HOWARD COUNTY ECONOMIC DEVELOPMENT AUTHORITY
Grow. Here's how.

MEMORANDUM

To: Lonnie R. Robbins
Chief Administrative Officer

From: Lawrence F. Twele
Chief Executive Officer

Re: Council Bill No. 38-2020; Data Centers Personal Property Tax Exemption - Enabling Legislation

Date: July 1, 2020

The Economic Development Authority is submitting this testimony as support for Council Bill No. 38-2020, the Data Center Personal Property Tax Exemption enabling legislation.

In an effort to maintain Howard County's position as a leader in economic development and accelerate the attraction and creation of technology jobs, the Howard County Economic Development Authority (HCEDA) is recommending the creation of an incentive to attract data centers based on recent legislation to enable counties to establish local incentives.

During the 2020 legislative session, the Maryland General Assembly passed SB397 "Data Center Tax Exemption" which becomes law on July 1, 2020. This legislation allows for the exemption of the State sales and use tax and enables local jurisdictions to provide exemptions of the local personal property tax to qualified data centers.

The use of tax incentives is not a new tool for HCEDA and Howard County. There is a Real Property Tax Exemption in Section 20.123 of the Howard County Code. HCEDA has been able to invest this credit into the attraction and retention of several major projects since 2012. This credit has resulted in the retention and creation of over 2,342 jobs and over $425 million dollars of capital investment through the deployment of $1,930,000 in tax credits.

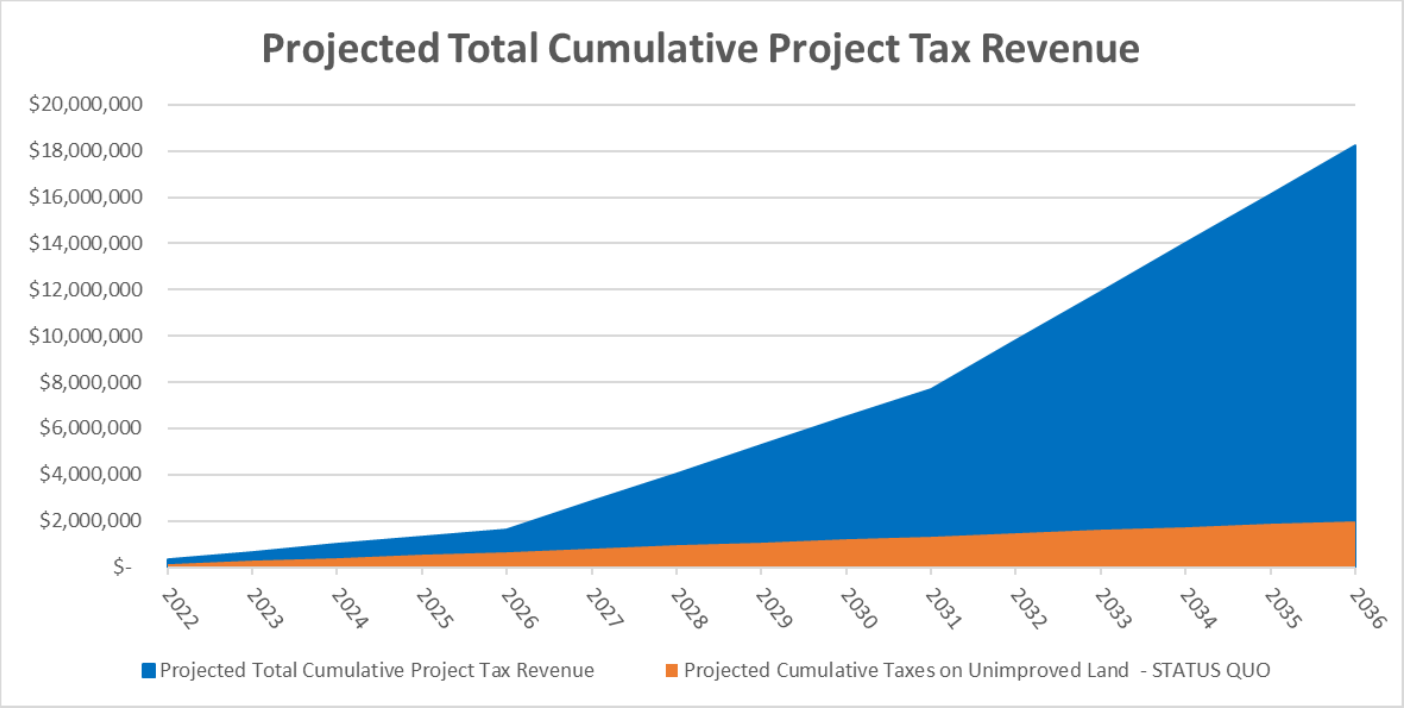
Data centers serve as data maintenance and storage repositories for business and government. Historically, Maryland has been uncompetitive in the attraction of data centers due to restrictive tax policies on the purchase and replacement of data center equipment. As the use of cloud computing and storage has grown over the past several years and is projected to accelerate, data centers seek to be close to their customers and users (i.e. technology companies) seek to be close to the centers. Capitalizing on this symbiosis is a strategic way to fuel the growth of technology firms in Howard County. Almost all neighboring states have provided tax exemptions for data centers and have witnessed the corresponding growth of small technology companies. Loudon County, Virginia alone has 18 million square feet of data center space and over 10,000

technology companies. Additionally, we expect our neighboring counties to introduce their own enabling legislation to aide in attracting data centers to their jurisdictions.

Attracting data centers is without question the number one priority of most if not all economic development organizations. Because of the passage of SB397, the HCEDA has been in conversation with several high-profile data center companies that seek locations in Howard and surrounding counties. Their proposed investments are in the hundreds of millions and potentially billions of dollars. Their employment requirements are 25-40 employees per facility. The attractiveness of data centers is not only in the high capital investment and construction jobs and expenditures but also that low employment levels place no pressure on schools, traffic or county services. Among Virginia's Loudon, Prince Williams, and Henrico Counties, for every $1.00 in county expenditures that the data center industry was responsible for generating, it provided approximately $15.22 in tax revenue. The ultimate benefits are data center's track record in drawing other data center companies and businesses desiring to be close to their data.

In the tax credit being proposed, 100% of the personal property tax is exempt for the first five (5) years, then in years six (6) through ten (10), 90% of the personal property tax is exempt. Because of the large amount of capital equipment necessary to operate a data center, this incentive still generates a large amount of revenue for the county.

Where land that could be considered for a project of this type is appraised as raw industrial land, with the addition of a data center facility/warehouse the tax assessment will increase significantly. The following chart provides an example of the net gain to the county based on the real estate tax increases to be realized and eventually the personal property tax that is phased in over time.



Source: HCEDA estimates

According to a 2020 study conducted by Mangum Economics on behalf of the Maryland Chamber Foundation, the potential economic and fiscal impact of data centers in Maryland is statistically positive. The study analyzed the impact of locating just one large data center in Howard County. The analysis determined that a large data center would provide a very high benefit to cost ratio for the county in terms of the tax revenue it would generate relative to the government services that it and its employees would require. The study showed that for every $1.00 in county expenditures that the hypothetical large data center was responsible for generating, it would provide approximately $21.20 in tax revenue. The analysis examined the economic impacts of the one-time construction benefits in addition to the ongoing operational benefits.

Estimated One-Time Economic and Fiscal Impact on Howard County from Construction of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	870	$88,200,000	$162,900,00
2nd Round Indirect and Induced Economic Activity	340	$22,800,000	$66,500,000
Total Economic Activity	**1,210**	**$111,000,000**	**$229,400,000**
Fiscal Impact			
Local Tax Revenue			**$3,600,000**

Source: *Potential impact of large data center development in Maryland*; Magnum Economics 2020

Estimated Annual Economic Impact on Howard County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	25	$2,800,000	$18,500,000
2nd Round Indirect and Induced Economic Activity	78	$4,700,000	$15,400,000
Total Economic Activity	**103**	**$7,500,000**	**$33,900,000**

Source: *Potential impact of large data center development in Maryland*; Magnum Economics 2020

Today, thirty-one (31) states provide data centers with some sort of sales-and-use tax exemptions for the purchases of required equipment. In 2019, Illinois, Indiana, and Alabama passed significant legislation helping to attract data centers to come to their states. Locally, in Virginia, data centers are a main economic driver, where employment and investment have increased as data center incentives have expanded in the state. Pennsylvania has also

introduced key legislation to expand existing incentives. Within the last five (5) years, no large-scale enterprise data center has located in a state that imposes its full tax burden on data center equipment which underlines the importance of this legislation to states seeking to share in the benefits of the digital economy.

Data centers will play a critical role in our economy now more than ever. The current COVID-19 pandemic has changed the way we work, pushing much more of the world's commerce to the cloud. As telework becomes more necessary and desirable, the need for data storage and access will increase. Data storage and retrieval has never been more important as we communicate and collaborate on digital platforms. HCEDA urges your favorable consideration of the Data Center Personal Property Tax Exemption and the enormous opportunity this presents to the growth of the tax base of Howard County.

MARCH 2020

MARYLAND Chamber FOUNDATION

POTENTIAL IMPACT OF LARGE DATA CENTER DEVELOPMENT IN MARYLAND

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About Mangum Economic Consulting, LLC

Mangum Economics, LLC is a Richmond, Virginia based firm that specializes in producing objective economic, quantitative, and qualitative analysis in support of strategic decision making. Much of our recent work relates to IT & Telecom Infrastructure (data centers, terrestrial and subsea fiber), Renewable Energy, Economic Development, and Tax and Regulatory Policy. Examples of typical studies include

- *The Potential Impact of a Data Center Incentive in Illinois*, 2018;
- *The Impact of Data Centers on the State and Local Economies of Virginia*, 2016, 2018, and 2020;
- *The Economic and Fiscal Contribution that Data Centers Make to Virginia: Spotlight on Prince William County*, 2018;
- *Opportunities for Southside Virginia to Participate in the Cloud Economy*, 2019; and
- *The Economic Development Potential of the MAREA and BRUSA Undersea Fiber Optic Cables*, 2017.

POLICY ANALYSIS

Identify the intended and, more importantly, unintended consequences of proposed legislation and other policy initiatives.

ECONOMIC IMPACT ASSESSMENTS AND RETURN ON INVESTMENT ANALYSES

Measure the economic contribution that business, education, or other enterprises make to their localities.

CLUSTER ANALYSIS

Use occupation and industry clusters to illuminate regional workforce and industry strengths and identify connections between the two.

The Project Team

A. Fletcher Mangum, Ph.D.
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Economist

Martina Arel, M.B.A.
Researcher and Economic Development Specialist

Executive Summary

In this report, we assess the economic and fiscal impact potential if just one large new data center were to locate in Maryland. For illustrative purposes, our analysis focuses on four Maryland Counties – Baltimore, Howard, Kent, and Prince George's. The primary findings from that assessment are:

1) A large data center would provide a very high benefit to cost ratio for these counties in terms of the tax revenue it would generate relative to the government services that it and its employees would require. We estimate that the local benefit to cost ratio would be approximately:

Table 1: Estimated Benefit/Cost Ratio Associated with a Hypothetical Large Data Center for Select Maryland Counties

Locality	Estimated Annual Tax Revenue Benefit	Estimated Annual Budgetary Cost	Benefit/Cost Ratio
Baltimore County	$5,628,000	$193,000	32.9
Howard County	$4,715,000	$223,000	21.2
Kent County	$2,197,000	$165,000	13.3
Prince George's County	$5,587,000	$193,000	29.0

2) A large data center would have a significant one-time economic and fiscal impact on these counties during its construction phase.

Table 2: Summary of One-Time Economic and Fiscal Impacts from Construction of a Hypothetical Large Data Center in Select Maryland Counties

Impact	Baltimore	Howard	Kent	Prince George's
Jobs	1,359	1,210	1,432	1,330
Pay & Benefits	$102,200,000	$111,000,000	$93,300,000	$97,300,000
Economic Output	$227,900,000	$229,400,000	$218,400,000	$218,800,000
County Tax Revenue*	$3,200,000	$3,600,000	$3,500,000	$3,000,000

* Tax revenue estimates exclude sales tax revenue

3) A large data center would have a significant annual economic and fiscal impact on these counties during its on-going operational phase.

Table 3: Summary of Annual Economic and Fiscal Impacts from the On-going Operation of a Hypothetical Large Data Center in Select Maryland Counties

Impact	Baltimore	Howard	Kent	Prince George's
Jobs	121	103	105	107
Pay & Benefits	$8,000,000	$7,500,000	$6,100,000	$6,200,000
Economic Output	$38,500,000	$33,900,000	$32,300,000	$32,700,000
County Tax Revenue*	$5,628,000	$4,715,000	$2,197,000	$5,587,000

* Tax revenue estimates include only real and personal property tax, and energy tax revenue paid directly by the data center.

Introduction

In this report, we illustrate the economic and fiscal impact potential if just one large new data center were to locate in Maryland. We describe a hypothetical large data center that is typical of one that might be constructed in Maryland, if Maryland offered incentives for data centers to locate there. We then illustrate the impact of constructing and operating such a data center in four counties in Maryland – Baltimore, Howard, Kent, and Prince George's.

We use the IMPLAN economic impact simulation model to estimate the economic and a portion of the fiscal impacts of the project. The impact of constructing and operating the same facility in different counties varies because different areas are home to different industries that will indirectly benefit from the new development. The more populated and more economically diverse a county economy is, the more dollars stay in the county, and the larger is the economic impact on the county. In addition, different local tax rates also affect the relative magnitude of the fiscal impact.

Hypothetical Large Data Center

The hypothetical large data center that we use in this analysis would require about 20 MW of electrical power capacity and a $215 million investment in construction, exclusive of the cost of the server computing equipment. We assume that $13.4 million is spent on land acquisition, $45.0 million on the construction of the shell of the building, and $156.3 million would be spent for interior construction, cooling and control equipment, and for installation, customization, and calibration of the equipment. Construction of a data center of this scale would typically take 18 to 24 months.

After construction and preparation are completed, the computer equipment can be installed and operations can begin. For purposes of our analysis, we assume that the data center would operate at 50 percent of server capacity and that would imply an investment of $250 million in server computing equipment. We also assume that the data center would hire 25 direct full-time-equivalent employees, not counting contractors that provide services such as security and maintenance, and would purchase $7.4 million of electricity annually for about 97 million kWh of power.

Our assumptions and calculations are based on actual large data center projects in the Mid-Atlantic and elsewhere and on information about expenditures from data center industry sources. Our calculations are consistent with those of the U.S. Chamber of Commerce report on the impact of data center construction in communities nationwide.

