

Report to the Governor and the General Assembly of Virginia

Data Center and Manufacturing Incentives Economic Development Incentives Evaluation Series



Joint Legislative Audit and Review Commission

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Summary: Data Center and Manufacturing Incentives

Virginia provides 11 incentives to promote data center and manufacturing growth in the state or to encourage environment-friendly practices, and spending on these incentives totaled \$559 million between FY10 and FY17. The data center sales and use tax exemption is by far Virginia's largest incentive in terms of forgone revenue, representing more than one-fifth of Virginia's total spending on economic development incentives during this period.

WHAT WE FOUND

Data Center Exemption appears relatively effective and generates moderate economic benefits

The data center exemption appears relatively effective. The exemption has a sizable influence on data center decisions to locate or expand in Virginia, and it is estimated to have a moderate economic benefit per \$1 million in spending by the state. It is reasonable for the state—which has identified data centers as a targeted industry—to continue the exemption. However, available information is insufficient to accurately estimate the full fiscal impact and the economic benefits of the exemption, and the exemption has not stimulated much growth in distressed areas. Some states are taking more aggressive actions to attract data centers, which may affect Virginia's competitive position.

Semiconductor Custom Grants did not lead to development of semiconductor industry but generated moderate economic benefits

Virginia provided sizable custom grants to attract two semiconductor manufacturers to locate and expand in the state, with the hope that a semiconductor industry would develop in Virginia. However, semiconductor activity in Virginia and the U.S. has declined over the past two decades, with much of the U.S. semiconductor activity moving overseas or remaining concentrated in a handful of states. Still, the custom grants for both semiconductor manufacturers generated moderate benefits per \$1 million in spending by the state over the period reviewed.

WHY WE DID THIS STUDY

Through language in the Appropriation Act, the General Assembly directed the Joint Legislative Audit and Review Commission (JLARC) to review and evaluate economic development initiatives. Topics include spending on incentives and activity generated by businesses receiving incentives; the economic benefits of incentives; and the effectiveness of incentives.

JLARC releases two reports each year: a high-level summary report on overall spending and business activity and an in-depth report on the effectiveness of individual incentives. (See Appendix A: Study mandate.) JLARC contracted with the Weldon Cooper Center for Public Service to perform the analysis for both reports.

This report is the third in the series of in-depth reports on the effectiveness of individual incentives and focuses on Virginia's data center and manufacturing incentives.

Manufacturers Single Sales Apportionment has not resulted in employment growth but generates moderate economic benefits

Virginia adopted provisions allowing manufacturers to use single sales apportionment—a method that could reduce their income tax liability—to help stem the decline of the industry in the state. Only a small portion of manufacturers have elected to use single sales apportionment, and manufacturing employment in Virginia is growing slightly less than manufacturing employment across the U.S. However, the incentive generates a moderate economic benefit per \$1 million in spending by the state. It may be difficult to improve the effectiveness of single sales apportionment without reducing its economic benefit to the state, therefore any changes should be part of a broader decision about the state’s apportionment policy.

Four tax incentives appear useful for other purposes even though they generate low economic benefits

Four tax incentives—the Semiconductor Manufacturers Exemption, Semiconductor Wafer Exemption, Pollution Control Equipment and Facilities Sales Tax Exemption, and Recyclable Materials Processing Equipment Tax Credit—have low economic benefits per \$1 million spent by the state. However, they serve other purposes, such as providing more efficient tax treatment and reducing the burden of complying with environmental regulations. The recyclable materials tax credit could become more useful if the recycling industry grows.

Two tax credits to support green industry do not achieve goals and generate negligible economic benefits

Virginia’s Green Job Creation Tax Credit and Biodiesel and Green Diesel Fuels Producers Tax Credit have low rates of utilization and little effect on the activity they were designed to encourage. The Green Job Creation Tax Credit has had little to no effect on employment in green energy jobs, and the Biodiesel and Green Diesel Fuel Producers Tax Credit has had no effect on Virginia’s biodiesel production rate. Both credits also have a negligible economic benefit to the state per \$1 million spent on the credits.

Economic benefit of data center and manufacturing incentives varies

Program	Spending FY10–FY17	Incentive type	Economic benefit per \$1M of spending
Data Center Exemption	\$417.47M	Exemption	Moderate
Manufacturers Single Sales Apportionment	67.80	Special tax apportionment	Moderate
Semiconductor Custom Grants (Micron and Qimonda)	27.00	Grant	Moderate
Pollution Control Equipment and Facilities Exemption	26.59	Exemption	Negligible
Recyclable Materials Processing Equipment Tax Credit	10.71	Tax credit	Negligible
Semiconductor Manufacturers Exemption	7.81	Exemption	Low
Semiconductor Wafers Exemption	1.14	Exemption	Low
Biodiesel and Green Diesel Fuels Producers Tax Credit	0.01	Tax credit	Negligible
Green Job Creation Tax Credit	<0.01	Tax credit	Negligible
Data Center Single Sales Apportionment	0.00	Special tax apportionment	n.a.

SOURCE: Weldon Cooper Center economic impact analysis of incentives.

NOTE: Special tax apportionment that is only available to eligible corporations. Economic benefits of data center single sales apportionment could not be estimated because the incentive has not been used to date. Micron and Qimonda received a total of \$93.4 million in grant payments but the majority of the payments were made prior to FY10.

n.a.: not available.

WHAT WE RECOMMEND

Legislative action

- Further reduce or remove the minimum job creation requirement in distressed areas or enterprise zones for the data center exemption.
- Require all data centers to report employment levels, capital investment, and tax benefit information to the Virginia Economic Development Partnership.
- Require a work group to examine Virginia’s infrastructure and other policies affecting data centers to identify (1) actions needed to maintain Virginia’s competitive position and (2) whether opportunities exist to reduce reliance on the sizable exemption without adversely affecting industry growth.
- Eliminate the Green Job Creation Tax Credit and Biodiesel and Green Diesel Fuel Producers Tax Credit.

Executive action

- The Virginia Economic Development Partnership should report to the legislature on how potential custom grants, similar to the semiconductor grants, align with state and regional industry clusters and strategic goals.
- The Department of Environmental Quality should develop a list of pre-approved equipment and facilities to expedite certification for the pollution control exemption.

The complete list of recommendations and options is available on page v.

Recommendations and Options: Data Center and Manufacturing Incentives

RECOMMENDATION 1

The General Assembly may wish to consider amending § 58.1-609.3 of the Code of Virginia to further reduce or remove the minimum job creation requirement of the sales and use tax exemption for data centers locating in a distressed area or an enterprise zone.

RECOMMENDATION 2

The General Assembly may wish to consider including language in the Appropriation Act directing the Secretary of Finance to convene a work group consisting of the Secretaries of Transportation, Commerce and Trade, and Administration; the staff directors of the House Appropriations Committee and Senate Finance Committee, or their designee; and other relevant agency stakeholders to conduct a data center industry study to examine actions that could be taken to maintain the state's competitive position to attract data centers and examine whether the opportunity exists to reduce the level of the exemption without adversely affecting industry growth.

RECOMMENDATION 3

The General Assembly may wish to amend § 58.1-609.3 of the Code of Virginia to require that (1) all data centers using the data center sales and use exemption be required to submit an annual report including their employment level, capital investment, and tax benefit to the Virginia Economic Development Partnership (VEDP) and (2) the Department of Taxation (TAX), in consultation with VEDP, publish an annual report on the data center exemption which should include, at a minimum, aggregate information on qualifying expenses that were exempt from the retail sales and use tax and the total value of the tax benefit.

RECOMMENDATION 4

The Virginia Economic Development Partnership should report to the Major Employment and Investment Project Approval Commission how each custom grant being considered by the commission aligns with state and regional targeted industries and strategic plans.

RECOMMENDATION 5

The General Assembly may wish to consider amending § 30-312 of the Code of Virginia to require that information on how custom grants align with state and regional target industries and strategic economic development plans be included in the annual report of the Major Employment and Investment Project Approval Commission.

RECOMMENDATION 6

The Department of Environmental Quality and Department of Mines, Minerals, and Energy should develop guidance documents on (1) the types of pollution control equipment and facilities that are exempt from the retail sales and use tax and (2) the decision-making process for approving certification.

RECOMMENDATION 7

The Department of Environmental Quality should develop a list of pre-approved equipment and facilities that typically meet the pollution control certification requirements and create an expedited certification process for equipment and facilities on that list.

RECOMMENDATION 8

The General Assembly may wish to consider eliminating the Green Job Creation Tax Credit and the Biodiesel and Green Diesel Fuel Producers Tax Credit.

OPTION 1

The General Assembly could amend § 58.1-609.3 or § 58.1-3660 of the Code of Virginia to clarify that the equipment or facility does not need to be constructed before certification can be granted for purposes of claiming the Pollution Control Equipment and Facilities Sales Tax Exemption.

Data Center and Manufacturing Incentives

Economic Development Incentives Evaluation Series

Virginia provides economic development incentives to encourage businesses to locate or expand their operations in the state. In order to better understand the effectiveness of these incentives in stimulating business activity, the General Assembly directed the Joint Legislative Audit and Review Commission (JLARC) to review and evaluate the effectiveness and economic benefits of economic development incentives, such as grants, tax preferences, and other assistance. (See Appendix A for the study mandate.)

This report is part of a series of annual reports that provide a comprehensive review of individual economic development incentives offered by the state. JLARC contracted with the University of Virginia's Weldon Cooper Center for Public Service to perform the evaluation.

This report focuses on 11 incentives designed to promote data center and manufacturing growth, reduce pollution from manufacturing, and to support green jobs (Table). Two incentives target the state's rapidly growing data center industry—a sales and use tax exemption for computer and equipment purchases and the ability to use a special apportionment (single sales factor) method to reduce corporate income tax liability.

Four incentives target the state's semiconductor manufacturing industry. Two of the incentives were large customized grants designed to encourage two semiconductor manufacturers, Micron and Qimonda, and their predecessors, to locate in the state in the 1990s and expand in 2005.

The remaining five incentives target manufacturers. One of the incentives is a special apportionment formula that can lower state income taxes for some manufacturers. The remaining incentives primarily are used by manufacturers and are designed to encourage environment-friendly practices.

State spending on these 11 incentives totaled \$559 million between FY10 and FY17. The data center exemption is by far the largest of the incentives evaluated in this report and the largest offered by Virginia. State spending on the data center exemption in the form of forgone revenue has grown with the sector's increasing economic footprint in the state. This exemption currently represents 22 percent of Virginia's total spending on incentives between FY10 and FY17 (\$1.9 billion). Manufacturers single sales apportionment is also among the state's 10 largest incentives.

For purposes of this report, **spending on incentives** refers to (1) actual expenditures by the state in the form of grant awards and (2) tax expenditures in the form of forgone revenue, through tax credits or sales and use tax exemptions.

TABLE: Eleven incentives targeting data centers and manufacturers are evaluated in this report

Program	Spending FY10–FY17	Purpose		
		Data center industry growth	Manufacturing industry growth	Promote environment- friendly practices
Data Center Exemption	\$417.47M	✓		
Manufacturers Single Sales Apportionment	67.80		✓	
Semiconductor Custom Grants (two grants for Micron and for Qimonda)	27.00		✓	
Pollution Control Equipment and Facilities Exemption	26.59		✓	✓
Recyclable Materials Processing Equipment Tax Credit	10.71		✓	✓
Semiconductor Manufacturers Exemption	7.81		✓	
Semiconductor Wafers Exemption	1.14		✓	
Biodiesel and Green Diesel Fuels Producers Tax Credit	0.01		✓	✓
Green Job Creation Tax Credit	<0.01		✓	✓
Data Center Single Sales Apportionment	0.00	✓		
All programs	\$558.52M			

SOURCE: Weldon Cooper Center review of Code of Virginia and agency documents.

NOTE: Spending on grants includes amounts for projects that have been completed or have reached milestones and received payments; tax credits includes amounts claimed; and exemptions are estimates of forgone revenue. Micron and Qimonda received a total of \$93.4 million in grant payments, but the majority of the payments were made prior to FY10. Data centers were not able to use the single sales apportionment until FY17, but none had met the eligibility and administrative requirements to use it by the end of FY17.

1. Data Center Incentives

Virginia offers two tax incentives to attract large-scale data centers: a data center retail sales and use tax exemption and a single sales factor apportionment formula designed to help enterprise data centers lower their state income tax liability (Table 1-1). Data centers are facilities that house computer equipment such as servers, data storage devices, and related equipment to manage, process, and distribute information. These incentives are restricted to data centers that meet minimum capital investment levels and other criteria. Both incentives are jointly administered by the Virginia Economic Development Partnership (VEDP) and the Department of Taxation (TAX). VEDP is responsible for assessing whether a data center meets the eligibility requirements and establishing a memorandum of understanding (MOU) with the data center. TAX issues exemption certificates to eligible data centers and ensures that single sales apportionment is used appropriately.

The General Assembly enacted Virginia's first data center incentive in 2008, creating a sales and use tax exemption to attract a specific data center to Virginia. This initial exemption was limited in scope. It applied only to data centers that located in a locality with an unemployment rate greater than 4.9 percent and required that the data center establish an MOU with VEDP during calendar year 2008. Even though the capital investment threshold was lower (\$75 million) than the current exemption, the exemption had higher job creation (100 new jobs) and average wage requirements (twice the average wage in the locality). The initial exemption also applied only to purchases for data processing, storage, retrieval, or communication made on or before June 30, 2011.

The General Assembly adopted a broader exemption in 2010 to attract additional data centers. This was in part designed to compete with North Carolina, which had recently been chosen for the location of two-large scale data centers—Google (a \$750 million data center in 2007) and Apple (a \$1 billion data center in 2009). The exemption expanded eligible purchases to include enabling hardware such as wiring, generators, chillers, and other similar items used to operate data centers. Data centers with an MOU would be able to make tax exempt purchases through 2020. The General Assembly expanded the exemption again in 2012 and 2016.

- **2012:** Expanded to tenants of colocation data centers and allowed jobs created by tenants to count toward the job creation requirement, in addition to the jobs created by the colocation data center owner.
- **2016:** Extended the sunset date on the exemption to 2035 and allowed data centers to relocate employees from an existing Virginia data center to meet new job requirements for a new data center, if it makes an investment of at least \$500 million.

Each state that imposes income taxes on businesses establishes an **apportionment formula** for businesses operating in multiple states to calculate the percentage of their income that is taxable in the state.

Enterprise data centers are in-house data centers owned and operated by a company for its own use, or use by its customers. Examples include Google, Facebook, and Microsoft.

Colocation data centers are owned by a "landlord" company that leases space to businesses on either a retail (multiple businesses or "tenants" lease space) or wholesale (one tenant leases the data center) basis.

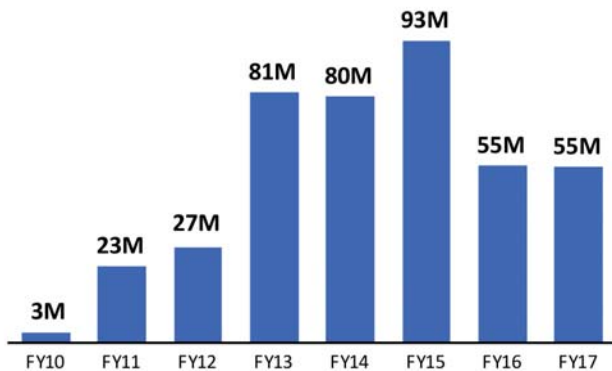
DATA CENTER EXEMPTION

Promote the establishment of large-scale data centers in Virginia

VALUE TO BENEFICIARIES

FY10-FY17

Beneficiary savings: \$417M total



Beneficiaries

159 data centers total
(including colocation tenants)

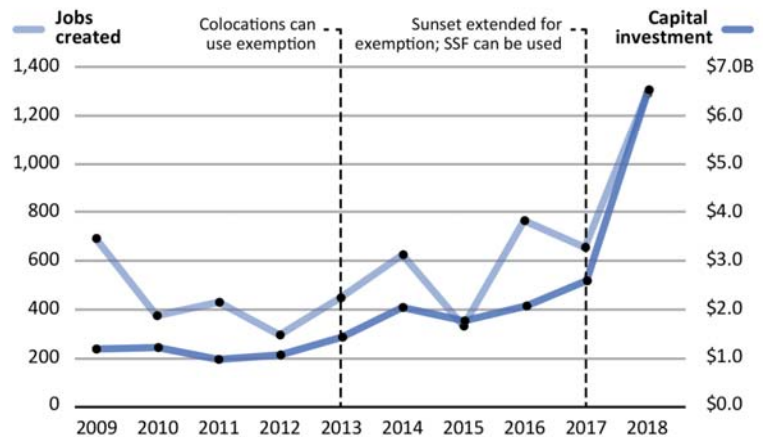


ACHIEVEMENT OF PURPOSE

Encourage data center location and expansion

Data center representatives rate exemption among top four location factors they currently use to select a site for location or expansion.

Data center employment and investment have increased in Virginia as data center incentives have expanded



IMPACT TO STATE ECONOMY

average FY98-FY17

Moderate economic benefit per \$1M of incentive



155 jobs



\$26.5M state GDP



\$14.6M personal income

Moderate return in revenue



72¢ per \$1 spent

TABLE 1-1
Virginia provides two incentives for data centers: sales and use tax exemption and single sales apportionment

Data Center Sales and Use Tax Exemption	
Purpose	Promote the establishment of large-scale data centers in Virginia
Eligible projects	<p>Enterprise or colocation data centers that make a new capital investment of at least \$150 million and create at least 50 new jobs in a Virginia locality</p> <p>Minimum new job requirement is lowered to 25 if 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</p> <p>New jobs must pay at least 1.5 times the annual average wage in the locality where the data center is located</p>
Program features	<p>Data centers must enter into an MOU with VEDP; colocation tenants must enter into a Participation Certificate Agreement with the colocation data center</p> <p>Minimum capital investment, job, and wage thresholds must be met by a performance date stipulated in the MOU, generally within 3 years after the MOU is established</p> <p>Exemption can be used before meeting the minimum thresholds, but repayment is required if thresholds are not met by the performance date</p> <p>MOU is only applicable to a specific data center in a single locality; if a company builds another data center outside of that locality, it must separately meet eligibility and file an MOU to use the exemption</p> <p>Once MOU is established for a data center and performance requirements are met, the exemption can be used for all qualifying purchases made through 2035, unless the expiration date is changed by the General Assembly</p>
Use of exemption	<p>Reduces costs of initially purchasing and upgrading or replacing eligible equipment including</p> <ul style="list-style-type: none"> - servers, mainframes, network infrastructure, data storage hardware, and other computer equipment used for data processing, storage, retrieval, or communication - enabling hardware such as cabling, switches, chillers, generators, monitoring systems, and similar items used to operate exempt equipment
Single Sales Apportionment for Enterprise Data Centers	
Purpose	Promote the establishment of large-scale enterprise data centers in Virginia
Eligible projects	<p>Enterprise data center operations (colocation centers not eligible)</p> <p>Make a new capital investment of at least \$150 million in Virginia</p>
Program features	<p>Data centers must enter into an MOU with VEDP</p> <p>Apportion income subject to Virginia tax based on the percentage of total sales in Virginia, rather than using the state’s standard formula, which also accounts for the company’s proportion of total property and payroll in Virginia. This percentage (the apportionment factor) is applied to total taxable income to calculate income subject to Virginia’s corporate income tax</p>
Use of incentive	Allows Virginia enterprise data centers to reduce their Virginia income tax liability

SOURCE: Weldon Cooper Center review of the Code of Virginia and agency documents.

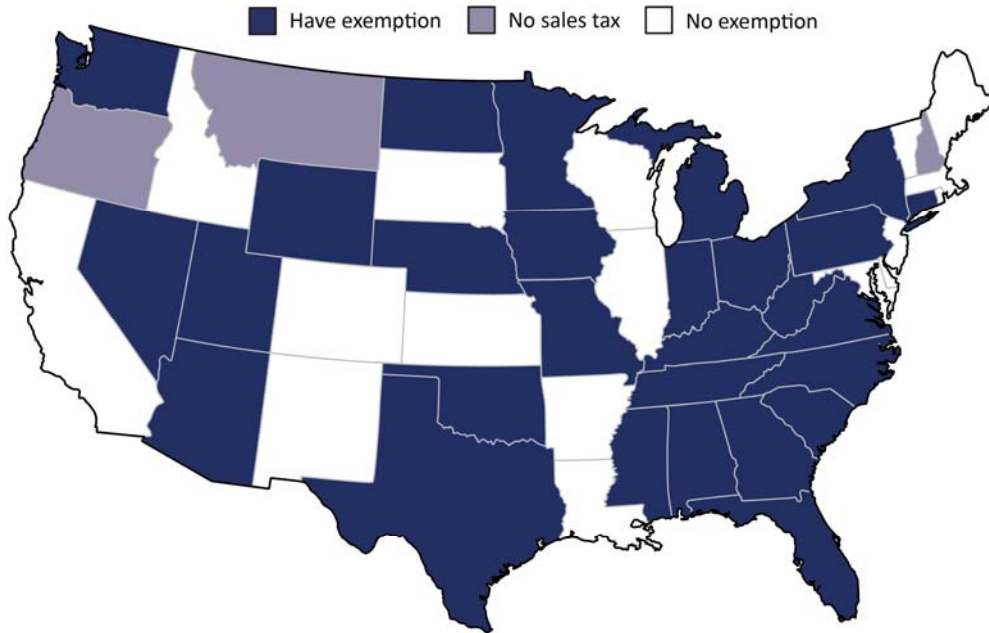
NOTE: Authorized by § 58.1-609.3 (exemption) and § 58.1-422.2 (single sales apportionment). Single sales apportionment was offered in phases. Between July 2016 and June 2017, data centers could use a quadruple-weighted sales apportionment formula. Single sales apportionment for data centers was fully phased in beginning July 2017.

In 2015, the General Assembly enacted legislation allowing enterprise data centers to use a single sales apportionment formula to lower their income tax liability to encourage them to locate or expand in Virginia. Multistate corporations typically use three factors to determine their Virginia income tax: property, payroll, and sales. Single sales apportionment can reduce the Virginia tax income liability for data centers that have sizable property and payroll in the state but sales that are spread out nationwide. (See Figure 3-1 on page 39 for more detail about how each apportionment formula is calculated.) To use single sales apportionment, eligible data centers must enter into an MOU with VEDP and agree to make a new capital investment of least \$150 million. Data centers could begin using single sales apportionment after July 2017. Through tax year 2017, no enterprise data centers had used single sales apportionment, most likely because insufficient time had passed. Several data center operators have since entered into MOUs with VEDP to use single sales apportionment and will likely begin using it within the next two years. Several others have expressed interest in using the incentive.

Virginia and many states have adopted incentives to attract data centers—a fast-growing industry viewed as highly desirable

Since the late 2000s, states have increased efforts to attract data centers. Virginia was the seventh state to adopt a sales and use tax exemption for data centers when it enacted its initial exemption in 2008. Currently, the majority of states provide favorable tax treatment to data centers either because they currently have some form of sales and use sales tax exemption for data centers (28) or they levy no sales and use tax (5) (Figure 1-2). All states bordering Virginia provide some form of sales tax exemption or other incentive to data centers. Virginia's adoption of single sales apportionment for enterprise data centers also makes Virginia's corporate tax system more competitive. (See Appendix C for more information about the data center exemptions offered by other states and Appendix D for more information about corporate apportionment by state.)

Figure 1-2
Majority of states provide favorable sales tax treatment to data centers



SOURCE: Weldon Cooper Center review and analysis of Mangum Economics (2018), Tarczynska (2016), and C2ER Business Incentives Database.

NOTE: Alaska, the District of Columbia, and Hawaii also have no data center incentives. Kansas and Maryland provide other incentives.

States view data centers as an attractive industry because they are capital intensive and require substantial investment and reinvestment in equipment. Even though the number of jobs associated with data centers is relatively small, wages are generally high. Construction spending for materials and labor is also substantial. Local governments in Virginia and across the nation also find data centers attractive because they are a valuable source of revenue. Loudoun County received more than \$154 million in property taxes from computer equipment in FY18, and Prince William County received more than \$25 million in FY17. Some localities in Virginia, such as Chesterfield, Henrico, and Prince William counties, have lowered the property tax rates on equipment used in data centers to attract data centers.

Technological advancements continue to drive growth of the data center industry. Significant improvements in telecommunications speed, capacity, and reliability (i.e., broadband) have increased consumer use of mobile devices, social media, and gaming applications and increased demand for remote storage and processing. Businesses are increasingly outsourcing their data processing, data storage and management, and computer applications to data center cloud operations to take advantage of low-cost scale economies and provide more uniform and higher quality software applications. Growth in the industry is projected to continue with the deployment of hyper-fast 5G

Data center **absorption** is a measure of how much of the net available data center capacity is claimed via new lease or expansion in a given period, usually measured in megawatts.

Data centers are often classified by their size, usually in square feet or megawatts (MW) of power usage.

networks and increasing vehicle automation, virtual and augmented reality capabilities, and use of “smart” appliances.

Northern Virginia is the premier data center market in U.S. and world

Northern Virginia is recognized as the nation’s premier data center market, with its size and growth outpacing other major metropolitan markets. Northern Virginia is rated first in data center space by the U.S. Business Facilities’ 13th Annual Rankings Report. The Northern Virginia market absorbed 270 megawatts (MW) of power capacity in 2018, far outpacing London (UK) in second place with just 69MW of absorption. Loudoun County has become known as “Data Center Alley” because of its massive concentration of data centers. An estimated 70 percent of international internet traffic flows through its telecommunications infrastructure.

Northern Virginia has key infrastructure to attract data centers

Northern Virginia’s dominant market position was driven by a clustering of data processing firms contracting with government agencies and high-technology government labs. These firms located near Dulles International Airport—the “Dulles Corridor”—as early as the 1940s and 1950s. An Internet exchange point was established in Tysons Corner in the 1990s, and this infrastructure attracted other pioneering telecommunication firms, such as MCI, AOL, and Network Solutions. The area became known as “Internet Alley” as additional telecommunication hubs were created in the region and additional investments were made in fiber optic cable. The Northern Virginia region now hosts at least two dozen Internet exchange points that provide the infrastructure through which regional, national, and international internet traffic flows.

Several **major telecommunications investments** in Virginia have occurred recently. Facebook and Microsoft formed a joint venture to build the 4,000-mile long MAREA (Spanish for “tide”) transatlantic cable between Spain and Virginia Beach that was completed in 2018.

BRUSA, another major international cable, links Virginia Beach to Brazil and was completed at the end of 2018.

SAex (South Atlantic Express) will establish service between South Africa, Latin America, and the U.S. and is scheduled to be operational in 2020.

Google announced a subsea cable project called “Dunant” that will connect Virginia Beach with France beginning in 2020.

Industry analysts credit other favorable factors to the region’s large data center market. These factors include

- a stable climate and low level of seismic activity,
- relatively low power rates,
- one of the nation’s best-educated metropolitan workforces, and
- proximity to major national customers (including most notably the federal government, government contractors, and tech firms that hold an enormous amount of government and other data).

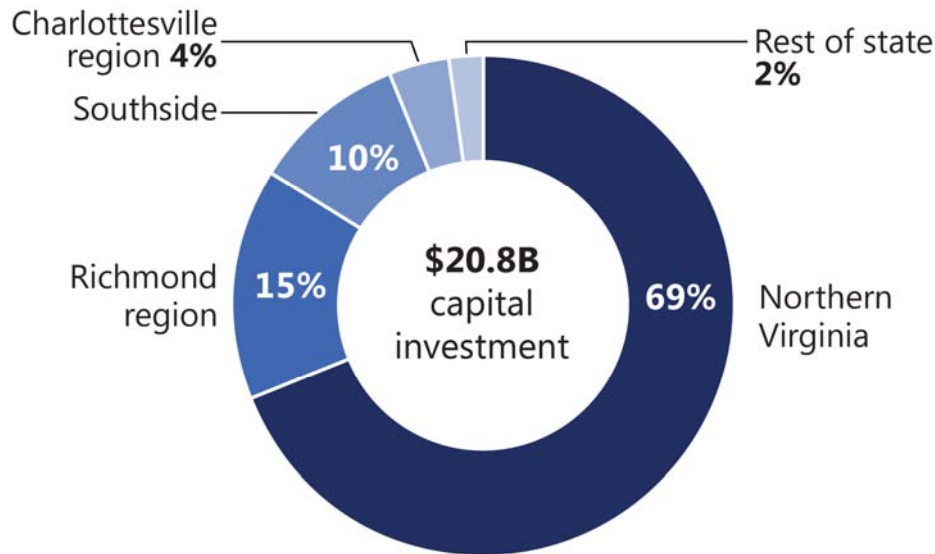
Some also cite the importance of private-industry groups, such as the Northern Virginia Technology Council (NVTC), for promoting and supporting industry investment and expansion.

Most data center activity has occurred in Northern Virginia, but Richmond area and Southside have sizable concentrations

While Northern Virginia continues to dominate the state’s data center market, data centers also have a sizable presence in the Richmond Metropolitan Area (15 percent of total capital investment) and in Southside (10 percent of total capital investment)

(Figure 1-2). Microsoft located a data center in Mecklenburg County in 2010, and has continued to expand its presence there with expansion announcements nearly every year. QTS announced the location and expansion of a data center in the Richmond Metropolitan area in 2010 and 2011, and the data center market greatly expanded with Facebook announcing the location of large data centers (2017 and 2018). Several smaller data centers have located in the Greater Charlottesville region (Culpeper and Fauquier counties).

Figure 1-2
Most data center activity has occurred in Northern Virginia, followed by Richmond and Southside (2009–2018)



SOURCE: Weldon Cooper Center analysis of VEDP announcements data 2009–2018, and undisclosed announcements by GO Virginia Region.

NOTE: Does not include some recent data center announcements in Virginia Beach.

