administrators are responsible for the day-to-day operation of computer networks.	Bachelor's degree	$83,510
Software Developers	Software developers create the applications or systems that run on a computer or another device.	Bachelor's degree	$107,510
Web Developers	Web developers design and create websites.	Associate degree	$73,760

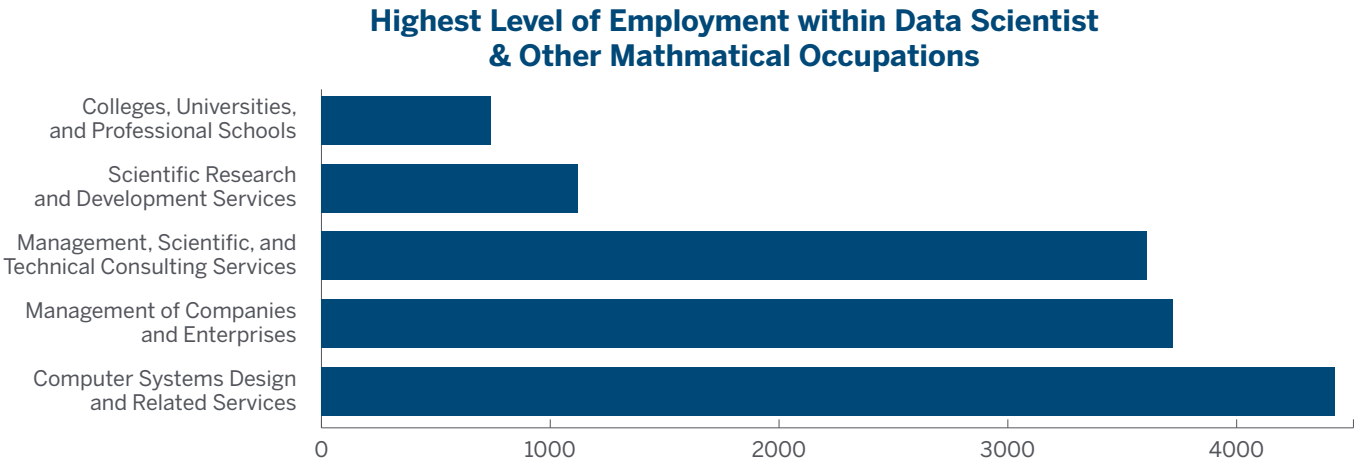
Source: https://www.bls.gov/ooh/computer-and-information-technology/home.htm

Employment in computer and information technology occupations is projected to grow 11 percent from 2019 to 2029, much faster than the average for all occupations. These occupations are projected to add about 531,200 new jobs, and demand for these workers will stem from greater emphasis on cloud computing, the collection and storage of big data, and information security.[128] The median annual wage for computer and information technology occupations was $88,240 in May 2019, which was higher than the median annual wage for all occupations of $39,810.[129]



Data scientist and other mathematical occupations are a central workforce for data centers. Data scientists develop and implement a set of techniques or analytics applications to transform raw data into meaningful information using data-oriented programming languages and visualization software.[130] They apply data mining, data modeling, natural language processing, and machine learning to extract and analyze information from large structured and unstructured datasets.[131] Data scientists also visualize, interpret, and report data findings and may create dynamic data reports.[132] Federal BLS data there are 30,810 data scientist and other mathematical occupations with an expected jobs increase of 3.1 % and a mean hourly wage of $48.35 or annual mean wage of $100,560.[133]

Highest Level of Employment within Data Scientist & Other Mathmatical Occupations



Like many other technology industries, data centers are facing a workforce development challenge. According to the Data Center 2025 survey, 16% of all participants expect to retire by 2025, and that number is a whopping 33% in the U.S.[134] Those retirement numbers are of greater concern in that there does not appear to be many regions or states focusing on developing the data center workforce pipeline that will be needed to replace these workers. Couple that with the ongoing changes in the industry, including the shift to the edge and more distributed networks, and those losses add a layer of complexity and uncertainty to an already complex ecosystem.[135]

An effort in West Des Moines, Iowa may offer an industry-based training model region should consider addressing the data center workforce challenge. Microsoft is teaming with Des Moines Area Community College (DMACC) West Des Moines Campus to create the Microsoft Datacenter Academy.[136] This academy will educate and train professionals to staff, maintain and service the growing number of computer networks located within the data centers throughout Central Iowa, and it is the first-of-its-kind program in the Midwest and only the fourth Microsoft Datacenter Academy in the nation.[137] Microsoft is donating to DMACC new specialized equipment from a Microsoft data center, and students will use the equipment to learn and train.[138] DMACC West Des Moines Campus will be offering hands-on training with data center and network equipment to help students gain job-ready skills. Training will include infrastructure cabling, copper and fiber optic testing, and computer network connectivity.[139] Additional programming will range from eight-weeks to approximately 20 months, and Microsoft is also providing $60,000 in student scholarships for the Datacenter Academy.[140] It is estimated the starting pay for these entry-level jobs in which these students will be trained for will fall within the $30,000 to $40,000 range with advancement common, and academy graduates will be qualified to enter the workforce or they can pursue their two- or four-year Information Technology degree.[141]

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