Potential Economic and Fiscal Impact in Baltimore County, Maryland

Baltimore County, Maryland is part of the Baltimore–Columbia–Towson metropolitan statistical area. Operational workforce, connectivity, accessibility, and power would be sufficient to support a large data center in the county.

CONSTRUCTION PHASE

By feeding the assumptions detailed in the "Hypothetical Large Data Center" section into the IMPLAN model, we obtain the following estimates of one-time impact from construction. As shown in Table 4, construction of a hypothetical large data center would directly provide a one-time pulse of approximately: 1) 984 jobs, 2) $79.5 million in pay and benefits, and 3) $162.9 million in economic output to Baltimore County.

Taking into account the economic ripple effects that direct impact would generate, we estimate that the one-time impact on Baltimore County would be a total of: 1) 1,359 jobs, 2) $102.2 million in pay and benefits, 3) $227.9 million in economic output, and 4) $3.2 million in local fiscal impact (excluding sales tax revenue).

Table 4: Estimated One-Time Economic and Fiscal Impact on Baltimore County from Construction of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	984	$79,500,000	$162,900,000
2nd Round Indirect and Induced Economic Activity	375	$22,700,000	$65,000,000
Total Economic Activity	**1,359**	**$102,200,000**	**$227,900,000**
Fiscal Impact			
Local Tax Revenue			**$3,200,000**

OPERATIONS PHASE

Economic Impact

By again feeding the previously detailed assumptions into the IMPLAN model, we obtain the following estimates of the annual impact once the hypothetical large data center is fully operational. As shown in Table 5, we estimate that on-going operation of the facility would provide a direct annual impact of approximately: 1) 25 full-time-equivalent jobs, 2) $2.8 million in pay and benefits, and 3) $18.5 million in economic output to Baltimore County.

Taking into account the economic ripple effects that direct impact would generate, we estimate that the annual impact on Baltimore County would be a total of: 1) 121 jobs, 2) $8.0 million in pay and benefits, and 3) $38.5 million in economic output.

Table 5: Estimated Annual Economic Impact on Baltimore County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	25	$2,800,000	$18,500,000
2nd Round Indirect and Induced Economic Activity	96	$5,200,000	$20,000,000
Total Economic Activity	**121**	**$8,000,000**	**$38,500,000**

Fiscal Impact

For purposes of our analysis, we assume that the hypothetical large data center would be located in Baltimore County, but outside of any town or other additional taxing jurisdiction within the county. As a result, only county tax rates apply.

During its ongoing operational phase, the hypothetical data center would provide Baltimore County with tax revenue from one primary revenue source – real estate taxes. Based on the previously detailed assumptions and published tax rates, as shown in Table 6 we estimate that the proposed facility would generate $5.6 million in new annual revenue for Baltimore County.

Table 6: Estimated Annual Fiscal Impact on Baltimore County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Revenue Source	Tax Base	Assessment	Tax Rate	Annual Revenue
Real Estate	$215,000,000	100%[1]	$1.10 per $100[2]	$2,365,000
Personal Property	$250,000,000	40%[3]	$2.75 per $100[4]	$2,750,000
Energy	96,732,000 kWh[5]		$0.00530	$513,000
Total Annual Revenue				**$5,628,000**

[1] Data Source: Maryland Department of Assessments and Taxation.

[2] Data Source: Maryland Department of Assessments and Taxation.

[3] Data Source: Maryland Department of Assessments and Taxation. Assumes that personal property would be at the mid-point (*i.e.*, year two) of its depreciation schedule.

[4] Data Source: Maryland Department of Assessments and Taxation.

[5] Calculated as $7.4 million in annual expenditures for electricity divided by $0.0765/KWh (the average industrial electricity rate reported for Maryland by the U.S. Energy Information Agency).

Potential Economic and Fiscal Impact in Howard County, Maryland

Howard County, Maryland is part of the Baltimore–Columbia–Towson metropolitan statistical area. Operational workforce, connectivity, accessibility, and power would be sufficient to support a large data center in the county.

CONSTRUCTION PHASE

By feeding the assumptions detailed in the "Hypothetical Large Data Center" section into the IMPLAN model, we obtain the following estimates of one-time impact from construction. As shown in Table 7, construction of a hypothetical large data center would directly provide a one-time pulse of approximately: 1) 870 jobs, 2) $88.2 million in pay and benefits, and 3) $162.9 million in economic output to Howard County.

Taking into account the economic ripple effects that direct impact would generate, we estimate that the one-time impact on Howard County would be a total of: 1) 1,210 jobs, 2) $111.0 million in pay and benefits, 3) $229.4 million in economic output, and 4) $3.6 million in local fiscal impact (excluding sales tax revenue).

Table 7: Estimated One-Time Economic and Fiscal Impact on Howard County from Construction of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	870	$88,200,000	$162,900,00
2nd Round Indirect and Induced Economic Activity	340	$22,800,000	$66,500,000
Total Economic Activity	**1,210**	**$111,000,000**	**$229,400,000**
Fiscal Impact			
Local Tax Revenue			**$3,600,000**

OPERATIONS PHASE

Economic Impact

By again feeding the previously detailed assumptions into the IMPLAN model, we obtain the following estimates of the annual impact once the hypothetical large data center is fully operational. As shown in Table 8, we estimate that on-going operation of the facility would provide a direct annual impact of approximately: 1) 25 full-time-equivalent jobs, 2) $2.8 million in pay and benefits, and 3) $18.5 million in economic output to Howard County.

Taking into account the economic ripple effects that direct impact would generate, we estimate that the annual impact on Howard County would be a total of: 1) 103 jobs, 2) $7.5 million in pay and benefits, and 3) $33.9 million in economic output.

Table 8: Estimated Annual Economic Impact on Howard County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	25	$2,800,000	$18,500,000
2nd Round Indirect and Induced Economic Activity	78	$4,700,000	$15,400,000
Total Economic Activity	**103**	**$7,500,000**	**$33,900,000**

Fiscal Impact

For purposes of our analysis, we assume that the hypothetical large data center would be located in Howard County, but outside of any town or other additional taxing jurisdiction within the county. As a result, only county tax rates apply.

During its ongoing operational phase, the hypothetical data center would provide Howard County with tax revenue from one primary revenue source – real estate taxes. Based on the previously detailed assumptions and published tax rates, as shown in Table 9 we estimate that the proposed facility would generate $4.7 million in new annual revenue for Howard County.

Table 9: Estimated Annual Fiscal Impact on Howard County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Revenue Source	Tax Base	Assessment	Tax Rate	Annual Revenue
Real Estate	$215,000,000	100%[6]	$1.01 per $100[7]	$2,180,000
Personal Property	$250,000,000	40%[8]	$2.54 per $100[9]	$2,535,000
Total Annual Revenue				**$4,715,000**

[6] Data Source: Maryland Department of Assessments and Taxation.
[7] Data Source: Maryland Department of Assessments and Taxation.
[8] Data Source: Maryland Department of Assessments and Taxation. Assumes that personal property would be at the mid-point (*i.e.*, year two) of its depreciation schedule.
[9] Data Source: Maryland Department of Assessments and Taxation.

Potential Economic and Fiscal Impact in Kent County, Maryland

Kent County, Maryland is located near the top of the Eastern Shore of Maryland. It is not part of any of the metropolitan statistical areas that cover other parts of the state. Because of its smaller population, a data center in Kent County would need to draw from surrounding areas for its operational workforce. It is also likely that upgrades would be needed for connectivity and power to support a large data center in the county. Although the economic and fiscal impact from a hypothetical large data center would likely spill over onto surrounding areas, our estimates only address the impact on Kent County specifically.

CONSTRUCTION PHASE

By feeding the assumptions detailed in the "Hypothetical Large Data Center" section into the IMPLAN model, we obtain the following estimates of one-time impact from construction. As shown in Table 10, construction of a hypothetical large data center would directly provide a one-time pulse of approximately: 1) 1,070 jobs, 2) $76.2 million in pay and benefits, and 3) $162.9 million in economic output to Kent County.

Taking into account the economic ripple effects that direct impact would generate, we estimate that the one-time impact on Kent County would be a total of: 1) 1,432 jobs, 2) $93.3 million in pay and benefits, 3) $218.4 million in economic output, and 4) $3.5 million in local fiscal impact.

Table 10: Estimated One-Time Economic and Fiscal Impact on Kent County from Construction of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	1,070	$76,200,000	$162,900,000
2nd Round Indirect and Induced Economic Activity	362	$17,100,000	$55,500,000
Total Economic Activity	**1,432**	**$93,300,000**	**$218,400,000**
Fiscal Impact			
Local Tax Revenue			**$3,500,000**

OPERATIONS PHASE

Economic Impact

By again feeding the previously detailed assumptions into the IMPLAN model, we obtain the following estimates of the annual impact once the hypothetical large data center is fully operational. As shown in Table 11, we estimate that on-going operation of the facility would provide a direct annual impact of approximately: 1) 25 full-time-equivalent jobs, 2) $2.8 million in pay and benefits, and 3) $18.5 million in economic output to Kent County.

Taking into account the economic ripple effects that direct impact would generate, we estimate that the annual impact on Kent County would be a total of: 1) 105 jobs, 2) $6.1 million in pay and benefits, and 3) $32.3 million in economic output.

Table 11: Estimated Annual Economic Impact on Kent County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	25	$2,800,000	$18,500,000
2nd Round Indirect and Induced Economic Activity	80	$3,300,000	$13,800,000
Total Economic Activity	**105**	**$6,100,000**	**$32,300,000**

Fiscal Impact

For purposes of our analysis, we assume that the hypothetical large data center would be located in Kent County, but outside of any town or other additional taxing jurisdiction within the county. As a result, only county tax rates apply.

During its ongoing operational phase, the hypothetical data center would provide Kent County with tax revenue from one primary revenue source – real estate taxes. Based on the previously detailed assumptions and published tax rates, as shown in Table 12 we estimate that the proposed facility would generate $2.2 million in new annual revenue for Kent County.

Table 12: Estimated Annual Fiscal Impact on Kent County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Revenue Source	Tax Base	Assessment	Tax Rate	Annual Revenue
Real Estate	$215,000,000	100%[10]	$1.022 per $100[11]	$2,197,300
Total Annual Revenue				**$2,197,300**

[10] Data Source: Maryland Department of Assessments and Taxation.

[11] Data Source: Maryland Department of Assessments and Taxation.

Potential Economic and Fiscal Impact in Prince George's County, MD

Prince George's County, Maryland borders the eastern side of the District of Columbia and is part of the Washington-Arlington-Alexandria, DC-VA-MD-WV metropolitan statistical area. Operational workforce, connectivity, accessibility, and power would be sufficient to support a large data center in the county.

CONSTRUCTION PHASE

By feeding the assumptions detailed in the "Hypothetical Large Data Center" section into the IMPLAN model, we obtain the following estimates of one-time impact from construction. As shown in Table 13, construction of a hypothetical large data center would directly provide a one-time pulse of approximately: 1) 990 jobs, 2) $79.7 million in pay and benefits, and 3) $162.9 million in economic output to Prince George's County.

Taking into account the economic ripple effects that direct impact would generate, we estimate that the one-time impact on Prince George's County would be a total of: 1) 1,330 jobs, 2) $97.3 million in pay and benefits, 3) $218.8 million in economic output, and 4) $3.0 million in local fiscal impact.

Table 13: Estimated One-Time Economic and Fiscal Impact on Prince George's County from Construction of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	990	$79,700,000	$162,900,000
2nd Round Indirect and Induced Economic Activity	350	$17,600,000	$55,900,000
Total Economic Activity	**1,330**	**$97,300,000**	**$218,800,000**
Fiscal Impact			
Local Tax Revenue			**$3,000,000**

OPERATIONS PHASE

Economic Impact

By again feeding the previously detailed assumptions into the IMPLAN model, we obtain the following estimates of the annual impact once the hypothetical large data center is fully operational. As shown in Table 14, we estimate that on-going operation of the facility would provide a direct annual impact of approximately: 1) 25 full-time-equivalent jobs, 2) $2.8 million in pay and benefits, and 3) $18.5 million in economic output to Prince George's County.

Taking into account the economic ripple effects that direct impact would generate, we estimate that the annual impact on Prince George's County would be a total of: 1) 107 jobs, 2) $6.2 million in pay and benefits, and 3) $32.7 million in economic output.

Table 14: Estimated Annual Economic Impact on Prince George's County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Economic Impact	Employment	Labor Income	Output
1st Round Direct Economic Activity	25	$2,800,000	$18,500,000
2nd Round Indirect and Induced Economic Activity	82	$3,400,000	$14,200,000
Total Economic Activity	**107**	**$6,200,000**	**$32,700,000**

Fiscal Impact

For purposes of our analysis, we assume that the hypothetical large data center would be located in Prince George's County, but outside of any town or other additional taxing jurisdiction within the county. As a result, only county tax rates apply.

During its ongoing operational phase, the hypothetical data center would provide Prince George's County with tax revenue from three primary revenue sources – real estate tax, personal property tax, and an energy tax on electricity consumption. Based on the previously detailed assumptions and published tax rates, as shown in Table 15 we estimate that the proposed facility would generate $5.6 million in new annual revenue for Prince George's County.

Table 15: Estimated Annual Fiscal Impact on Prince George's County from the on-going Operation of a Hypothetical Large Data Center (2020 dollars)

Revenue Source	Tax Base	Assessment	Tax Rate	Annual Revenue
Real Estate	$215,000,000	100%[12]	$1.00 per $100[13]	$2,150,000
Personal Property	$250,000,000	40%[14]	$2.50 per $100[15]	$2,500,000
Energy	96,732,000 kWh[16]		$0.00969	$937,000
Total Annual Revenue				**$5,587,000**

[12] Data Source: Maryland Department of Assessments and Taxation.

[13] Data Source: Maryland Department of Assessments and Taxation.

[14] Data Source: Maryland Department of Assessments and Taxation. Assumes that personal property would be at the mid-point (*i.e.*, year two) of its depreciation schedule.

[15] Data Source: Maryland Department of Assessments and Taxation.

[16] Calculated as $7.4 million in annual expenditures for electricity divided by $0.0765/KWh (the average industrial electricity rate reported for Maryland by the U.S. Energy Information Agency).

Local Benefit to Cost Ratio

Typically, the largest source of local revenue for a county is property taxes, while the largest source of local expenditures is education. As a result, because the data centers need more equipment than they need employees, they provide a high benefit to cost ratio to localities in terms of the tax revenue they generate relative to the government services that they and their employees require. In this section, we quantify what the benefit to cost ratio would be for Baltimore, Howard, Kent, and Prince George's Counties from a hypothetical large data center.