Data center exemption made up more than one-fifth of Virginia’s incentives spending FY10–FY17

The data center exemption is by far Virginia’s largest incentive (see *Economic Development Incentives 2018*, JLARC 2018), and estimates developed for this report suggest it represented more than one-fifth of Virginia’s total incentive spending between FY10 and FY17. The single sales apportionment for data centers has not been used to date. The amount of forgone revenue because of the special apportionment formula is expected to be minimal, at least initially.

Data centers saved an estimated \$417 million because of data center exemption FY10–FY17

The estimated value of the data center exemption was approximately \$417 million between FY10 and FY17. As of FY2017, 159 data centers (including enterprise data

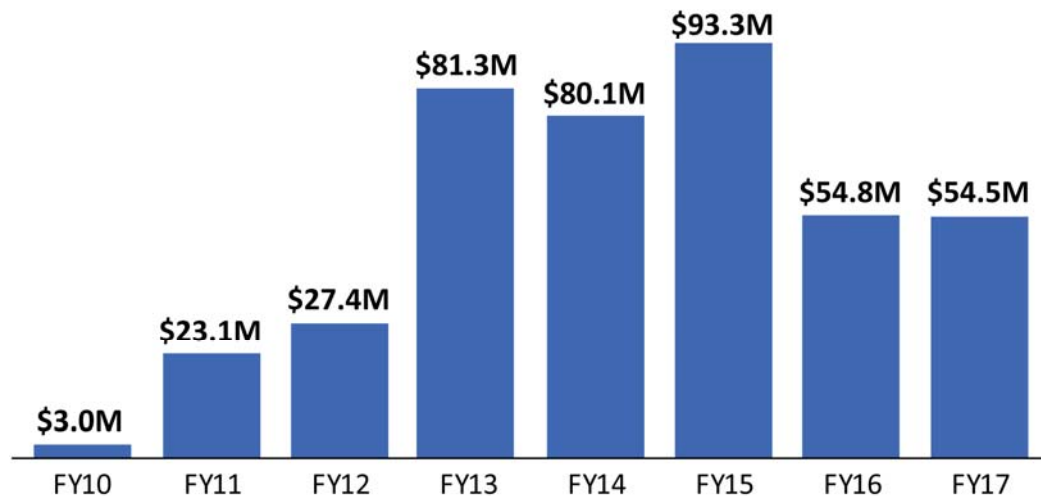
This report includes a revised estimate of the forgone revenue because of the data center exemption. Previous JLARC reports included estimates developed by the Department of Taxation (TAX). Weldon Cooper staff developed a revised estimate for this report. This change increased estimated total spending on all incentives between FY10 and FY17 from \$1.8 billion to \$1.9 billion. (*Economic Development Incentives 2018*).

This method likely still underestimates forgone revenue because companies with an existing MOU may make major data center campus expansions at an existing location without needing to enter into another MOU.

centers and landlords and tenants of colocation centers) have signed MOUs with VEDP to use the exemption. The state revenue impact of the current sales and use tax exemption has increased since its introduction in 2010, from an estimated \$3 million in FY10 to an estimated high of \$93 million in FY15 (Figure 1-4). The revenue impact was highest between FY13 and FY15 when substantial data center investments were made. Much of the investment that was made in FY16 and FY17 was for replacing and upgrading equipment.

Figure 1-4

Data centers saved an estimated \$417 million from data center equipment purchases because of exemption (FY10–FY17)

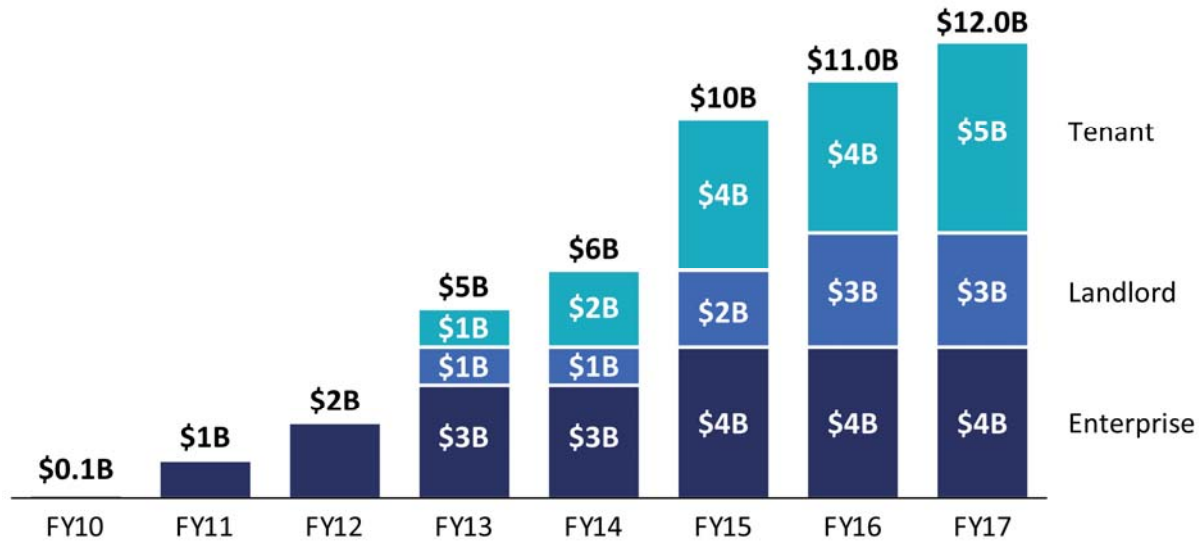


SOURCE: Weldon Cooper Center analysis of information provided by VEDP.

NOTE: Estimates of spending on exemption are underestimates because some data centers report only the minimum threshold amounts of capital expenditures. See Appendix B for more information about how the estimate was derived. The estimated exempt amount for FY18 is \$86.5 million but is not included to maintain consistency with the reporting of information for other incentives in this report.

While the exemption was originally adopted to benefit enterprise data centers, colocation data centers now are the largest group of beneficiaries. Many colocation centers began to qualify for the exemption after changes were implemented in FY13. Of the data centers using the sales and use tax exemption as of June 2017, 10 were enterprise or single use data centers, and the remainder were landlords of colocation data centers (14) or their tenants (135). Capital investments reported by data centers to VEDP, as required by their MOUs, show that investment for enterprise data centers slowed after FY13 and that most of the investment growth since then has been for colocation data centers (Figure 1-5). By FY17, cumulative investments by colocation landlord and tenants had reached \$8 billion (69 percent of total data center investment).

Figure 1-5
Colocation data centers are increasingly benefiting from the exemption as indicated by capital expenditures (FY10–FY17)



SOURCE: Weldon Cooper Center analysis of MOU information provided by VEDP.

NOTE: Colocation includes landlord and tenant. Capital expenditures for some data centers exceed the announced capital investments in Figure 1-2. Capital expenditures are assigned to the year in which MOU was signed.

No data centers have used single sales apportionment, and future forgone revenue is expected to be minimal

Single sales apportionment for enterprise data centers has not been used yet on tax returns, although some data centers may begin using it soon. It was not used on income tax returns for tax year 2017—the first year that firms were eligible to begin using it—according to TAX staff. Several data centers since have entered into MOUs with VEDP. It is estimated that corporate tax liability could be reduced by \$100,000 in FY19 and \$240,000 by FY24 if data centers and current data center prospects begin using single sales apportionment (Table 1-2). (See Appendix B for the methodology for computing these revenue reductions.)

Because data centers have not used **single sales apportionment**, it could not be evaluated at this time. The remainder of the section focuses on the data center exemption.

The projected revenue reduction from single sales apportionment is much less than for the data center exemption because it can only be used by enterprise data centers. The revenue reduction is also dependent on data center profits rather than expenditures.

Table 1-2
Single sales apportionment for data centers is projected to lead to minimal reductions in state revenue

Year	Reduction in state revenue
FY19	\$0.10M
FY20	0.13
FY21	0.15
FY22	0.17
FY23	0.19
FY24	0.22
FY25	0.24
7-year total	\$1.20M

SOURCE: Weldon Cooper Center estimates based on VEDP MOU data for enterprise data centers and secondary public data.

Tracking **growth in data center employment** and other activity over time is difficult. Data centers, unlike many industries, do not have a predefined industry or NAICS code.

The NAICS code most likely to include data centers is 518210—data processing, hosting, and related services—but a review of data from the Virginia Employment Commission suggests the majority of data center employment in Virginia is included in other sectors.

See Appendix B for the methodology for tracking data center employment.

Exemption is influential in data center growth

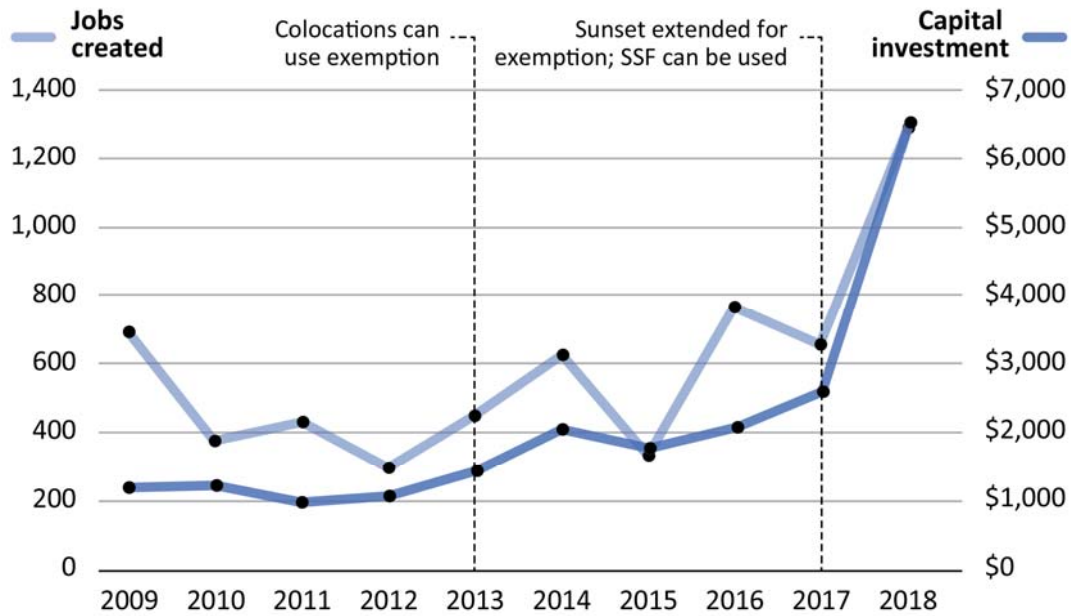
Virginia has several advantages to attract data centers, but the exemption has been a key factor in the industry's growth. As previously mentioned, the state offers the necessary fiber and power infrastructure, lower utility rates, and a skilled workforce for building and operating data centers. Data center representatives acknowledge these advantages have strongly contributed to the high level of industry clustering in Virginia. They also indicated that incentives have increasingly become more important since the late 2000s, when additional states began offering incentives to attract data centers.

Data center employment and investment increased as Virginia broadened its incentives

Data center job creation and capital investment, in particular, have increased as Virginia expanded eligibility of its data center incentives (Figure 1-6). These increases also correspond with steady growth of cloud computing. Job creation and investment increased following the extension of the data center exemption to colocation data center tenants after July 2012.

Job creation and capital investment increased substantially after the exemption sunset date was extended to 2035 in 2016 and again when enterprise data centers could use single sales apportionment in 2017. Even though single sales apportionment has not been used through tax year 2017, its adoption was instrumental in attracting large enterprise data center investments that plan to use it in the future, according to data center representatives. The majority (58 percent) of the job creation and most (72 percent) of the investment appear to have been by data centers using the exemption based on analysis of VEDP announcement and MOU data. This information alone, however, is only suggestive of cause and effect and does not separate the influence of these tax policy changes from pre-existing growth trends in the industry and other factors.

Figure 1-6
Data center employment and investment increased in Virginia as data center incentives broadened



SOURCE: Weldon Cooper Center analysis of VEDP Announcements and Closings Database.
 NOTE: SSF, single sales factor. Job creation and investment are assigned to the year they were announced.

Virginia data center representatives rated exemption among top location factors

Data center representatives in Virginia rated incentives among the top four location factors they use to select a site for location or expansion. Although the importance of specific site selection factors differed among companies, they generally indicated that top factors included infrastructure and utility costs, availability of skilled labor for data center operation and construction, the business-friendliness of the state and local jurisdiction, and state and local business taxes and tax incentives. All data center representatives said the exemption was instrumental in tipping the balance for a site when site development and operating costs were similar.

The sales and use tax exemption is regarded as important because of the capital intensity of the industry. The initial investment to establish the data center is substantial. Additional substantial investments are necessary to sustain data centers because they must replace or upgrade their equipment frequently, usually every three to five years. Local property taxes, corporate income taxes, and availability of discretionary economic development incentives were also identified as factors that played a role in location decisions but were mentioned less frequently than the sales and use tax exemption.

Exemption size makes it an influential factor in data center growth

The **scale** estimating the amount of economic activity attributed to an incentive is based on the incentive amount as a percentage of the business's operating costs for the related activity over a 20-year period. The estimate is based on costs and does not account for other factors that may influence a business's location or expansion decisions. See Appendix M [online only] for more detail on the difficulty of precisely estimating incentives' effects and the methodology used in this report.

It is estimated that the majority of the economic activity generated by the data centers using the exemption is attributable to the incentive. The exempted amount represents a sizable fraction of data centers' estimated operating costs for the new activity. Data centers using the exemption saved an estimated \$417 million in taxes from FY10–FY17, representing 21 percent of operating costs for this new activity over a 20-year period. Based solely on this cost analysis, the exemption is estimated to induce up to 90 percent of the economic activity of these data centers, according to a scale developed by a leading researcher of incentives from analysis of incentive activity across the nation (Bartik 2018b). However, it is difficult to precisely estimate the impact incentives have on business location decisions, including the impact of Virginia's data center incentives. Business executives consider many site location factors, and it is impossible to verify their motivations. This report estimates incentives' impacts using a cost analysis based on best available research. However, it does not include other site location factors or incentive features that may affect data center location decisions (sidebar).

Virginia's data centers also received incentives from several other grant and tax credit programs, but it is unlikely that much data center activity can be directly attributed to them. The amount data centers received from these other programs is small (\$17 million) relative to the total exemption amount (\$417 million). Most of the \$17 million went to one company (Microsoft for its data centers in Mecklenburg County).

Exemption has moderate economic benefit and moderate return in state revenue

The data center exemption is estimated to have generated additional economic activity for the state between FY10 and FY17. Estimates show that each year private sector employment increased by 7,665 jobs, Virginia GDP increased by \$1.3 billion, and statewide personal income increased by \$724.9 million, on average, because of the data center exemption (Table 1-4). These estimates assume that 90 percent of total economic activity generated by the incentivized data centers is attributed to the data center exemption.

Much of the economic benefit occurs during construction of the data center and from initial and ongoing expenditures for equipment, rather than the daily operation of the data center. Capital investments to build and equip the facility and to update or replace equipment every three to five years account for approximately two-thirds of the additional employment (67 percent), Virginia GDP (58 percent), and personal income (64 percent) that was generated by the exemption between FY10 and FY17.

TABLE 1-4
Data center sales tax exemption has moderate economic benefit and moderate return in revenue to the state (FY10–FY17)

	Annual average (FY10–FY17)
Net impact to Virginia economy	
Private employment	7,665 jobs
Virginia GDP	\$1.3 billion
Personal income	\$724.9 million
Impact to Virginia economy per \$1 million of exemption	
Private employment	155 jobs
Virginia GDP	\$26.5 million
Personal income	\$14.6 million
Impact to state revenue	
Total revenue	\$37.7 million
Exempted amount	\$52.2 million
Revenue net of exempted amount	(\$14.5 million)
Return in revenue	72¢ per \$1 spent

Economic impact analysis of expenditures by exemption recipients between FY10 and FY17 was conducted using economic modeling software developed by REMI, Inc. (See Appendix M [online only] for the economic impact analysis used in this study.)

SOURCE: Weldon Cooper Center economic analysis of estimated exempted amounts between FY10 and FY17.
 NOTE: Includes direct, indirect, and induced impacts. Assumes that 90 percent of the economic activity is attributable to the exemption. The gross impact on Virginia’s economy is used to calculate the impact per \$1 million in exempted amount. This is consistent with how the economic development research literature typically calculates these impacts. (See Appendix N [online only] for detailed results on total impact of the exemption, impact of raising income taxes by the amount exempted [opportunity cost], and revenue generated by source.)

Overall, this economic benefit is moderate compared to the economic benefits of other incentives that have been assessed so far in this series. The data center exemption is estimated to generate \$27 million in Virginia GDP per \$1 million in spending on the exemption. This amount is higher than the Virginia GDP per \$1 million in spending generated by most other incentives reviewed in this report and slightly less than the economic benefits of several workforce grant programs reviewed in 2018. (See *Workforce and Small Business Incentives*, JLARC, 2018.) Although the economic benefit is moderate compared to incentives overall, it is particularly large for a tax incentive. In fact, it is substantially larger than the estimated \$1.6 million in Virginia GDP generated per \$1 million spent on all exemptions and the estimated \$1 million in Virginia GDP generated per \$1 million spent on all tax credits. (See *Economic Development Incentives 2018*, JLARC 2018.)

The data center exemption also has a moderate return in revenue of 72¢ for every \$1 spent on the exemption. Again, this return is higher than the return in revenue for most other incentives reviewed in this report and slightly less than the return in state revenue generated by several workforce grant programs reviewed in 2018. This return is also substantially higher than the return in revenue for other tax incentives reviewed to date, on average. (See *Economic Development Incentives 2018*, JLARC 2018.)

Even though the program likely influences more economic development projects than the typical Virginia incentive, the sizable tax revenue generated (\$38 million) by the exemption does not cover its costs. This exemption is much more expensive in terms of direct job creation and capital investment than most other incentives. The cost is

Net impact is the increase in economic activity induced by the exemption after adjusting for the opportunity cost of increasing taxes to pay for the exemption. (See Appendix N [online only] for information on the total economic impact and the opportunity cost of increasing taxes.)

\$223,125 per data center job compared to \$4,189 per job for the average Virginia incentive. It is not surprising that the exemption has a higher cost per job because the data center industry is not job-intensive. Instead, it is heavily capital intensive. However, the cost is \$33 per \$1,000 in capital investment, which is higher than the cost of the average Virginia incentive of \$24 per \$1,000 in capital investment. (See *Economic Development Incentives 2018*, JLARC 2018.)

Representatives reported data centers have other economic and social benefits

Data center representatives reported that data centers provide other economic and social benefits to a region that are not captured in the economic analysis described above. Several representatives indicated that data center investments, particularly if they are clustered within a region like Northern Virginia, have indirect or “knock-on” effects that result in other economic development. The clustering of data centers, related businesses, and skilled workers can further improve the attraction of the region and lead to additional telecommunication investments. The location of large enterprise data centers—such as the location of Facebook in Henrico County—may also have “follow the leader” effects by attracting smaller data centers to locate nearby. A smaller data center may not be eligible for the exemption, but it may benefit from using infrastructure that serves the enterprise data center at a lower cost than if it had to install the infrastructure itself. Data centers may also have “add on” effects for a region. These effects may occur if a company with a data center presence in Virginia makes a broader commitment to the state by moving other company operations, such as a corporate office, to the state. In this case, the presence of the data center may have served as a recruitment tool.

Several data center representatives indicated that data centers have had a positive effect on the development of the clean and renewable energy industry in the state. Despite data center commitments to renewable energy procurement policies, there is significant controversy over the actual impact of the state’s data center industry to Virginia’s carbon footprint and renewable energy supply, particularly because data centers are a primary source of growing electricity demand in the state. Concerns have also been raised about the impact increased data center demand will have on utility prices, particularly as costs for some infrastructure projects may be paid for by all electricity rate payers.

Continuation of data center exemption appears reasonable but several actions should be considered

The data center exemption is the costliest of Virginia’s incentives in terms of forgone revenue, but it appears to be relatively effective. It has a sizable influence on data center behavior—even in Northern Virginia which has multiple other advantages—because interstate competition to attract data centers has increased over the past decade. The data center exemption also generates moderate economic benefits to the state relative

to other incentives and generates substantially higher economic benefits than other tax incentives. Data centers also provide sizable tax revenue to the localities in which they locate.

Substantial changes to Virginia's data center exemption do not appear necessary to keep Virginia competitive. However, actions can be taken to attract data centers to distressed areas that could benefit from the additional local tax revenue. In addition, the state should consider actions that could reduce the level of the incentive offered without adversely affecting industry growth.

Virginia's data center exemption is considered very competitive

Some data center representatives characterized Virginia's exemption as one of the more aggressive incentives to attract data centers. Nearly all thought Virginia's data center exemption was competitive with incentives provided by other states. Colocation data centers find it particularly attractive because few other states offer a special exemption for this type of data center.

Eligibility requirements were generally characterized by data center representatives as favorable. Representatives said the exemption's three-year investment timetable, set in the MOU with VEDP, is reasonable. In addition, Virginia's capital expenditure threshold (\$150 million) is appropriate because the industry is so capital intensive. Virginia's lack of a minimum square footage requirement also was viewed positively. One data center representative stated that square footage requirements in other states limit flexibility in choosing the optimal architecture and layout for the data center. The current 2035 sunset date is also viewed positively because it creates long-term certainty for business planning, but representatives indicated removal of the sunset would provide even greater certainty.

A lower job creation threshold could encourage data center growth outside of Northern Virginia

Multiple data center representatives said that the exemption's new jobs threshold was a barrier to data center growth, particularly in areas outside of Northern Virginia. Because the Northern Virginia region faces rising real estate and congestion costs, a decreasing supply of developable land, and mounting difficulties building power distribution and other infrastructure, data centers are likely to seek lower cost locations elsewhere, either inside or outside of the state.

Data center representatives had two main concerns with the exemption's job requirements. One concern is that the 50-job requirement is out of sync with the capital investment requirement. One representative said: "Data centers are not job creators; they are revenue producers." Data centers continue to become more efficient through automation, which means fewer jobs are necessary. Based on an analysis of capital investment and job creation figures from data centers' MOUs with the state, one job is associated with \$6.3 million in capital investment. Thus, a \$150 million investment would be expected to create 24 jobs, on average. Virginia and Mississippi are the only

For purposes of the data center exemption, a **distressed area** is a locality that had an unemployment rate for the previous year of at least 150 percent of the average statewide unemployment rate as determined by the Virginia Economic Development Partnership.

VEDP requires that **all jobs must be within the same locality**. The statutory language states the minimum requirements are for a “data center” but does not define what constitutes a data center. VEDP requires the job creation and capital investment all be within the same locality, because the statute makes multiple references to “in the locality.”

Chapter 512 of the 2019 Acts of Assembly (§ 2.2-621) specifies that the creation of off-site or teleworking jobs for Virginia residents by a recipient company or its affiliates may be included in assessing compliance with a job creation requirement for a grant or incentive issued by a state agency.

states that have a 50-job requirement. Most data center sales and use incentives from other states do not have employment creation requirements or they are lower. (See Appendix C for minimum requirements in other states.)

The other main concern is that the job creation threshold is a barrier for locating data centers in more distressed areas of the state, an area where data centers could have a big impact on the regional economy, according to data center representatives. Even though the job threshold is reduced to 25 jobs for distressed areas and enterprise zones, it has had little to no impact on encouraging data centers to locate in these areas. So far, only one data center (Microsoft) using the exemption has located in a distressed locality (Mecklenburg County). Representatives indicated that smaller data centers meeting the capital investment threshold may be more likely to locate in distressed areas if the exemption did not have a minimum job requirement. Distressed regions generally do not already have the skilled workforce necessary, and it is often difficult to relocate workers from elsewhere. Savings from the exemption can provide resources to address these challenges.

Data center representatives also noted that all jobs must be within the same locality to qualify for the exemption, which is a barrier for distressed areas. Jobs created at a data center owned by the company in another locality do not count toward meeting the minimum threshold. This requirement encourages a campus approach of clustering data center buildings in select localities, such as in Loudoun and Prince William counties, when some companies may prefer to spread their operations out statewide.

Data center executives suggested several changes to the job creation requirement:

- remove requirement that all jobs be in the same locality to encourage data center growth statewide;
- further reduce or remove the minimum job creation threshold in distressed areas and enterprise zones to encourage data center growth outside of Northern Virginia; and
- reduce or eliminate the job creation thresholds (both the standard 50 job requirement and the 25 job requirement in distressed areas or enterprise zones.)

The best approach at this time may be to reduce or remove the minimum job creation threshold in distressed areas and enterprise zones (55 localities met at least one of the criteria in 2017) to encourage data center growth in these areas. The General Assembly could also allow the provisions of new legislation adopted in 2019 (Chapter 512) to apply to the exemption, for data centers in distressed areas or enterprise zones. Localities with data centers reported data centers are important sources of tax revenue, and they do not require substantial local government services. Therefore, data centers could provide substantial benefits to distressed areas. The other two suggested changes could increase the amount of forgone revenue to the state by allowing smaller data centers owned by the same company, that would have located in Virginia regardless of the incentive, to qualify for the exemption. They also do not directly incentivize data center growth outside Northern Virginia.

RECOMMENDATION 1

The General Assembly may wish to consider amending § 58.1-609.3 of the Code of Virginia to further reduce or remove the minimum job creation requirement of the sales and use tax exemption for data centers locating in a distressed area or an enterprise zone.

Virginia should examine how to best maintain the state's competitive position

The state has indicated that attracting data centers is important by offering multiple incentives targeted specifically to the industry. VEDP has also identified data centers as one of its targeted industries. However, data center representatives indicated that the state risks losing its competitive position because other states are adopting more aggressive infrastructure policies.

The state should commission a comprehensive data center industry study to assess opportunities to maintain Virginia's competitiveness. Although Virginia has developed an excellent and diverse fiber network, particularly in Northern Virginia, a study could address the challenges of attracting data center development in distressed or rural regions, such as lack of redundant telecommunications fiber, difficulties in accessing utilities, and workforce readiness. For example, Utah has encouraged the expansion of broadband infrastructure into rural areas through public-private partnerships and by leveraging rights-of-way along interstate and state highways. In addition, Utah lowered installation costs for broadband service providers by facilitating cooperative fiber and conduit trades. Virginia could similarly improve its utility and telecommunications infrastructure through how it addresses co-development projects and easements. The study should also assess how Virginia's renewable energy policies, local personal property taxation policies, and regulatory framework affect data centers.

Given the size of the exemption, the study should examine whether the opportunity exists to reduce the level of the incentive and still maintain Virginia's competitive position. Economic theory also suggests incentives should be used to help emerging markets and industry clusters develop in a region. However, the current exemption is mostly used by data centers in Northern Virginia where a strong industry cluster is already well-developed.

RECOMMENDATION 2

The General Assembly may wish to consider including language in the Appropriation Act directing the Secretary of Finance to convene a work group consisting of the Secretaries of Transportation, Commerce and Trade, and Administration; the staff directors of the House Appropriations Committee and Senate Finance Committee, or their designee; and other relevant agency stakeholders to conduct a data center industry study to examine actions that could be taken to maintain the state's competitive position to attract data centers and examine whether the opportunity exists to reduce the level of the exemption without adversely affecting industry growth.

Better track data center investments to improve estimates of fiscal impact and economic benefit

Current information collected from data centers using the sales and use tax exemption is limited in scope. During a three-year performance period, VEDP requires data centers using the exemption to provide progress reports and a final performance report that provides information on job creation and capital investment. TAX, which is frequently asked to report on the fiscal impact of the data center exemption by legislative committees, uses the capital investment information in these reports to develop an estimate of the forgone revenue from the exemption. VEDP recently began asking data centers to include the tax benefit of the exemption in these reports.

The reports, however, do not have enough information to accurately estimate the exemption's fiscal impact and economic benefits. Some data centers report only jobs and spending up to the minimum threshold, so the reports underestimate data centers' employment and capital investment. In addition, data centers are required to submit these reports only until the end of the performance period, even though they can continue to use the exemption until 2035. Therefore, no new information on employment, investments, and tax benefits is available and must be estimated from past levels.

The General Assembly could require that all data centers using the exemption provide an annual report to VEDP that includes their current employment levels, capital investment, and tax benefits, even after their performance period. The information reported by data centers could be considered proprietary confidential information and exempt from public disclosure under the Virginia Freedom of Information Act, which is the current practice. The new reporting requirement would allow TAX and JLARC to develop more accurate estimates of the exemption's fiscal impact and economic benefit. Improving the accuracy of tax benefit estimates for previous years also would be beneficial, and the General Assembly could require data centers to report historical information for past years in which they used the exemption, at least for the past three years. It may be difficult for data centers that have been using the exemption for many years to provide accurate information beyond three years. The General Assembly may wish to require TAX to publish an annual report on the data center exemption, similar to the report it is required to publish on the Motion Picture Production Tax Credit. Information could be reported in aggregate form only, statewide and by region, to protect the confidentiality of proprietary information.

VEDP should work with TAX and JLARC staff to ensure that the annual reports from data centers include the necessary information so that (1) VEDP can ensure data centers achieve their minimum requirements pursuant to the MOU; (2) TAX can develop a more accurate estimate of the cost of the data center exemption; and (3) JLARC staff can evaluate more precisely the impact of the data center exemption.

RECOMMENDATION 3

The General Assembly may wish to amend § 58.1-609.3 of the Code of Virginia to require that (1) all data centers using the data center sales and use exemption be required to submit an annual report including their employment level, capital investment, and tax benefit to the Virginia Economic Development Partnership (VEDP) and (2) the Department of Taxation (TAX), in consultation with VEDP, publish an annual report on the data center exemption that should include, at a minimum, aggregate information on qualifying expenses that were exempt from the retail sales and use tax and the total value of the tax benefit.