To quantify the budgetary cost that a hypothetical large data center would impose on these counties, we use data from the Maryland Department of Legislative Services on local government finances, in combination with data from the Maryland Department of Education, U.S. Census Bureau, and U.S. Bureau of Labor Statistics to compute the per-employee cost of educational and non-educational county services for data center employees. This approach focuses on the largest costs that any business imposes on a local government – the costs associated with providing primary and secondary education, and other county services, to the employees of that business.

Table 16 details the calculations used to estimate the annual budgetary cost that a hypothetical large data center would impose on each of these four counties. As shown, we estimate those costs to be approximately $171,000 in Baltimore County, $223,000 in Howard County, $165,000 in Kent County, and $193,000 in Prince George's County.

Table 16: Estimated Annual County Service Costs Imposed by Hypothetical Large Data Center Employees

	Baltimore County	Howard County	Kent County	Prince George's County
Direct Data Center Employment	25	25	25	25
Students per Employee[17]	0.29	0.33	0.23	0.40
Per Student County Contribution to K-12 Education Expenditures[18]	$8,698	$11,115	$9,760	$6,434
Total Education Costs[19]	**$62,807**	**$91,247**	**$54,947**	**$64,013**
County Residents per Employee[20]	2.18	1.88	2.42	2.84
Per Resident Non-Education County Expenditures[21]	$1,985	$2,807	$1,823	$1,812
Total Non-Education Costs[22]	**$108,044**	**$131,639**	**$110,492**	**$128,578**
TOTAL COSTS	**$170,851**	**$222,886**	**$165,439**	**$192,592**

As shown in Table 17, combining the estimates of budgetary cost from Table 16 with data from Tables 6, 9, 12, and 15 on the estimated local revenue that would be generated by a hypothetical large data center shows that the local benefit to cost ratio would be:

- 32.9 in Baltimore County. This means that for every $1.00 in county expenditures that the hypothetical large data center was responsible for generating, it would provide approximately $32.90 in tax revenue.
- 21.2 in Howard County. This means that for every $1.00 in county expenditures that the hypothetical large data center was responsible for generating, it would provide approximately $21.20 in tax revenue.

[17] Data Source: Maryland Department of Education and U.S. Bureau of Labor Statistics. Derived by dividing total county K-12 school enrollment in 2018 by total county employment in 2018.

[18] Data Source: Maryland Department of Legislative Services, "Local Government Finances in Maryland," 2019, and Maryland Department of Education. Derived by dividing total county contribution to K-12 educational expenditures in 2018 by total county K-12 school enrollment in 2018.

[19] Calculated as data center employment, times students per employee, times per student local contribution to K-12 education expenditures.

[20] Data Source: U.S. Census Bureau and U.S. Bureau of Labor Statistics. Calculated by dividing total county population in 2018 by total county employment in 2018.

[21] Data Source: Maryland Department of Legislative Services, "Local Government Finances in Maryland," 2019, and U.S. Census Bureau. Derived by dividing total county non-educational expenditures in 2018 by total county population in 2018.

[22] Calculated as data center employment, times county residents per employee, times per resident non-education expenditures.

- 13.3 in Kent County. This means that for every $1.00 in county expenditures that the hypothetical large data center was responsible for generating, it would provide approximately $13.30 in tax revenue.
- 29.0 in Prince George's County. This means that for every $1.00 in county expenditures that the hypothetical large data center was responsible for generating, it would provide approximately $29.00 in tax revenue.

Table 17: Estimated Benefit/Cost Ratio Associated with a Hypothetical Large Data Center

Locality	Estimated Tax Revenue Benefit	Estimated Budgetary Cost	Benefit/Cost Ratio
Baltimore County	$5,628,000	$171,000	32.9
Howard County	$4,715,000	$223,000	21.2
Kent County	$2,197,000	$165,000	13.3
Prince George's County	$5,587,000	$193,000	29.0

Conclusion

Data centers generate millions of dollars in local tax revenue on an annual basis while imposing few costs on local services. Local fiscal benefit-cost ratios for data centers in the four counties considered in this report range from 13-to-1 to almost 33-to-1. Additionally, the construction of a large data center in Maryland would provide work for over a thousand construction workers, while its subsequent operation would support over 100 jobs and provide millions of dollars in local pay and benefits.

JANUARY 2020

NORTHERN VIRGINIA TECHNOLOGY COUNCIL

THE IMPACT OF DATA CENTERS ON THE STATE AND LOCAL ECONOMIES OF VIRGINIA

PREPARED BY

MANGUM economics

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Table of Contents

About Mangum Economics, LLC

Mangum Economics, LLC is a Richmond, Virginia based firm that specializes in producing objective economic, quantitative, and qualitative analysis in support of strategic decision making. Much of our recent work relates to IT & Telecom Infrastructure (data centers, terrestrial and subsea fiber), Renewable Energy, and Economic Development. Examples of typical studies include:

POLICY ANALYSIS

Identify the intended and, more importantly, unintended consequences of proposed legislation and other policy initiatives.

ECONOMIC IMPACT ASSESSMENTS AND RETURN ON INVESTMENT ANALYSES

Measure the economic contribution that businesses and other enterprises make to their localities.

WORKFORCE ANALYSIS

Project the demand for, and supply of, qualified workers.

CLUSTER ANALYSIS

Use occupation and industry clusters to illuminate regional workforce and industry strengths and identify connections between the two.

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About the Northern Virginia Technology Council

The Northern Virginia Technology Council (NVTC) is the regional voice of technology, representing a diverse and thriving technology ecosystem, promoting innovation, and convening, educating, and advocating for the region's technology community.

NVTC is the membership and trade association for the technology community in Northern Virginia. As the largest technology council in the nation, NVTC serves about 1,000 companies and organizations, including businesses from all sectors of the technology industry, service providers, universities, foreign embassies, non-profit organizations and government agencies. Through its member companies, NVTC represents about 300,000 employees in the region. NVTC provides its members with:

- Over 150 networking and educational events per year.
- Comprehensive member benefit services.
- Public policy advocacy on a broad range of technology issues at the state and regional levels, with involvement in federal issues as they relate to workforce and education concerns.
- Community service opportunities through involvement in community projects and philanthropy.

NVTC's Data Center and Cloud Committee provides a clear, consistent, collective and compelling voice for promoting the interests of the region's growing data center, cloud, and critical infrastructure community to contribute to the long-term growth and prosperity of the industry. The committee:

- Promotes the interests of anyone with a stake in ensuring that Northern Virginia continues to be a leading global destination not just for data centers but also for the wider ecosystem that relies on the data center as the commerce platform of the 21st century.
- Provides educational and training programming for its members and provides forums for thought leadership and the sharing of best practices.
- Leads efforts to identify the needs of the future workforce and advocates for industry-specific education programming.
- Informs the community of the industry's vital role as a contributor to today's technology-led economy and a major factor in the prosperity and economic stability of the region.
- Works to ensure the sustainability of the industry by thoughtfully discussing potential barriers to growth and acts as an advocate for policies that prompt the overall health of the industry.
- Addresses the short- and long-term competitiveness of the data center industry in Virginia.
- Bolsters the data center and critical infrastructure industry through public policy advocacy.
- Promotes initiatives to increase data center investment and expansion throughout Virginia.

Acknowledgements

This report was made possible in part by the unique data supplied by the Loudoun County Department of Economic Development (especially, Alex Gonski and Buddy Rizer), the Prince William County Department of Economic Development (especially, Allisha Abraham, Thomas Flynn, and Jim Gahres), and the Virginia Economic Development Partnership (especially, Brian Kroll).

Executive Summary

Northern Virginia is the largest data center market in the world, but the data center industry has an important footprint in every part of the Commonwealth of Virginia. Central Virginia and Hampton Roads each account for almost ten percent of overall industry employment in the state. Data center industry pay has increased twice as fast as the statewide average since 2001.

We estimate 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.

Taking into account the economic ripple effects that direct investment generated, we estimate 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.

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. 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. We estimate that in 2018, data centers were directly and indirectly responsible for generating $600.1 million in state and local tax revenue in Virginia.

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. For example, we estimate 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.
- $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.

In June of 2019, Virginia's Joint Legislative Audit and Review Commission (JLARC) published an evaluation of the state's data center sales and use tax incentive. JLARC found that 90 percent of the data center investment made by the companies that received the sales and use tax exemption would not have occurred in the state of Virginia without the incentive. Instead, that data center investment would have occurred in other states. So, the "cost" of the State data center incentive is only 10 percent of the amount of State sales tax revenue exempted. In fact, in 2017, the data center tax incentive generated

$1.09 of State tax revenue for every dollar that it exempted; and in 2016, the incentive was revenue neutral. Since 2013, after the General Assembly significantly revised the Virginia data center incentive, the State has recovered 75 cents of every dollar of potential tax revenue that it exempted. In the process it created thousands of Virginia jobs with billions of dollars in pay and benefits and billions of dollars in economic activity throughout the state.

Virginia is one of 31 states that actively offer incentives to attract data centers to locate in their states. Several states are in the process of revising their incentives to remain competitive. Virginia's data center incentive is one of the most restrictive in the country. Of the 31 states that actively offer data center incentives, only 11 require a minimum number of new jobs to qualify for an incentive, and only Virginia, Mississippi, and Nevada require the creation of 50 or more new jobs.

Virginia's data center incentive has been important in the spread of technology industries across the Commonwealth and in attracting smaller data centers that do not qualify for the incentive to invest in the state as well. Recently several localities have reduced their local property tax rates in order to attract data centers to support their economies.

Introduction to Data Centers in Virginia

Life is increasingly digitized, and our digitized lives are stored, secured, processed, enhanced, and distributed by data centers. Our finances, communications, health care, recreation, entertainment, education, transportation, work, and social lives are often and increasingly online. Data centers are more than just the redundant warehouses for our digital lives. They are also the generators of much of the interactive digital content that we use. The personalized shopping recommendations; the on-the-fly driving directions; the online assistance selecting a restaurant, hotel, plane flight; the digital grocery coupons; the machine responses to banking and billing inquiries, etc. are all provided by data centers.

In 2012, IBM published an estimate that 90 percent of all data have been created in the last two years.[1] In other words, at that time, the total amount of data was increasing by ten times every two years. At that rate, from 2010 to 2020 the total amount of data has increased by 100,000 times. Now consider that the IBM estimate was made prior to the widespread adoption of commercial connected sensors and smart consumer appliances. The expansion of artificial intelligence, machine learning, and augmented reality are all putting increasing demands on data centers. So, it is quite likely that the rate of growth of data is even greater than in 2012. We have not yet reached "peak data center."

In addition, with the rollout of 5G technology to wireless networks, the shape of the industry will change. Edge data centers that are relatively smaller than large cloud data centers will need to be located near places where people congregate and move. However, edge data centers will not be substitutes for large enterprise data centers or cloud data centers. Instead, edge data centers will be constructed as a complement to large data centers as the data center industry continues to grow and evolve to meet the demands of new technology.

Because data centers use large amounts of costly electricity and water, they have emerged as leading innovators at the forefront of increasing operational efficiency in the use of energy and water.[2] Among other innovations, data centers have used digitization, advanced sensors, and machine learning (within data centers) to dramatically reduce energy and water consumption. For example, Google has been able to reduce the amount of energy used for cooling in its data centers by up to 40 percent, reducing overall energy usage in its data centers by 15 percent on top of previous efficiency enhancements.[3] Data center companies have also made large commitments to the purchase of energy from renewable sources here in Virginia and nationwide. For utility companies to move to different and initially costlier sources of renewable power, they need this kind of commitment to provide a stable demand to ensure that the large upfront investments that are required are financially sustainable.

This report quantifies the significant contribution that this dynamic and rapidly evolving industry makes to the state of Virginia and its localities.

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[1] David Greer, "System z Helps Address the Data Analytics Power Crunch," *IBM Systems magazine*, April 2012.
[2] https://www.osti.gov/servlets/purl/1372902/
[3] https://deepmind.com/blog/article/deepmind-ai-reduces-google-data-centre-cooling-bill-40

ECONOMIC PROFILE OF DATA CENTERS IN VIRGINIA

Virginia now has data centers located throughout the state, from Wise County in Southwestern Virginia and Harrisonburg in the Valley to Mecklenburg County in Southern Virginia, Virginia Beach in Hampton Roads, and Henrico County in Central Virginia to Loudoun County in Northern Virginia, and other localities. This report shows how the data center industry in every part of the state makes an important economic contribution to employment and taxes in every region and to the state as a whole. However, we begin with an update on the remarkable data center market in Northern Virginia.

The Northern Virginia Data Center Market in 2019

Northern Virginia has the largest data center market in the world. According to the latest data from CBRE[4], measured in megawatts (MW) of power capacity, Northern Virginia has more data center inventory than the 6th through the 15th largest markets (New York Tri-State, Atlanta, Austin-San Antonio, Houston, Southern California, Seattle, Denver, Boston, Charlotte-Raleigh, and Minneapolis) combined and almost as much as the 2nd, 3rd, 4th and 5th largest markets (Dallas-Fort Worth, Silicon Valley, Chicago, and Phoenix) combined.

The large capacity of Northern Virginia's data center market is matched by its growth. Twenty-two percent of the total data center capacity in Northern Virginia was added between the second half of 2018 and the first half of 2019.

The growth in the Northern Virginia data center market has not only served technology, data center, and data dependent companies, but construction companies.

Northern Virginia's place at the top of the data center market is a relatively recent development. In 2016, Northern Virginia had just supplanted the New York market as the largest data center market in the United States. In 2017, the New York Tri-State area had fallen to the sixth largest data center market. A 2011 report on the data center market in the United States contains only one mention of Virginia in four pages – "Reston, VA has excess supply and new construction will be minimal for a few years."[5] The locations that were highlighted as important in the industry were Chicago, Silicon Valley, Southern California, Phoenix, New York, St. Louis, Washington State, Boston, Minneapolis, Denver, and Charlotte. Regarding what has become the second largest data center market, the report says, "Dallas has excess capacity and growth remains slow."

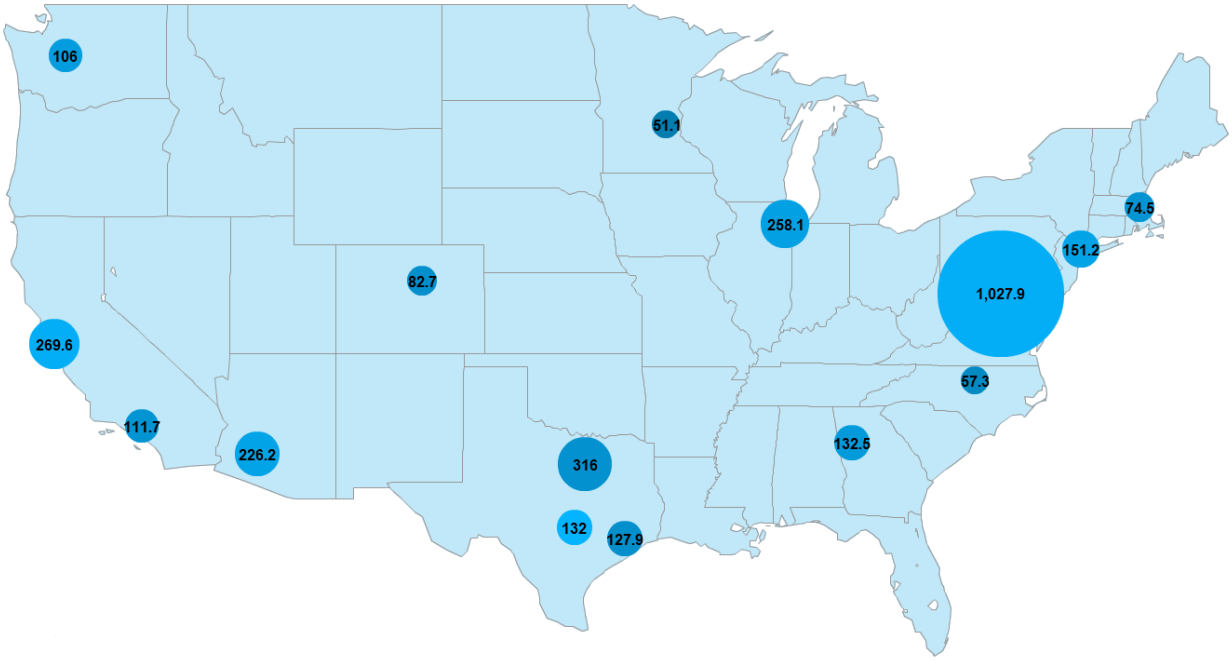
This illustrates the fluid nature of the data center industry and the speed with which market conditions can change in the industry. Once hot markets can cool off rapidly. A year ago, the data center market in Phoenix had enormous growth, but between the second half of 2018 and the first half of 2019, Phoenix saw net outflows of 26.5 MW worth of tenants, which is almost the same amount that Northern Virginia

[4] CBRE, *Large Supply Pipeline Sets Stage for Market Growth in 2019 North American Data Center Report H1 2019*.
[5] ESD (Environmental Systems Design, Inc.), *2011 Data Center Technical Market Report*. February 2011.

added in the same period.[6] The computer equipment in data centers is replaced on average every three years. Should circumstances require it, data center tenants can move from one location to another and leave significant vacancies in colocation data centers.

Figure 1 shows the top 15 largest data center markets in the United States. The area of each circle indicates the relative amount of power capacity (MW labeled in black) in each market. Brighter blue circles indicate markets with higher occupancy rates, with Austin-San Antonio, Silicon Valley, and Northern Virginia having occupancy rates of about 96 to 93 percent (in order of occupancy).

Figure 1. Relative Sizes of Largest Data Center Markets (megawatts of power capacity) – 2019[7]

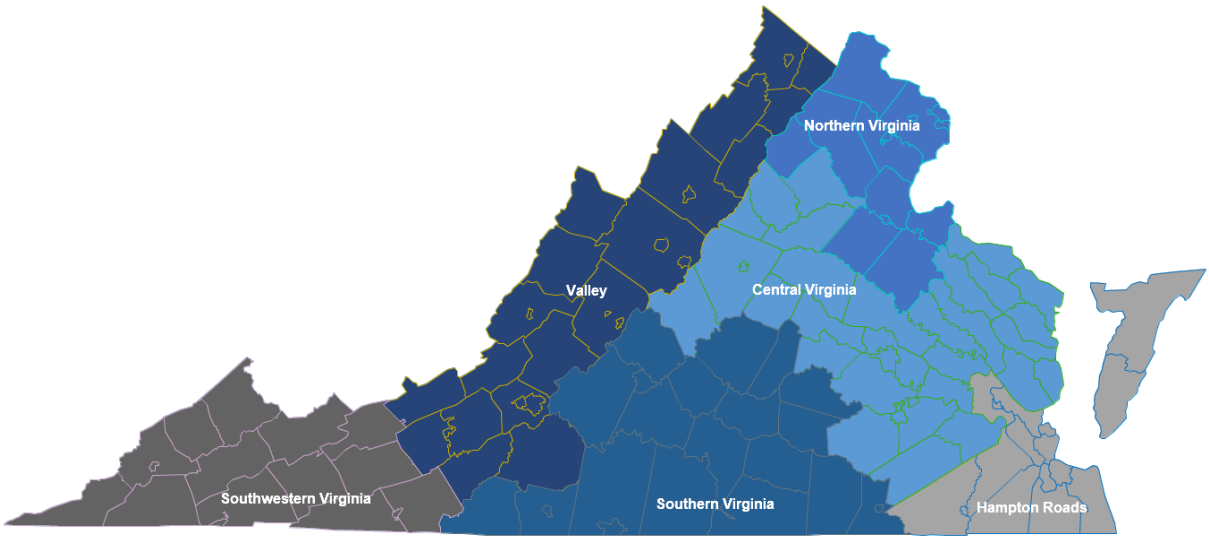


[6] CBRE, *Large Supply Pipeline Sets Stage for Market Growth in 2019 North American Data Center Report H1 2019*.
[7] CBRE, *Large Supply Pipeline Sets Stage for Market Growth in 2019 North American Data Center Report H1 2019*.

The Regional Distribution of Data Centers in Virginia

The Virginia Economic Development Partnership (VEDP) provided data on the private sector Data Processing, Hosting, and Related Services industry (as defined by the U.S. Bureau of Labor Statistics) for this economic profile.[8] VEDP divided the statewide data into six sub-state regions depicted in Figure 2.

Figure 2. Six Sub-State Regions Defined by the Virginia Economic Development Partnership

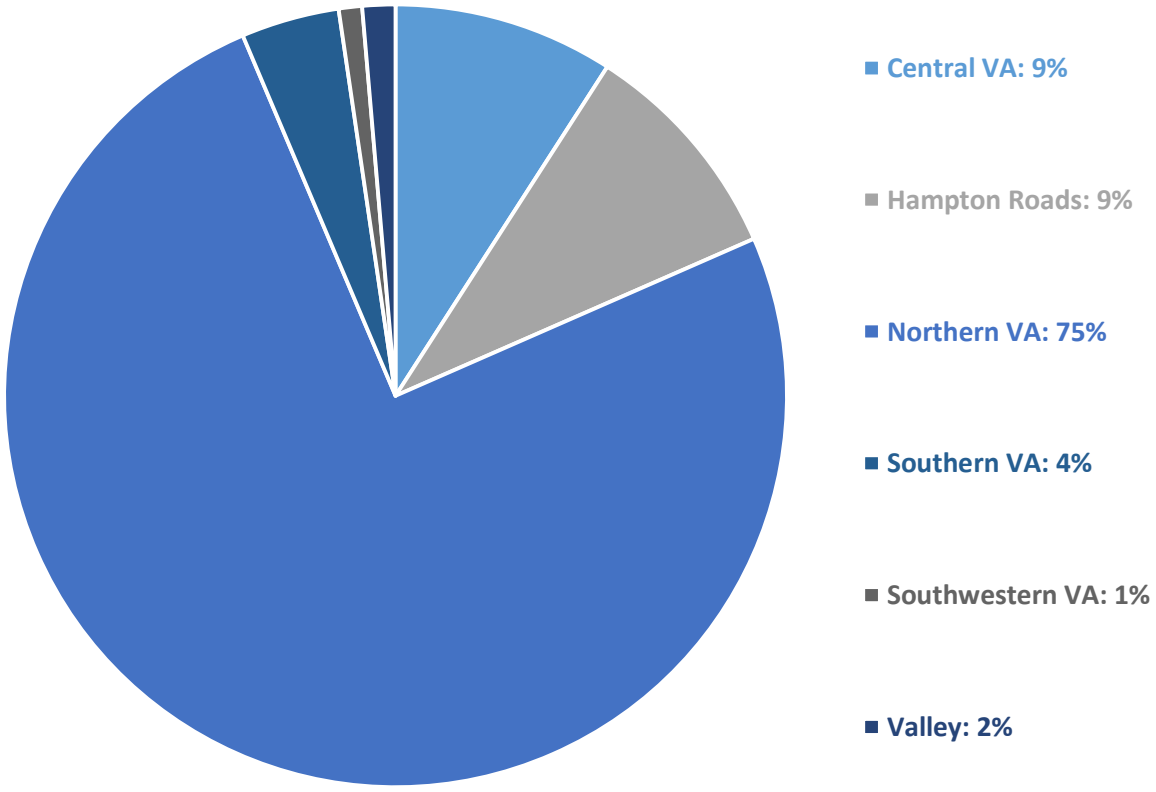


According to VEDP, in 2018, the private sector data center industry employed 14,644 people (full-time equivalents) statewide.

[8] As is common practice, we use the Data Processing, Hosting, and Related Services industry as defined by the U.S. Bureau of Labor Statistics as a proxy for the data center industry. The data and methods applied in this report are described in the separate accompanying Appendix.

Figure 3 shows the regional distribution of that employment. Seventy-five percent of data center employment was located in Northern Virginia. However, industry employment was distributed across other regions of the Commonwealth, as well. Central Virginia and Hampton Roads accounted for nine percent of data center jobs each. Southern Virginia (home to Microsoft's Boydton data center campus, the east coast hub for Microsoft Azure) accounted for four percent of private sector data center employment, one percent of industry employment was in Southwestern Virginia, and two percent was in the Valley.

Figure 3. Regional Distribution of Private Sector Data Center Employment in Virginia in 2018[9]



The Upward Trend in Virginia's Data Center Industry

Data center employment in Virginia generally declined between 2004 and 2012, but it has since escalated rapidly to 14,644 jobs in 2018.[10] That change to the uptrend in employment that began in 2012 coincides with the year that Virginia significantly revised its data center incentive to make it more competitive with other states in attracting data centers. More detail on the employment trends in the industry is included in the separate Appendix that accompanies this report.

[9] Data Source: Virginia Economic Development Partnership.
[10] Data Source: Virginia Economic Development Partnership.

The High-Performance Data Center Industry in Virginia

One of the key characteristics of the data center industry is that it is extremely capital intensive. In other words, the industry employs a relatively small number of highly skilled and highly paid people to operate and maintain a very large amount of very expensive equipment. Therefore, it is useful to also look at trends in private sector average annual wages in the industry.

Between 2001 and 2018 the average annual private sector wage in the data center industry in Virginia grew from $61,310 to $126,050 – a 106 percent increase.[11] In comparison, over the same period average private wages across all industries in Virginia went from $36,525 to $57,846 – an increase of 58 percent.[12] In other words, over the 18-year period, the average private sector employee of a Virginia data center saw their gross income go up almost twice as fast as the average private sector employee in Virginia. More detail on the employment trends in the industry is included in the separate Appendix that accompanies this report.

This combination of steadily rising employment and rapidly rising wages make the data center industry one of Virginia's most high-performance industries and an important (and growing) contributor to a strong and robust state economy. Moreover, in a state such as Virginia where roughly two-thirds of state revenue comes from personal income tax, high growth/high wage industries such as the data center industry also play a disproportionate role in ensuring the health of the State's budget.

The Impact of Data Centers on Virginia State and Local Economies

The construction and ongoing operation of data centers in Virginia has large, broad effects across the state economy. In this section, we estimate the statewide economic impact that the data center industry has on Virginia, as well as in each of the six sub-state regions detailed earlier. To empirically evaluate the statewide and regional economic impact attributable to the data center industry, we employ a commonly used regional economic impact model called IMPLAN Pro.[13] The methodology for modeling the economic impact of data centers is explained in more detail in the separate Appendix that accompanies this report.

Regional economic impact modeling measures the ripple effects that an expenditure generates as it makes its way through the economy. For this report, spending by the data center industry in Virginia has a direct economic impact on the state economy in terms of people hired as data center employees, employee pay and benefits, and economic activity in the region for utilities, construction, and equipment. That direct spending by the data centers creates the first ripple of economic activity.

[11] Data Source: Virginia Economic Development Partnership.
[12] Data Source: U.S. Bureau of Labor Statistics.
[13] IMPLAN Pro is produced by IMPLAN Group, LLC.

As data center employees and businesses (like construction contractors for data centers, power companies that supply data centers, and data center equipment suppliers) spend the money that they were paid by data center companies, they create another *indirect* ripple of economic activity that is part of the second-round effects of the data center industry.

There are many Virginia businesses that are part of the data center supply chain. To illustrate some of the types of companies located in Virginia that benefit from the data center industry in Virginia and that, in turn, generate economic activity in the state, in Table 1 we list a few different types of businesses in the Virginia data center supply chain. The list of businesses in Table 1 is not an endorsement, promotion, or commendation of them, and it is far from a complete list of companies. We only provide it to illustrate some of the types of businesses that are part of the second ripple effect of economic activity related to spending by data centers.

Table 1. Some Businesses Serving Virginia Data Centers

Company	Line of Business
Anord Mardix	data center power distribution and management products and services
Compu Dynamics	data center design, construction, optimization, and maintenance
Fulcrum Collaborations	data center facilities management cloud-based platform
Hanley Energy	data center energy management services
Interglobix	data center and fiber interconnectivity consulting and marketing
Metro Fiber Networks	carrier-neutral fiber connecting Virginia Beach to Henrico data centers
Power Distribution Incorporated	data center power transformation, distribution, and monitoring
Rosendin Electric	data center design and construction services
Submer	data center IT hardware immersion cooling
Technoguard	data center materials, cleaning, decontamination, and disaster recovery
Timmons Group	data center site certification and development
Windward Consulting	data center management consulting

In addition to the economic effects in the Virginia state and local economies of the data center-to-other business transactions, there are also the second-round economic effects associated with data center employee-to-business transactions that ripple through local economies. These effects occur when data center employees buy groceries; pay rent; go out for dinner, entertainment, or other recreation; pay for schooling in Virginia; or make other local purchases. Additionally, there are the second-round economic effects of business-to-business transactions between the direct vendors to data centers and their suppliers.