SEMICONDUCTOR CUSTOM GRANTS

Attract semiconductor manufacturers to locate and expand in the state

VALUE TO BENEFICIARIES

FY98-FY17

Grant awards: \$93.4M to 2 semiconductor manufacturers

Micron



\$18.6M to locate in state
\$27.0M to expand in state
\$45.6M total

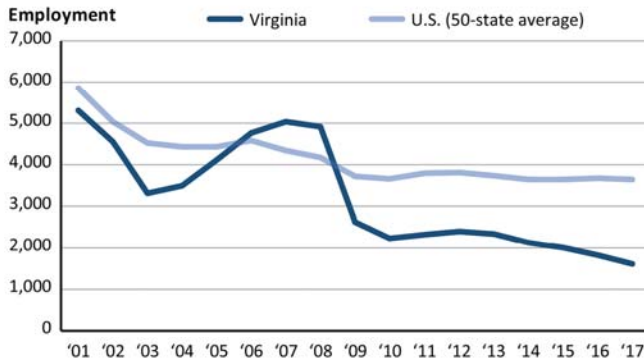
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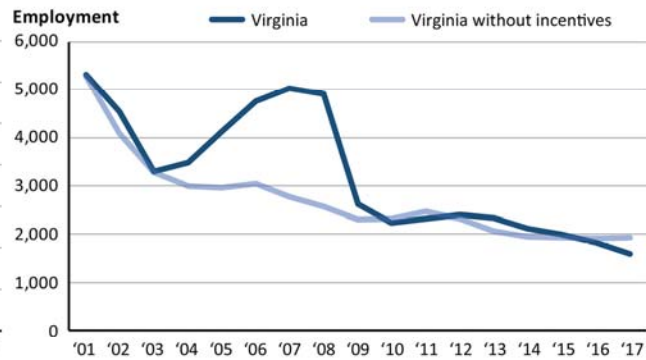
\$15.0M to locate in state
\$32.8M to expand in state
\$47.8M total

ACHIEVEMENT OF PURPOSE

Virginia semiconductor manufacturing employment has declined more than the industry's national employment



Custom grants had short-term positive impacts on Virginia semiconductor employment



IMPACT TO STATE ECONOMY

average FY98-FY17

Moderate economic benefit per \$1M of grant



67 jobs



\$21.9M
state GDP



\$13.3M
personal income

Moderate return in revenue



72¢
per \$1 spent

2. Semiconductor Manufacturing Incentives

Virginia has offered custom incentive grants and special sales tax exemptions to attract semiconductor manufacturing to the state. The custom grants by far are the largest of these incentives and were created to attract three semiconductor plants to Virginia in the late 1990s when the state aspired to establish a “Silicon Dominion.” Custom grants have periodically been offered to attract specific large manufacturers or other companies to the state, because the state’s typical package of incentives (grants, tax credits, exemptions, etc.) provides relatively small to modest awards (awards of \$205,000, on average, between FY10 and FY17). Custom grants often provide large award amounts ranging from \$30 million to \$550 million.

Multiple states offer “megadeal” incentives to attract semiconductor manufacturers

Semiconductor manufacturers are viewed as valuable to states: they require a large workforce and regularly purchase, replace, and upgrade expensive equipment. Some of the jobs require highly skilled workers to design and fabricate the electronic chips from a silicon-based wafer. The technology used to produce semiconductor chips quickly becomes obsolete requiring equipment to be replaced about every five to seven years. Semiconductor manufacturing also relies on substantial investments in research and development to design increasingly smaller and more powerful semiconductors.

Like Virginia, other states have frequently used large incentives packages or “megadeals” (i.e., \$75 million or more in total incentives) to incentivize the location or expansion of semiconductor manufacturers (Figure 2-1). These projects would also qualify for most available job creation tax credits, investment tax credits, R&D tax credits, or similar incentives, but these incentives may not be sufficient to sway the location decision of semiconductor manufacturers because they would only amount to a relatively small part of the relocation and expansion expenses.

Semiconductors are electronic chips or circuits made out of silicon—a material that has both conductive and insulative properties—and are the size of a postage stamp or smaller. The two main types of semiconductors are logical process chips (microprocessors) and memory chips for storage and retrieval. Anything that is computerized depends on semiconductors.

SEMICONDUCTOR EXEMPTIONS

Attract semiconductor manufacturers to locate and expand in the state

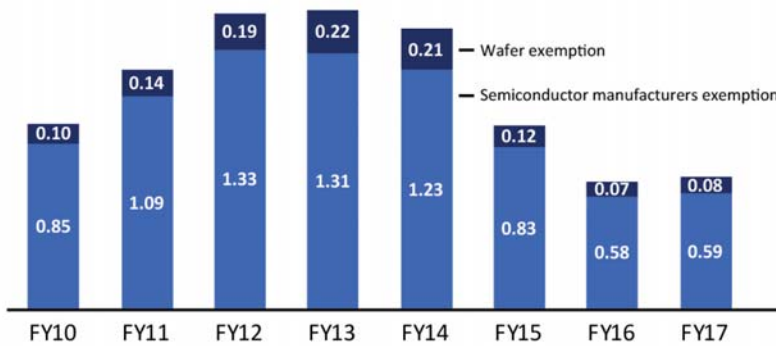
VALUE TO BENEFICIARIES

FY10-FY17

Beneficiary savings: \$8.9M

Beneficiaries

An estimated 20 businesses per year are eligible to claim exemptions



ACHIEVEMENT OF PURPOSE

Encourage semiconductor activity

Research has not found a strong relationship between sales and use taxes and manufacturing employment.

Improve tax efficiency

Expands manufacturing exemption to purchases of equipment, supplies and testing and quality control products used indirectly to develop final product.

IMPACT TO STATE ECONOMY

average FY10-FY17

Low economic benefit per \$1M of incentive



47
jobs



\$7.1M
state GDP



\$4.7M
personal income

Negligible return in revenue



6¢
per \$1 spent

Multiple states have offered “megadeal” incentives to semiconductor manufacturers, with several exceeding \$1 billion



SOURCE: Weldon Cooper Center review of information available from Good Jobs First.
 NOTE: See Appendix E for more detail about the incentive packages awarded by state.

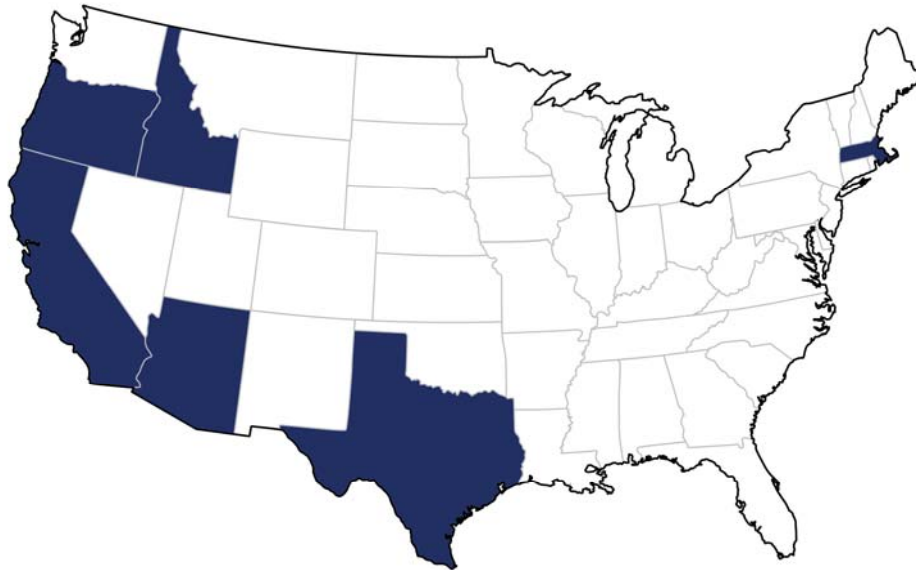
Semiconductor industry in U.S. remains concentrated in six states

The U.S. semiconductor industry has not moved much beyond its origins. The industry was established by Texas Instruments in Dallas, Texas, and Fairchild Semiconductor in San Jose, California, in the late 1950s and 1960s. Corporate spinoffs (AMD, Intel, and National Semiconductors) by former Fairchild employees remained in the area around San Jose resulting in the creation of “Silicon Valley.” Much of today’s semiconductor activity in the U.S. can be traced to these companies, with later manufacturing plants mostly in the western and southwestern U.S. To remain competitive, most U.S. semiconductor companies now manufacture semiconductor chips overseas or outsource fabrication to other businesses that specialize in manufacturing. These “fab-less firms” focus on design and engineering instead, the bulk of which continues to occur in California.

Currently, most U.S. semiconductor activity is located in six states: Arizona, California, Idaho, Oregon, Texas, and Massachusetts (Figure 2-2). These six states account for 74 percent of the nation’s employment in semiconductor manufacturing and 85 percent of the nation’s employment in semiconductor machinery manufacturing. These states also represent nearly half (43 percent) of the employment in the electronics manufacturers upstream industries—like computer storage device manufacturing and electronic computer manufacturing—that use semiconductor chips. Only three of these states offer “megadeal” incentives to these firms.

Upstream industries
 process basic or raw material into an intermediary product that is converted into a finished product by other downstream industries.

Figure 2-2
Semiconductor manufacturing and related supply chain industries are concentrated in a handful of states



SOURCE: Weldon Cooper Center analysis of EMSI employment data.
 NOTE: See Appendix F for more detail of employment and location quotient by state.

Location quotient indicates how concentrated an industry or occupation is in a region compared to the national average.

A location quotient above 1.0 indicates the industry or occupation in a region is more concentrated than the national average. A location quotient below 1.0 indicates it is less concentrated.

An **industry cluster** is a regional concentration of related businesses including suppliers, service providers, and other agencies and institutions to support the industry.

These six states also have high concentrations of semiconductor and related employment, with sizable location quotients particularly for semiconductor manufacturing and semiconductor machinery manufacturing. In contrast, Virginia has a low rate of concentration for all semiconductor-related industries, with location quotients less than 1.0. The absence of these industries and other semiconductor R&D activities point to substantial challenges for growing a semiconductor industry cluster within the state.

Virginia approved five grants totaling \$195 million but paid out less than half that amount (FY96–FY17)

Between FY96 and FY17, the General Assembly authorized five grants totaling \$195 million to attract semiconductor manufacturers (Table 2-1). The first three were authorized in the mid-1990s to attract three semiconductor manufacturers to locate production facilities in Virginia. They included grants for

- Motorola to locate a plant in Goochland County (1996),
- Dominion Semiconductor LLC to locate a plant in the City of Manassas (1996), and
- White Oak Semiconductor Partnership to locate a plant in Henrico County (1997).

In 2001, the General Assembly authorized additional grants for the expansion of semiconductor production facilities in Manassas and Henrico. The expansion plans,

though, were delayed because of a downturn in the semiconductor chip market and were never awarded. In 2005, the General Assembly revised the statutes authorizing the grants to offer a custom grant for

- Micron, which purchased Dominion Semiconductors in 2002, to expand the Manassas plant and
- Infineon, formerly White Oak Semiconductors Partnership, to expand the Henrico plant.

In 2019, the General Assembly authorized another \$70 million custom grant for the expansion of Micron in Manassas. Because it is newly authorized, this grant is not reviewed in this report.

Table 2-1

Virginia approved \$195 million for semiconductor manufacturers but paid out only \$93 million in awards (FY96–FY17)

Custom grant project	Year authorized	Job creation requirement	Capital investment requirement	Maximum award	Amount paid
Motorola (Goochland)	1996	--	\$1.0B	\$60.0M	\$0.0M
Dominion Semiconductor LLC (Manassas)	1996	4,000 FTEs	4.0	38.4	18.6
White Oak Semiconductor Partnership (Henrico)	1997	1,500	1.5	15.0	15.0
Micron (Manassas)	2005	860	1.2	27.0	27.0
Infineon (Henrico)	2005	1,200	1.2	55.0	32.8
All custom projects		7,560 FTEs	\$8.9B	\$195.4M	\$93.4M

SOURCE: Weldon Cooper Center review of Chapters 642, 645, 651, and 652, 1996 Acts of Assembly; Chapters 789, 1997 Acts of Assembly; Chapter 392, 2005 Acts of Assembly; and documentation provided by VEDP.

NOTE: Reflects year grants were authorized in statute by the General Assembly. FTEs, full time equivalents. Job creation requirements for Dominion Semiconductor (1996) and White Oak Semiconductor reflect the requirements stated in the memorandum of understanding between the company and VEDP. See Appendix G for more detail on the requirements and the payment schedule for the grants.

Virginia spent \$93.4 million on the custom grants for semiconductor manufacturers between FY96 and FY17, which is less than half of the total approved (\$195 million). No funding was paid out for the Motorola facility in Goochland County, which was approved in 1995. The project was just underway when Motorola halted construction because of declining market conditions, and the grant was canceled in 1998. Dominion Semiconductors LLC in Manassas, which later was purchased by Micron, only met the first milestone of its 1996 grant, receiving \$18.6 million out of a potential \$38.4 million. The grant for Micron's expansion in 2005 was paid in full. The Henrico County plant, which underwent several different owners before shutting down, received full payment for its first grant approved in 1997 but only partial payment for its 2005 grant. Virginia only awarded \$32.8 million of the \$55 million maximum award for the Henrico plant because the company (Qimonda) shut down the plant in 2009 because of corporate insolvency. The grant's final milestone was not met.

In addition to receiving the custom grants, the state also provided other incentives to Qimonda and Micron. Qimonda received a \$3 million Governor’s Development Opportunity Fund (now Commonwealth’s Opportunity Fund) grant. Micron received \$4.3 million in additional grants since 2005 including

- a \$1 million grant from the Virginia Investment Partnership;
- two grants totaling \$2.5 million from the Governor’s Development Opportunity Fund; and
- two grants totaling \$790,486 from the Virginia Jobs Investment Partnership program.

Virginia adopted two sales and use tax exemptions for semiconductor manufacturers resulting in \$9 million in forgone revenue (FY10–FY17)

In 2006, the General Assembly also adopted two retail sales and use tax exemptions for semiconductor manufacturers to extend the retail sales and use tax exemption for purchases of manufacturing inputs to purchases of inputs used *indirectly* in the semiconductor manufacturing process (Table 2-2). Semiconductor manufacturers—like any manufacturer—can claim the manufacturing exemption for purchases of goods that are used *directly* in the manufacturing of semiconductor chips.

TABLE 2-2

Virginia offers two sales and use tax exemptions for semiconductor manufacturers

Exemption	Purpose
Semiconductor Manufacturers Exemption	Exempts equipment, fuel, power, energy, and supplies used primarily in the integrated process or sub-process of designing, developing, manufacturing, or testing semiconductor chips Extends existing exempt status to items used before or after production, or in the cleanroom (lab designed to maintain low levels of particulates and necessary to ensure quality and integrity of product)
Semiconductor Wafer Exemption	Allows all semiconductor wafers used by semiconductor manufacturers to be tax exempt, not just those used directly in the manufacturing process Extends exempt status to wafers used indirectly in production for cleaning, process control, and testing

SOURCE: Weldon Cooper Center review of the Code of Virginia and agency documents.

NOTE: Authorized by § 58.1.-609.3(14)(15). Semiconductor and other manufacturers can exempt purchases of equipment, supplies, and other tangible property used directly in the manufacturing process through the state’s manufacturing exemption.

It is estimated that the cost of the two sales and use tax exemptions in terms of forgone revenue has been relatively small, totaling only \$9 million between FY10 and FY17. Most of the forgone revenue comes from the semiconductor manufacturing exemption, which is estimated to have resulted in \$7.8 million in forgone revenue during the period, or nearly \$1 million per year, on average. The semiconductor wafer exemption is estimated to have resulted in \$1.1 million in forgone revenue during the

period, or \$142,000 per year, on average. The estimates are small because very few businesses in Virginia are in semiconductor manufacturing and are eligible for the exemptions. Industry representatives reported that only a small portion of their total purchases are related to indirect activities.

Virginia incentives for semiconductor manufacturers have had limited effects on employment

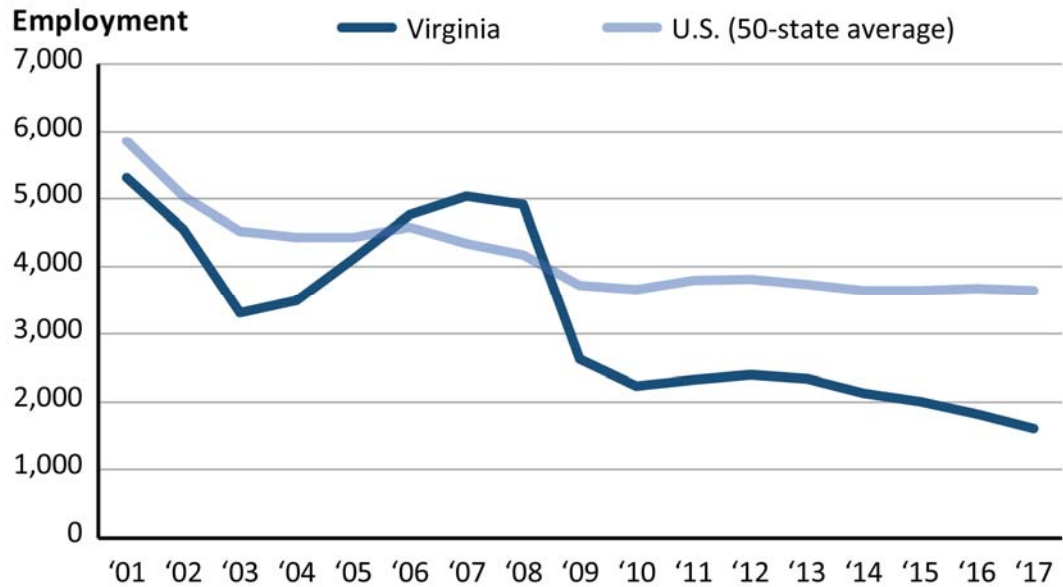
The semiconductor manufacturing industry and related jobs—like all manufacturing jobs—have been declining across the nation. Semiconductor production in the U.S. made up 42 percent of global production in 1980 but fell to 30 percent in 1990 and to 13 percent in 2015. The decline comes from several challenges, including the rise of global competitors, increasing costs of design and fabrication, technological change, and difficulties in finding technical talent. U.S. production of semiconductors has offshored to countries such as Taiwan, Korea, and China, where producers benefit from proximity to other electronic industries and from active government-sponsored industrial policies that promote industry growth, including incentives and research sponsorship.

Semiconductor manufacturing employment in Virginia declined more than industry employment nationally

Virginia semiconductor manufacturing employment declined 70 percent between 2001 and 2017 (Figure 2-3). This decline is at a substantially greater rate than the 38 percent decline nationwide, despite Virginia’s custom incentive grants. The decline in Virginia was temporarily halted between 2003 and 2008 by the expansion of the plant in Henrico but then sharply declined again after Qimonda closed.

The greater employment declines in Virginia partly reflect company specialization in memory chips rather than microprocessors (like U.S. companies such as Intel). The memory chip market is a more “commodified” market because chips between one manufacturer and another can be easily substituted. The U.S. market for memory chips also faces fierce international competition with Asian producers. While Virginia has other businesses classified as semiconductor and related devices, they include only a handful of companies with few employees.

Figure 2-3
Virginia semiconductor manufacturing employment has declined more than industry employment nationally (2001–2017)



A synthetic control group to represent Virginia without semiconductor incentives was constructed from states that did not have significant semiconductor incentives during the time period studied. Select characteristics of states that made up the synthetic control group were weighted so that once combined, it closely resembled Virginia on those characteristics. (See Appendix M for research methods used for this analysis.)

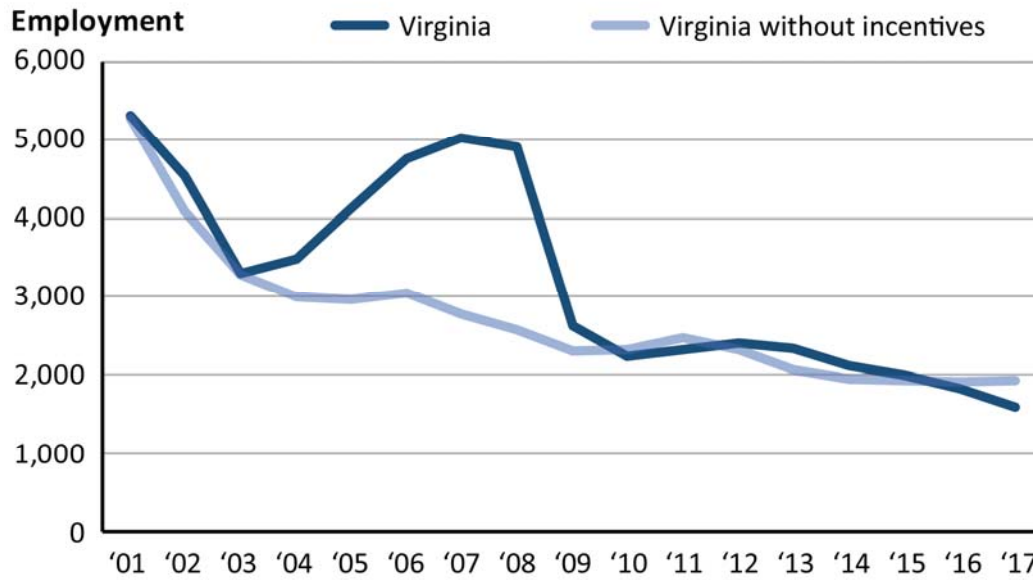
SOURCE: Weldon Cooper Center analysis of EMSI employment data for the semiconductor and related device manufacturing sector for Virginia and U.S. states.

NOTE: Excludes employment in fabless design and engineering semiconductor firms.

Grants may have provided a short-term boost to semiconductor manufacturing employment

The custom incentive grants may have provided a substantial short-term boost to semiconductor manufacturing employment in Virginia. Between 2005 and 2009, Virginia semiconductor manufacturing employment was higher than what it likely would have been without the incentives (Figure 2-4). This time period reflects the five-year performance period agreed to in the MOU between the companies and VEDP. After 2009, semiconductor manufacturing employment in Virginia resumed its decline in a pattern similar to states with comparable characteristics that did not award incentives.

Figure 2-4
Virginia semiconductor custom grants had short-term positive impacts on semiconductor employment (2001–2017)



SOURCE: Weldon Cooper Center analysis of EMSI data for the semiconductor and related device manufacturing sector.
 NOTE: Excludes employment in fabless design and engineering semiconductor firms.

While incentives are important to manufacturers, Virginia’s custom grants may not have been sufficient to sway behavior

Semiconductor manufacturers have reported that financial incentives and subsidies rate highly among site location factors. Tax advantages ranked first in international location decisions, followed by the supply of an engineering and technical workforce and the availability and reliability of utilities, according to a survey of 10 executives at major semiconductor companies (Leachman and Leachman 2004). A study of the semiconductor industry in the Kumamoto Prefecture of Japan indicates that financial incentives and subsidies ranked fourth, preceded by workforce (first), proximity to customers (second), and input costs (third). Representatives of Global Foundries indicated that the large incentive package was a crucial component of the decision to locate in upper New York, although workforce/education, existing semiconductor industry operations, R&D infrastructure, and stable geology were also important. Virginia’s custom incentives for semiconductor manufacturers, which have been substantially less than incentives provided by many other states, represent a very small portion of operating costs for the new semiconductor manufacturing activity and, alone, may not be enough to sway decisions.

The scale estimating the amount of economic activity attributed to an incentive is based on the incentive amount as a percentage of the business's operating costs for the related activity over a 20-year period. The estimate is based on costs and does not account for other factors that may influence a business's location or expansion decisions. See Appendix M [online only] for more detail on the difficulty of precisely estimating incentives' effects and the methodology used in this report.

Estimates indicate a relatively small portion of economic activity by semiconductor manufacturers in Virginia is likely attributed to custom grants

The custom grants—while sizable compared to the average Virginia incentive—represented only a small fraction of the total operating costs for the Micron (0.8 percent) and Qimonda (0.7 percent) semiconductor plants over a 20-year period. These low percentages are expected to induce less than 10 percent of Micron's (8 percent) and Qimonda's (6 percent) economic activity, according to a scale developed by a leading researcher of incentives (Bartik 2018b).

The custom grants may not be big enough to compete with less expensive labor and capital overseas. The development of new large semiconductor fabrication plants has become increasingly rare in the U.S., with most investment now occurring at existing facilities. One industry source reports that building, equipping, and operating a fabrication facility in the U.S. costs \$1 billion more than a similar facility overseas. Virginia's custom grant payments to Micron and Qimonda totaled \$45.6 million and \$47.8 million, respectively.

Exemptions for semiconductor manufacturers likely have had limited effect

The sales tax exemptions for semiconductor manufacturers also likely had a limited effect on economic activity in the state. Studies of sales and use tax exemptions and tax rates on manufacturing and other industry economic activity are limited and generally have not found a strong relationship between sales and use taxes and industry employment. Two recent studies have attempted to measure the economic effects of similar exemptions and have found little to no impact. One study examined the effect of the state sales and use tax burden on machinery and materials and found they are negatively associated with manufacturing capital expenditures and employment, but the effect is relatively small (Hageman, Bobek, and Luna 2013). Another study using county data across state borders finds that retail sales taxation levels for manufacturing machinery and equipment has little or no effect on employment levels (Mikesell and Ross 2017).

Economic benefits of semiconductor custom grants are moderate and are larger for Micron than for Qimonda

The custom grants for Micron and Qimonda generated economic activity for Virginia. Each year employment increased by 287 jobs, Virginia GDP increased by \$100 million, and personal income increased by \$58 million, on average, because of the grants between FY98 and FY17 (Table 2-3). These estimates assume that 8 percent of the activity generated by Micron and 6 percent of the economic activity generated by Qimonda are attributable to the custom grants.

The economic benefits of both Micron and Qimonda were highest during site development and construction. Once both companies were operational, the highest impacts

Economic impact analysis of expenditures by custom grant recipients between FY98 and FY17 was conducted using economic modeling software developed by REMI, Inc.

(See Appendix M [online only] for the economic impact analysis used in this study.)

occurred when the companies were at their highest levels of employment (1,800 workers for Micron and 2,500 for Qimonda). The economic benefits were larger for Micron even though Qimonda was the larger project in terms of jobs created and capital investment. Economic benefits generated by Qimonda over the 20-year period are lower, because the Qimonda plant shut down in 2009.

The economic benefits generated by the custom grants are moderate compared to those generated by other incentives. The custom grant for Micron generated an estimated \$30 million in Virginia GDP per \$1 million spent on the grant, and the grant for Qimonda generated an estimated \$14 million in Virginia GDP per \$1 million spent. These amounts are higher than the estimated Virginia GDP per \$1 million spent for tax incentives (with the exception of the data center exemption) reviewed in this report and in other reports in this series. These amounts are similar to the estimated benefits generated collectively by all Virginia’s incentive grants per \$1 million spent on grants. (See *Economic Incentive Grants 2018*, JLARC, 2018.)

Net impact is the increase in economic activity induced by the incentive after adjusting for the opportunity cost of increasing taxes to pay for the loan assistance.

(See Appendix N [online only] for information on the total economic impact and the opportunity cost of increasing taxes.)

Table 2-3
Economic benefits of semiconductor custom grants are moderate and are larger for Micron (FY96–FY17)

	Annual average FY98–FY17		
	Micron	Qimonda	Total semiconductor custom grants
Net impact to Virginia economy			
Private employment	154 jobs	134 jobs	287 jobs
Virginia GDP	\$66.9 million	\$31.6 million	\$98.5 million
Personal income	\$38.9 million	\$19.2 million	\$58.1 million
Impact to Virginia economy per \$1 million of grants			
Private employment	73 jobs	62 jobs	67 jobs
Virginia GDP	\$30.1 million	\$14.0 million	\$21.9 million
Personal income	\$17.8 million	\$8.9 million	\$13.3 million
Impact to state revenue			
Total revenue	\$2.2 million	\$1.2 million	\$3.4 million
Grant awards	\$2.3 million	\$2.4 million	\$4.7 million
Revenue net of awards	(\$0.1 million)	(\$1.2 million)	(\$1.3 million)
Return in revenue	97¢ for every \$1 spent	49¢ for every \$1 spent	72¢ for every \$1 spent

SOURCE: Weldon Cooper Center economic impact analysis of amount of credits claimed FY98–FY17.

NOTE: Includes direct, indirect, and induced impacts. Gross impact on Virginia’s economy is used to calculate impact per \$1 million in incentive awards. This is consistent with how the economic development research literature typically calculates these impacts. (See Appendix N [online only] for detailed results on total impact of the custom grants, impact of raising income taxes by the amount of the grants [opportunity cost], and revenue generated by source.)

The return in revenue from both custom grants is also moderate, with Micron again yielding a higher return. The return in revenue for every \$1 spent on the Micron custom grants was 97¢ annually, on average, and the return in revenue for the Qimonda custom grants was 49¢. These returns in revenue are similar to the returns (55¢) for all grants collectively per \$1 dollar in total grant spending. (See *Economic Incentive Grants 2018*, JLARC, 2018.)

Because the custom grants are well-targeted to projects expected to have large economic benefits, these economic benefits and the returns in revenue should be higher than those across all incentive grants. However, the custom grants are substantially costlier on a per-job basis (approximately \$21,457 per job for both Qimonda and Micron) than the cost per job (\$4,189) for the typical incentive grant provided by Virginia's programs.

Economic benefits of semiconductor exemptions are low and returns in revenue are negligible

The semiconductor manufacturers and wafers exemptions generate relatively low economic benefits and returns in revenue to the state, according to estimates. These exemptions on average generated an additional 43 jobs, \$7 million in Virginia GDP, and \$4.3 million in personal income annually, on average, between FY10 and FY17 (Table 2-4). These economic benefits are low relative to the economic benefits generated by other incentives. The exemptions are estimated to generate an additional \$7.1 million in Virginia GDP per \$1 million spent on the exemptions. This amount is less than the \$14.6 million in Virginia GDP generated across all incentive grants per \$1 million in grant spending. (See *Economic Development Incentive Grants 2018*, JLARC, 2018.) However, this amount is higher than the additional Virginia GDP generated per \$1 million spent by most other tax exemptions and credits that have been reviewed to date in this series of reports. One factor likely limiting the economic benefits of the sales tax exemptions for semiconductors is that, unlike the data center exemption and many incentive grants, eligibility is not contingent on the companies achieving certain levels of job creation and capital investment.