The total impact is simply the sum of the first round direct and second round impacts. These categories of impact are then further defined in terms of employment (the jobs that are created), labor income (the pay and benefits associated with those jobs), and economic output (the total amount of economic activity that is created in the economy).

VIRGINIA STATEWIDE

We estimate that in 2018 the data center industry in Virginia directly provided approximately:

- 14,644 full-time-equivalent jobs,
- $1.9 billion in associated employee pay and benefits, and
- $4.5 billion in economic output.

Taking into account the economic ripple effects generated by that direct impact, we estimate 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 employee pay and benefits, and
- $10.1 billion in economic output.

Table 2. Economic Impact of the Data Center Industry in Virginia in 2018 (2018 dollars)

1st Round Direct Effects	Jobs	Pay	Economic Output
Data Centers	14,644[14]	$1,908,963,000	$4,541,390,000
2nd Round Indirect and Induced Effects[15]			
Operations	23,796	$1,223,797,000	$4,566,184,000
Healthcare	1,932	$152,433,000	$292,468,000
Construction	4,918	$263,018,000	$690,126,000[16]
Total Impact			
Total Economic Impact in Virginia Statewide[17]	**45,290**	**$3,548,212,000**	**$10,090,168,000**

[14] Data Source: Virginia Economic Development Partnership.
[15] The methodology for estimating and characterizing 2nd round effects is described in detail in the separate Appendix that accompanies this report.
[16] Derived from Virginia Economic Development Partnership Announcements.
[17] The statewide estimates of jobs, pay, and economic output is larger than the sum of the individual regional estimates reported separately in the following tables because the regional totals only register jobs, pay, and economic output in a region caused by the direct data center investment in the same region. The regional amounts do not count jobs, pay, and economic output generated in one region caused by direct data center investment that occurred in another region.

CENTRAL VIRGINIA

We estimate that in 2018 the data center industry in Central Virginia directly provided approximately:

- 1,275 full-time-equivalent jobs,
- $141.5 million in associated employee pay and benefits, and
- $341.4 million in economic output.

Taking into account the economic ripple effects generated by that direct impact, we estimate that the total impact on Central Virginia from the data center industry in 2018 was approximately:

- 5,248 full-time-equivalent jobs,
- $347 million in associated employee pay and benefits, and
- $1 billion in economic output.

Table 3. Economic Impact of the Data Center Industry in Central Virginia in 2018 (2018 dollars)

1st Round Direct Effects	Jobs	Pay	Economic Output
Data Centers	1,275[18]	$141,500,000	$341,382,000
2nd Round Indirect and Induced Effects[19]			
Operations	2,042	$105,729,000	$407,868,000
Healthcare	144	$11,812,000	$22,584,000
Construction	1,787	$87,949,000	$244,267,000[20]
Total Impact			
Total Economic Impact in Central Virginia	**5,248**	**$346,990,000**	**$1,016,102,000**

[18] Data Source: Virginia Economic Development Partnership.
[19] The methodology for estimating and characterizing 2nd round effects is described in detail in the separate Appendix that accompanies this report.
[20] Derived from Virginia Economic Development Partnership Announcements.

HAMPTON ROADS

We estimate that in 2018 the data center industry in Hampton Roads directly provided approximately:

- 1,322 full-time-equivalent jobs,
- $72.6 million in associated employee pay and benefits, and
- $329.4 million in economic output.

Taking into account the economic ripple effects generated by that direct impact, we estimate that the total impact on Hampton Roads from the data center industry in 2018 was approximately:

- 3,510 full-time-equivalent jobs,
- $166.2 million in associated employee pay and benefits, and
- $667.6 million in economic output.

Table 4. Economic Impact of the Data Center Industry in Hampton Roads in 2018 (2018 dollars)

1st Round Direct Effects	Jobs	Pay	Economic Output
Data Centers	1,322[21]	$72,565,000	$329,362,000
2nd Round Indirect and Induced Effects[22]			
Operations	1,804	$73,436,000	$287,200,000
Healthcare	76	$5,466,000	$10,764,000
Construction	309	$14,775,000	$40,288,000[23]
Total Impact			
Total Economic Impact in Hampton Roads	**3,510**	**$166,241,000**	**$667,614,000**

[21] Data Source: Virginia Economic Development Partnership.
[22] The methodology for estimating and characterizing 2nd round effects is described in detail in the separate Appendix that accompanies this report.
[23] Derived from Virginia Economic Development Partnership Announcements.

NORTHERN VIRGINIA

We estimate that in 2018 the data center industry in Northern Virginia directly provided approximately:

- 10,663 full-time-equivalent jobs,
- $1.6 billion in associated employee pay and benefits, and
- $3.5 billion in economic output.

Taking into account the economic ripple effects generated by that direct impact, we estimate that the total impact on Northern Virginia from the data center industry in 2018 was approximately:

- 28,196 full-time-equivalent jobs,
- $2.6 billion in associated employee pay and benefits, and
- $6.9 billion in economic output.

Table 5. Economic Impact of the Data Center Industry in Northern Virginia in 2018 (2018 dollars)

1st Round Direct Effects	Jobs	Pay	Economic Output
Data Centers	10,663[24]	$1,554,239,000	$3,517,485,000
2nd Round Indirect and Induced Effects[25]			
Operations	13,692	$786,373,000	$2,744,347,000
Healthcare	1,397	$121,517,000	$221,932,000
Construction	2,445	$163,753,000	$382,561,000[26]
Total Impact			
Total Economic Impact in Northern Virginia	**28,196**	**$2,625,883,000**	**$6,866,325,000**

The Northern Virginia Community College Programs

Northern Virginia Community College (NOVA) has developed programs to help address the challenges that data centers in the Northern Virginia area have meeting their staffing needs. Amazon Web Services (AWS) has a paid apprenticeship program at the NOVA.[27] In December 2018, the program graduated its first students into full-time Associate Cloud Consultant jobs with AWS.

NOVA also has a 2-year Associate of Applied Science program to train Datacenter Operations Technicians.[28] The program includes lab training at a training data center that the State of Virginia built on the NOVA-Loudoun Campus. The program started with 19 students in its very first year, almost half of them have already found internships or full-time jobs in Northern Virginia data centers or full-time jobs with companies that work for data centers.

[24] Data Source: Virginia Economic Development Partnership.
[25] The methodology for estimating and characterizing 2nd round effects is described in detail in the separate Appendix that accompanies this report.
[26] Derived from Virginia Economic Development Partnership Announcements.
[27] NOVA, "Amazon and Northern Virginia Community College Announce Graduation of the First Veteran Technical Apprenticeship Cohort on the East Coast," December 12, 2018.
[28] NOVA 2019-2020 Catalog, Engineering Technology: Data Center Operations Specialization, A.A.S.

SOUTHERN VIRGINIA

We estimate that in 2018 the data center industry in Southern Virginia directly provided approximately:

- 568 full-time-equivalent jobs,
- $33 million in associated employee pay and benefits, and
- $137.2 million in economic output.

Taking into account the economic ripple effects generated by that direct impact, we estimate that the total impact on Southern Virginia from the data center industry in 2018 was approximately:

- 1,236 full-time-equivalent jobs,
- $57.5 million in associated employee pay and benefits, and
- $237.4 million in economic output.

Table 6. Economic Impact of the Data Center Industry in Southern Virginia in 2018 (2018 dollars)

1st Round Direct Effects	Jobs	Pay	Economic Output
Data Centers	568[29]	$33,030,000	$137,223,000
2nd Round Indirect and Induced Effects[30]			
Operations	637	$22,286,000	$96,006,000
Healthcare	32	$2,228,000	$4,159,000
Construction[31]			
Total Impact			
Total Economic Impact in Southern Virginia	**1,236**	**$57,544,000**	**$237,388,000**

[29] Data Source: Virginia Economic Development Partnership.
[30] The methodology for estimating and characterizing 2nd round effects is described in detail in the separate Appendix that accompanies this report.
[31] VEDP registered no data center investment announcements in 2018 in Southern Virginia, and therefore we do not estimate construction activity in the area. However, it is important to note that we attribute construction only to the first year of an announcement and, unlike ongoing data center operations, construction is episodic. For example, we estimate that as recently as 2016, Southern Virginia enjoyed approximately $50 million in data center construction. This estimate may actually understate the actual economic impact of data center construction.

SOUTHWESTERN VIRGINIA

We estimate that in 2018 the data center industry in Southwestern Virginia directly provided approximately:

- 135 full-time-equivalent jobs,
- $8.6 million in associated employee pay and benefits, and
- $28.9 million in economic output.

Taking into account the economic ripple effects generated by that direct impact, we estimate that the total impact on Southwestern Virginia from the data center industry in 2018 was approximately:

- 257 full-time-equivalent jobs,
- $13.1 million in associated employee pay and benefits, and
- $45.8 million in economic output.

Table 7. Economic Impact of the Data Center Industry in Southwestern Virginia in 2018 (2018 dollars)

1st Round Direct Effects	Jobs	Pay	Economic Output
Data Centers	135[32]	$8,552,000	$28,869,000
2nd Round Indirect and Induced Effects[33]			
Operations	113	$3,940,000	$15,787,000
Healthcare	8	$532,000	$1,031,000
Construction	1	$27,000	$80,000[34]
Total Impact			
Total Economic Impact in Southwestern Virginia	**257**	**$13,051,000**	**$45,767,000**

[32] Data Source: Virginia Economic Development Partnership.
[33] The methodology for estimating and characterizing 2nd round effects is described in detail in the separate Appendix that accompanies this report.
[34] Derived from Virginia Economic Development Partnership Announcements. However, it is important to note that we attribute construction only to the first year of an announcement and, unlike ongoing data center operations, construction is episodic. This estimate may actually understate the actual economic impact of data center construction.

VALLEY

We estimate that in 2018 the data center industry in the Valley directly provided approximately:

- 191 full-time-equivalent jobs,
- $14.3 million in associated employee pay and benefits, and
- $46.1 million in economic output.

Taking into account the economic ripple effects generated by that direct impact, we estimate that the total impact on the Valley from the data center industry in 2018 was approximately:

- 461 full-time-equivalent jobs,
- $24.9 million in associated employee pay and benefits, and
- $86.6 million in economic output.

Table 8. Economic Impact of the Data Center Industry in the Valley in 2018 (2018 dollars)

1st Round Direct Effects	Jobs	Pay	Economic Output
Data Centers	191[35]	$14,255,000	$46,088,000
2nd Round Indirect and Induced Effects[36]			
Operations	255	$9,555,000	$38,439,000
Healthcare	15	$1,046,000	$2,041,000
Construction[37]			
Total Impact			
Total Economic Impact in the Valley	**461**	**$24,856,000**	**$86,568,000**

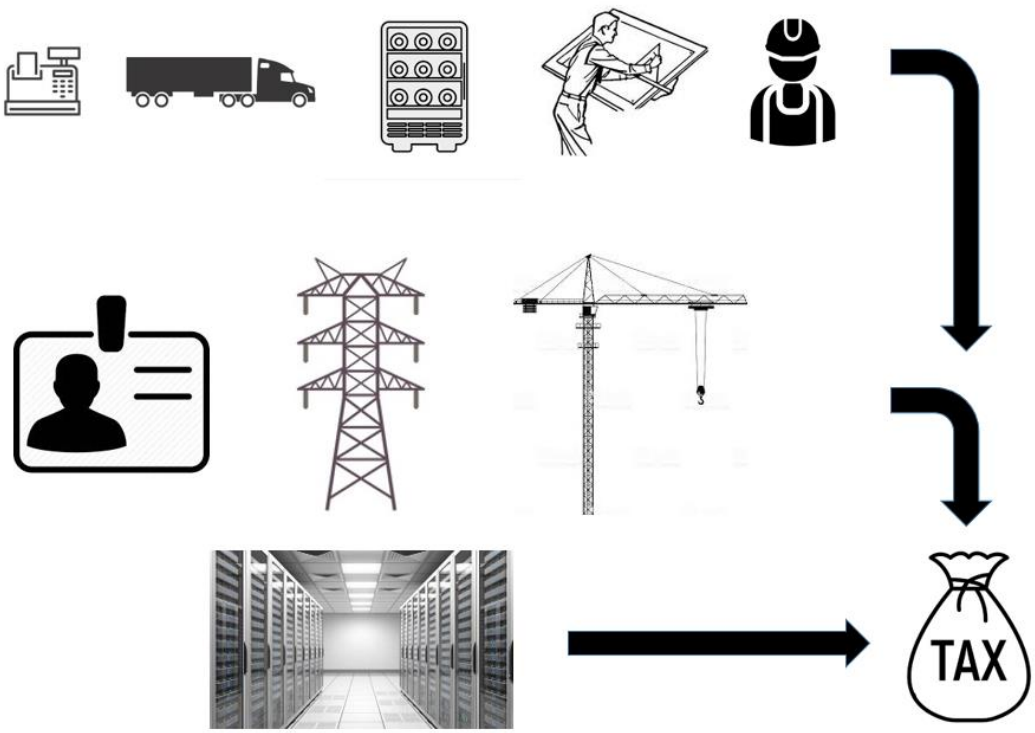
[35] Data Source: Virginia Economic Development Partnership.
[36] The methodology for estimating and characterizing 2nd round effects is described in detail in the separate Appendix that accompanies this report.
[37] No data center investment announcements were made in 2018 in the Valley. However, it is important to note that we attribute construction only to the first year of an announcement and, unlike ongoing data center operations, construction is episodic. This estimate may actually understate the actual economic impact of data center construction.

State and Local Taxes Generated by Data Centers in Virginia

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. All data centers (large and small) pay state employer withholding taxes and corporate income tax. At the local level, both large and small data centers pay real estate taxes, tangible personal property taxes, business license taxes, and industrial utilities taxes. Additionally, many data centers still must pay state sales and use taxes on their purchases of data center equipment because they are not large enough to qualify for the Virginia data center incentive.

In addition to the taxes that data centers pay directly, the economic activity that they generate also results in additional tax collections. Figure 4 illustrates the sources of tax revenues associated with data centers. On the bottom row, data centers pay taxes directly to federal, state, and local governments. On the second row, the employees and business suppliers that are paid directly by the data centers also pay taxes; and, additionally, on the third row, the people and businesses that are paid by the employees and suppliers of data centers pay taxes. All of these sources of tax revenue are included in the tax revenue estimates described in this report.

Figure 4. Sources of Tax Revenue Associated with Data Centers



STATEWIDE AND REGIONAL TAX COLLECTIONS ASSOCIATED WITH DATA CENTERS

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. Table 9 shows our estimates of the taxes directly and indirectly generated by the data center industry statewide in Virginia and in each of the six sub-state regions in 2018 through that first round and second round economic activity.

We estimate that in 2018, data centers were directly and indirectly responsible for generating $600.1 million in state and local tax revenue in Virginia.

Table 9. Tax Revenue Directly and Indirectly Generated by the Data Centers Industry in Virginia in 2018

Region	State and Local Taxes Collected	Federal Taxes Collected	Total Taxes Collected
Central Virginia	$37,231,000	$83,069,000	$120,300,000
Hampton Roads	$21,260,000	$38,624,000	$59,885,000
Northern Virginia	$460,534,000	$587,517,000	$1,048,051,000
Southern Virginia	$7,823,000	$13,643,000	$21,466,000
Southwestern Virginia	$1,469,000	$2,945,000	$4,414,000
Valley	$2,985,000	$5,745,000	$8,731,000
Virginia Statewide[38]	**$600,120,000**	**$812,308,000**	**$1,412,428,000**

CONTRIBUTION TO LOCAL GOVERNMENT BUDGETS

Because the data centers need more equipment and utilities than they need employees, the data center industry provides a large amount of property tax revenue for local governments. Additionally, the industry also places downward pressure on overall tax rates, thereby improving the locality's business climate and economic attractiveness.

High Local Benefit to Cost Ratio

Data centers provide a high benefit to cost ratio in terms of the tax revenue they generate relative to the government services that they and their employees require. Loudoun County, Prince William County, and Henrico County are home to the most significant concentrations of data centers in Virginia. County staff in those localities were able to provide us with detailed data on the tax revenue generated by this industry in each locality from real and business personal property taxes.[39] As a result, we are able

[38] The statewide estimates of taxes collected is larger than the sum of the taxes collected in the individual regions separately because the regional totals only register tax revenue in a region caused by the direct data center investment in the same region. The regional amounts do not count taxes generated in one region caused by direct data center investment that occurred in another region.

[39] It should be noted that, of necessity, these estimates exclude BPOL and other local taxes that also apply to the data center industry. As a result, the revenue estimates provided almost certainly under-estimate the actual local tax revenues of the data center industry.

to use those data in combination with data from other sources to compute the benefit to cost ratio associated with the data center industry in each locality.

To quantify the budgetary cost that the data center industry and its employees imposed on these localities in 2018, we use data from the Virginia Department of Education on local elementary and secondary education expenditures per student, and data from the Virginia Auditor of Public Accounts on local non-education expenditures per county resident. This approach focuses on the largest costs that any business imposes on a local government – the costs associated with providing primary and secondary education, and other county services, to the employees of that business.

Table 10 details the calculations used to estimate the budgetary cost that the data center industry and its employees imposed on each of these three counties in 2018. As shown, we estimate those costs to be approximately $400,000 in Henrico County, $17.7 million in Loudoun County, and $2 million in Prince William County.

Table 10. Estimate of Total Budgetary Costs Imposed by the Data Center Industry and Employees in 2018

	Henrico County	Loudoun County	Prince William County
County Private Sector Employment in Data Processing, Hosting, and Related Services in 2018[40]	115	2,278	241
Students per Employee[41]	0.27	0.48	0.69
Per Student County Education Expenditures[42]	$4,852	$10,069	$5,296
Total Education Costs[43]	**$150,000**	**$11,005,000**	**$886,000**
County Residents per Employee[44]	1.72	2.41	3.59
Per Resident Non-Education County Expenditures[45]	$1,477	$1,216	$1,294
Total Non-Education Costs[46]	**$292,000**	**$6,667,000**	**$1,120,000**
TOTAL COSTS[47]	**$442,000**	**$17,672,000**	**$2,006,000**

[40] Data Source: U.S. Bureau of Labor Statistics.
[41] Data Source: Virginia Department of Education and U.S. Bureau of Labor Statistics. Derived by dividing total county elementary and secondary school enrollment in 2018 by total county employment in 2018.
[42] Data Source: Virginia Department of Education.
[43] Calculated as county private sector employment in the data center industry in 2018, times students per employee, times per student education expenditures.
[44] Data Source: U.S. Census Bureau and U.S. Bureau of Labor Statistics. Calculated by dividing total county population in 2018 by total county employment in 2018.
[45] Data Source: Virginia Auditor of Public Accounts and U.S. Census Bureau. Derived by dividing total county non-educational expenditures in 2018 by total county population in 2018.
[46] Derived as county private sector employment in the data center industry in 2018, times county residents per employee, times per resident non-education expenditures.
[47] Derived as the sum of total education costs and total non-education costs.

As shown in Table 11, combining the estimates of budgetary cost from Table 9 with data from each of the localities on the local revenue generated by the data center industry shows that in 2018 the benefit/cost ratio associated with the industry was:

- 8.6 in Henrico County. Which means that for every $1.00 in county expenditures that the data center industry was responsible for generating in 2018, it provided approximately $8.60 in tax revenue.
- 15.1 in Loudoun County. Which means that for every $1.00 in county expenditures that the data center industry was responsible for generating in 2018, it provided approximately $15.10 in tax revenue.
- 17.8 in Prince William County. Which means that for every $1.00 in county expenditures that the data center industry was responsible for generating in 2018, it provided approximately $17.80 in tax revenue.

Table 11. Estimated Benefit/Cost Ratio Associated with the Data Center Industry and Employees in 2018

Locality	Estimated Tax Revenue (Benefit)	Estimated Budgetary Cost	Benefit/Cost Ratio
Henrico County	$3,784,000	$442,000	8.6
Loudoun County	$266,623,000	$17,672,000	15.1
Prince William County	$35,802,000	$2,006,000	17.8

Reduces the Tax Burden on Local Residents and Lowers Tax Rates

One of the most useful concepts in economics is the concept of opportunity cost – what is the cost of not doing something? Or in this case, what would have been the cost to these localities if their data centers had not existed in 2018? The obvious answer is that they would not have received the estimated $306.2 million in county tax revenue that this industry provided in 2018. Therefore, in order to maintain county expenditures at the same level, that revenue would have had to come from other sources. The two most likely sources would have been: 1) additional education funding from the state triggered by the negative impact that this loss in tax base would have had on the composite index formula Virginia uses to allocate education funding to localities, and 2) an increase in each county's real property tax rate.

On average, the state of Virginia funds 55 percent of primary and secondary education expenditures, and localities are required to locally fund the remaining 45 percent.[48] But, that local funding percentage is adjusted up or down based on each locality's "ability to pay" as measured by Virginia's composite index formula that takes into account the locality's property tax base, adjusted gross income, and

[48] In actuality, however, baseline local funding percentages are typically higher than 45 percent because of local initiatives.

taxable retail sales. Of these three factors, property tax base receives the highest weight (50 percent) and, therefore, has the largest influence on the final calculation.[49]

The 2018 composite index for Henrico County was 0.4183, for Loudoun County 0.5383 and for Prince William County 0.3783.[50] If we recalculate those indexes to take into account the loss of tax base implied by the $306.2 million loss in tax revenue that would have occurred if the data center industry had not existed in these localities, those indexes fall to 0.4162, 0.5065, and 0.3692 respectively.

As shown in Table 12, according to our estimates, this means that the state would have had to reallocate $55.8 million in state education funding away from other Virginia localities to provide $1 million in additional formula-driven funding to Henrico County, $44.3 million in additional funding to Loudoun County, and $10.5 million in additional funding to Prince William County.

Table 12. Estimated Additional Revenue Required to Compensate for Loss of the Data Center Industry in 2018 by Source

Locality	Revenue Loss	State Education Funding Off-Set	Additional Local Tax Revenue Required from Other Sources
Henrico County	($3,784,000)	$1,043,000	$2,741,000
Loudoun County	($266,623,000)	$44,285,000	$223,338,000
Prince William County	($35,802,000)	$10,465,000	$25,337,000
Total*	**($306,210,000)**	**$55,794,000**	**$250,416,000**

*May not sum due to rounding

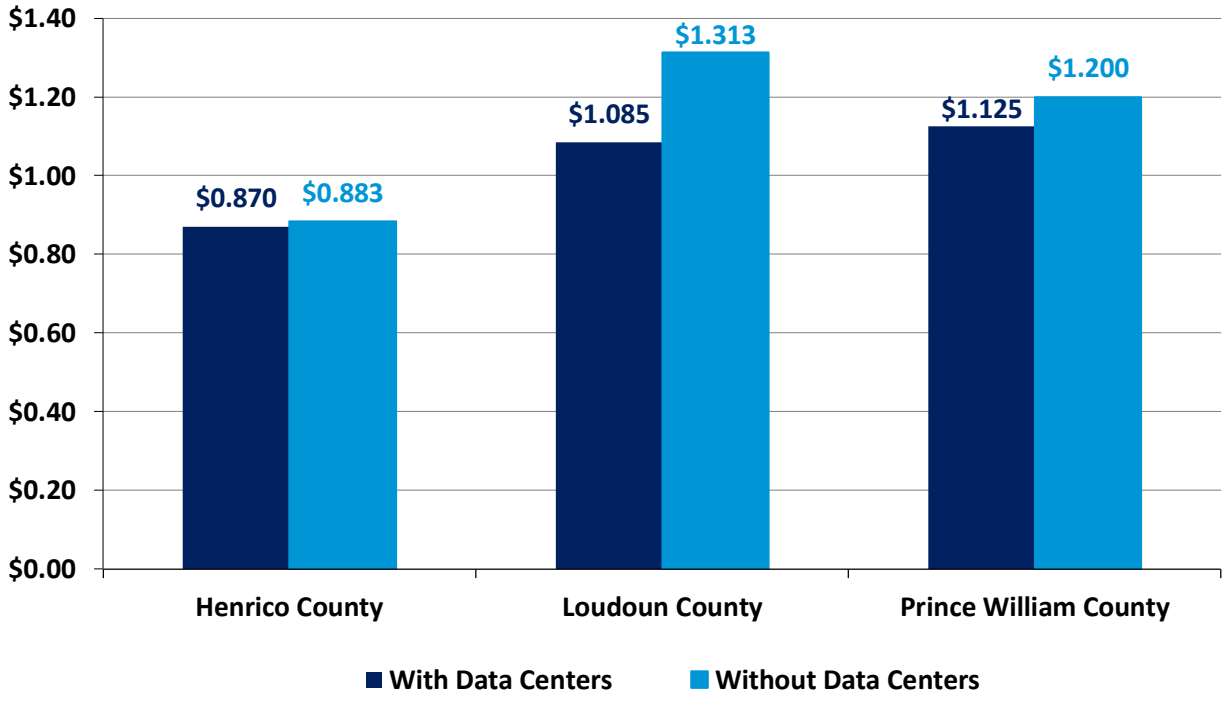
[49] Virginia Department of Education. The actual formula weights each locality's property tax base by 0.5, adjusted gross income by 0.4, and taxable retail sales by 0.1. Each metric is then divided by school population and total population and those per capita figures are divided by the average across all localities to determine ability to pay. The per capita figures are then themselves weighted with each per capita school population metric receiving a weight of 0.66 and each per capita population metric receiving a weight of 0.33.

[50] Virginia Department of Education.

The remaining $250.4 million in lost tax revenue would likely have been made up through increased property taxes (by far the largest source of revenue for most localities). Figure 8 depicts our estimate of the increase in each County's real property tax rates that would have been required to generate this $250.4 million in lost tax revenue. As shown:

- Henrico County's real property tax rate would have likely had to increase from $0.870 per $100 of assessed value to $0.883 (a 1 percent increase),
- Loudoun County's real property tax rate would have likely had to increase from $1.085 per $100 of assessed value to $1.313 (a 21 percent increase), and
- Prince William County's would have likely had to increase from $1.125 per $100 of assessed value to $1.200 (a 7 percent increase).

Figure 5. Estimated County Real Property Tax Rates per $100 of Assessed Value with and without the Data Center Industry



Data Center Incentives in Virginia

Data centers in Virginia can qualify for two types of incentives: those offered by the state of Virginia and those offered by individual localities.

VIRGINIA'S STATE INCENTIVES

At the state level, two incentives are offered: a sales and use tax exemption and a single sales apportionment incentive. According to the Joint Legislative Audit and Review Commission (JLARC), the single sales apportionment incentive has not been used by any data centers as of fiscal year 2017 (the latest year that data is available), so we will not give more attention to it in this report.[51]

The sales and use tax exemption is available to data centers that make a minimum new capital investment of $150 million and that create a minimum of 50 new jobs in a Virginia locality. If the data center is located in an enterprise zone or in a locality with an unemployment rate at least 1.5 times the average statewide unemployment rate, the minimum new job requirement is reduced to 25. Each new job must pay at least 150 percent of the annual average wage in the locality where the data center is located. Tenants of colocation data centers that qualify for the incentive may also receive the sales and use tax exemption. According to the JLARC, as of fiscal year 2017, 24 data centers had qualified for the incentive, plus 135 colocation data center tenants. [52] According to JLARC's latest report, in fiscal year 2018, $86 million of sales and use tax was exempted under the incentive.[53]

JLARC's Evaluation and Findings

In June of 2019, Virginia's Joint Legislative Audit and Review Commission published an evaluation of the state's data center incentive using confidential tax information that is not publicly available.[54]

JLARC found that 90 percent of the data center investment made by the companies that received the sales and use tax exemption would not have occurred in the state of Virginia without the incentive. Instead, that 90 percent of data center investment would have occurred in states other than Virginia. So, the "cost" of the State data center incentive is only 10 percent of the amount of State sales tax revenue exempted. Using the confidential tax information, JLARC estimated the economic and government budgetary impact, not of the total data center industry in Virginia (as we have done in this report), but specifically, of Virginia's data center sales and use tax exemption.[55]

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[51] Joint Legislative Audit and Review Commission, *Data Center and Manufacturing Incentives Economic Development Incentives Evaluation Series*. June 17, 2019. (*JLARC, Data Center Evaluation*)
[52] Joint Legislative Audit and Review Commission, *Data Center and Manufacturing Incentives, Economic Development Incentives Evaluation Series*. June 17, 2019.
[53] Joint Legislative Audit and Review Commission, *Economic Development Incentives 2019, Spending and Performance.* December 16, 2019.
[54] Joint Legislative Audit and Review Commission, *Data Center and Manufacturing Incentives, Economic Development Incentives Evaluation Series*. June 17, 2019.
[55] Appendix N: Results of economic and revenue impact analyses.