The return in state revenue for the exemptions, like most other tax incentives reviewed in this series, is negligible. For every \$1 spent on the semiconductor manufacturing exemption, the return in state revenue is 5¢. The return in state revenue for the semiconductor wafers exemption is slightly higher at 12¢ per \$1 dollar spent.

Table 2-4

Economic benefits of semiconductor manufacturing exemption and wafers exemption are low (FY10–FY17)

	Annual average FY10–FY17		
	Semiconductor Manufacturing Exemption	Semiconductor Wafer Exemption	Total semiconductor exemptions
Net impact to Virginia economy			
Private employment	36 jobs	7 jobs	43 jobs
Virginia GDP	\$5.8 million	\$1.2 million	\$7.0 million
Personal income	\$3.6 million	\$0.7 million	\$4.3 million
Impact to Virginia economy per \$1 million of exemptions			
Private employment	45 jobs	57 jobs	47 jobs
Virginia GDP	\$6.8 million	\$9.2 million	\$7.1 million
Personal income	\$4.5 million	\$5.9 million	\$4.7 million
Impact to state revenue			
Total revenue	\$47,359	\$16,878	\$64,237
Spending on exemption	\$975,760	\$142,357	\$1,118,117
Revenue net of awards	(\$928,402)	(\$125,479)	(\$1,053,881)
Return in revenue	5¢ for every \$1 spent	12¢ for every \$1 spent	6¢ for every \$1 spent

SOURCE: Weldon Cooper Center economic impact analysis of amount of exemption spending FY10–FY17.

NOTE: Includes direct, indirect, and induced impacts. Gross impact on Virginia's economy is used to calculate impact per \$1 million in exemption spending. This is consistent with how the economic development research literature typically calculates these impacts. (See Appendix N [online only] for detailed results on total impact of the exemptions, impact of raising income taxes by the amount of the exemptions [opportunity cost], and revenue generated by source.)

Exemptions have little effect on semiconductor activity but may create more efficient tax

Even though the semiconductor manufacturers and wafer exemptions likely have little effect on semiconductor activity in the state and have low economic benefits and returns in state revenue, the exemptions appear warranted to create a more efficient tax. Purchases of machinery and equipment directly used in manufacturing industries and for research and design have been exempted since the sales tax was adopted in Virginia. These exemptions expand this tax treatment to purchases of equipment and supplies that are not in the final product, but are arguably important for development of quality final products. From a tax policy perspective, sales and use taxes are generally considered by economists as most efficient when taxing only final sales for personal consumption. These exemptions, however, should be considered for elimination if its main beneficiary, Micron, ceases operation in the state.

Virginia should develop principles for providing custom grants

Virginia provided semiconductor manufacturers with custom grants in the 1990s and in 2005 with hopes of establishing a semiconductor industry cluster—the “Silicon Dominion”—in the state. At one time, three semiconductor manufacturers and multiple suppliers had a presence in the state, but ultimately an industry cluster was never developed and only one major company, Micron, remains. Based on reviews of the

process for awarding the custom grants to Micron and Qimonda (or their predecessors) in the 1990s and 2005 and the economic activity generated by the companies on a long-term basis, several principles were identified that should be used for awarding future custom grants. These principles could improve the effectiveness (short- and long-term) of future custom grants offered by Virginia.

Ensure custom grants generally align to state or regional target industry clusters and strategic goals

Economic incentives are likely to be most effective when they leverage investment in an industry targeted by a region in its economic development strategy. However, it is unclear that there is deliberate alignment between custom grants and targeted industries during the decision-making process in Virginia, based on attendance of legislative meetings and discussions with legislative staff.

The Major Employment and Investment (MEI) Project Approval Commission, which reviews and approves custom grants, could assess the extent to which proposed grants align with state and regional targeted industry sectors and strategic plans. VEDP provides one or more presentations about the project and its economic impact to the MEI commission. VEDP's internal project review process considers whether projects align with strategic industry sectors and state and local strategies, according to agency documents. The MEI Commission could direct VEDP to include in its presentation a discussion of how the custom grant aligns with state and regional targeted industries and strategic plans, or provide other justification for the necessity of providing custom incentives. The MEI Commission could then include this information, at least at a basic level to avoid revealing company proprietary information or confidential strategic plan details, in its annual report.

RECOMMENDATION 4

The Virginia Economic Development Partnership should report to the Major Employment and Investment Project Approval Commission how each custom grant being considered by the commission aligns with state and regional targeted industries and strategic plans.

RECOMMENDATION 5

The General Assembly may wish to consider amending § 30-312 of the Code of Virginia to require that information on how custom grants align with state and regional target industries and strategic economic development plans be included in the annual report of the Major Employment and Investment Project Approval Commission.

Ensure custom grants are matched with local incentives

With the escalating capital investments required to open new facilities or expand existing ones and the attractiveness of high-tech development, “megadeal” packages often are accompanied by local incentives. Local incentives serve as a signal to the state that a locality is a willing economic development partner.

The local incentives provided to Micron and Qimonda made up a large part of the total incentive package from Virginia, and are estimated to have doubled Virginia’s ability to encourage the companies to locate and expand in the state. Both companies received large local incentives. Micron received an estimated \$93 million in local incentives over the 20-year period, two-thirds of the total incentive value, and Qimonda received an estimated \$27 million, one-third of the total incentive value. These local incentives increase the percentage of operating costs covered to 2.3 percent for Micron and 1.0 percent for Qimonda, which is estimated to increase the amount of economic activity that can be attributed to the incentives to 20.7 percent for Micron and to 9.6 percent for Qimonda. (The economic activity that can be attributed to the state incentives alone is 8 percent for Micron and 6 percent for Qimonda.)

The economic benefits and returns in revenue of the custom grants for Micron and Qimonda to the state are estimated to be substantially larger when accounting for the fact that the local communities made a sizeable contribution to the total incentive packages that attracted the companies. The local incentives are estimated to have more than doubled the chances of attracting the businesses, thereby doubling the estimated economic benefits and returns in revenue to the state that can be attributed to the grants (Table 2-5). Thus, local contributions play an important part in determining the impact on state revenue of the grants at current levels of support (\$19,176 per job for Qimonda and \$24,756 per job for Micron compared to a Virginia average incentive of \$4,189).

For these custom grant projects, ensuring localities’ participation seems warranted to increase the chances of securing a location or expansion decision, increase the economic benefits to the state, and help offset the relatively high cost of providing incentives. Many other grant-funded projects in Virginia already receive local incentives. The Commonwealth’s Opportunity Fund grant requires a 100 percent local match. Several projects in Virginia that received custom grants have also received local incentives, including Micron, Amazon, Newport News Shipbuilding, and Rolls-Royce. By nature of the scale of the custom projects, it is likely that the local government will also provide monetary or in-kind incentives to help attract the project to its area. To ensure local participation, the MEI Commission could consider establishing a policy that requires custom grants to be accompanied by local incentives, either monetary or in-kind.

Table 2-5
Economic benefits of semiconductor custom grants are higher when local incentives are included

	Annual average FY98–FY17		
	Micron	Qimonda	Total semiconductor custom grants
Net impact to Virginia economy			
Private employment	650 jobs	209 jobs	859 jobs
Virginia GDP	\$66.9 million	\$31.6 million	\$235.7 million
Personal income	\$38.9 million	\$19.2 million	\$139.8 million
Impact to Virginia economy per \$1 million of grants			
Private employment	290 jobs	93 jobs	190 jobs
Virginia GDP	\$82.9 million	\$21.2 million	\$51.4 million
Personal income	\$49.0 million	\$13.4 million	\$30.9 million
Impact to state revenue			
Total revenue	\$6.1 million	\$1.8 million	\$7.9 million
Grant awards	\$2.3 million	\$2.4 million	\$4.7 million
Revenue net of awards	\$3.8 million	(\$0.6 million)	(\$3.2 million)
Return in revenue	\$2.66 for every \$1 spent	74¢ for every \$1 spent	\$1.68 for every \$1 spent

SOURCE: Weldon Cooper Center economic impact analysis of amount of credits claimed FY98–FY17.

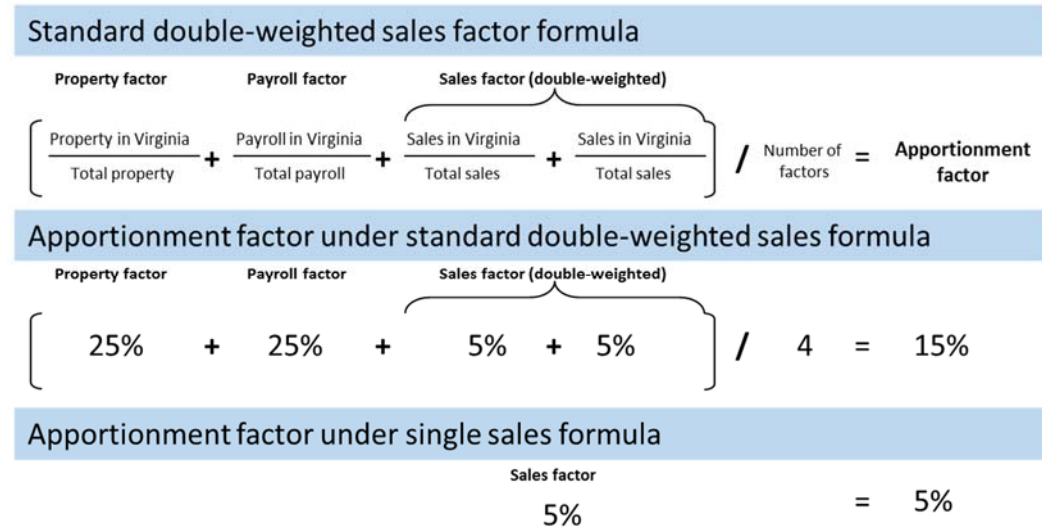
NOTE: Includes direct, indirect, and induced impacts. Gross impact on Virginia's economy is used to calculate impact per \$1 million in incentive awards. This is consistent with how the economic development research typically calculates these impacts. (See Appendix N [online only] for detailed results on total impact of the custom grants, impact of raising income taxes by the amount of the grants [opportunity cost], and revenue generated by source.)

3. Manufacturing Single Sales Apportionment

Following the lead of many states, the General Assembly adopted legislation in 2009 to allow manufacturers to use a single sales income tax apportionment formula that could reduce their Virginia income tax liability. Multistate manufacturers are typically required to use a three-factor apportionment formula based on the proportion of their total property, payroll, and sales in Virginia. This formula double-weights the sales factor, and corporations must use this “double-weighted sales” formula unless otherwise specified in statute. The single sales formula allows manufacturers to calculate their taxable income in Virginia based solely on the proportion of total sales that are in Virginia. This formula allows manufacturers that have a sizable proportion of property and payroll in Virginia and a smaller proportion of sales to lower their tax liability (Figure 3-1). Thus, it is considered a tool to attract businesses to locate and expand in the state. Single sales apportionment was phased in from July 2011 to July 2014 with increasing weights for the sales factor each year until July 2014, when companies could use just sales (Table 3-1).

A uniform apportionment formula was developed by a group of state tax professionals to ensure that states do not tax more than their share of income, and thus comply with the U.S. Commerce Clause requirement for fair apportionment. The formula apportions income to states according to where products are made (where property and payroll are located) and where products are sold, with each of the three factors (property, payroll, and sales) equally weighted. Nearly all states adopted the formula. States began to double-weight the sales factor to equalize the weight given to supply (property and payroll) and demand (sales). Later, states began to use only sales in the formula.

Figure 3-1
Single-sales apportionment allows manufacturers to potentially reduce their Virginia tax income



SOURCE: Weldon Cooper Center review of the Code of Virginia, Virginia Administrative Code, and TAX forms and guidance documents.

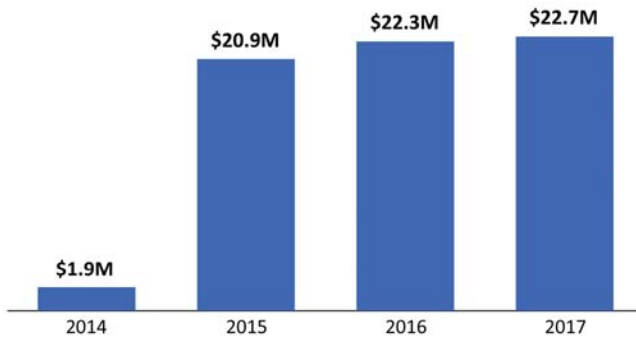
SINGLE SALES APPORTIONMENT FOR MANUFACTURERS

Promote the manufacturing industry in the state and slow the decline of manufacturing jobs

VALUE TO BENEFICIARIES

2014-2017

Beneficiary savings: \$67.8M total

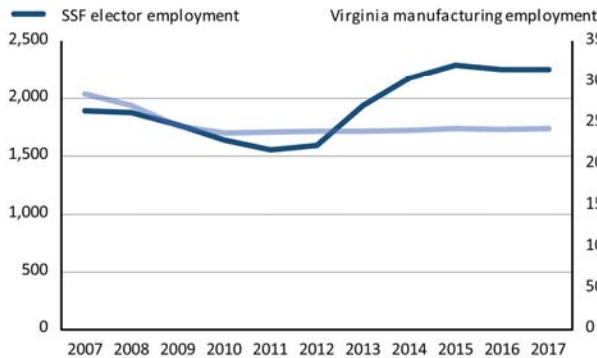


Beneficiaries
Increased from
16 companies (2014)
to
70 companies (2016)

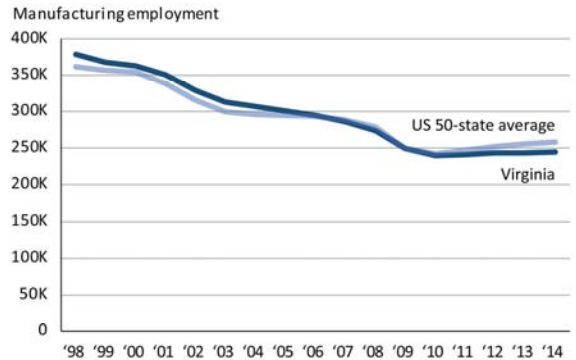


ACHIEVEMENT OF PURPOSE

Manufacturers using single sales apportionment had more employment growth than other manufacturers



Virginia manufacturing employment has grown slightly less than the nation after adoption of single sales apportionment



IMPACT TO STATE ECONOMY

average FY14-FY17

Moderate economic benefit per \$1M of incentive



98
jobs



\$17.6M
state GDP



\$6.9M
personal income

Moderate return in revenue



54¢
per \$1 spent

NOTE: Beneficiary savings for 2017 are estimated by inflating 2016 savings.

Virginia adopted a single sales apportionment option for manufacturers to maintain industry employment

Virginia’s manufacturing industry, which is relatively small, has declined at a much faster rate—34 percent—than the 26.5 percent decline nationwide over the past two decades (1998 to 2017). Virginia’s manufacturing employment declined for reasons similar to the decline in national employment. Many overseas manufacturers, particularly in China and other Asian countries, have low labor costs. In addition, technological improvements have reduced the demand for U.S. labor. Cyclical forces (a lack of available jobs because of decreased demand) contributed to a sharper reduction in Virginia manufacturing employment during and immediately following the 2007–09 recession. Much of the employment loss was in lower-wage industries—textiles, apparel, furniture, and wood products—that were more concentrated in Virginia than in other states. The textile, apparel, and furniture industries faced increasing competition from lower price imports. The wood products industry was affected by the downturn in the housing market and construction activity during the recession and the slow recovery afterward.

Virginia’s manufacturing industry is relatively small, representing 4.8 percent of total employment in the state compared with 6.8 percent nationwide.

TABLE 3-1
Manufacturers in Virginia may elect to use a single sales apportionment formula

Purpose	Incentivize the state’s manufacturing industry and slow the decline of manufacturing jobs
Eligible businesses	Corporations classified under the traditional manufacturing NAICS codes of 31, 32, and 33 and the agriculture, forestry, fishing and hunting NAICS code of 11 Maintain employment levels at 90% of the base year (year elected to use single sales apportionment) for 3 years Pay employees at least as much as the state or local average weekly wage for the company’s industry, whichever is higher, for 3 years
Program features	Must use the single sales apportionment for 3 years after electing to use it <ul style="list-style-type: none"> – Must maintain employment and wages at levels described or face recapture of the difference between tax liability calculated under single sales apportionment and tax liability under double-weighted sales apportionment plus interest – To avoid recapture and interest in a tax year, company can notify the Department of Taxation (TAX) that it expects to not meet the wage or employment requirements and instead use double-weighted sales apportionment After the 3 years, not required to maintain the employment and wage requirements; can continue to use the single sales apportionment or switch back to double-weighted sales Applies to corporations that pay corporate income taxes and businesses organized as pass-through entities whose owners pay individual income taxes
Use of incentive	Allow manufacturers to reduce tax liability by choosing to use a more beneficial apportionment method, particularly if they have high proportions of property and payroll in the state relative to their sales in the state

SOURCE: Weldon Cooper Center review of the Code of Virginia and agency documents.

NOTE: NAICS, North American Industrial Classification System. The elective single sales apportionment statute included a 10 percent penalty for not meeting the requirements and required businesses to maintain base year employment (at 100 percent). The penalty was removed and the maintenance level reduced to 90 percent during the 2012 legislative session.

Estimates of forgone revenue begin in tax year 2014 because it is the first year that single sales apportionment was used. In previous years, sales were triple and quadruple weighted.

Estimates do not include forgone revenue from pass-through entities whose owners pay individual income taxes. Forgone revenue for these businesses is expected to be small, based on a previous JLARC report (*Review of Virginia's Corporate Tax System*, JLARC, 2010).

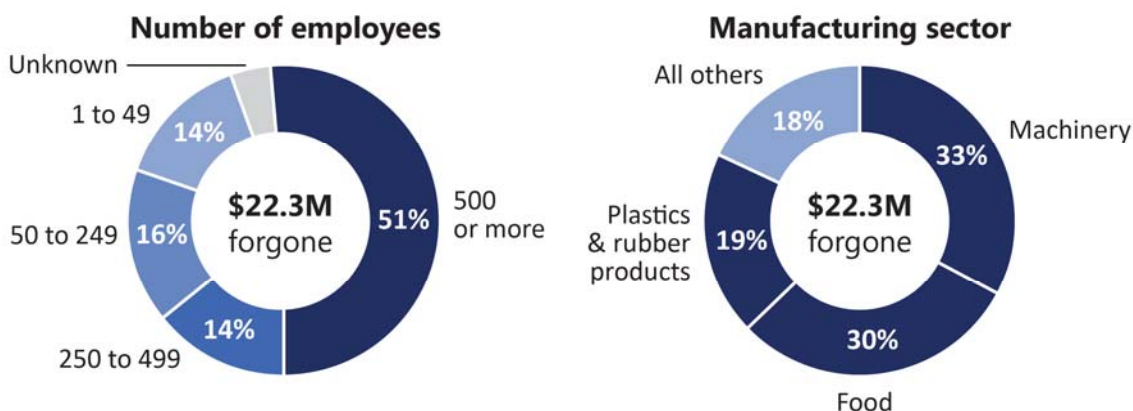
Virginia adopted the elective single sales apportionment for manufacturers to slow the decline in manufacturing employment. The goals were to (1) incentivize Virginia manufacturers to remain in the state rather than moving operations to a state with a more favorable tax system and (2) attract additional manufacturers to the state. Many other states were beginning to use a single sales factor formula at the time of Virginia's adoption, usually for all corporations rather than for certain industries, such as manufacturers.

Elective single sales apportionment for manufacturers resulted in \$68 million in forgone revenue 2014–2017

The elective single sales apportionment resulted in an estimated \$68 million in forgone revenue between tax year 2014 and tax year 2017. Manufacturers electing to use single sales apportionment increased substantially between 2014 and 2015, from 16 to 76 taxpayers. As a result, forgone revenue increased from \$1.9 million to \$20.9 million. Forgone revenue in tax year 2016 was slightly higher at \$22.3 million, but the number of taxpayers was lower (70).

Manufacturers electing to use single sales apportionment typically included larger employers from certain sectors. More than 50 percent of the forgone revenue is from manufacturers with 500 or more employees. They are typically concentrated in certain manufacturing sectors: more than 80 percent of the forgone revenue is from manufacturers in the machinery, food, and plastics and rubber products manufacturing sub-sectors (Figure 3-2).

Figure 3-2
Majority of forgone revenue was for large manufacturers and manufacturers producing machinery, food, and plastics and rubber products (2016)



SOURCE: Weldon Cooper Center analysis of corporate income tax returns for tax year 2016 and Virginia Employment Commission ES202 data.

Forgone revenue could increase in future years. Several manufacturers that elected to use single sales apportionment appear to have reverted back to using the standard “double-weighted” apportionment in some years within the three-year period after the

election. This reversion is allowed to avoid the process of recapture, in which the manufacturer would have to pay the difference between tax liability using single sales and double-weighted sales plus interest, if the company does not expect to meet the wage or job requirements. Once this three-year period is up, these manufacturers can use single sales apportionment without needing to meet job or wage requirements. It would take only the addition of a small number of highly profitable manufacturers using single sales apportionment to have a large effect on forgone revenue.

Single sales apportionment for manufacturers has had mixed impacts

Some manufacturers interviewed for this report said the elective single sales apportionment formula played a role in their decisions to locate in or to remain in Virginia and preserve jobs. The single sales formula also offsets some negative features of state and local government taxation of capital. This includes local machinery and tools taxes in Virginia, which make the state less competitive according to state rankings on business taxation (e.g., *Tax Foundation State Business Tax Climate Index* and *Location Matters*). Further review, however, indicates that the impact of elective single sales apportionment is mixed.

Manufacturers using single sales apportionment had more employment growth, but some growth likely would have occurred without incentive

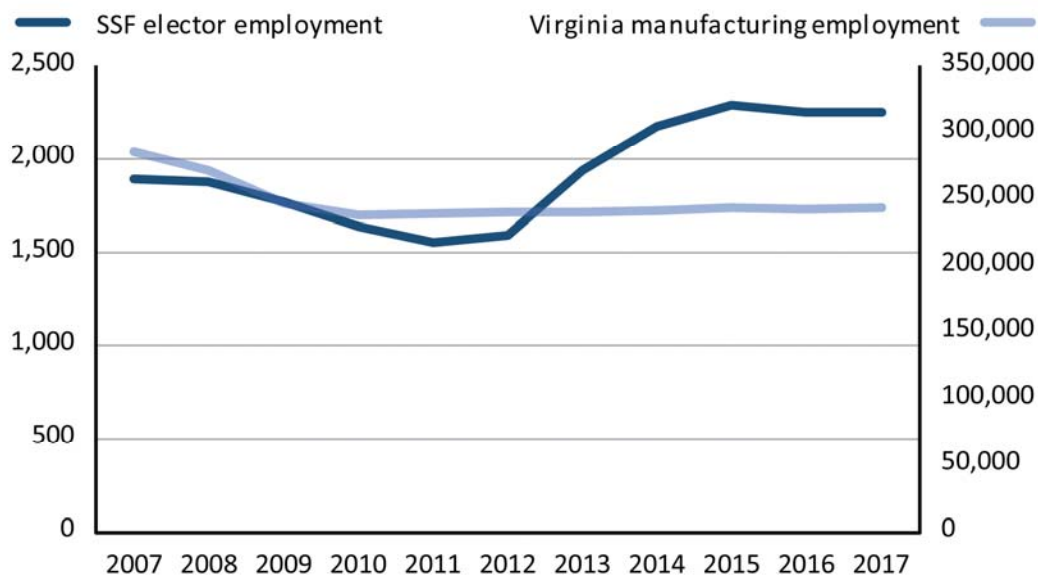
Collectively, the employment levels of Virginia manufacturers using single sales apportionment in tax year 2014 grew by 16.3 percent (or 316 jobs) between 2013 and 2017. This growth rate is substantially greater than the 1.5 percent growth rate of total manufacturing employment in Virginia over the same period (Figure 3-3). Nine of the 11 manufacturers added jobs, and all others maintained employment of at least 90 percent of the baseline (2013) employment levels. Only one firm dropped below the baseline by 2017. Further statistical analysis indicates that early single sales apportionment electors added significantly more jobs than other multistate manufacturers. (See Appendix M, available online, for more information on the regression analysis.)

However, manufacturers that elected to use single sales apportionment may have grown anyway. Therefore, not all of the job growth can be attributed to single sales apportionment. Manufacturers must maintain employment levels for at least three years, so manufacturers that expected to grow were more likely to use it than those that are contracting. Estimates indicate that elective single sales apportionment may induce a modest portion of the economic activity generated by manufacturers making the election. Tax savings for electors represent 1.7 percent of their estimated costs for the new economic activity, which is expected to induce 15 percent of the economic activity generated (Bartik 2018b). (See Appendix M for the methodology used in estimating the percentage of economic activity influenced by incentives.)

Employment levels of manufacturers that **elected to use single sales apportionment in tax year 2014** and used single sales apportionment for tax years 2014–2016 (2014 cohort) were tracked from 2013 (the base year) to 2017. Employment records for 11 of the 13 firms in the cohort were identified.

The **scale** estimating the amount of economic activity attributed to an incentive is based on the incentive amount as a percentage of the business's operating costs for the related activity over a 20-year period. The estimate is based on costs and does not account for other factors that may influence a business's location or expansion decisions. See Appendix M [online only] for more detail on precisely estimating incentives' effects and the methodology used in this report.

Figure 3-3
Employment of manufacturers electing single sales apportionment grew more than Virginia manufacturers' overall employment (2013–2017)



SOURCE: Weldon Cooper Center analysis of corporate income tax returns and Virginia Employment Commission ES202 employment records.

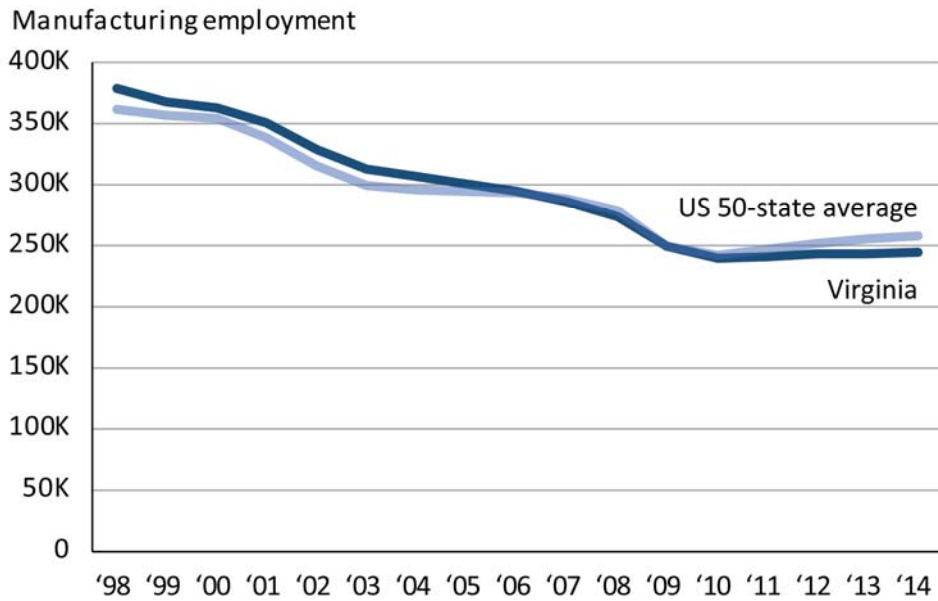
NOTE: SSF, single sales factor. SSF electors are those in the 2014 cohort.

Virginia manufacturing growth is slightly less than national growth despite adoption of single sales apportionment

Even though elective single sales apportionment has had a positive effect on manufacturing employment in the state, Virginia’s manufacturing growth is still slightly less than the nation. After manufacturing single sales apportionment was fully implemented in 2014, Virginia’s manufacturing industry grew 2.6 percent between 2013 and 2016 compared with 4.3 percent nationally (Figure 3-4).

Only a small portion of manufacturers in Virginia are using single sales apportionment. Electors account for only 70 tax returns out of approximately 6,000 manufacturers in 2016, though several returns contained multiple businesses. In addition, manufacturers using single sales apportionment in tax year 2016 employed 12,641 workers, or just 5 percent of the state’s manufacturing jobs. The majority of the benefit is also used by a few large taxpayers, with five taxpayers, out of the 70 returns, in tax year 2016 receiving 61 percent of the total savings. These five taxpayers employed approximately 28 percent of the total employment of all manufacturers that elected to use single sales apportionment.

Figure 3-4
Virginia manufacturing employment grew slightly less than the nation after the recession, even after adoption of single sales apportionment



SOURCE: Weldon Cooper Center analysis of Bureau of Economic Analysis employment data for Virginia and the United States.

It is unlikely that the single sales apportionment for manufacturers will encourage employment growth in the future. Most existing Virginia manufacturers that are likely to use the single sales formula are probably already taking advantage of it, according to stakeholders and several companies using it. Manufacturers may have difficulty maintaining employment because of technology changes, difficulties recruiting skilled workers in tight labor markets, the fading appeal of manufacturing jobs to younger workers, and retirements. Some manufacturers in rural regions may face difficulty meeting the wage requirement, which is based on industry average wages, even if they pay substantially more than the average wage for the region. Virginia manufacturers that have elected not to use single sales apportionment also have lower proportions of property (4 percent) and payroll (6 percent) than manufacturers that have elected to use it (32 percent and 24 percent, respectively). These manufacturers would not benefit, or would achieve only minimal benefits, from using single sales apportionment. However, some manufacturers relocating to Virginia may choose to use single sales apportionment.