Table 13 shows the text of Appendix N from the JLARC report with JLARC's calculations of the amount of State tax revenue exempted by the Virginia incentive; the amount of additional State tax revenue that was generated by the investment of the data centers that received the tax incentive; the net impact of the incentive on the State budget (additional tax received minus tax revenue exempted); net new jobs added, net additional state gross domestic product (GDP) generated, and net new worker pay generated throughout the statewide economy as a result of the investment by data centers that received the incentive. Table 13 shows data for the fiscal years 2013 through 2017. This is the most recent data available that covers the years when the current version of Virginia's data center incentive has been implemented. The General Assembly made significant revisions to the data center incentive in 2012.

Table 13. Economic and Tax Impacts of Virginia's Sales and Use Tax Exemption for Data Centers[56]

With Data Center Incentive	FY2013	FY2014	FY2015	FY2016	FY2017
State Tax Revenue Exempted	($81,298,000)	($80,131,000)	($93,249,000)	($54,757,000)	($54,516,000)
Additional State Tax Revenue	$44,548,000	$49,705,000	$64,494,000	$54,742,000	$59,171,000
Net State Budgetary Impact	($36,751,000)	($30,426,000)	($28,755,000)	($15,000)	$4,655,000*
State Revenue Recovered per $1 of State Revenue Exempted	$0.55	$0.62	$0.69	$1.00	$1.09
Net Additional Jobs	11,631	12,168	14,138	9,968	10,324
Net Additional State GDP	$1,594,238,000	$1,838,394,000	$2,268,541,000	$1,862,303,000	$2,028,606,000
Net Additional Worker Pay	$852,123,000	$987,672,000	$1,238,666,000	$1,022,226,000	$1,126,545,000

* In 2017, the data center tax incentive generated more State tax revenue than it exempted.

[56] Data Source: *Appendix N: Results of Economic and Revenue Impact Analyses*.

The appendix to the JLARC report shows that

- In 2017, the State took in $1.09 in state tax revenue from data center related activity for every $1 of potential state tax revenue that was exempted from qualifying data centers.
- In 2016, the data center incentive was revenue neutral – it generated one dollar in additional state tax revenue for every dollar of potential state tax revenue that it exempted.
- In every year since the data center incentive was modified in 2012, the State recovered the majority of the state tax revenue that was exempted from qualifying data centers.
- From 2013 through 2017, on average the State recovered 75 cents in state tax revenue for every dollar of potential tax revenue exempted from qualifying data centers.[57]

Virginia's Incentive is One of the Most Restrictive

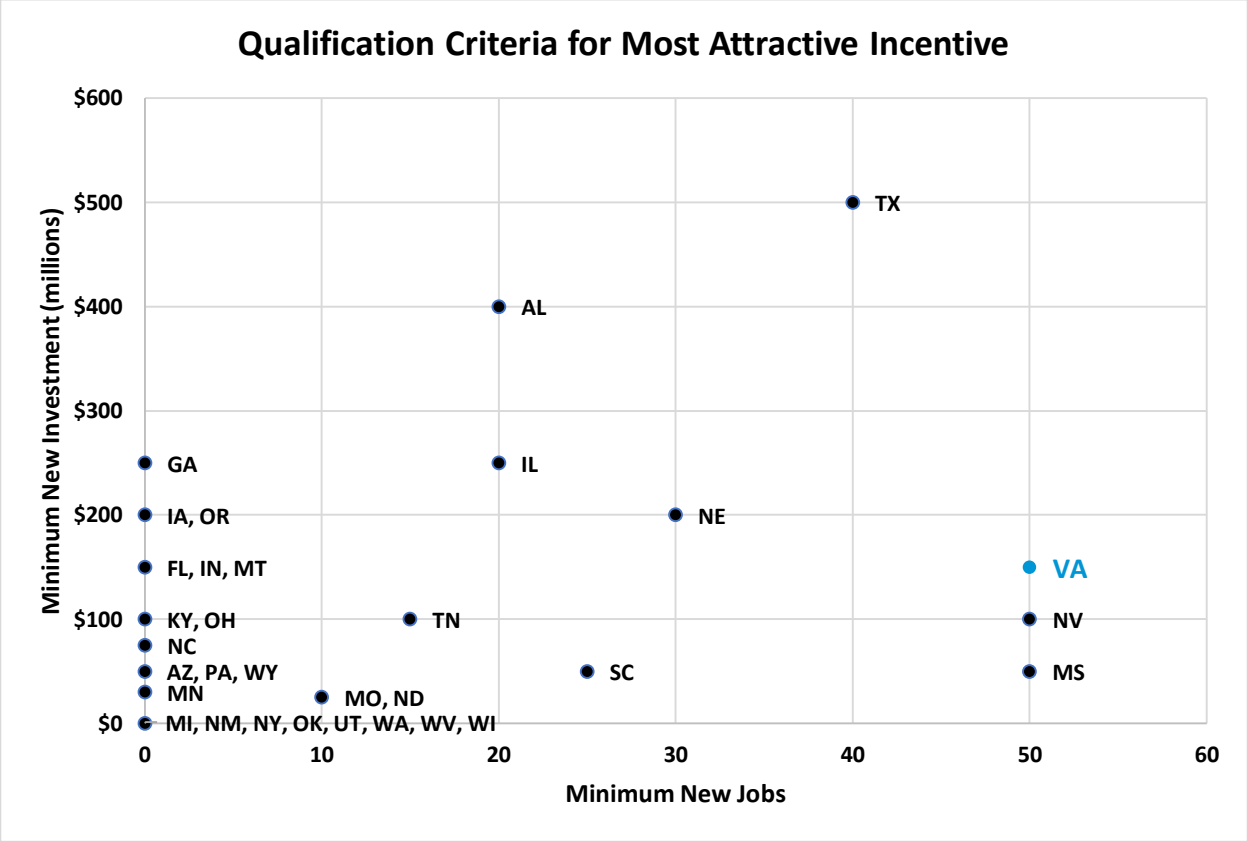
Virginia's data center incentive is structured so that it is only available to data centers that bring a certain minimum number of jobs and a minimum amount of investment to the state. In order to qualify, a data center must invest at least $150 million and add 50 new jobs to the local economy paying 50 percent more than the average annual wage in the locality (only 25 new jobs are required in unemployment distressed localities). These restrictions incentivize data center companies to make sizable investments in property and employment in the state.

Virginia's data center incentive is very stringent in terms of the number of new jobs required to qualify for it. Of the 31 states that actively offer data center incentives, only 11 require a minimum number of new jobs to qualify for an incentive, and only Virginia, Mississippi, and Nevada require the creation of 50 or more new jobs. In terms of the minimum amount of investment required to qualify for an incentive, Virginia's incentive is more restrictive than most other states. Only seven states (Alabama, Georgia, Illinois, Iowa, Nebraska, Oregon, and Texas) require a higher amount of investment in order to receive the state's most attractive incentive (and Alabama, Georgia, Iowa, Nebraska, and Texas all have graduated incentive criteria, so that lesser investments may still qualify for incentives). At the same time, 16 states offer their most attractive incentive to data center investments that are half as large as the amount that Virginia requires to qualify for its incentive.

[57] The JLARC report states that the data center incentive recovered 72 cents in state tax revenue for every dollar of potential tax revenue exempted from qualifying data centers. That conclusion is based on including the years 2010 through 2012, prior to the significant change made to the incentive in 2012. The 75-cent estimate more accurately reflects current state policy.

Figure 6 shows how the investment and job creation criteria in different states compare. The closer a state is to the lower-left corner of the graph, the less restrictive are the criteria to qualify for the state's most attractive incentive.

Figure 6. Minimum Investment and Job Creation Criteria for State Data Center Incentives[58]



JLARC's Primary Recommendation

In its evaluation, JLARC made some administrative and exploratory recommendations regarding the State's data center incentive. Its primary recommendation was for the General Assembly to consider "reduc[ing] or remov[ing] the minimum job creation requirement of the sales and use tax exemption for data centers locating in a distressed area or an enterprise zone."[59] JLARC suggested that a lower job creation threshold could encourage more data center growth in rural areas, based on its discussions with data center industry representatives.

Because of reduced availability and rising prices of land in Northern Virginia, data centers are likely to seek lower cost locations elsewhere in Virginia or outside of the state. Virginia has the opportunity to

[58] A list and brief description of state incentives is located in the separate accompanying Appendix.
[59] Joint Legislative Audit and Review Commission, *Data Center and Manufacturing Incentives, Economic Development Incentives Evaluation Series*. June 17, 2019.

continue to attract data centers to lower cost locations within the state, if the incentive requirements stay competitive. However, the 50-job requirement is hard to meet for data centers that are not larger than $300 million in capital investment. JLARC found that "one job is generally associated with $6.3 million in capital investment. Thus, a $150 million investment would be expected to create 24 jobs, on average."[60] As shown in Figure 9, Virginia, Mississippi, and Nevada are the only states that have a 50-job requirement to receive the most attractive incentive.

Areas of Virginia that are relatively more distressed could benefit significantly from data centers which are important sources of tax revenue, but which do not require substantial, costly local government services. However, according to JLARC, generally, distressed regions do not already have the skilled workforce in place that is necessary for data center operation, and it is often difficult to relocate workers from other locations. According to JLARC, "Savings from the exemption can provide resources to address these challenges."[61]

JLARC concluded that "The best approach at this time may be to reduce or remove the minimum job creation threshold in distressed areas and enterprise zones … to encourage data center growth in these areas."[62]

Incentives have been Instrumental in the Development of Virginia's High-Tech Infrastructure

The way that the high-tech industry has developed in Virginia is instructive as to the value of the data center incentive. The earliest data centers began to cluster around Ashburn, Virginia at the dawn of the internet because that was one of the four original network access points serving the entire country. In 2010, Microsoft began building its data center in Mecklenburg County after Virginia had enacted its initial data center incentive bill. However, the growing industry did not begin to boom until after the General Assembly strengthened and expanded Virginia's data center tax incentive in 2012. The fiber installed to support the large data center investments in Northern Virginia and Southern Virginia allowed for a dramatic expansion of the industry in Virginia. As a result, Northern Virginia overtook the New York City area in 2015 as the world's largest data center market.

This expansion provided the impetus for Microsoft and Facebook to invest in bringing the MAREA subsea cable to Virginia Beach, instead of only relying on the transatlantic cables that land in the New York City area. Simultaneously, Telxius invested in the BRUSA cable connecting Virginia Beach to Puerto Rico and Brazil. The cable landing station in Virginia Beach has attracted the Globalinx, NextVN, and PointOne data centers to Virginia Beach. Virginia is recognized worldwide for its high-tech physical

[60] Joint Legislative Audit and Review Commission, *Data Center and Manufacturing Incentives, Economic Development Incentives Evaluation Series*. June 17, 2019.
[61] Joint Legislative Audit and Review Commission, *Data Center and Manufacturing Incentives, Economic Development Incentives Evaluation Series*. June 17, 2019.
[62] Joint Legislative Audit and Review Commission, *Data Center and Manufacturing Incentives, Economic Development Incentives Evaluation Series*. June 17, 2019.

infrastructure (conventional and renewable electric power facilities, terrestrial and subsea fiber networks, and data centers) as well as for its high-tech workforce.

The DP Facilities data center that opened in Wise County in 2017 takes advantage of the MidAtlantic Broadband Communities Corporation fiber connections to the MAREA subsea cable. The data centers in Northern Virginia and the cable landing station in Virginia Beach attracted Facebook to invest in its large data center in Henrico County, midway between the two locations. Additionally, QTS has connected its large data center and network access point in Henrico County to the subsea cables in Virginia Beach, offering very low latency connections to Europe and Brazil. Google is in the process of bringing its DUNANT cable from northern Europe to Virginia Beach, and SAEx International has planned a global cable system that will eventually connect Virginia Beach to Brazil, South Africa, India, and Singapore. This system will provide a digital global superhighway, providing a unique four-continent link from Asia to the Americas through Africa and creating a secure new submarine link that is able to avoid all the common choke and risk points, such as the current network route through the Mediterranean and Red Seas and the routes that are exposed to the seismic risks that exist in the Pacific Ring of Fire.

Data centers also are important for attracting other businesses to Virginia. For example, biotech firms are extremely dependent on the storage and computing capacity of data centers for healthcare innovations. This summer, after an extensive search, the biotech firm, Aperiomics chose Loudoun County for its permanent corporate headquarters. Aperiomics is the only firm able to identify every known bacterium, virus, fungus, and parasite. The company has created a new gold standard in identifying the root cause of infectious diseases, allowing doctors to prescribe precise treatments for specific infections. Aperiomics specifically identified the nearby access to data centers as one of the reasons that it chose Loudoun County. “With its growing reputation as a major technology hub, access to major data centers that allow us to maximize our Artificial Intelligence and genomic research and quick access to major healthcare hubs across the East Coast, we cannot imagine a better place to call home.”[63]

The Virginia data center tax incentive sends a clear signal to potential investors worldwide that the business climate in Virginia is friendly to the high-tech industry. Beyond reputation, the incentive supports the investment in data centers, in conventional and renewable energy, in a robust fiber network, and in a high-tech workforce.

The Incentive Helps to Attract Some Data Centers that Do Not Qualify for the Incentive

Data centers tend to cluster, with smaller data centers often locating adjacent to larger data centers. Therefore, one data center that is attracted by the incentive can attract other data centers to take advantage of the then existing local fiber and power infrastructure.[64] Some of these follow-on data centers will be smaller than the larger data center projects that qualified for the tax incentive and may,

[63] https://biz.loudoun.gov/2019/05/30/aperiomics-headquarters/
[64] https://www.datacenterknowledge.com/industry-perspectives/finding-strength-numbers-data-center-clustering-effect

themselves, not initially achieve the investment and job creation thresholds required to receive tax benefit from the state.

Because large data centers that qualify for Virginia's incentive help provide the infrastructure and technology supply chain to attract smaller data centers that do not initially qualify for the incentive, the incentive yields more data center investment than is measured by just counting the data centers that qualify for the incentive. Virginia's data center tax incentive plays an important role in attracting new data centers to the state and in keeping them from moving to other states.

LOCAL INCENTIVES

Spurred by data center development in Northern Virginia, the growing importance of Virginia Beach as a landing site for subsea cables that provide high-speed connectivity between Virginia and the rest of the world, and Mid-Atlantic Broadband Communities Corporation's pioneering work in providing high-speed terrestrial connectivity in the southern half of Virginia, the data center industry is now spilling out from Northern Virginia and spreading throughout the state. In no small part because of the exceptionally high benefit to cost ratio that data centers provide to localities, many communities are working to take advantage of this trend by making themselves more attractive to the data center industry.