Research suggests increased sales factor weighting has less effect than previously indicated

In theory, a heavier weighting of the sales factor in the apportionment formula should stimulate state economic activity in many circumstances. It should decrease the tax burden of multistate businesses that export a high share of their product out-of-state

Empirical studies of the effects of single sales apportionment have generally focused on four types of economic impacts: (1) employment, (2) capital expenditures, (3) sales or shipments, and (4) tax revenues.

The Goolsbee and Maydew (2000a) and Edmiston (2002) studies were presented as evidence for adopting single sales apportionment to Virginia's Joint Subcommittee Studying Benefits of Adopting a Single Sales Factor for Corporate Income Tax Purposes in 2008.

but have a strong payroll and property presence in the state. It may also encourage businesses that sell a large number of goods in Virginia but that produce their goods primarily outside the state to increase their state production footprint.

Advocates of single sales apportionment frequently touted two early studies from 2000 and 2002 that showed a substantial positive effect of sales reapportionment on manufacturing employment. These studies found that states that moved from an equally weighted formula to a single sales factor formula would see a 1.1 percent increase in manufacturing employment (Goolsbee and Maydew 2000a) and a 2.0 percent increase in firm property and payroll (Edmiston 2002). Subsequent studies indicate that states would see significant manufacturing job growth from switching to single sales factor, with New York experiencing a 3.5 percent increase in manufacturing jobs as a result of moving from double-weighted sales to single sales apportionment (Goolsbee and Maydew 2000b).

More recent studies have generally found smaller or no effects. Later replications of the earlier studies have not corroborated their findings. One study replicated the analysis for the same time period (1978–1993) and found that the relationship between sales apportionment and manufacturing employment was not statistically significant (Bernthal et al 2012). The study also used a newer data set (1978–2010) and found a statistically significant relationship, but the magnitude of the effect was just one-fourth of the size previously reported. Another replication study (Merriman 2014) suggests that the previous results are not reflected if new sample data or improved econometrics methods are used. That study and several others have failed to find empirical support for greater sales weighting. (See Appendix O, available online, for more detail of each study.)

There are at least two possible explanations for the differences between the earlier and more recent studies. First, many earlier studies relied on a relatively basic representation of the corporate tax code and used older econometric methods. Since then, many researchers have concluded that other factors affect corporate tax liability, such as tax rates, combined reporting rules, depreciation rules, and tax base definition (Serrato and Zidar 2017; Moore and Bruce 2014). After accounting for these factors and correcting for recognized econometric problems, the effects of sales factor weighting appear smaller in magnitude or statistically insignificant. Second, many of the earlier studies were conducted when single sales apportionment was less prevalent, and as with any incentive, first adopters experience the largest impacts. As more states adopt the incentive, net gains to later adopting states dissipate (Edmiston 2002).

Single sales apportionment for manufacturers has moderate economic benefits and moderate return in state revenue

The elective single sales factor apportionment for manufacturers has generated economic activity for the state economy. It is estimated that each year private employment increased by 126 jobs, Virginia GDP increased by \$23.9 million, and personal income increased by \$8.8 million because of elective single sales apportionment (Table 3-2).

These findings assume that 15 percent of the economic activity can be attributed to elective single sales apportionment.

TABLE 3-2
Elective single sales apportionment for manufacturers has moderate benefit and moderate return in revenue to the state

	Annual average FY14–FY17
Net impact to Virginia economy	
Private employment	126 jobs
Virginia GDP	\$23.9 million
Personal income	\$8.8 million
Impact to Virginia economy per \$1 million of forgone revenue	
Private employment	98 jobs
Virginia GDP	\$17.6 million
Personal income	\$6.9 million
Impact to state revenue	
Total revenue	\$0.8 million
Forgone revenue because of single sales election	\$1.4 million
Revenue net of awards	(\$0.7 million)
Return in revenue	54¢ for every \$1 spent

SOURCE: Weldon Cooper Center economic impact analysis of taxpayers that elected to use the single sales apportionment for manufacturers in tax year 2014 (2014 cohort) over the time period FY14–FY17.

NOTE: Includes direct, indirect, and induced impacts. Estimates assume that 15 percent of the 316 jobs created by the 2014 cohort can be attributed to elective single sales apportionment. Gross impact on Virginia’s economy is used to calculate impact per \$1 million in incentive awards. This is consistent with how the economic development research literature typically calculates these impacts. (See Appendix N [online only] for detailed results on total impact of the incentive, impact of raising income taxes by the amount of the incentive [opportunity cost], and revenue generated by source.)

These economic benefits are moderate relative to the economic benefits generated by other incentives. Elective single sales apportionment for manufacturers is estimated to generate \$17.6 million in additional Virginia GDP for every \$1 million in forgone revenue (Table 3-2). This is higher than estimates of additional Virginia GDP per \$1 million spent for many other incentives included in this report and similar to estimates of additional Virginia GDP per \$1 million in spending generated by all grant programs. (See *Economic Development Incentives 2018*, JLARC 2018.) Like the data center exemption, this estimate is also higher than estimates for other tax incentives.

The return in revenue to the state is also moderate at 54¢ for every \$1 in forgone revenue because of manufacturers using the elective apportionment. This return is substantially higher than the return for other tax incentives and similar to the return (55¢) for all grant programs. (See *Economic Development Incentives 2018* JLARC, 2018.)

The economic benefits are moderate because elective single sales apportionment is relatively well-targeted to businesses that should generate higher economic benefits. Only multistate businesses apportion their income among states, therefore the tax in-

Economic impact analysis of taxpayer expenditures that elected to use single sales apportionment in tax year 2014 (2014 cohort) between FY14 and FY17 was conducted using economic modeling software developed by REMI, Inc.

(See Appendix M [online only] for the economic impact analysis used in this study.)

Net impact is the increase in economic activity induced by the incentive, adjusted for the opportunity cost of increasing taxes to pay for the incentive.

(See Appendix N [online only] for information on the total economic impact and the opportunity cost of increasing taxes.)

centive is targeted to businesses that likely have greater opportunities to locate elsewhere. The elective apportionment also effectively targets manufacturers that export a majority of their product outside of the state. The higher the sales outside the state, the higher the amounts of new revenue brought into the state economy. Therefore, the elective single sales apportionment for manufacturers is probably one of the most effective incentive programs at targeting exporters. Many of Virginia's grant programs benefit exporters, but the elective single sales apportionment is the only one where the benefit increases as the export percentage increases.

Several factors limit the benefits of the elective single sales apportionment. It does not incentivize new investment or job creation like incentives for other industries, such as Virginia's single sales apportionment for data centers. Some states, such as Florida and Oklahoma, incentivize new activity in their single factor apportionment formula requirements. Virginia's elective single sales apportionment for manufacturers instead incentivizes job maintenance, but only during the three years after manufacturers elect to use single sales apportionment.

The estimated cost of single sales apportionment per job (\$17,939 per job) is more than four times the cost per job across all incentive programs (\$4,189 per job). (See *Economic Development Incentives 2018*, JLARC 2018.) Only the Transportation Partnership Opportunity Fund (\$48,348), Advanced Shipbuilding Training Facility Grant (\$32,778), and the semiconductor grants and data center exemption reviewed in this report have higher costs per job. Manufacturers that have elected to use single sales apportionment have also tended to be in lower-wage sectors, paying an average wage of \$67,362 compared to an average wage of \$70,244 for all manufacturers, based on average wages reported by the Bureau of Economic Analysis for 2017.

Changes to elective single sales apportionment should be part of broader tax policy decision

The elective single sales factor apportionment has been somewhat effective. Manufacturers using it have experienced higher rates of employment growth than manufacturers using standard apportionment. However, their employment growth has not been large enough to bring Virginia more in line with manufacturing growth nationally (based on the 50-state average), and it seems unlikely that many more manufacturers will choose to use it. Still, it has generated moderate economic benefits and returns in state revenue relative to other incentives.

It may be difficult to improve its effectiveness without negatively affecting its economic benefits and return in revenue to the state. In order to incentivize more manufacturers to use it, the job and wage requirements would likely need to be removed. This change would allow manufacturers with declining employment levels and lower wages to use it, which would reduce the economic benefits and return in revenue generated.

Instead, changes to Virginia's elective single sales apportionment would be better made as part of changes to the state's broader income tax apportionment policy. Today, most states are using single sales apportionment, or phasing it in, and almost all apply it uniformly across industries and make it mandatory. (See Appendix D for more detail about apportionment factors by state.) Adopting single sales apportionment across all industries and making it mandatory would provide more equitable treatment across taxpayers and simplify administrative and compliance activities on behalf of both the Department of Taxation and the taxpayer. By using methods consistent with other states, Virginia may reduce the potential for income shifting to states that use more favorable apportionment rules and also ensure that these rules are not viewed as a detriment to businesses location decisions.

These changes would reduce state revenue generated by the corporate income tax. However, keeping it optional would reduce revenue by a substantially larger amount. In 2008, when Virginia originally considered adopting single sales apportionment more broadly, the Department of Taxation estimated that uniformly applying mandatory single sales apportionment to all industries would reduce state revenue by \$47 million. Making it optional would reduce revenue by \$123 million because taxpayers would choose the method that would most reduce their tax liability.

ENVIRONMENTAL INCENTIVES FOR MANUFACTURERS

Encourage economic activity that is more environmentally friendly

VALUE TO BENEFICIARIES

FY10-FY17

Incentive	Total spending	Beneficiaries per year
Pollution Control Equipment and Facilities Exemption	\$26.59M	86
Recyclable Materials Processing Equipment Tax Credit	\$10.71M	92
Biodiesel and Green Diesel Fuels Producers Tax Credit	\$0.1M	<5
Green Job Creation Tax Credit	<\$0.1M	<5
All incentives	\$37.31M	

ACHIEVEMENT OF PURPOSE

Pollution Control Equipment and Facilities Exemption: reduces costs of regulatory compliance but certification process often burdensome

Recyclable Materials Processing Equipment Tax Credit: has low utilization and effect on industrial recycling activity is unknown; could be more useful in future

Biodiesel and Green Diesel Producers Tax Credit: use is lower than expected and biodiesel production has decreased after adoption of credit

Green Job Creation Tax Credit: use has been negligible and research on effect of green job incentives has no conclusive effect on employment

IMPACT TO STATE ECONOMY

average FY10-FY17

Negligible economic benefit per \$1M of incentive



13
jobs



\$1.1M
state GDP



\$1.1M
personal income

Negligible return in revenue



5¢
per \$1 spent

NOTE: Beneficiaries for the tax credits are the number of tax returns claiming the credit and not the count of the businesses claiming it.

4. Environmental Incentives for Manufacturers

Virginia offers four incentives to encourage economic activity that is environmentally friendly or to compensate facilities required to control or abate pollution. These incentives include the Pollution Control Equipment and Facilities Tax Exemption and three tax credits—the Green Jobs Creation Tax Credit, Biodiesel and Green Diesel Fuels Producers Tax Credit, and Recyclable Materials Processing Equipment Tax Credit. These incentives are all administered by the Department of Taxation (TAX), and three require certification by the Department of Environmental Quality (DEQ) or another agency to verify eligibility. These incentives are relatively small compared to other incentives reviewed in this report. In total, they represent less than 2 percent of Virginia’s total spending on incentives in FY17.

Pollution Control Equipment and Facilities Sales Tax Exemption reduces costs of regulatory compliance

Virginia adopted a retail sales and use exemption for pollution control equipment and facilities in 1972 (Table 4-1). Initially manufacturers and other businesses were exempted from paying sales taxes on purchases of property and equipment used primarily to abate or prevent air or water pollution. The property or equipment had to be certified by the appropriate state agency to be eligible for the exemption. The exemption has been expanded several times to additional industries:

- **1995:** coal, oil, and gas production and waste disposal
- **2003:** forestry and other vegetative waste products
- **2006:** landfill gas and recovery
- **2016:** property used to generate solar and wind energy.

The **1972 legislation** exempted certified pollution control equipment from local taxation, including local property taxes. A provision of this legislation also exempted pollution control equipment from all state taxes, including sales taxes. This report focuses on the sales tax exemption.

Table 4-1
Virginia provides a Pollution Control Equipment and Facilities Sales Tax Exemption

Purpose	Reduce financial burden of complying with federal environmental regulations and encourage use of pollution control measures
Eligibility	Purchase of real or personal property, equipment, facilities, or devices used primarily for the purpose of abating or preventing pollution Purchasers may include either the manufacturer or a contractor or subcontractor that installs the equipment for use by the manufacturer
Use of exemption	Lowers the capital costs associated with installing required pollution control equipment

SOURCE: Weldon Cooper Center analysis of the Code of Virginia and agency documents.

NOTE: Section § 58.1-609.3 exempts pollution control equipment as defined in § 58.1-3660 (local property tax exemption) from the retail sales and use tax. Before adoption of the exemption, TAX administratively exempted pollution control measures from the sales tax under the manufacturing exemption if the equipment and facility was used directly in the manufacturing process.

Certifying authorities include DEQ on behalf of the State Water Control Board, State Air Pollution Control Board, and Virginia Waste Management Board; the Department of Mines, Minerals, and Energy; and “any interstate agency authorized to act in place of a certifying authority of the Commonwealth.”

The financial impact of **environmental regulations** per manufacturer is eight times more than the impact on the average U.S. company (National Association of Manufacturers 2014).

Every state currently offers incentives to offset the costs, which can be substantial, for installing pollution control equipment. Pollution from U.S. manufacturing has declined considerably in recent decades, and most of the decline is attributed to strict environmental regulations, such as the federal Clean Air Act. However, these regulations also have the side effect of dampening manufacturing employment, productivity, and foreign investment in the U.S.

Sales and use exemptions are the most common state-level pollution control equipment incentive. Only five states with sales and use taxes do not offer an exemption for pollution control equipment. Instead, these states offer other incentives, such as local property tax exemptions. Some states, such as Kansas and Louisiana, exempt pollution control equipment as part of their general manufacturing sales and use exemption if the equipment is used in the manufacturing process. Some states offer incentives in addition to sales and use tax exemptions, such as local property tax exemptions, tax credits, and loan assistance programs. (See Appendix I for more detail on pollution control equipment incentives by state.)

Prior to 1972, TAX administratively exempted purchases of pollution control equipment under the state’s **manufacturing exemption**. However, the equipment had to be used *directly* in the manufacturing process.

Pollution control equipment sales tax exemption saved businesses an estimated \$27 million between FY10 and FY17

Manufacturers and contractors received an estimated \$26.6 million in tax savings from the pollution control equipment sales tax exemption between FY10 and FY17. Savings are estimated to be approximately \$3.3 million per year, on average. These savings were estimated based on a Weldon Cooper Center survey of 230 businesses deemed eligible to use the exemption from a review of certification records maintained by TAX. (See Appendix B for more detail about the methodology.)

Businesses reported administrative burdens to obtain certification

Manufacturers reported that pollution control equipment makes up a large portion of their capital expenses, but they often forgo using the sales tax exemption because of the administrative burden of achieving certification, particularly from DEQ. Manufacturers indicated that the certifying agency reviews each request on a case-by-case basis, sometimes resulting in a lengthy approval process. The certification process can also be complicated because third parties (contractors and subcontractors installing equipment and engineers that designed the equipment) often must be involved. As required by statute, DEQ requires that the equipment be installed or the facility built before granting certification, meaning manufacturers must pay the sales tax upfront before later seeking a refund. Construction times are often lengthy, sometimes resulting in decisions to forgo using the exemption entirely.

Section 58.1-3660 requires that pollution control equipment be certified as “constructed, reconstructed, erected, or acquired.”

Pollution control equipment exemption may be an ineffective tool for reducing pollution

While the pollution control equipment exemption helps businesses defray part of the costs of complying with federal environmental regulations, it may not be an efficient and effective tool for reducing pollution. Research suggests these subsidies violate the “pollution payer principle,” which requires the pollution emitter to bear the cost of managing or reducing pollution. The exemption instead passes the cost on to society in the form of reduced tax revenues. Exemptions and other subsidies may also encourage the use of pollution control equipment instead of the adoption of newer, less polluting production technologies and practices. Exemptions and other subsidies, which reduce costs of production, may encourage businesses to produce more, which results in more pollution than would occur without the subsidy (Jenkins and Lamech 1994; Goulder and Parry 2008).

Evaluating the **effectiveness of the exemption** on industrial activity or pollution reduction was not performed because industries are required by federal regulation to reduce pollutants, often through pollution control devices.

Recyclable Materials Processing Equipment Tax Credit was adopted to encourage businesses to invest in equipment to recycle waste

The Recyclable Materials Processing Equipment Tax Credit was adopted in 1990 to reimburse businesses for purchasing equipment to produce new products from recycled materials (Table 4-2). The intent of the credit appears to be twofold. It aims to encourage businesses to recycle industrial and consumer solid waste and encourage additional employment and economic activity associated with recycling. The credit has been modified several times since its adoption, including increasing the amount of the credit from 10 percent to 20 percent of eligible purchases, imposing an annual \$2 million cap per fiscal year, and extending the carryover period from five to 10 years. Virginia is one of only 13 states that offers a recycling equipment tax credit. (See Appendix J for recycling equipment tax credits by state.)

Table 4-2
Virginia offers a Recyclable Materials Processing Equipment Tax Credit

Purpose	Promote recycling of industrial and consumer solid waste and expand recycling equipment investment
Eligibility	Businesses that purchase machinery and equipment predominantly used to manufacture, process, compound, or produce items of tangible goods from recyclable materials to be sold Machinery and equipment must be certified by DEQ as integral to the recycling process
Credit features	Nonrefundable credit equal to 20 percent of purchase price of eligible machinery and equipment Credit can be claimed against individual and corporate income taxes but cannot exceed 40 percent of taxpayer’s total tax liability; can be carried over for 10 years Capped at \$2 million in total credits per year

SOURCE: Weldon Cooper Center review of Code of Virginia and agency documents.
NOTE: Authorized by § 58.1-439.7 and expires in 2020.

Recycling materials tax credit saved businesses \$10.7 million FY10–FY17

The total number of businesses using the credit is unknown. Half (54 percent) of the credit amount was claimed on corporate tax returns, and the remaining amount was claimed by business owners on individual tax returns because the business was structured as a pass-through entity.

Businesses producing goods from recyclable materials saved \$10.7 million because of the recyclable materials tax credit between FY10 and FY17. Beneficiary savings each year have been fairly stable, averaging \$1.3 million per year. Manufacturers accounted for over 80 percent of the amount claimed on corporate returns between FY10 and FY17, mostly by chemical product and preparation manufacturers (36 percent) and iron and steel mills and ferroalloy manufacturers (29 percent). These manufacturers recycle the waste generated during the production of their primary products. Other notable non-manufacturers that have claimed the credit include miscellaneous durable goods merchant wholesalers (17 percent), which include businesses involved in recycling and wholesale distribution of automotive scrap, industrial scrap, and other consumer and commercial waste.

Manufacturers expect the credit may be used more frequently in the future, but the current annual cap of \$2 million could be a barrier. Some industries, such as pulp and paper companies, are required to use a certain amount of recycled materials in their products (e.g., corrugated paper uses post-consumer materials), and the U.S. Plastics Resin Producers has established a national goal to recycle 100 percent of plastics. In addition, U.S. companies have historically exported recyclable plastic, but China has banned imports of certain grades of recycling plastic making growth of the domestic recycling industry more likely.

Effect of recyclable materials tax credit on industrial recycling activity is unknown

National sources for industrial recycling are limited. The U.S. Environmental Protection Agency Toxics Release Inventory provides a national database of toxic chemical and other material recycling by state but covers only selected industries.

The U.S. Census Pollution Abatement Costs and Expenditures survey was discontinued in 2008. It provided costs of industrial pollution abatement related recycling by state.

Limited data makes it difficult to assess the effect of the recyclable materials tax credit on industrial recycling activity. Businesses using the tax credit may recycle municipal solid waste (residential and commercial trash) or recycle their own industrial solid waste. Statewide and local statistics for municipal solid waste recycling in Virginia are available from DEQ, but statistics of industrial solid waste recycling are not. Municipal solid waste represents only a small share of total waste generation. National sources for industrial recycling are either limited or have been discontinued. Currently, it is estimated that 236 million tons of municipal solid waste and 7.6 billion tons of non-hazardous industrial solid waste are generated per year nationally.

It is also difficult to assess industry activity, such as employment and production changes. There are several industry sectors for recycling processors, but these exclude scrap materials recycled by other sectors, such as pulp, paper, and paperboard mills, and plastics manufacturers. Most of these manufacturing industries, however, use original materials rather than recyclable scrap materials. Therefore, their industrial activity cannot be used to infer recycling activity levels by these industries. These sectors also tend to not report recycled material.

Green Job Creation Tax Credit was adopted to encourage creation of green energy jobs but use has been low

The Virginia Green Job Creation Tax Credit provides a nonrefundable tax credit to Virginia businesses that create and retain new jobs that promote renewable and alternative energy (Table 4-3). The credit targets green jobs, which include employment in the renewable and alternative energy industry, and other jobs as defined by the Secretary of Commerce and Trade. Virginia’s green job tax credit is set to expire January 1, 2021.

The green job tax credit was adopted in 2010 as part of Governor McDonnell’s job creation and green energy agendas. Virginia and many states were increasingly promoting green industry activity, corresponding with the clean energy and green industry funding initiatives in the American Recovery and Reinvestment Act of 2009. These programs were motivated in part by a desire to stimulate job growth as well to enhance energy security, promote conservation, and expand investment in research and development on new environmental technologies. However, Virginia is one of the few states that created a job creation incentive targeting green jobs.

Virginia is one of the few states with green job tax incentives. Massachusetts established a “green jobs” program in 2008, which created a Clean Energy Technology Center that provides grant funding to startups. Pennsylvania created the Alternative and Clean Energy Program to provide grants of \$10,000 per clean and alternative energy job. Tax credits adopted by New Mexico and Arizona also target industry clean energy investments and job creation.

TABLE 4-3
Virginia offers a Green Job Creation Tax Credit

Purpose	Encourage the creation and retention of green energy jobs
Eligibility	Businesses that create new green jobs that are full-time and pay at least \$50,000 annually Green jobs include jobs in <ul style="list-style-type: none"> - industries relating to the field of renewable, alternative energies, including the manufacture of products used to generate electricity and other forms of energy from alternative sources - businesses that produce goods or provide services that benefit the environment or conserve natural resources - which workers’ duties involve making their establishment’s production processes more environmentally friendly or using fewer natural resources
Credit features	Nonrefundable tax credit of \$500 per job annually, up to 350 green jobs per business; can be claimed against corporate and individual income tax Claimed after the job is filled for 1 year; can be claimed for up to 5 years (for a total of \$2,500 per job) as long as job is continuously filled 5-year carryover period Cannot claim Major Business Facility Tax Credit or federal credit for investing in clean energy technologies for the same job

SOURCE: Weldon Cooper Center review of the Code of Virginia and agency documents.
NOTE: Authorized by § 58.1-439.12:05 and sunsets in 2021.

Green job tax credit use is low likely because other incentives offer higher values and fewer restrictions

Only \$4,362 in green job tax credits have been claimed on taxpayer returns between FY10 and FY17. Thus, it has had the lowest level of utilization of any economic development incentive program reviewed by JLARC to date. However, \$63,501 in green job credits were claimed in FY18 by taxpayers who earned credits in previous years but did not have sufficient tax liability to claim them.

This credit is likely only attractive to businesses that do not meet eligibility criteria for more valuable Virginia economic development incentives. For example, a business creating a substantial number of jobs that is eligible for both the Green Job Creation and the Major Business Facility Jobs tax credits would likely claim the Major Business Facility Jobs Tax Credit. Even though the green jobs tax credit offers higher potential tax savings (\$2,500) per job, a taxpayer can only claim the credit for up to 350 jobs with annual salaries of \$50,000. While the Major Business Facility Jobs Tax Credit pays only \$1,000 per job, it has no maximum number of jobs, no minimum wage requirement, and no restrictions on claiming federal credits for the same jobs.

Many blue-collar, green job occupations pay less than \$50,000 annually, which likely prevents more taxpayers from claiming the green job creation credit. Median average wages were \$39,490 for solar photovoltaic installers, \$41,400 for hazardous materials removal workers, and \$45,490 for environmental science and protection technicians in 2017, according to the Bureau of Labor Statistics. The \$50,000 wage requirement is also substantially higher than many other grant and tax credit programs.

Research on effect of green job incentives on employment is limited and inconclusive

Existing literature on environmental incentives' impacts on state and local green industry growth is limited and provides conflicting results. (See Appendix O, available online, for findings of peer-reviewed research.) Even if green job incentives create new green jobs, the net effect on total employment is unclear. Although there is some evidence that clean energy employment is more likely to be found in export-based industries than general employment (Muro, Rothwell, and Saha 2011), not all green jobs are export-oriented. Virginia's green jobs tax credit does not specifically target export-based sectors as do many other Virginia economic development incentive programs. Thus green incentives, in general and in Virginia, could fund jobs that substitute for existing jobs and have no net employment creation effects. Some critics contend that green jobs programs fund lower productivity employment that displaces traditional fossil fuel related jobs, which tend to be export-oriented and pay high wages.

Biodiesel and Green Diesel Fuels Producers Tax Credit was designed to promote clean energy production but use has been low

The Biodiesel and Green Diesel Fuels Producers Tax Credit was adopted to promote production of biodiesel and green diesel in the Commonwealth (Table 4-4). The program appears to have multiple goals, including supporting farm and forestry commodity production, promoting waste recycling, stimulating value-added refinery production, and improving the environment by promoting clean energy substitutes for fossil fuels. Since the state imports the vast majority of its energy needs, including gasoline and diesel, the program encourages the substitution of Virginia-produced fuel for imported fuels and the creation of new employment opportunities. The biodiesel tax credit was adopted in the 2008 session and provides a nonrefundable but transferable credit of 1¢ per gallon of fuel produced that can be claimed for up to three years, with a taxpayer cap of \$5,000 per year. Thus, it applies mostly to smaller producers. The Department of Mines, Minerals, and Energy certifies whether production requirements have been met for receiving the credit.

Biodiesel is fuel made from new and used vegetable oils or animal fats or similar materials. Biodiesel is commonly made from recycled cooking oils and fats derived from restaurant waste.

Green diesel is fuel made from nonfossil renewable resources including cultivated plants and trees, their byproducts, animal fats, and other renewable resources.

Table 4-4
Virginia offers a Biodiesel and Green Diesel Producers Tax Credit

Purpose	Promote production of biodiesel and green diesel products
Eligibility	Producers of biodiesel or green diesel (1) making up to 2 million gallons of biodiesel or green diesel per year and (2) within the first 3 years of production (cannot be claimed after the first three years of production) Certified by Virginia Department of Mines, Minerals, and Energy that meet requirements
Credit features	Nonrefundable credit equal to 1¢ per gallon of fuel produced; can be claimed against individual and corporate income taxes Maximum credit allowed is \$5,000; can be carried over for 3 years; unused credits can be transferred for use by another taxpayer

SOURCE: Weldon Cooper Center review of the Code of Virginia and agency documents.
NOTE: Authorized by § 58.1-439.12:02.

All U.S. states except for Delaware had at least one type of renewable fuel tax incentive when Virginia adopted the biodiesel credit. These incentives were popular following the federal enactment of the biodiesel tax credit in 2004 (equal to \$1 per gallon for agricultural-based biodiesel and 50¢ per gallon for recycled feedstock) and later American Recovery and Revitalization Act fiscal stimulus programs that included temporary federal programs for environmental and green job creation. As these federal programs ended, state support for these incentives also declined. A number of states that had biodiesel production incentives have repealed them in the last decade, including Arkansas (eliminated a grant but still has a tax credit), Florida, Kansas, Maine, Mississippi, Nebraska (eliminated one of two tax credits), North Carolina, and Oklahoma. Currently, only 10 states have biofuels tax incentives. (See Appendix K for information on biodiesel credits by state.)

Use of biodiesel tax credits was much lower than expected

Only six taxpayers claimed a total of \$11,212 in biofuel tax credits between FY10 and FY17, according to annual reports by TAX. This credit amount—valued at 1¢ per gallon—represents only 2 percent (1,121,200 gallons) of total biodiesel capacity in the state during the same time period. This amount is significantly lower than estimated claims of \$15,000 per year that TAX projected based on potential usage by three bio-refineries in Virginia at the time. In addition, TAX also found that some companies were claiming the credit without certification. TAX issued fewer than four biodiesel tax credit approvals since the credit was adopted. A total of \$4,309 in properly issued credits have been claimed in total, all of which was claimed in FY11. Some of the companies that erroneously claimed the credit may be involved in biodiesel blending and distribution rather than production. Therefore, eligible credits totaled less than the \$11,212 claimed between FY10 and FY17.

Several factors could explain low usage of the credits. Some of Virginia’s biodiesel refineries may be too large to claim the credit. The Environmental Protection Agency and *Biodiesel Magazine* report there were five registered biodiesel refineries in Virginia in 2018 (Ditzel et al. 2018) and all but one had the capacity to exceed the tax credit’s production limit of two million gallons per year:

- Reco Biodiesel LLC in Richmond (3.6 million gallons),
- Red Birch Energy Inc. in Bassett (3 million) (now closed),
- Shenandoah Agricultural Products in Frederick (300,000 gallons),
- Synergy Biofuels LLC in Pennington Gap (3 million gallons) (now closed), and
- Virginia Biodiesel Refinery LLC in West Point (3 million).

The refineries also all existed prior to the adoption of the tax credit, and the credit may not have been available during the first three years of production. In addition, companies may not have had sufficient tax liability, the certification process and paperwork may be too onerous, or the incentive amount too meager to make applying for it worthwhile.

Virginia’s biodiesel credit is likely too small to influence production decisions

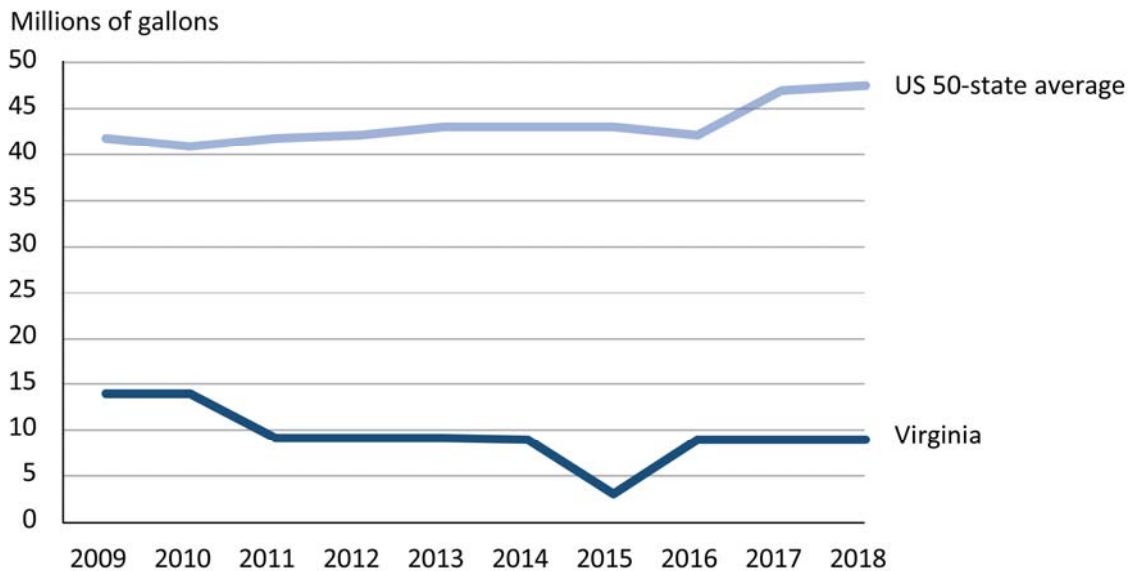
Virginia’s biodiesel tax credit has not had an impact on biodiesel production in the state, likely because it is too small to make a difference in production decisions. Virginia’s biodiesel production capacity has dropped from approximately 15 million gallons in 2009, when the tax credit was first available, to nine million gallons in 2018, a decrease of 36 percent (Figure 4-1). In contrast, national production capacity has increased by 14 percent. Virginia’s credit is valued at 1¢ per gallon of biodiesel produced and is lower than credits in other states (ranging from 5¢ to 30¢ per gallon) and substantially lower than the federal credit (\$1 per gallon for agricultural based biodiesel and 50¢ per gallon for recycled feedstock). It is also smaller than other Virginia incentives that were unsuccessful at attracting biodiesel producers to the state and have since been repealed.

The federal tax credit and fuel standard regulations (blending biodiesel with standard petroleum-based diesel fuel products) have played a critical role in U.S. biodiesel production. Biodiesel production in the U.S. was less than one million gallons in 1999. Federal subsidies and fuel standards were adopted (federal Energy Policy Act of 2005) and later expanded (Energy Independence and Security Act of 2017). By 2006, biodiesel production had risen to 250 million gallons, and by 2017, it had risen to 1.6 billion gallons.

- **Clean-Fuel Vehicle and Vehicle Emissions Testing Equipment Tax Credit** (1996–2014)—tax credit of \$700 per job for a variety of biofuel-related manufacturing and energy conversion activities, including the production of biodiesel fuel manufactured from biomass or algae.
- **Biofuels Production Grant Incentive Program** (2006–2011; 2014–2017)—grant valued at 10¢ per gallon to new producers who produce at least 10 million gallons per year of unblended biodiesel or ethanol fuels and existing producers that increased their production by an additional 10 million gallons. The program was repealed, then reenacted later but with reduced value per gallon, and then repealed again.
- **Clean Energy Manufacturing Incentive Grant Program** (2011–2017)—custom grant to encourage eligible clean energy manufacturers, including biofuel producers, who made a capital investment of at least \$50 million and created 200 new full-time jobs. This custom grant was adopted to attract a Hopewell facility.

Biodiesel production is concentrated in a handful of states, with approximately half of U.S. biodiesel production capacity in 2017 occurring in the 10 states that produce the majority of the U.S. soybean crop—the principal oilseed for making green diesel. Virginia, however, ranks 19th for soybean production despite it being the state’s largest cash crop.

Figure 4-1
Virginia biodiesel production decreased after biodiesel tax credit was adopted



SOURCE: Weldon Cooper Center analysis of Energy Information Administration Monthly Biodiesel Production Reports for Virginia and the U.S.

Increased biodiesel production likely has some negative environmental effects

While one of the motivations for encouraging biodiesel production subsidies is to improve the environment, it may have some negative environmental effects. Biofuel production may not lead to reduced greenhouse emissions because crop cultivation requires fertilizers that release greenhouse gases during production and consumption. In addition, converting forest and grassland to farmland may release greenhouse gases (Ng, Ng, and Gan 2010). Increased crop production for biodiesel may have other negative environmental consequences, including water pollution from increased nutrient runoff, soil erosion, and decreased biodiversity (Janda, Kristoufek, and Zilberman: Searchinger 2008). Substituting biodiesel for fossil fuels should lower carbon emissions, but production subsidies also lower the consumer price of fuel, which may result in increased consumption of fuel and increased consumer emissions (de Gorter and Just 2010; Yoder 2008).

Biofuel and biodiesel tax credits may not be as cost effective as other market-based policies for reducing greenhouse gas emissions. The cost of reducing emissions using biodiesel tax credits is substantially higher than the cost of reducing emissions through a cap-and-trade program that imposes a price on emissions and then allows the market to determine how to reduce emissions throughout the economy (CBO 2010).

Economic impact analysis of expenditures by incentives recipients between FY10 and FY17 was conducted using economic modeling software developed by REMI, Inc.

(See Appendix M [online only] for the economic impact analysis used in this study.)

Net impact is the increase in economic activity caused by the incentives after adjusting for the opportunity cost of increasing taxes to pay for the incentives.

(See Appendix N [online only] for information on the total economic impact and the opportunity cost of increasing taxes.)

Environmental incentives generate negligible economic benefits and returns in state revenue

The manufacturing environmental incentives generate relatively low economic activity for the Virginia economy. Of the four incentives, the pollution control equipment exemption generated the highest levels of additional economic activity (Table 4-5). It is also the largest of the programs. It was the only incentive estimated to increase private employment (24 new jobs annually, on average) between FY10 and FY17. The pollution control exemption annually generated nearly \$700,000 in additional Virginia GDP and \$1.75 million in additional personal income between FY10 and FY17, but increases to Virginia GDP and personal income for the other three incentives were far less. Estimated economic activity is low because the programs provide relatively low levels of financial assistance (less than \$10,000 in total for the green jobs and biodiesel tax credits) to a few businesses.

When measured per \$1 million in spending, the economic benefits of the manufacturing environmental incentives are negligible relative to other incentives. They are the lowest of the 23 incentives that JLARC has evaluated to date. The estimated Virginia GDP generated for each of the four incentives is \$1 million or less for every \$1 million spent on the incentives.

The returns in state revenue are also negligible relative to other incentives. Returns range from a low of 3¢ (recyclable materials tax credit) to a high of 13¢ (biodiesel tax

credit). This amount is less than the estimated 19¢ return across all economic development incentives. (See *Economic Development Incentives*, JLARC 2018.) This amount, however, is similar to the returns for most other tax incentives.

TABLE 4-5
Manufacturing environmental incentives generate negligible economic benefits and returns in state revenue (FY10–FY17)

	Annual average (FY10–FY17)				
	Pollution Control Equipment and Facilities Exemption	Recyclable Materials Processing Equipment Tax Credit	Green Job Creation Tax Credit	Biodiesel and Green Diesel Fuels Producers Tax Credit	All programs
Net impact to Virginia economy					
Private employment	24 jobs	0 jobs	0 jobs	0 jobs	24 jobs
Virginia GDP	\$0.71 M	\$0.06 M	<\$0.01 M	<\$0.01 M	\$0.77 M
Personal income	\$1.75 M	(\$0.07 M)	<\$0.01 M	<\$0.01 M	\$1.68 M
Impact to Virginia economy per \$1 million of spending on incentive					
Private employment	15 jobs	8 jobs	13 jobs	4 jobs	13 jobs
Virginia GDP	\$1.11 M	\$0.94 M	\$0.56 M	\$0.74 M	\$1.1 M
Personal income	\$1.28 M	\$0.69 M	\$1.04 M	\$0.43 M	\$1.1 M
Impact to state revenue					
Total revenue	\$198,295	\$40,943	\$27	\$181	\$239,446
Cost of incentive	\$3,323,469	\$1,338,166	\$545	\$1,401	\$4,663,581
Net revenue	(\$3,125,174)	(\$1,297,223)	(\$518)	(\$1,220)	\$1,302,086
Return in revenue for every \$1 spent	6¢	3¢	5¢	13¢	5¢

SOURCE: Weldon Cooper Center economic impact analysis of economic activity induced by manufacturing environmental incentives between FY10 and FY17.

NOTE: Includes direct, indirect, and induced impacts. The gross impact on Virginia's economy is used to calculate the impact per \$1 million in incentive awards. This is consistent with how the economic development research literature typically calculates these impacts. (See Appendix N [online only] for detailed results on total impact of the loans, impact of raising income taxes by the amount of the incentives [opportunity cost], and revenue generated by source.)

Changes should be considered to improve the exemption, and green job and biodiesel tax credits should be eliminated

None of the four environmental incentives appears to be effective at increasing industry productivity or improving the environment. Further, they all have a negligible economic benefit and return in revenue to the state. Two of the incentives—the pollution control equipment exemption and recyclable materials tax credit—should be considered for continuation. The pollution control equipment sales tax exemption was primarily designed to reduce the burden of regulatory compliance rather than to promote economic activity. Repealing it could also place Virginia at a competitive disadvantage

with other states, all of which provide some type of pollution control equipment incentive. The recyclable materials tax credit could be continued—and the expiration date continued—to see if its use increases because of additional need to recycle industrial and consumer waste. If more businesses use it, and the amount businesses seek to claim exceeds the \$2 million annual cap, the General Assembly may want to increase the credit cap or adopt minimum job creation or capital investment requirements. Two tax credits—the green job and biodiesel tax credits—should be eliminated.

Changes to certification process for pollution control equipment exemption could increase transparency and reduce compliance burden

The certification process for the pollution control equipment exemption could be improved to reduce compliance burden. To use the exemption, businesses generally must receive certification from either DEQ—regional offices rather than the central office—or DMME. Each agency has its own process and uses its own forms to collect information. Neither agency provides much information about the process on its website, with exception of the certification for solar energy equipment or facilities. The certification process, therefore, is not transparent and likely not consistent, adding to the compliance burdens reported by exemption users.

Several changes could be made to increase transparency and reduce compliance burden. At a minimum, DEQ and DMME should develop guidance documents to provide greater assistance to businesses and contractors as to the types of equipment and facilities that are exempt and the decision-making process used to approve certification. Guidance documents should be available on the agency website.

RECOMMENDATION 6

The Department of Environmental Quality and Department of Mines, Minerals, and Energy should develop guidance documents on (1) the types of pollution control equipment and facilities that are exempt from the retail sales and use tax and (2) the decision-making process for approving certification.

DEQ should also develop a list of pre-approved equipment or facilities that are typically exempt and develop an expedited certification process for certifying property or facilities on this list. It does not appear necessary for DMME to take similar action at this time. DMME staff indicated they approve solar equipment and facility certification requests within 48 hours and coal, oil, and gas equipment certification requests, for which few have been made, within 30 days. Several states—Iowa, Michigan, Mississippi, and Texas—have developed lists of pre-approved equipment. Texas has a three-tiered application process for its pollution control equipment property tax exemption. A Tier 1 application is used for certification of equipment that is on a pre-approved list and that will be used solely for pollution control purposes. A certification decision must be made within 30 days. A Tier 2 application is used for property that will be used solely for pollution control but is not on the pre-approved list, and a Tier 3 application is used for property that is partially used for pollution control. Tier 2 and

Tier 3 applications are limited to a 60-day review period as long as the application is complete. A tiered process may be particularly beneficial for smaller manufacturers or contractors that may not have the resources to devote substantial effort to applying for the exemption.

RECOMMENDATION 7

The Department of Environmental Quality should develop a list of pre-approved equipment and facilities that typically meet the pollution control certification requirements and create an expedited certification process for equipment and facilities on that list.

Several stakeholders said requiring that pollution control equipment be installed or the facility built before certification is burdensome. The statutory language requiring the state certifying authority to certify that the pollution control equipment has been “constructed, reconstructed, erected, or acquired” is within the Code section for local property taxation. It is unclear whether it was the General Assembly’s intent to require that pollution control equipment be in place before companies could receive certification to use the sales tax exemption. Other sales tax exemptions in Virginia are self-enforcing and do not have a certification requirement, but this requirement for pollution control equipment and other equipment or property is not uncommon for other states. Statute also allows certain pollution control equipment or property to be exempt whether or not it has been certified, allowing the sales tax exemption to be claimed before equipment is in place. The General Assembly could amend the Code if members think certification should be allowed before the pollution control equipment is in place or the facility built.

OPTION 1

The General Assembly could amend § 58.1-609.3 or § 58.1-3660 of the Code of Virginia to clarify that the equipment or facility does not need to be constructed before certification can be granted for purposes of claiming the Pollution Control Equipment and Facilities Sales Tax Exemption.

DEQ, DMME, and TAX could collaborate and develop a web-based application system for businesses to apply for certification and then be issued exemption certificates. This system would streamline the process for obtaining certification and the exemption certificate. This web-based system could also be used to uniformly collect estimates about the costs of the equipment and facilities to be purchased that would provide more accurate estimates of forgone revenue and economic benefits because of the exemption. According to DEQ staff, some applicants already provide this information even though it is not required.

Green jobs and biodiesel tax credits should be eliminated

The Green Jobs Creation Tax Credit and the Biodiesel and Green Diesel Fuels Producers Tax Credit should be eliminated. Alternatively, the green jobs tax credit could be allowed to expire on its expiration date in 2021. Both tax credits have low rates of utilization and appear to have little effect on the activity they were intended to incentivize. The tax credits are also estimated to provide negligible economic benefits to the state.

RECOMMENDATION 8

The General Assembly may wish to consider eliminating the Green Job Creation Tax Credit and the Biodiesel and Green Diesel Fuel Producers Tax Credit.

Appendix A: Study mandate

2018-2020 Appropriation Act

Passed as Chapter 2 of the Acts Assembly, May 20, 2018

§ 1-11 Item 31 F

F.1. The General Assembly hereby designates the Joint Legislative Audit and Review Commission (JLARC) to conduct, on a continuing basis, a review and evaluation of economic development initiatives and policies and to make such special studies and reports as may be requested by the General Assembly, the House Appropriations Committee, or the Senate Finance Committee.

2. The areas of review and evaluation to be conducted by the Commission shall include, but are not limited to, the following: (i) spending on and performance of individual economic development incentives, including grants, tax preferences, and other assistance; (ii) economic benefits to Virginia of total spending on economic development initiatives at least biennially; (iii) effectiveness, value to taxpayers, and economic benefits to Virginia of individual economic development initiatives on a cycle approved by the Commission; and (iv) design, oversight, and accountability of economic development entities, initiatives, and policies as needed.

3. For the purpose of carrying out its duties under this authority and notwithstanding any contrary provision of law, JLARC shall have the legal authority to access the facilities, employees, information, and records, including confidential information, and the public and executive session meetings and records of the board of VEDP, involved in economic development initiatives and policies for the purpose of carrying out such duties in accordance with the established standards, processes, and practices exercised by JLARC pursuant to its statutory authority. Access shall include the right to attend such meetings for the purpose of carrying out such duties. Any non-disclosure agreement that VEDP enters into on or after July 1, 2016, for the provision of confidential and proprietary information to VEDP by a third party shall require that JLARC also be allowed access to such information for the purposes of carrying out its duties.

4. Notwithstanding the provisions of subsection A or B of § 58.1-3 or any other provision of law, unless prohibited by federal law, an agreement with a federal entity, or a court decree, the Tax Commissioner is authorized to provide to JLARC such tax information as may be necessary to conduct oversight of economic development initiatives and policies.

5. The following records shall be excluded from the provisions of the Virginia Freedom of Information Act (§ 2.2-3700 et seq.), and shall not be disclosed by JLARC:

(a) records provided by a public body as defined in § 2.2-3701, Code of Virginia, to JLARC in connection with its oversight of economic development initiatives and policies, where the records would not be subject to disclosure by the public body providing the records. The public body providing the records to JLARC shall identify the specific portion of the records to be protected and the applicable provision of the Freedom of Information Act or other provision of law that excludes the record or portions thereof from mandatory disclosure.

(b) confidential proprietary records provided by private entities pursuant to a promise of confidentiality from JLARC, used by JLARC in connection with its oversight of economic

development initiatives and policies where, if such records are made public, the financial interest of the private entity would be adversely affected.

6. By August 15 of each year, the Secretary of Commerce and Trade shall provide to JLARC all information collected pursuant to § 2.2-206.2, Code of Virginia, in a format and manner specified by JLARC to ensure that the final report to be submitted by the Secretary fulfills the intent of the General Assembly and provides the data and evaluation in a meaningful manner for decision-makers.

7. JLARC shall assist the agencies submitting information to the Secretary of Commerce and Trade pursuant to the provisions of § 2.2-206.2, Code of Virginia, to ensure that the agencies work together to effectively develop standard definitions and measures for the data required to be reported and facilitate the development of appropriate unique project identifiers to be used by the impacted agencies.

8. The Chairman of JLARC may appoint a permanent subcommittee to provide guidance and direction for ongoing review and evaluation activities, subject to the full Commission's supervision and such guidelines as the Commission itself may provide.

9. JLARC may employ on a consulting basis such professional or technical experts as may be reasonably necessary for the Commission to fulfill its responsibilities under this authority.

10. All agencies of the Commonwealth shall cooperate as requested by JLARC in the performance of its duties under this authority.

Appendix B: Research activities and methods

JLARC contracted with the University of Virginia's Weldon Cooper Center for Public Service (Weldon Cooper Center) for this review. Key research activities performed by Weldon Cooper Center staff for this study included

- collection and analysis of national- and state-level financial and economic data and state agency incentive program data;
- estimation of business savings and tax revenue impacts from incentives;
- program employment performance tracking;
- statistical analysis of incentive program effects and quantitative analysis of the economic and fiscal impacts of Virginia incentives using a dynamic economic model (See Appendix M, available online, for more detail on the analyses);
- interviews with agencies and stakeholders;
- review of other states' manufacturing and data center incentive programs; and
- review of documents and literature.

Collection and analysis of national- and state-level financial and economic data and state agency incentive program data

This report drew on several federal, state, and private industry sources of economic data. Some of this data was used primarily for descriptive purposes, including to highlight trends in state economic activity, such as manufacturing employment and biodiesel production (Table B-1).

Information from state agencies, including the Virginia Economic Development Partnership, Virginia Employment Commission, and Department of Taxation was used for both descriptive and analytical purposes. First, project-level information was aggregated to show characteristics of program users and features of the programs, including industry and employment size. Second, agency data was used in conjunction with other data, such as confidential Virginia Employment Commission (VEC) ES202 payroll employment records, to track employment outcomes and conduct economic analyses. Third, Department of Taxation data on form ST-11A pollution control equipment and facility users and VEDP data center MOU records were used to estimate program revenue impacts. These analyses are described further in the sections that follow.

Obtaining reliable public data for empirical analysis of data center activity was a challenge. Data centers do not have a dedicated industry code, such as semiconductor manufacturing; instead, data centers can be found in a variety of industries. Most companies have strict privacy/confidentiality requirements to protect their clients and ensure facility and data security. Thus, less is known about the industry than others. In addition, the data center market changes rapidly with addition of many new companies and frequent mergers and acquisitions, making it difficult to track company employment activity over time using unit record data.

TABLE B-1
Multiple data sources were collected and used for a variety of analyses

Data source	Description of data	Analysis
Financial and economic data		
Bureau of Economic Analysis	State Personal Income and Employment—Data by two-digit NAICS industry	Compute state and national employment change for manufacturing industry
Good Jobs First	Subsidy tracker	Identify large state semiconductor manufacturing incentives
EMSI	Employment data by six-digit NAICS industry	Compute state and national employment change for semiconductor industry
U.S. Census Bureau, American Community Survey	Information on educational achievement levels of residents 25 years and older by state and county; information on average wage levels by state for computer and electronic product manufacturing	Use in statistical analyses (synthetic control analysis and panel data regression)
U.S. Energy Information Administration	Monthly Biodiesel Production Report (2009-2018); Electric Power Monthly (2001-2017)	Compute state and national biofuel production and capacity, use in statistical analysis of semiconductor manufacturing employment
Virginia Economic Development Partnership	Announcements and Closings Database (including data not disclosed to the public)	Analysis of data center responsiveness to state and local economic incentives
Virginia Employment Commission	Employment Security (ES 202) payroll employment records	Track employment performance and conduct quasi-experimental statistical analyses
Weldon Cooper Center	Information on local tangible personal property rates for data center equipment and machinery and tool rates for semiconductor industry from Virginia Local Tax Rates	Estimate size of local machinery tools and tax incentives for semiconductor plants; conduct statistical analysis of tangible personal property tax rates on data center location
Virginia incentive programs		
Department of Taxation	Tax credit utilization for the Green Job Creation Tax Credit, Biodiesel and Green Diesel Fuel Producers Tax Credit, and Recyclable Materials Processing Equipment Tax Credit	Computation of tax credit usage by fiscal year
Department of Taxation	Corporate income tax Form 500 and Form 500A data for tax years 2013–2016	Tabulate revenue impact of single sales apportionment factor for manufacturing
Department of Taxation	Records on firms in ST-11A certification database	Conduct survey of pollution control equipment and facility sales and use tax exemption
Virginia Economic Development Partnership	Data on Data Center Sales and Use Tax Exemption MOU employment and capital investment attainment	Estimate economic and revenue impact of data center sales and use tax exemption

Other		
Census of Government, Annual Survey of State Government Finances	State tax revenue by tax category and fiscal year	Tax revenue impact analysis
IMPLAN	Regional SAM Balances, institution industry demand, regional employment multipliers, study area industry data	Estimation of tax revenue impacts of semiconductor manufacturers and semiconductor wafers exemptions
REMI PI+	Demand by industry, GDP, personal income, and transfer receipts by year; value added and employment by industry	Tax revenue impact analysis. Computation of "but for" effect of incentives (semiconductor grants, data center tax exemption); computation of value-added per employee by industry for "but for" calculations
Urban-Brookings Tax Policy Center	Returns of active corporations: income by industry 2009–2013 based on Internal Revenue Service, Statistics of Income, corporation income tax returns	Calculate fiscal impact of data center single sales factor apportionment

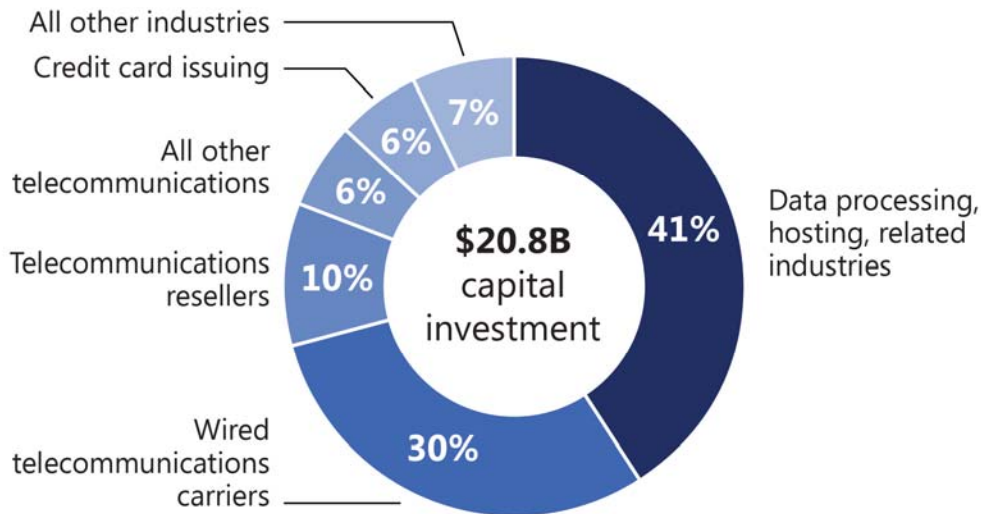
SOURCE: Weldon Cooper Center.

Some industry studies have used the industry “data processing, hosting, and related services” (NAICS 518210) as a proxy for data center industry activity. This is likely to be a poor measure for several reasons. First, data centers were identified using a variety of sources (DataHawk, VEDP announcements data, and search engine searches of company data, and other sources) and combined with Virginia Employment Commission establishment employment data for 2016. The result was that the bulk of “data processing, hosting, and related services” were found to be various types of data processing, IT work, document scanning, online business and educational services, and software development. Much of it is connected to federal IT contracting in Northern Virginia. Approximately 15 percent of the total employment in the sector is data center employment with other data center, cloud computing, and cybersecurity-related support services making up perhaps 2 percent to 5 percent more.

Second, data centers are more likely to be found outside of “data processing, hosting, and related services” than inside it. An examination of data center employment indicated that less than half (41 percent) of data center employment was in the data processing, hosting, and related services sector (Figure B-1). Three telecommunications sectors (i.e., wired telecommunications carriers, telecommunications resellers, and all other telecommunications carriers), collectively made up an even higher share (44 percent). These figures do not include employment for certain enterprise data centers located adjacent to other larger company operations, where it was not possible to segregate data center employment from other principal operations at the location, and almost all collocating firms that make up the bulk of employment in the sector. Finding collocation center tenants is difficult if not impossible because their employment may be reported in other branch locations. However, if these jobs were included, a significant portion would likely be found outside of the data processing, hosting, and related services sector.

Figure B-1

Majority of Virginia data center employment is found outside the data processing, hosting, and related services industry



SOURCE: Weldon Cooper Center analysis of Virginia Employment Commission data.

Third, actual employment data for the data processing, hosting, and related services sector does not appear to represent growth in the data center industry. VEDP announcement data suggests that employment in the sector has grown rapidly in the last 15 to 20 years. Yet EMSI employment data for Virginia shows that the data processing, hosting, and related services sector has experienced little net growth over the 2001–2017 period.

Estimating business savings or forgone taxes because of incentives

Information to estimate business savings, or forgone taxes because of incentive programs, came from several sources, including agency records and other data, secondary source data, and a Weldon Cooper Center survey. The amounts of funds awarded and disbursed to semiconductor customized grant recipients (Micron and Qimonda) were obtained from Virginia Economic Development Partnership MOUs and correspondence with the firms. Firm tax credit data for the Biodiesel and Green Diesel Fuels Production, Green Job Creation, and Recyclable Materials Processing Equipment Tax credits was obtained from the Virginia Department of Taxation Annual Reports. Business savings and associated state forgone revenue for the other incentive programs were estimated using both primary and secondary data as explained below.

Manufacturers Single Sales Apportionment

The Weldon Cooper Center estimated forgone revenue from single sales apportionment for manufacturers for tax years 2014–2017 using Virginia Department of Taxation corporate tax form submissions from tax years 2013–2016. Information from Form 500 (Virginia Corporation Income Tax Return) and Schedule 500A (Multistate Corporation Allocation and Apportionment of Income) were used. Schedule 500A identifies multistate firms using the manufacturer’s modified apportionment method

for the corresponding year. Together, both forms are used to compute corporate income tax liability. Businesses using single sales apportionment are required to provide only information on the sales factor and not information on all three factors (property, payroll, and sales). The property, payroll, and sales factor information was obtained from the closest year before each firm elected the single sales apportionment method to compute the baseline double-weighted sales factor the company would use otherwise. For most firms, this was either tax year 2013 or tax year 2014. Additional information was obtained from individual hardcopy corporate tax records.

Two estimates were calculated: one estimate apportioned taxable income and calculated tax liability using the traditional double-weighted sales factor (the default apportionment formula) to determine baseline data. The second estimate apportioned taxable income and calculated tax liability with single sales factor apportionment using the baseline data. The two estimates (double-weighted sales estimate and single-factor sales estimate) were compared using the same baseline data. The implicit assumption in both calculations is that the property and payroll factor proportions did not change markedly over the period; there is no way of validating this assumption. However, a comparison of the sales factor proportions indicated that the sales factor did not vary much. In order to provide the most conservative estimate of fiscal impact, the minimum of these two estimates is shown as the final estimate. Since no information was available from tax year 2017 returns to estimate tax returns, a consumer price index cost escalation factor is applied to the tax year 2016 estimate to obtain the revenue impact for that year.

The estimates made here did not take into account any recapture for single sales factor electors who did not meet the wage and employment requirements for using the single sales factor manufacturing apportionment. There is no way to determine the status of such recaptures using electronic returns data.

Semiconductor Manufacturing and Wafers exemptions

The Weldon Cooper Center estimated the semiconductor sales and use tax exemptions based on IMPLAN data and assumptions about the percentage of semiconductor company purchases likely to be affected by the exemption. IMPLAN is a commercial economic impact model produced by MIG Inc. It is based on input-output analysis, which requires estimates of the value of intermediate input purchase for each industry. The intermediate input purchase estimates for Virginia formed the basis of the relevant sales tax base for sales and use tax revenue impact calculations. In the case of the semiconductor manufacturing exemptions, spending on eligible inputs (i.e., equipment, fuel, power, enginery, supplies, or other tangible personal property) is estimated by multiplying semiconductor and related device manufacturing (IMPLAN sector 309) industry output by gross absorption coefficients for IMPLAN commodity sectors 3040-3051 (utilities) and 3112-3394 (durable and some nondurable manufactured goods) using the most recent data for 536 industries and commodities. These coefficients represent the input purchases for various commodities per dollar of output. For example, the semiconductor and related device manufacturing industry spent \$0.0180 per dollar of output on commodity 49 (electricity transmission and distribution). This absorption coefficient was multiplied by the output of the semiconductor and related device manufacturing for 2016 (\$973,343,567) to obtain the estimated expenditure on this input (\$17,520,184). Since only a small portion of this input was eligible for the manufacturing exemption for purposes such as design, development, and testing purposes,

only a portion of these purchases (obtained from a semiconductor industry source) was used for the base calculations. The eligible purchases base estimate was multiplied by the state sales and use tax to obtain the revenue impact. The same methodology was used for estimating the semiconductor wafer exemption. However, in this instance, only purchases of semiconductor and related device inputs (a commodity category that includes wafers) were counted. Once again, an industry source provided an estimate of the percentage of wafer inputs that were used as filler, cleaning, engineering, or process control purposes.