As discussed elsewhere in this report, data centers are a very capital-intensive industry. As a result, relative to less capital-intensive industries they are disproportionately and adversely impacted by taxes on expensive and short-lived capital equipment such as servers and other computer equipment. To address this disparity and provide a more welcoming business climate for data center development, several Virginia localities have recently lowered the business personal property tax rates that they charge to data centers.

A listing of Virginia localities creating special property tax rates for data center equipment is provided in Table 14. As this list shows, all of these communities are located in the corridor between the Richmond metropolitan statistical area and Northern Virginia, in proximity to the high-speed subsea cable landings in Virginia Beach, or, in the case of Danville, within the service area of the Mid-Atlantic Broadband Communities Corporation.

Table 14. Localities with Reduced Property Tax Rates for Data Centers

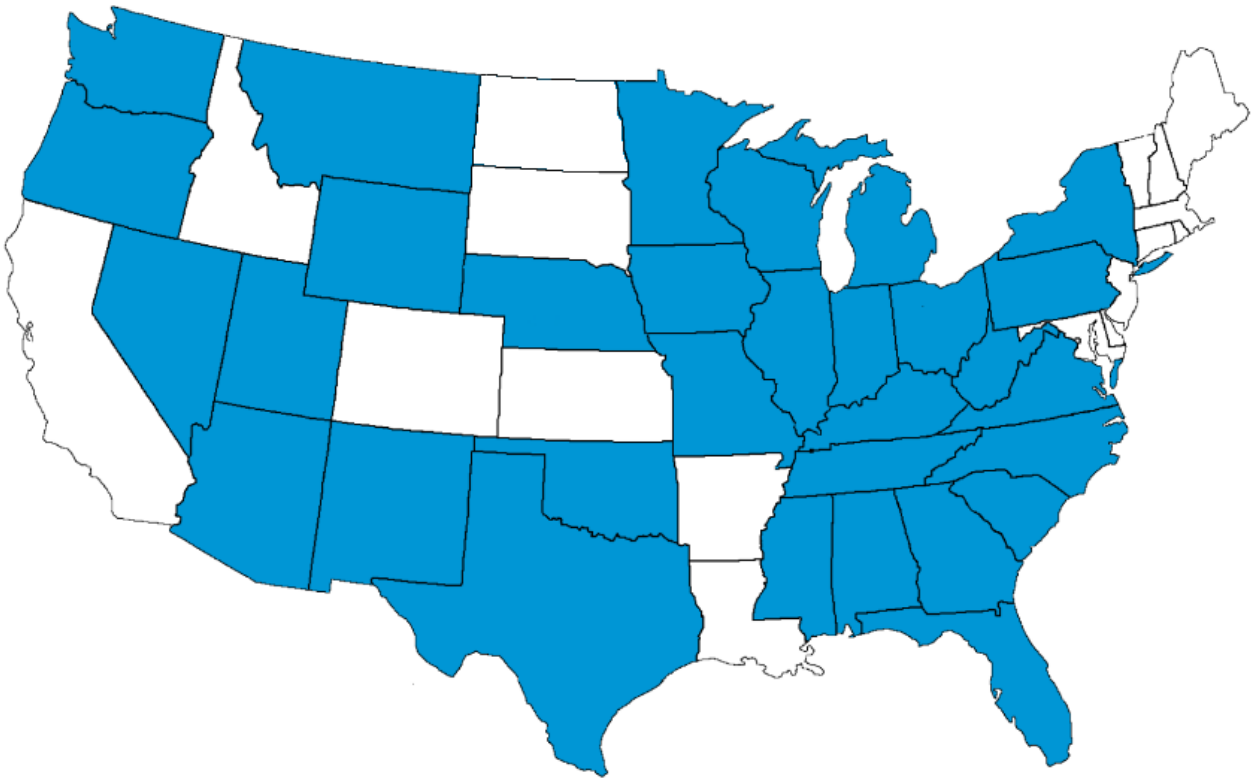
Locality	Nominal Business Property Tax Rate (per $100 assessed value)[65]	Special Property Tax Rate for Data Center Equipment (per $100 assessed value)
Caroline County	$3.80	$1.25[66]
Chesapeake	$4.08	$0.48[67]
Chesterfield County	$3.60	$0.24[68]
Danville	$3.50	$0.25[69]
Fredericksburg	$3.40	$1.25[70]
Goochland County	$3.95	$0.40[71]
Henrico County	$3.50	$0.40[72]
Prince William County	$3.70	$1.25[73]
Spotsylvania County	$5.95	$1.25[74]
Stafford County	$5.49	$1.25[75]
Virginia Beach	$4.00	$0.40[76]

[65] Does not include assessment ratios, which reduces the effective tax rate over time.
[66] Caroline County Economic Development. "Data Center Site".
[67] "Chesapeake City Council Makes Strategic Move to Attract Business in Data Center Sector". CoVABiz, April 2018 and Chesapeake Local Tax Rates.
[68] "Chesterfield County Cuts Data Center Tax Rate to Lowest in Virginia". Chesterfield Business News, April 2019 and Chesterfield County Business Tax Rates.
[69] John Crane. "Danville council OKs low rate for data centers", GoDanRiver, October 2018.
[70] Fredericksburg News. "Fredericksburg City Council Sets Highly Competitive Tax Rate for Data Centers," April 2019.
[71] Goochland County Fiscal Year 2020 Adopted Budget.
[72] Henrico County Fiscal 2018-2019 Approved Budget.
[73] Prince William County Tax Rates.
[74] Spotsylvania County FY 2020 Adopted Budget.
[75] Stafford County Tax Rates.
[76] Virginia Beach Tax Rates.

National Context for Virginia Incentives

Virginia is one of 31 states that actively offer incentives to attract data centers to locate in their states. Figure 7 highlights the states with active data center incentives.[77]

Figure 7. States with Active Data Center Incentives



In June of 2019, Illinois became the latest state to add a new data center incentive.[78] Although the Chicago area is one of the largest data center markets in the United States, it was not keeping pace with the growth of data centers in the markets of Northern Virginia, Dallas, and Phoenix – all states that provide incentives to attract data center investment. Additionally, Illinois was failing to attract data centers to the more rural parts of the state, while several large data centers had located across the border in rural Iowa. The neighboring state of Indiana also strengthened its incentives in June 2019 by

[77] North Dakota has an incentive that was capped and is no longer available to new data centers, so we do not count it as an active incentive. In addition to the 31 states that have active specific incentives for data centers, four of the other states have tax policies that are beneficial to data centers. Alaska and New Hampshire have no statewide sales tax; Delaware has no state property or sales tax; and Kansas has no state property tax on equipment.

[78] Ally Marotti. "Data center boosters hope new tax incentives 'stop the bleeding,' keep tech sites in Illinois," *Chicago Tribune*, June 2019.

adding a sales and use tax exemption for data centers to its existing targeted property tax exemption.[79] Developers are hoping to attract data centers to the Indiana suburbs of Chicago.

The competition among states for data centers is keen, and data centers pay close attention to the business climate in various states when making location decisions. States with existing incentives revise and extend them from time to time to make them more attractive. In May of 2018, Georgia expanded its data center tax incentive to include colocation data centers. Days after the governor of Georgia signed the bill into law, the colocation provider Switch announced plans to begin construction on a one million square foot data center campus in Atlanta.[80] Earlier this year, bills were introduced in the Pennsylvania state legislature to expand data center incentives that were enacted in 2016.[81] After Illinois enacted a data center incentive, Indiana revised its data center incentive to lengthen the amount of time that large data centers could receive that state's incentive.[82]

WASHINGTON STATE HAS PROVEN THE EFFECTIVENESS OF INCENTIVES

Washington State is home to the corporate headquarters of Microsoft and Amazon. In 2007, Washington's Attorney General ruled the state's data center incentives invalid. Microsoft and Yahoo immediately halted construction on data center facilities in rural Quincy, Washington, and Microsoft subsequently chose to move its Windows Azure cloud computing service to Texas. Facebook and Amazon also cited state and local taxes as an important consideration in their decisions to construct new data center facilities in Oregon.

Washington's data center incentives were legislatively re-enacted in 2010, sparking a construction boom and up to $2 billion in new private investment in the state. But, in 2011 the incentives lapsed, which once again halted data center growth in Washington and was associated with $1 billion in new data center investment by Adobe and Apple in Oregon. In 2012, Washington again re-enacted their data center incentives, only to fail to reauthorize them in 2014. At least one major software company cited that lack of reauthorization as a motivating factor in its decision to build a new $1.1 billion data center in Iowa. Washington then re-enacted its data center incentives yet again in July 2015. The current incentive is only available in rural counties. This restriction in Washington has led to a boom in the colocation data center market in the suburbs of Portland, Oregon, just across the border from Washington State.[83] The state is debating revising the incentive again to remove the restriction to rural counties.[84]

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[79] Dan Carden. "Tax incentives for Hammond data center advance to governor for final approval," *The Times*, April 2019.
[80] Switch. "Georgia Governor Nathan Deal Signs "Switch Bill" Data Center Tax Exemption Legislation."
[81] General Assembly of Pennsylvania, House Bill 1088, Session of 2018.
[82] Alex Brown. "Governor Signs Data Center Incentive Bill," *Inside Indiana Business*, June 2019.
[83] Washington State Department of Commerce, *State of the Data Center Industry An Analysis of Washington's Competitiveness In This Fast-Growing High-Tech Field*, January 2018.
[84] The Herald Editorial Board. "Editorial: Tax break could bring more data centers to state," *HeraldNet*, March 2018.

Conclusion

Life is increasingly digitized, and our digitized lives are stored, secured, processed, enhanced, and distributed by data centers. Our finances, communications, health care, recreation, entertainment, education, transportation, work, and social lives are often and increasingly online. Data centers are more than just the redundant warehouses for our digital lives. They are also the generators of much of the interactive digital content that we use. The personalized shopping recommendations; the on-the-fly driving directions; the online assistance selecting a restaurant, hotel, plane flight; the digital grocery coupons; the machine responses to banking and billing inquiries, etc. are all provided by data centers.

Because data centers use large amounts of costly electricity and water, they have emerged as leading innovators at the forefront of increasing operational efficiency in the use of energy and water. Among other innovations, data centers have used digitization, advanced sensors, and machine learning (within data centers) to dramatically reduce energy and water consumption. For example, Google has been able to reduce the amount of energy used for cooling in its data centers by up to 40 percent, reducing overall energy usage in its data centers by 15 percent on top of previous efficiency enhancements.3 Data center companies have also made large commitments to the purchase of energy from renewable sources here in Virginia and nationwide. For utility companies to move to different and initially costlier sources of renewable power, they need this kind of commitment to provide a stable demand to ensure that the large upfront investments that are required are financially sustainable.

Northern Virginia is the largest data center market in the world, but the data center industry has an important footprint in every part of the Commonwealth of Virginia. Central Virginia and Hampton Roads each account for almost ten percent of overall industry employment in the state. Data center industry pay has increased twice as fast as the statewide average since 2001.

We estimate 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.

Taking into account the economic ripple effects that direct investment generated, we estimate 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.

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. All data centers pay state employer withholding taxes and corporate income tax. At the local level, they pay real estate taxes, tangible personal property taxes, business license taxes, and industrial

utilities taxes. Additionally, many data centers still must pay state sales and use taxes on their purchases of data center equipment because they are not large enough to qualify for the Virginia data center incentive. 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. We estimate that in 2018, data centers were directly and indirectly responsible for generating $600.1 million in state and local tax revenue in Virginia.

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. For example, we estimate 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.
- $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.

In June of 2019, Virginia's Joint Legislative Audit and Review Commission (JLARC) published an evaluation of the state's data center sales and use tax incentive. JLARC found that 90 percent of the data center investment made by the companies that received the sales and use tax exemption would not have occurred in the state of Virginia without the incentive. Instead, that data center investment would have occurred in other states. So, the "cost" of the State data center incentive is only 10 percent of the amount of State sales tax revenue exempted. In fact, in 2017, the data center tax incentive generated $1.09 of State tax revenue for every dollar that it exempted; and in 2016, the incentive was revenue neutral. Since 2013, after the General Assembly significantly revised the Virginia data center incentive, the State has recovered 75 cents of every dollar of potential tax revenue that it exempted. In the process it created thousands of Virginia jobs with billions of dollars in pay and benefits and billions of dollars in economic activity throughout the state.

Virginia is one of 31 states that actively offer incentives to attract data centers to locate in their states. Several states are in the process of revising their incentives to remain competitive. In May of 2018, Georgia expanded its data center tax incentive to include colocation data centers. In 2019, bills were introduced in Idaho to enact an incentive for the first time, and the Pennsylvania state legislature to expand data center incentives that were enacted in 2016. After Illinois enacted a data center incentive in 2019, Indiana revised its data center incentive to lengthen the amount of time that large data centers could receive that state's incentive. Also in 2019, the State of Washington debated whether to continue restricting its incentive to rural counties, because of the loss of many colocation data centers to the Portland area just across the border with Oregon-Washington border.

Virginia's data center incentive is one of the most restrictive in the country. Of the 31 states that actively offer data center incentives, only 11 require a minimum number of new jobs to qualify for an incentive, and only Virginia, Mississippi, and Nevada require the creation of 50 or more new jobs. In its evaluation,

JLARC recommended "reduc[ing] or remov[ing] the minimum job creation requirement of the sales and use tax exemption for data centers locating in a distressed area or an enterprise zone." JLARC suggested that a lower job creation threshold could encourage more data center growth in rural areas. The 50-job requirement is hard to meet for data centers that are not larger than $300 million in capital investment. Virginia, Mississippi, and Nevada are the only states that have a 50-job requirement to receive each state's most attractive incentive. Areas of Virginia that are relatively more distressed could benefit significantly from data centers which are important sources of tax revenue, but which do not require substantial, costly local government services. However, according to JLARC, generally, distressed regions do not already have the skilled workforce in place that is necessary for data center operations, and it is often difficult to relocate workers from other locations.

Virginia's incentive is more restrictive than most other states in terms of minimum investment. Only seven states require a higher amount of investment in order to receive the state's most attractive incentive. At the same time, 16 states offer their most attractive incentive to data center investments that are half as large as the amount that Virginia requires to qualify for its incentive.

Virginia's data center incentive has been important in the spread of technology industries across the Commonwealth and in attracting smaller data centers that do not qualify for the incentive to invest in the state as well. Recently several localities have reduced their local property tax rates in order to attract data centers to support their economies.