The semiconductor manufacturing and wafers exemptions estimates provided in this report are substantially lower than those published in previous JLARC reports (*Economic Development Incentives*, 2017 and 2018). For those reports, the wafer exemption was based on an assumption that 3.3 percent of wafers would be scrapped using IBM estimates. However, this estimate includes loss due to defects and production losses in addition to the eligible exemption uses defined by the statute. An industry source provided a smaller estimate of the percentage of wafers that would be eligible for the exemption. For the manufacturing exemption, it was assumed in previous JLARC reports that 33.5 percent of purchases in eligible commodities would be eligible for the semiconductor manufacturing exemption. This estimate was based on the percentage of total semiconductor and other electronic component manufacturing (NAICS 3344) employment in related scientific and engineering occupations (computer and mathematical occupations, architecture and engineering occupations, and life, physical, and social science occupations) from U.S. Bureau of Labor Statistics data. An industry source indicated that the actual proportion of eligible activities is significantly lower than the percentage of personnel in related occupations.

Data Center Exemption

For most sales and use tax exemptions, no agency records are available to estimate tax revenue impacts. However, for the data center exemption, users are statutorily required to enter into a memorandum of understanding (MOU) with the Virginia Economic Development Partnership (VEDP). Firms must report their capital investment to determine whether they have complied with terms of the MOU. JLARC and Weldon Cooper Center obtained data from VEDP regarding all MOUs since enactment of the exemption. Under the terms of the program, data center firms (including colocating firms) must make a total capital investment of at least \$150 million. Capital investment includes new real property purchases and eligible IT and related machinery and equipment used to establish the facility. Only the portion of the capital investment made in machinery and equipment is eligible for the exemption. The assumption is made that 77.72 percent of total capital investment was used for IT and other eligible equipment. This percentage is based on capital costs of construction breakdown obtained from a publication by the U.S. Chamber of Commerce Technology Engagement Center, *Data centers: Jobs and opportunities in communities nationwide* (Day and Pham 2017).

The data file from VEDP included date of MOU execution, targeted capital investment amount, and, for firms that qualified for the exemption, actual capital investment amounts for enterprise data centers and for both landlords and tenants of colocation centers. For most qualified firms, firms report actual capital investment levels; however, some report only that they met the minimum statutory requirement (\$150 million). For firms that had entered into a MOU but had not yet completed their performance period (or those that received extensions to comply with the MOU, usually employment

requirement levels), no information is available on capital investment to date. However, these firms use the exemption during the interim period, which results in forgone state tax revenue. To adjust for these data centers, exemption use on all estimated eligible equipment purchases are imputed. Based on qualified exemption firms, capital investment targets underestimated actual investment by a factor of 1.74. Therefore, for firms that did not report actual capital investment, actual levels were estimated to be 1.74 times as large as the targeted (usually statutory minimum) level. In addition, capital investment was assumed to be spread out over a three-year period.

Finally, based on data center firm interviews, the IT equipment refresh cycle (three to five years) forms the basis for future sales and use tax savings after the facility is established and equipped. Weldon Cooper assumes that new equipment equivalent in value to the original equipment investment occurs five years later. For example, a firm that signed an MOU in 2010 and completed the facility in 2013 would begin a new equipment refresh cycle in year 2015 and again in 2020.

The revenue impact estimates provided here are significantly higher than previous estimates developed by the Department of Taxation and used in previous JLARC reports (*Economic Development Incentives*, 2017 and 2018). The 2018 JLARC report indicates forgone revenue totaled \$284.9 million between FY10 and FY17 compared to \$417.47 million in this report, a 40 percent increase. The primary reason for the discrepancy is this report uses information on actual investment for qualified projects rather than minimum qualifying equipment targets. It also extrapolates the investment performance of qualified projects to other pending projects. This method likely still underestimates the actual forgone revenue because companies with an existing MOU do not need to apply for an additional MOU when they undertake major expansions. For example, Microsoft has expanded its Mecklenburg data center campus several times since entering into its MOU in 2010. The documented capital investment would reflect only re-equipping the original buildings and not the current use of the exemption.

Data Center Single Sales Apportionment

Ordinarily, corporate tax returns could be used to determine the impact of the data center single sales apportionment on state revenues. However, most companies operating enterprise data centers in the state (e.g. Amazon, Microsoft, Visa) also have other unrelated operations in the state (i.e., multiproduct firms), and it is difficult to disentangle these operations and employment from data centers. Furthermore, no information is available about future data center expansion. Therefore, revenue impacts are estimated using Virginia Economic Development Partnership MOU and Department of Taxation information in conjunction with secondary data and certain assumptions to arrive at plausible estimates and projections of future revenue impact. These are described below.

Revenue estimates depend on data from the Internal Revenue Service Corporation Income Tax Returns by Industry reported by the Brookings-Urban Tax Policy Center for five years (2009–2013). Income subject to tax for the data processing, hosting, and related service and telecommunications (including paging, cellular, satellite, cable, and internet service providers) industries (50-50 split) is assumed to be representative of the data center industry based on information presented earlier. Employment data for the same sectors and corresponding years was obtained from Bureau of Economic Analysis State Personal Income and Employment. Federal taxable income per employee was calculated for each tax year and inflated to 2018 using the consumer price index. The average of five years was assumed to be representative of the typical year and would persist into the future with only a consumer

price index inflation adjustment (assumed to be 2.2 percent per year over the period 2019–2024). It is assumed that federal taxable income per employee nationwide is an adequate gauge of Virginia taxable income per employee (i.e., there are no other tax additions and subtractions).

Weldon Cooper Center collected information on enterprise data centers that are currently eligible for single sale apportionment by reviewing data that VEDP collects from companies using the data center sales tax exemption. Qualifying companies must make capital investments in data center operations to be eligible for the exemption; the same capital investment requirement (\$150 million) applies to using single sales apportionment. The MOU data for the sales tax exemption also contains information on actual job creation associated with each data center investment. Seven enterprise data centers qualified for a sales and tax use exemption over the 2011–2018 period. Over that period, the companies created an estimated 812 jobs (102 per year). This annual rate of employment gain was projected to persist over the 2019–2024 period for eligible firms and incrementally increase Virginia taxable income. To qualify to use single sales apportionment, an enterprise data center would have to make an investment and enter into an MOU with VEDP after July 1, 2015, the effective date of the incentive. For taxable years 2018 and beyond, two firms that qualified for the exemption have also qualified to use single sales apportionment. Single sales apportionment for data centers may have a tax revenue impact for FY18 and beyond depending on the profitability of these and other firms that may qualify in the future.

Calculating the effect of switching from standard double sales apportionment to single sales requires estimates of companies' payroll, property, and sales. Estimates of these factors came from two sources. Actual apportionment factor data was obtained from corporate returns filed with the Department of Taxation. When this data was not available, estimates were made by assuming that the Virginia percentage of total data centers was representative of the property and payroll factors. For example, if a company had 52 U.S. data centers and 37 were located in Virginia, it was assumed that 71 percent (37/52) of property and payroll are located in Virginia. For these same firms, it was assumed that 5 percent of company sales originated in Virginia. This percentage is roughly double Virginia's percentage of total U.S. population (2.6 percent). Using this approach, it was estimated that the typical enterprise data center has 5 percent of payroll, 20 percent of property, and less than 1 percent of sales in Virginia. Thus, under standard double sales factor approximately 6 percent of income would be taxable. Under single sales apportionment less than 1 percent would be taxable. The difference of the two was applied to estimated income subject to Virginia tax. This difference then was multiplied by the 6 percent corporate tax rate.

This method may slightly undercount or over count the impact on revenue for several reasons. First, it is possible that data centers are more profitable (and have greater federal tax liability per employee) than the composite telecommunications and data processing, hosting, and related service industry firm. Second, data centers that invested at least \$150 million but did not meet job creation thresholds for the program would not be captured in the MOU data used to estimate revenue impact. Third, the projects do not take into consideration expansion of existing data center campuses that had already qualified for the tax exemption and whose subsequent expansions investments are not captured in the MOU data. Fourth, failure to account for tax subtractions to arrive at Virginia taxable income may lead to over counting of state tax liability per employee.

Pollution Control Equipment and Facilities Exemption

Limited data is available to estimate the forgone revenue of the pollution control equipment and facilities exemption. To be eligible for the exemption, manufacturing firms must first obtain certification from the relevant state agency. For most water, air, and solid waste mitigation equipment, the Department of Environmental Quality provides the certification based on federal and state regulatory requirements. The Department of Mines, Minerals, and Energy provides the certification for solar projects and coal, oil, and gas production related pollution mitigation equipment. Manufacturers who make the improvements must complete form ST-11 (Sales and Use Tax Certificate of Exemption) and provide this form to suppliers to receive the exemption. Construction and other firms who install and equip pollution control facilities for manufacturers and other firms must first obtain approval from the Department of Taxation and file instead form ST-11A (Sales and Use Tax Certificate of Exemption for construction contractors and non-manufacturers).

The Department of Taxation archives information obtained from regional DEQ offices on candidates for obtaining the ST-11A form, including contractors and other firms. In some instances, the files contain information regarding the entity receiving certification, including public entities like local governments that did not need to use the exemption since they use the governmental exemption instead. The files contain information on claimants, including the construction contractor or other firm purchasing and installing the equipment, a description of the project, a contact address that is either the installation site or the contracting firm address, date of application, and date of approval. This information was compiled into a database, cleaned, and aggregated to identify firms potentially using the exemption in years 2010–2017 and the number of pollution mitigation projects for which they might use the exemption. In total, 280 firms were identified as potentially using the exemption during the 2015–2017 period for an estimated 1,284 projects. In addition, since the contact information was often imprecise or incorrect, supplemental contact information was gathered from a variety of industry sources, including points of contact within the firm such as CEO/president/owner or CFO/director of finance/comptroller.

Using this contact database, the Weldon Cooper Center conducted a survey of the 280 firms. Firms were asked to provide the total amounts spent on exemption eligible equipment and number of pollution control projects for each year over the period 2015–2017. In addition, firms were asked to identify their 2-digit NAICS industry. Finally, firms were given an opportunity to offer comments about the program and their use or non-use of the exemption during the period. Firms were contacted multiple times by email, regular mail, and telephone to encourage participation in the survey. The survey was offered in an online format using Qualtrics software with the option of mailing a completed survey form and sending by mail in a postage-paid, self-addressed envelope.

Seventy-four firms responded out of an adjusted sample size of 230 firms (accounting for duplicates, firm closures, and other usual circumstances) for an adjusted response rate of 32.2 percent. Estimates of the exemption-eligible purchases were made by extrapolating the average spending on a per-project basis (\$208,310), weighted by the original number of projects in the contact database. These estimates were extrapolated backwards in time (2010–2014) based on the number of projects and an inflation adjustment factor based on the consumer price index. State tax revenue impact was obtained by multiplying the effective state sales and use tax rates for each fiscal year (3.92 in 2010; 3.98 in 2011 and 2012; and 4.28 in 2014–2017) by estimated eligible sales.

The results (an average revenue impact of \$3.815 million in FY15–FY17) are similar to Department of Taxation estimates based on an earlier (pre-2010) survey. Using this base information, TAX projected forward by inflating the baseline number by the consumer price index to adjust to nominal values, with FY17 estimated at \$3.64 million. Another comparison was made to estimates based on information from the U.S. Census Bureau’s Pollution Abatement Costs and Expenditures (PACE): 2005 and the Annual Survey of Manufacturers. The Annual Survey of Manufacturers reports total capital expenditures of \$2.731 billion, while PACE reports depreciation of \$46.1 million on pollution control equipment used by manufacturers for 2005. To determine the tax impact, the Weldon Cooper Center used depreciation as a proxy for replacement expenditures needed to maintain pollution control efforts and extrapolated Virginia manufacturing capital expenditures of \$2.963 million in 2016. Therefore, Weldon Cooper estimated that Virginia manufacturers in 2016 spent \$50 million to generate a \$2.65 million sales and use tax impact.

Employment performance tracking

Four of the incentive programs examined in this report establish employment performance benchmarks as a condition for receiving the incentive. The MOUs between VEDP and Micron and Qimonda specify employment levels before grant funds will be disbursed. The data center tax exemption also establishes minimum job requirements. Manufacturers single sales apportionment requires firms to maintain employment for three years to retain eligibility. Employment must be kept at least 90 percent of the year before electing single sales apportionment. Information on compliance with the employment requirements for the Micron and Qimonda grants and data center exemption was obtained from VEDP based on company reporting and VEDP follow-up.

The Weldon Cooper Center evaluated electors’ compliance with employment performance requirements by examining Virginia Employment Commission ES202 annual employment data for the 2013–2017 period. Program project records for tax year 2014 manufacturers single sales apportionment electors were matched with 2013–2017 quarterly VEC ES202 payroll employment data using FEIN (i.e., taxpayer identification number) and company name from Department of Taxation Corporate Income tax records (forms 500 and 500A). The FEIN (Federal Employer Identification Number) is a unique nine-digit number that identifies a firm for federal tax purposes. VEC employment data was aggregated to the FEIN level for each firm.

Interviews with agencies and stakeholders

JLARC and Weldon Center Cooper staff held meetings and phone conference calls with staff from agencies administering the incentives evaluated for this report and include the

- Department of Environmental Quality;
- Department of Mines, Minerals, and Energy;
- Department of Taxation;
- Virginia Economic Development Partnership; and
- Virginia Clean Energy Program.

In addition, meetings were held with interested members of the Virginia Manufacturers Association Taxation Committee to discuss the importance of manufacturing incentives and consultants for the

Northern Virginia Technology Council. Representatives of semiconductor manufacturers and data centers were also interviewed.

In December 2018 and January 2019, Weldon Cooper Center and JLARC analysts interviewed seven data center companies with a presence in Virginia. The names and contacts for the data centers were provided by the Northern Virginia Technology Council as representatives of the industry. They included firms operating enterprise and colocation data centers, with some interviewees operating facilities outside of the Northern Virginia region. Those interviewed included company staff involved in finance and accounting, state and local taxation, state relations, public policy, technology, economic development, and site selection. Each had significant experience with their firms and experience needed to assess site selection criteria and the importance of economic development incentives. All of the firms interviewed are currently using the data center sales and use tax exemption. Some of the enterprise data centers interviewed might also be eligible to use the newly enacted single sales apportionment for data centers in the future. Most had centers elsewhere in the U.S. and some internationally. They represent collectively over one quarter of the estimated number of data centers in Virginia. During the interviews, data center representatives were asked about what location and expansion factors are most important for their firm; the role of incentives in location decisions; Virginia's infrastructure and other factors, including incentives, considered in site location decisions compared with other states; potential improvements of Virginia's data center incentive programs; data centers' impact on local and state economic development; and the technological, economic, and social trends affecting data center growth in Virginia and elsewhere.

Review of data center and manufacturing incentives in other states

Weldon Cooper Center staff reviewed several sources to obtain information on comparable manufacturing and data center incentives offered by other states. Sources often varied by the type of incentive, since there is no authoritative comprehensive source on all state incentives. The Council for Community and Economic Research (C2ER) online State Business Incentives Database, which reflects incentive programs in place as of 2015 (the last time the database was updated), was used to confirm and supplement information for several programs (e.g., data centers, semiconductor incentives, biodiesel tax credits, recycling tax credits). For corporate manufacturing apportionment factors, Commerce Clearing House or CCH (2018) and Federation of Tax Administrators (2018) survey information was used. CCH (2018) was also used to identify recycling equipment tax credits. CCH (2017) and Potter, Steward and Kessler (2017) were used to assemble information on pollution control equipment and facilities sales and use exemptions and other similar types of pollution control investment incentives (e.g., tax credits, property tax abatements, loans). Keve, Verdi, and English (2010) served as the starting point for state biodiesel incentives, although many of the programs listed by that publication have since expired. Search engine keyword searches and information culled from a report by Washington JLARC (2016) were the primary sources of information to identify comparable semiconductor manufacturing sales and use tax exemptions, while Good Jobs First provided information on large semiconductor industry customized incentive programs to attract new plants or encourage plant expansion. Information on state data center incentives was assembled with assistance of Tarczynska (2016) and Mangum Economics (2018). In each instance, these sources were supplemented with reviews of state departments of economic development and tax/revenue

websites to confirm that the information was still current or to obtain a better understanding of particular features of incentives.

Review of documents and literature

During this study, several sources of information, including documents, reports, and published or unpublished research, were examined. The purpose of this literature review was to understand the purpose and goals of Virginia incentive programs, industry site location factors, role and importance of economic incentives, market imperfection rationales for programs, and methodological approaches for quantifying the economic and tax revenue impacts of economic incentives. Sources consulted included

- materials describing the programs, Virginia agency reports describing program usage, and legislative statutes authorizing the programs;
- state evaluations and economic impact studies published by state agencies or their consultants in other states;
- scholarly books and articles that examine the (1) features and locational characteristics of the manufacturing industry, semiconductor manufacturing industry, and data centers and (2) effect of corporate tax apportionment factors and other types of economic incentives on firm growth, employment, and other outcomes (e.g., environmental emissions); and
- studies that attempt to quantify the economic impact of economic development incentives using forecasting and retrospective modeling methods.

Appendix C: State data center incentives

A majority of states offer data center sales and use tax exemptions to attract data centers. This exemption has greater value for data centers than for other industries, including manufacturers, because of the high cost of capital investment in plant and equipment and a rapid depreciation cycle of three to five years. Twenty-eight states currently have some form of sales and use tax exemption for data centers (Table C-1).

Table C-1
Data center sales and use tax exemptions by state

State	Year established/ last enhanced	Requirements	Eligible purchases	Other data center incentives
Alabama	2012	Create at least 20 jobs and average compensation of \$40,000. Sales and use exemption period varies with amount of investment	Construction and equipment	Property Tax Abatement
Alaska				
Arizona	2013	Capital investment \$25 million to \$50 million within 5 years	Equipment	
Connecticut				State offers energy efficiency program to enhance efficiency for energy-intensive businesses
Florida	2017	Capital investment of at least \$150 million dollars over 5 years and a "critical IT load" of 15 megawatts or higher and a critical IT load of 1 megawatt or higher dedicated to each individual owner or tenant within the data center.	Infrastructure, equipment, personal property, and electricity	Enterprise zone program eligible
Georgia	2005	Sales and use exemption for \$15 million capital investment	Computer hardware and software	Tax credit available for "telecommunication support companies"; 8% of qualified investments for investment of \$50k or more

Appendixes

State	Year established/ last enhanced	Requirements	Eligible purchases	Other data center incentives
Georgia	2018	Create at least 20 "quality jobs" (30-hour regular workweek, pays at least 110% of average wage) for single user and colocation and qualified customers. Minimum investment thresholds for 7 year period are \$100 million for counties with populations less than 30k, \$150 million for 30–50k), and \$250 million (50k+)	Equipment, materials, components used in data centers	
Indiana	2012	\$10 million investment in qualifying high technology districts and pays at least 125% of average county wage	Computing, networking, data storage equipment, and power supply equipment	
Iowa	2007 / 2009	Exemption (\$200M investment) and refund (50%) with items and duration depending on investment level (\$1 million and \$200 million). Facility must adhere to sustainable design standards and be at least 5,000 square feet	Construction, computers and equipment, fuel, and electricity	Personal property tax abatement
Kansas				State does not have new equipment property tax
Kentucky	2009	Tax refund for capital equipment investment of at least \$100 million	Communications equipment, computer equipment, and computer software	
Maryland				Data energy efficiency grant
Michigan	2015 / 2016	Exemption for equipment purchases for enterprises that receives 75% or more of its sales from colocated businesses	Construction materials and equipment	
Minnesota	2012	Exemption for data centers with at least 25,000 square feet and investment of \$30 million	Equipment, software, and energy	Property tax abatement
Mississippi	2010	Exemption for investment of at least \$50 million, creates at least 50 jobs, and pays 150% of average state wage	Construction and equipment	
Missouri	2010 / 2015	New centers must have investment of at least \$25 million and create 10 jobs. Existing centers must invest \$5 million and create 5 jobs. Jobs must pay at least 150% of county average wage		
Montana	<i>No state sales tax</i>			Property tax abatement

Appendixes

State	Year established/ last enhanced	Requirements	Eligible purchases	Other data center incentives
Nebraska	2012	General economic development program has multitiered system of sales tax refunds based on investment and employment levels with specific thresholds. Data center eligibility starts at \$3 million in investment and 30 new full-time jobs		Job creation tax credit. Investment tax credit and personal property tax exemption also are awarded.
Nevada	2015	Partial (75%) sales and use exemption for \$25 million investment and 10 jobs at 100% of state average wage		Partial personal property tax abatement
New Hampshire	<i>No state sales tax</i>			
New York	2000	Internet web hosting data centers	Equipment, software, and other personal property	
North Carolina	2006 / 2015	\$75 million investment and meet county wage and benefit standards	Equipment, software, and electricity	
North Dakota	2015	Data centers at least 16,000 square feet		
Ohio	2011 / 2013	\$100 million investment and \$1.5 million payroll. Colocation centers eligible	Construction materials and equipment	
Oklahoma	1993	Computer system sales tax exemption (not data center specific) if 80% of sales from out-of-state	Computer systems	
Oregon	<i>No state sales tax</i>			Property tax abatements
Pennsylvania	2016	Sales and tax refund. Minimal investment of \$50 million in counties with 250,000+ population or \$25 million with less than 250,000 population and pays at least \$1 million in total employee compensation. Program cap of \$5 million.	Equipment, software, and other personal property	
Rhode Island				
South Carolina	2012	\$50 million minimum investment and 25 job creation minimum. Jobs must pay at least 150% of average wage.		
Tennessee	2007 / 2016	\$100 million investment and 15 jobs created that pay 150% of state average occupational wage and offer health-care benefits.	Computer systems, communication systems, software, backup power and HVAC equipment	
Texas	2013	\$200 million investment and create at least 20 jobs that pay 120% of average county wage.	Computers, equipment, HVAC and power equipment, electricity and fuel	

Appendixes

State	Year established/ last enhanced	Requirements	Eligible purchases	Other data center incentives
Utah	2010 / 2016	At least 150,000 square feet	Machinery, equipment and replacement parts, with economic life of at least one year	
Virginia	2009 / 2016	\$150 million investment, create 50 jobs that pay 150% of average county wage. Job creation threshold is 25 jobs in rural or economically distressed counties.		Property tax abatement (local option)
Washington	2010	Rural enterprise zone. Must be at least 100,000 square feet	Server equipment and power infrastructure	
West Virginia	2009	No specific minimum investment or job creation levels	Construction materials, equipment, and software	Personal property tax abatement
Wyoming	2011	Two-tier structure. \$5 million and \$50 million infrastructure investment tiers combined with \$2 million in equipment and software expenditure.	Lower tier investment creates exemption for computer equipment. Higher tier qualifies power supply and generation and HVAC equipment also.	

SOURCE: Weldon Cooper Center analysis based on Mangum Economic (2018), Tarczynska (2016), and C2ER Business Incentives Database.

Appendix D: Corporate tax apportionment formulas by state

Despite the original recommendation by state tax professionals, many states have questioned the rationale and continued relevancy of the standard equally weighted, three-factor (property, payroll, and sales) apportionment formula. Currently, only a few states still use it. Today, most states use single sales factor apportionment (Table D-1). Unlike Virginia, most states require all industries to use single sales apportionment rather than allowing only certain industries to use it.

TABLE D-1
Corporate tax apportionment rules by state

State	Apportionment Formula
Alabama	3 factors with sales double-weighted
Alaska	Sales, property, and payroll equally weighted
Arizona	Elective sales or 3 factors with sales double-weighted
Arkansas	3 factors with sales double-weighted
California	Sales
Colorado	Sales
Connecticut	Sales
Delaware	3 factors with sales triple-weighted; Single-sales factor phased in by tax year 2020
District of Columbia	Sales
Florida	3 factors with sales double-weighted. Corporations making capital investment of at least \$250 million may choose one-factor sales
Georgia	Sales
Hawaii	Sales, property, and payroll equally weighted
Idaho	3 factors with sales double-weighted
Illinois	Sales
Indiana	Sales
Iowa	Sales
Kansas	Sales, property, and payroll equally weighted. Corporations where payroll exceeds 200% of average of property and sales factor may choose two-factor formula of property and sales.
Kentucky	Sales
Louisiana	Sales

State	Apportionment Formula
Maine	Sales
Maryland	Sales/3 factors with sales triple-weighted; Single-sales factor phased in by tax year 2022
Massachusetts	Sales
Michigan	Sales
Minnesota	Sales
Mississippi	Factor formula varies by manufacturing category with sales, property, and payroll equally weighted for wholesale sellers, three factors with sales double-weighted for retail sellers, and single sales for selected other incentivized manufacturers
Missouri	Sales, property, and payroll equally weighted
Montana	Sales, property, and payroll equally weighted
Nebraska	Sales
Nevada	No state corporate income tax
New Hampshire	3 factors with sales double-weighted
New Jersey	Sales
New Mexico	Elective sales factor or 3 factors equally weighted
New York	Sales
North Carolina	Sales
North Dakota	Sales, property, and payroll equally weighted. Recently underwent gradual phase in of incentive that since tax year 2018 allows manufacturers to elect to use sales as a single-factor. Election is binding for five years.
Ohio	N/A*
Oklahoma	Sales, property, and payroll equally weighted. Corporations making capital investment of at least \$200 million may choose three factors with sales double-weighted.
Oregon	Sales
Pennsylvania	Sales
Rhode Island	Sales
South Carolina	Sales
South Dakota	No state corporate income tax
Tennessee	3 factors with sales triple-weighted
Texas	Sales
Utah	Elective 3 factor with sales double-weighted or 3 factors equally weighted. Single sales option will be phased in by tax year 2021 with optional opt-out category
Vermont	3 factors with sales double-weighted
Virginia	Elective sales or 3 factors with sales double-weighted for manufacturing and data centers
Washington	No state corporate income tax
West Virginia	3 factors with sales double-weighted

State	Apportionment Formula
Wisconsin	Sales
Wyoming	No state corporate income tax

SOURCE: Weldon Cooper Center review of 2019 U.S. Master Multistate Corporate Tax Guide and Federation of Tax Administrators (2018).

*Ohio has a gross receipts tax instead of corporate income tax.

Appendix E: Semiconductor incentives by state

States want to recruit and retain semiconductor manufacturers because they require large capital investments and create a large number of jobs. States often offer large “megadeal” (\$75 million or more) incentives or customized incentive packages (Table E-1).

Table E-1
Multiple states have offered “megadeal” incentives to attract semiconductor manufacturers

State	Incentive package
Arizona	\$84 million in tax abatements, exemptions, and credits for Intel to locate \$1.3 billion plant employing 1,500 workers (1994) \$17.5 million in tax credits for Intel plant expansion (2014)
Maine	\$116 million in tax abatements, tax increment financing, and Business Equipment Tax Reimbursements for National Semiconductor (later acquired by Texas Instruments) to establish \$500 million plant and create 450 jobs (1997) \$17 million from the Business Equipment and Tax Reimbursement program to Texas Instruments (2009–2016)
New Mexico	\$645 million in property and other tax abatements, tax credits, and corporate income tax reductions to Intel for expansion (1993) \$2 billion in financial assistance through an industrial revenue bond for Intel expansion (2004)
New York	\$1.5 billion in grants, loans, property tax abatements, sales tax exemptions, tax credits, and state investment in R&D and education facilities for IBM (now owned by Global Foundries) (2008) \$1.4 billion in capital grant and tax credits to Global Foundries for establishing \$4.6 billion facility in Saratoga County (2010-2012)
North Carolina	\$14.1 million in grants and tax credits to RF Micro Devices and Triquint Semiconductors, and their successor Qorvo, for plant expansions and other activities (2002–2012)
Texas	\$600 million in local property tax abatements over 24 years and a \$50 million grant to Texas Instruments for establishing a \$3 billion plant employing 1,000 workers (2003) \$233.4 million in local property abatements and a \$10.8 million grant to Samsung to locate a \$3.5 billion plant to employ 900 workers (2006) \$83.6 million in property tax abatements to Samsung for expansion of plant (2012)
Oregon	\$121.5 million in incentives to establish Intel plant (1996) \$200 million in incentives for Intel expansion (1999) \$579 million in tax incentives for retention and expansion of Intel plant (2005) \$2 billion in property tax abatements for additional investment by Intel (2014)
Utah	\$125 million in property tax abatements, sales tax exemptions, and other assistance to Micron to establish plant (1995) \$45.9 million in tax increment financing to Micron for a \$1.5 billion plant expansion to employ 200 additional workers in joint venture with Intel (2011)
Virginia	\$18.6 million custom grant for Dominion Semiconductor for \$4 billion plant creating 4,000 jobs (1996) \$15 million custom grant for White Oak Semiconductor Partnership for \$1.5 billion plant creating 1,500 jobs (1997) \$59.8 million in custom grants for expansion of Micron and Qimonda plants to collectively employ 2,060 additional workers and invest \$2.4 million (2005)

SOURCE: Weldon Cooper Center review of Good Jobs First.

Appendix F: Semiconductor manufacturing is concentrated in six states

Most (74 percent) semiconductor and related device manufacturing is concentrated in six states with location quotients well over 1.0: Arizona, California, Idaho, Massachusetts, Oregon, and Texas (Table F-1). Three of these states—California, Massachusetts, and Oregon—also have most (77 percent) of the nation’s employment in semiconductor machinery manufacturing.

Table F-1
Semiconductor manufacturing and related supply chain industries are highly concentrated in a few states

	Semiconductor and related device manufacturing		Semiconductor machinery manufacturing		Upstream industries	
	Jobs	Location quotient	Jobs	Location quotient	Jobs	Location quotient
Arizona	17,443	5.02	837	2.20	5,049	0.69
California	46,568	2.12	10,179	4.23	91,996	2.00
Colorado	2,388	0.71	81	0.22	6,938	0.98
Florida	7,602	0.71	188	0.16	9,747	0.43
Idaho	8,619	9.39	18	0.18	838	0.43
Maine	796	1.01	0	0.00	472	0.28
Massachusetts	8,302	1.86	2,403	4.92	15,887	1.70
Minnesota	2,170	0.61	78	0.20	10,316	1.37
Missouri	1,102	0.31	2	0.00	3,355	0.45
New Hampshire	500	0.60	50	0.55	3,046	1.75
New Jersey	1,828	0.37	30	0.06	3,982	0.38
New Mexico	1,943	1.86	0	0.00	3,596	1.64
New York	7,731	0.67	545	0.43	16,582	0.68
North Carolina	4,646	0.84	25	0.04	8,169	0.70
Ohio	1,732	0.26	88	0.12	11,028	0.79
Oregon	25,279	10.52	2,672	10.15	2,583	0.51
Pennsylvania	1,936	0.27	440	0.55	8,800	0.58
South Dakota	673	1.21	0	0.00	831	0.71
Texas	27,869	1.82	763	0.46	47,537	1.48
Utah	2,272	1.26	14	0.07	964	0.25
Vermont	3,030	7.47	27	0.62	182	0.21
Virginia	1,602	0.33	7	0.01	4,452	0.43

	Semiconductor and related device manufacturing		Semiconductor machinery manufacturing		Upstream industries	
	Jobs	Location quotient	Jobs	Location quotient	Jobs	Location quotient
Washington	3,090	0.73	0	0.00	12,525	1.41
All Others	2,901	0.05	1,502	0.22	113,594	0.87
Total	182,022		19,952		382,469	

SOURCE: Weldon Cooper Center analysis of EMSI employment data..

NOTE: Upstream electronic industries using approximately 20% of semiconductor and related device output according to IMPLAN include printed circuit assembly manufacturing (334418), computer storage device manufacturing (334112), wireless telecommunications carriers (517312), electronic computer manufacturing (334111), telephone apparatus manufacturing (334210), and motor vehicle electrical and electronic equipment manufacturing (336320).

Appendix G: Virginia custom grants for semiconductor manufacturers

TABLE G-1

Virginia approved five custom grants to attract semiconductor production facilities FY96–FY17

Custom grant: Motorola	
Purpose	Encourage White Oak Semiconductor to construct and operate a 200mm semiconductor production facility in Henrico County
Performance requirements	Enter into MOU with VEDP Create 1,500 FTEs and \$1.5 billion in capital investment
Payment structure and schedule	In the amount of \$100 per memory wafer and \$250 per logic wafer produced and sold by the Henrico facility Authorized between 2003 and 2009 if performance achieved and VEDP notified pursuant to MOU. Maximum aggregate payment was \$15 million to be paid in annual installments that may vary depending on attainment of performance and number of chips sold but are not to exceed <ul style="list-style-type: none"> – \$3 million in 2003 – \$6 million in 2004 (less any amounts paid in 2003) – \$9 million in 2005 (less any amounts paid since 2003) – \$12 million in 2006 (less any amounts paid since 2003) and – \$15 million for 2007 through 2009 (less any amounts paid since 2003)
Custom grant: Dominion Semiconductor LLC (became Micron)	
Purpose	Encourage Dominion Semiconductor—a joint venture of Toshiba and IBM—to occupy a shutdown facility in the City of Manassas and produce DRAM (dynamic random-access memory) memory chips
Performance requirements	Enter into MOU with VEDP Create 4,000 FTEs and \$4 billion in capital investment within 3 performance milestones (cumulative): <ul style="list-style-type: none"> – Milestone 1: 1,200 FTEs and \$1 billion in capital investment by December 1998 – Milestone 2: 2,500 FTEs and \$2.5 billion in capital investment by December 2002 – Milestone 3: 4,000 FTEs and \$4 billion in capital investment by December 2005
Payment structure and schedule	Begin 5 years after milestone is reached and VEDP is notified In the amount of \$100 per memory wafer and \$250 per logic wafer produced and sold by the Manassas facility with annual and cumulative maximums depending on the milestone achieved. <ul style="list-style-type: none"> – Milestone 1: \$3,720,000 annual and \$18.6 million cumulative – Milestone 2: \$6,080,000 annual and \$30.4 million cumulative – Milestone 3: \$7,680,000 annual and \$38.4 million cumulative

Custom grant: White Oak Semiconductor Partnership (became Infineon)	
Purpose	Encourage White Oak Semiconductor to construct and operate a 200mm semiconductor production facility in Henrico County
Performance requirements	Enter into MOU with VEDP Create 1,500 FTEs and \$1.5 billion in capital investment
Payment structure and schedule	In the amount of \$100 per memory wafer and \$250 per logic wafer produced and sold by the Henrico facility Authorized between 2003 and 2009 if performance achieved and VEDP notified pursuant to MOU. Maximum aggregate payment was \$15 million to be paid in annual installments that may vary depending on attainment of performance and number of chips sold but are not to exceed <ul style="list-style-type: none"> - \$3 million in 2003 - \$6 million in 2004 (less any amounts paid in 2003) - \$9 million in 2005 (less any amounts paid since 2003) - \$12 million in 2006 (less any amounts paid since 2003) and - \$15 million for 2007 through 2009 (less any amounts paid since 2003)
Custom grant: Micron	
Purpose	Encourage Micron to expand its 300mm semiconductor wafer plant in Manassas
Performance requirements	Enter into MOU with VEDP Create 860 FTEs and \$1.2 billion in capital investment within 3 performance tiers (cumulative) <ul style="list-style-type: none"> - Tier 1: 300 FTEs and \$400 million in capital investment by 2007 - Tier 2: 640 FTEs and \$800 million in capital investment by 2009 - Tier 3: 860 FTEs and \$1.2 billion in capital investment by 2011
Payment structure and schedule	Maximum of \$27 million Begin 5 years after performance for each tier reached and VEDP notified <ul style="list-style-type: none"> - Tier 1: \$8 million to be paid in 5 annual installments of \$1.6 million - Tier 2: \$11 million to be paid in 5 annual installments of \$2.2 million - Tier 3: \$8 million to be paid in 5 annual installments of \$1.6 million
Custom grant: Infineon (became Qimonda)	
Purpose	Encourage Infineon to expand its semiconductor plant in Henrico
Performance requirements	Enter into MOU with VEDP Create 1,200 FTEs with an average annual salary of at least \$65,000 and make \$1.2 billion in capital investment within 3 performance tiers (cumulative) <ul style="list-style-type: none"> - Tier 1: \$550 million in capital investment by 2006 - Tier 2: 1,000 FTEs by 2008 - Tier 3: 200 additional FTEs and \$1.2 billion in capital investment by 2011
Payment structure and schedule	Maximum of \$55 million Begin 5 years after performance for each tier reached and VEDP notified <ul style="list-style-type: none"> - Tier 1: \$15 million to be paid in 2 annual installments of \$7.5 million - Tier 2: \$35 million to be paid in 4 annual installments of \$8.75 million - Tier 3: \$5 million to be paid in 2 annual installments of \$2.5 million

SOURCE: Weldon Cooper Center review of Chapters 642, 645, 651, and 652, 1996 Acts of Assembly; Chapter 789, 1997 Acts of Assembly; Chapter 392, 2005 Acts of Assembly; and documentation provided by VEDP.

Appendix H: Semiconductor manufacturing sales and use tax exemptions by state

Only nine states, including Virginia, offer exemptions from the sales and use tax to semiconductor manufacturers (Table H-1).

TABLE H-1
Semiconductor manufacturing sales and use tax exemptions by state

State	Name	Description
Arizona	Clean room* sales and use tax exemption	Exempts semiconductor clean rooms used for manufacturing, processing, fabrication, or R&D from sales and use tax.
California	Manufacturing and R&D partial sales and use exemption	Sales and use tax exclusions for qualifying manufacturing enterprises, including semiconductor industry. Includes tangible personal property used in manufacturing, R&D, testing, and special purposes.
Florida	Semiconductor, defense, or space technology sales and use tax exemption	Sales and use tax exemption on semiconductor, defense, and space technology-based purchases of production and/or research and development equipment.
Georgia	Clean room sales and use tax exemption	Exempts machinery and equipment and materials used in the construction or operation of a clean room of Class 100 or less when the clean room is used directly in the manufacture of tangible personal property.
Idaho	Clean room environment in semiconductor manufacturing sales and use tax exemption	Sales and use tax exemption on tangible personal property used in, or to maintain, clean rooms and for research and development or production of semiconductors.
Texas	Semiconductor manufacturing exemption	Additional sales exemption for semiconductor manufacturers beyond what is available to other manufacturers, including tangible personal property outside the cleanroom such as integrated systems, airflow systems, fixtures and piping, and other items
Utah	Semiconductor fabricating, processing, or R&D material exemption	Sales and use tax exemption for fabricating, processing, or R&D materials used for research or development, manufacturing, or fabricating of semiconductors.
Virginia	Semiconductor manufacturing exemption; Semiconductor wafer exemption	Sales and use tax exemptions for equipment, fuel, supplies, wafers used in semiconductor manufacturing

State	Name	Description
Washington	Reduced business and occupation (B&O) tax rate for manufacturers of semiconductor materials; sales/use tax exemption for purchases of semiconductor gasses & chemicals	The Reduced B&O tax rate for manufacturers of semiconductor materials is available to manufacturers or processors for hire of semiconductor materials; the sales and use tax exemption for purchases of semiconductor gasses and chemicals is available to manufacturers or processors for hire of semiconductor materials.

SOURCE: Weldon Cooper Center analysis based on Washington JLARC (2016) and C2ER Business Incentives Database.

NOTE: *Clean rooms are laboratories that contain extremely low levels of air contaminants. They are used by specialty manufacturers, such as semiconductor and biotechnology companies.

Appendix I: Pollution control equipment exemptions by state

Sales and use tax exemptions are the most common incentive for the purchase of pollution control equipment and facilities (Table I-1). Only five states with sales and use taxes do not offer the exemption, though they typically offer other incentives such as property tax exemptions.

TABLE I-1
Pollution control equipment sales and use tax exemptions by state

State	Have exemption	Air	Water	Land/solid	Other	Eligible purchases	Industry or other restrictions	Other pollution control incentives
Alabama	Yes	X	X			Facilities, machinery, equipment and materials		Gross receipts tax deduction, property tax exemption
Alaska	No sales tax							
Arizona	Yes	X	X	X		Machinery and equipment	Manufacturing, processing, power generation, mining, and selected other industries	Business income tax credit
Arkansas	Yes	X	X			Tangible personal property installed and used by manufacturing and processing industries		

State	Have exemption	Air	Water	Land/solid	Other	Eligible purchases	Industry or other restrictions	Other pollution control incentives
California	Yes						Exemption restricted to transfers between California Pollution Control Financing Authority and participating party	Loan programs
Colorado	Yes	X				Equipment	Exemption availability depends on amount of state fiscal surplus	
Connecticut	Yes	X	X	X	X (Solid waste to energy)	Tangible personal property installed or used		Business income tax credit, property tax exemption
Delaware	No sales tax							
District of Columbia	No							
Florida	Yes	X	X	X		Facility, equipment, machinery and chemicals.	Manufacturing and other goods producing industries	Property tax
Georgia	Yes	X	X	X		Machinery, equipment, and parts		Business income tax credit (part of investment tax credit)
Hawaii	Yes	X				Facility, machinery, equipment, and supplies		Property tax exemption
Idaho	Yes	X	X			Tangible personal property used for pollution control		Business income tax credit (part of investment tax credit)

State	Have exemption			Land/solid	Other	Eligible purchases	Industry or other restrictions	Other pollution control incentives
	Air	Water						
Illinois	Yes	X				Equipment	Restricted to low sulfur dioxide emission coal fueled devices	Loan program
Indiana	Yes	X	X			Tangible personal property used in construction and operation	Manufacturing, processing, refining, mining, or agriculture	Property tax exemption
Iowa	Yes	X				Equipment	Manufacturing	Property tax exemption
Kansas	Yes	X	X	X		Machinery and equipment	Manufacturing or processing	Property tax exemption (power generation only)
Kentucky	Yes	X	X	X	X (noise)	Facility, machinery, and equipment		Reduced personal property tax rate
Louisiana	Yes	X	X	X	X (noise)	Machinery and equipment		80% property tax abatement for equipment
Maine	Yes	X	X			Machinery, equipment, and parts		Property tax exemption
Maryland	Yes	X	X			Construction and items considered part of real property		Property tax exemption for coal industry
Massachusetts	No							Business income tax credit (part of investment tax credit), property tax exemption
Michigan	Yes	X	X			Facilities, machinery, and equipment		Property tax exemption
Minnesota	Yes	X	X	X	X (solid waste to energy)	Equipment; facilities for waste-to-energy	Steel reprocessing firm, resource recovery facility, and waste-to energy resource recovery facility	Property tax exemption

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State	Have exemption	Air	Water	Land/solid	Other	Eligible purchases	Industry or other restrictions	Other pollution control incentives
Mississippi	Yes	X	X	X		Equipment	Manufacturing and processing	
Missouri	Yes	X	X			Materials and supplies for construction of facility; machinery and equipment		
Montana	No sales tax							Property tax exemption
Nebraska	Yes	X	X			Tangible personal property used for pollution control facility		
Nevada	No							Property tax exemption
New Hampshire	No sales tax							Property tax exemption
New Jersey	Yes		X	X	X (zero emission vehicles)	Equipment	Wastewater treatment facilities, other	Property tax exemption
New Mexico	No							Property tax exemption
New York	Yes	X	X			Machinery and equipment	Manufacturing, must result in over 50% waste reduction	Business income tax credit (part of investment tax credit), property tax exemption
North Carolina	Yes	X	X	X		Equipment and chemicals	Manufacturing	Property tax exemption
North Dakota	Yes	X	X	X		Machinery and equipment	Power plants, oil refineries, gas processing plants, recycling facility	Property tax exemption

State	Have exemption	Air	Water	Land/solid	Other	Eligible purchases	Industry or other restrictions	Other pollution control incentives
Ohio	Yes	X	X		X (noise)	Materials or parts used in facility		Property tax exemption
Oklahoma	Yes			X		Machinery, equipment, fuels, and chemicals		
Oregon	No sales tax							Property tax exemption
Pennsylvania	Yes	X	X		X (noise)	Machinery, equipment, and supplies	Manufacturing, processing, mining, and public utilities	
Rhode Island	Yes	X	X	X		Tangible personal property used in construction or operation		Business income tax credit (part of investment tax credit), property tax exemption
South Carolina	Yes	X	X		X (noise)	Machinery	Manufacturing, processing, recycling, and mining	Property tax exemption
South Dakota	No							Property tax exemption
Tennessee	Yes	X	X	X		Systems, chemicals, and supplies		Property tax exemption
Texas	Yes	X	X	X			Offshore spill response containment property and repair, remodeling, and restoration services performed on personal property required to protect environment	Property tax exemption

State	Have exemption	Air	Water	Land/solid	Other	Eligible purchases	Industry or other restrictions	Other pollution control incentives
Utah	Yes	X	X			Property, materials, or services used in construction or installation		
Vermont	No							Property tax exemption
Virginia	Yes	X	X	X	X (landfill gas, solar, storage)	Personal property, equipment, facilities, and devices	Manufacturing and other goods producing industries, mining, and public utilities	Property tax exemption
Washington	Yes	X				Equipment or tangible personal property, labor, and services depending on industry	Manufacturing, testing, research and development operation; thermal electric generation facility	Business and occupation tax exemption, utility tax exemption
West Virginia	Yes	X	X	X		Tangible personal property or services	Manufacturing, transportation, communication, transmission, or production of natural resources	Property tax exemption
Wisconsin	Yes	X	X	X			Vehicles, waste treatment facility, recycling, biomass to residential fuel; wind, solar, and gas-powered products	Property tax exemption
Wyoming	No							Property tax exemption

Source: Weldon Cooper Center analysis based on 2018 State Tax Handbook, Potter, Stewart and Kessler (2017), and online search of state tax/revenue department websites

Appendix J: Recycling equipment tax credits by state

Thirteen states offer some form of recycling tax credit (Table J-1). One state—Nebraska—offers a recycling grant program to businesses for recycling and waste reduction. Direct comparisons of the tax credits are difficult because eligibility requirements vary widely, including eligible industries, types of waste targeted, and eligible purchases. Several states had recycling equipment tax credits but allowed them to expire: New Jersey (1996), Oklahoma (Recycling Reuse, and Source Reduction Incentive expired in 2014), and Oregon (2002 and 2008).

TABLE J-1
Recycling equipment tax credits by state

State	Tax credit	Eligibility	Incentive amount
Arizona	Environmental Technology Facility Tax Credit	Available to manufacturers for cost of building or improving facilities where products are made out of recycled materials.	10% of qualifying construction and equipment costs
Arkansas	Recycling Equipment	Taxpayers engaged in business of reducing, reusing, or recycling waste for commercial purposes may claim credit for purchase of related equipment. Waste reduction, reuse, or recycling equipment must be used exclusively in the collection, separation, processing, modification, conversion, treatment, or manufacturing of products containing at least 50% recovered materials, of which at least 10% of the recovered materials shall be post-consumer waste.	30% of cost, including installation, of equipment purchased

State	Tax credit	Eligibility	Incentive amount
Delaware	(1) Recycled Materials and (2) Waste Materials Processing Tax credits	(1) Manufacturer that derives at least 25% of weight of raw materials from recycled materials or materials removed from solid waste stream. (2) Engaged in business of processing materials from solid waste stream for resale as raw materials to manufacturers. Facility must employ five or more employees and have qualified investment of \$200,000 or more in facility.	\$650 per new employee plus \$650 per \$100,000 of investment. In targeted areas, credit increased to \$900 per employee and \$900 per \$100,000 investment
Georgia	Investment Tax Credit can be used for recycling equipment	Manufacturing or telecommunications facility. Can be used for construction or equipment.	3–8% of investment
Idaho	Postconsumer Waste Equipment	Purchased equipment used to manufacture a product from postconsumer or postindustrial waste (i.e., glass, paper, or plastic). Ninety percent of equipment's production must result in products using postconsumer or postindustrial waste. Product must comprise at least 50% of postconsumer or postindustrial waste (\$30,000 tax credit limit).	20% of investment
Kentucky	(1) Purchasing of Recycling or Composting Equipment (2) Major Recycling Project Credit	Purchase of recycling or composting equipment	(1) credit equals 50% of installed cost of equipment. Credit claimed in tax year limited to 10% of total credit allowable and 25% of tax liability for year. Amount is increased for large projects: limit is 50% of tax liability in year and maximum of \$2.5 million.
Louisiana	New Recycling Manufacturing or Process Equipment and/or Service Contracts Tax Credit	Purchases of qualified recycling manufacturing or process equipment or qualified service contracts.	14% of costs of equipment or service contract. Amount claimed may not exceed 20% of total credit allowable. May not exceed 50% of tax liability for tax period.

State	Tax credit	Eligibility	Incentive amount
Montana	Investment in Property for Recycling	Investments in depreciable property used primarily to collect or process reclaimable material or manufacture a product from reclaimed material.	25% of cost of property for first \$250,000 invested; 15% for next \$250,000 invested, and 5% for next \$500,000 invested
Nevada	No corporate income tax		
North Carolina	Recycling Facility Investments	Facility must invest at least \$300 million and create at least 250 new full-time jobs within four years of construction. Must be located in tier-one development area.	50% of purchase or lease costs
Oklahoma	Hazardous Waste Control	Businesses engaged in recycling, reuse, or source reduction of hazardous waste	20% of net investment in equipment and installation
South Carolina	Recycling Facility Investment	Business operating a qualified recycling facility that makes minimum investment of \$300 million by five years after beginning construction	30% of investment
South Dakota	No corporate income tax		
Utah	Recycling Market Development Zone Credits	Credit of up to \$2,000 annually for expenditures paid to third parties for expenses of establishing and operating recycling or composting technology in state	20% of net expenditures up to \$10,000
Virginia	Purchases of Recycling Machinery and Equipment	Recycling machinery and equipment used predominantly in manufacturing facility or plant that manufactures, processes, or produces products from recyclable materials for sale.	20% of purchase price. May not exceed 40% of business tax liability in year.
Washington	No corporate income tax		
Wyoming	No corporate income tax		

Source: Weldon Cooper Center Analysis based on 2019 U.S. Master Multistate Corporate Tax Guide, C2ER Business Incentives Database, and online search of state taxation/revenue and economic development agency websites

Appendix K: Biodiesel production incentive by state

All states except for Delaware had at least one type of renewable energy tax incentive when Virginia's biodiesel tax credit was created. The high point for state incentives seems to be around the time of the enactment of the federal credit and the temporary federal programs for environmental and green job creation that were part of the American Recovery and Revitalization Act fiscal stimulus program. Now, only nine states have biodiesel production incentives (Table K-1).

TABLE K-1
Biodiesel and green diesel production incentives by state

State	Tax credit	Requirements	Other biofuel/biodiesel incentives
Arkansas	Biodiesel Incentive Act	Income tax credit to biodiesel suppliers equal to 5% of the cost of facilities and equipment used directly in the wholesale or retail distribution of biodiesel fuels.	
California	Ultra-Low Sulfur Diesel Fuel Credit	Tax credit of 5 cents per gallon of low-sulphur diesel fuel produced by a small refiner.	
Hawaii	Renewable Fuels Production Tax Credit	Credit for biofuel (including biodiesel). Company must produce at least 15 billion British thermal units (BTU) of renewable fuels per year. The credit is equal to 20 cents per 76,000 BTU of renewable fuels. The credit is capped annually at \$3 million per taxpayer and \$3 million in the aggregate.	The Alternative Energy Loan Program was established to help full-time farmers, ranchers, and aquaculturalists produce renewable energy through sources such as photovoltaic, hydroelectric, wind, methane, biodiesel, and ethanol.
Kentucky	Biodiesel Tax Credit	Tax credit of \$1 per gallon for production and blending of biodiesel (credit cap of \$10 million).	
Missouri			Missouri Qualified Biodiesel Producer Incentive Fund, biodiesel produced in the state by a facility that is at least 51% owned by Missouri agricultural producers or which uses feedstock that is at least 80% of Missouri origin, is eligible for a grant in any fiscal year equal to 30 cents per gallon for the first 15 million gallons produced from Missouri agricultural products and 10 cents per gallon for the next 15 million gallons.

Appendixes

State	Tax credit	Requirements	Other biofuel/biodiesel incentives
Montana	Biodiesel/Biolubricant Production Facilities Credit	Credit for up to 15% of the cost of investments in depreciable property for constructing or equipping a facility.	
Nebraska		Biodiesel Facility Credit (30% of amount invested in biodiesel facility)	
New York	Biofuel Production Tax Credit	Biofuel tax credit (15 cents for each gallon of biofuel produced after production of first 40,000 gallons; capped at \$2.5 million)	
North Dakota	Biodiesel or Green Diesel Production Equipment	Credit for investment in biodiesel or green diesel production facility equal to 10% of equipment cost per year for five years (maximum of \$250,000).	Biofuels PACE Program provides interest buydown on loans to biodiesel, ethanol, or green diesel production facilities and livestock operations. The Envest Loan is to purchase shares in an agriculture processing plant intended to process North Dakota products or for the purchase of equity shares in a North Dakota feedlot or dairy operation that feeds a byproduct of an ethanol or biodiesel facility.
South Carolina	Ethanol or Biodiesel Production Credits	South Carolina provides several income tax credits for a facility that produces ethanol or biodiesel at a plant in South Carolina at which all fermentation, distillation, and dehydration takes place.	
Virginia	Biodiesel fuels credit	A credit is available for Virginia biodiesel and green diesel fuel producers who produce up to two million gallons of fuel per year.	

Source: Weldon Cooper Center Analysis based on 2019 U.S. Master Multistate Corporate Tax Guide, C2ER Business Incentives Database, eve, Verdi, and English (2010) and online search of state taxation/revenue and economic development agency websites.

Appendix L: Agency responses

As part of an extensive validation process, the state agencies and other entities that are subject to a JLARC assessment are given the opportunity to comment on an exposure draft of the report. JLARC staff sent an exposure draft of this report to the Virginia Economic Development Partnership; Department of Taxation; Department of Environmental Quality; Department of Mines, Minerals, and Energy; Secretary of Commerce and Trade; and Secretary of Finance.

Appropriate corrections resulting from technical and substantive comments are incorporated in this version of the report. This appendix includes response letters from the

- Department of Taxation,
- Department of Environmental Quality, and
- Virginia Economic Development Partnership.



COMMONWEALTH of VIRGINIA

Department of Taxation

June 10, 2019

Mr. Hal E. Greer, Director
Joint Legislative Audit and Review Commission
919 East Main Street, Suite 2101
Richmond, Virginia 23219

Dear Mr. Greer:

Thank you for the opportunity to review and comment on the exposure draft report: Data Center and Manufacturing Incentives. We believe the report is very well done and will be useful to the members of the General Assembly going forward. As requested, we provided our comments and clarification under separate cover, for your consideration in the report.

Thank you again for the opportunity to review the draft report. Should you have any additional questions, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Craig M. Burns".

Craig M. Burns
Tax Commissioner

c: The Honorable Aubrey L. Layne, Jr., Secretary of Finance



Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

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Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director
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June 5, 2019

VIA EMAIL

Ms. Ellen J. Miller
Chief Economic Development and Quantitative Analyst
Joint Legislative Audit and Review Commission
ejmiller@jlarc.virginia.gov

**RE: DEQ Comments on Provided Portions of JLARC Exposure Draft for
Data Centers and Manufacturing Incentives**

Dear Ms. Miller:

DEQ appreciates the opportunity to provide comments regarding tax exemption certification for pollution control equipment and facilities included in shared portions of JLARC's Exposure Draft for "Data Center and Manufacturing Incentives" (pp 49-62). In addition to specific comments regarding the language provided, it is important to add some context and general discussion regarding DEQ's implementation of §58.1-3660.

DEQ currently has individual guidance available for each division (i.e., air, land, water) to provide clarity for DEQ's required certification of pollution control equipment and facilities pursuant to §58.1-3660. DEQ's role is clear; as the State Certifying Authority, DEQ certifies that certain property meets the definition in the statute. Specifically, this section of the Code of Virginia falls within Chapter 36 "Tax Exempt Property" under TAX's Subtitle III "Local Taxes." §58.1-609.3 is a separate section within Chapter 6 "Retail Sales and Use Tax" under TAX's Subtitle I "Taxes Administered by the Department of Taxation" that provides commercial and industrial exemptions for certified pollution control equipment and facilities as defined in §58.1-3660. So, briefly stated, DEQ certifies that certain property meets the definition for a local property tax exemption, and TAX provides a separate (piggybacked) sales and use tax exemption for the property that DEQ has certified.

Ms. Ellen J. Miller
June 5, 2019
Page Two

DEQ has an additional responsibility under the Constitution of Virginia. Specifically Section 6 f of Article X states in part that

“Exemptions of property from taxation as established or authorized hereby shall be strictly construed...”

As a result, DEQ has attempted to meet this requirement by considering whether the property requiring certification meets all parts of the definition. §58.1-3660 B defines “certified pollution control equipment and facilities” as

“...any property, including real or personal property, equipment, facilities, or devices, used primarily for the purpose of abating or preventing pollution of the atmosphere or waters of the Commonwealth and which the state certifying authority having jurisdiction with respect to such property has certified to the Department of Taxation as having been constructed, reconstructed, erected, or acquired in conformity with the state program or requirements for abatement or control of water or atmospheric pollution or contamination.” [The definition goes on to include other property that is exempt *“...whether or not such property has been certified...”* and will therefore not be discussed with these comments.]

To certify (and strictly construe as required by the state constitution) whether property meets this lengthy multipart definition, DEQ must consider each clause individually and in the context provided. More specifically, DEQ is tasked by §58.1-3660 to certify the following:

“...any property, including real or personal property, equipment, facilities, or devices...”
(Is this property as opposed to a service or intangible?)

“...used primarily for the purpose of abating or preventing pollution of the atmosphere or waters of the Commonwealth...”
(What is its primary purpose?)

“...and which [DEQ] having the jurisdiction with respect to the property...”
(Is DEQ the delegated authority for the program or requirements?)

“...having been constructed, reconstructed, erected or acquired...”
(Is it already onsite and installed?)

“...in conformity with the state program or requirements for abatement or control of water or atmospheric pollution or contamination...”
(Is it required and installed in compliance with those requirements?)

On the other hand, §58.1-609.3 is not prescriptive and simply requires TAX to exempt property that DEQ has already certified under §58.1-3660. Considering a sales tax exemption at the time of purchase instead of after DEQ certifies the property has been constructed, reconstructed, erected, or acquired could result in purchasers not paying sales tax on a prospective property improvement, and then owing sales tax on all or portions of the purchase that was not used to install it. (Example: An owner/contractor/subcontractor prospectively purchases concrete and related materials to build the foundation for an air pollution control device, but not all of it is used and/or the contract is not awarded. How is the exempted sales tax recovered?)

DEQ provides the aforementioned information as general comments to JLARC's draft report to provide context and background for the following specific comments regarding pp 49-62.

Page 49, Paragraph 1, Sentence 1: The exemption for pollution control equipment and facilities does not encourage or incentivize voluntary installation of the property; rather, the exemption is provided only for equipment that is required for abatement or control of pollution. Add "...or to compensate facilities required to control or abate pollution."

Page 49, Paragraph 2: Per differences discussed above regarding §58.1-3660 and §58.1-609.3, this paragraph appears to be incorrect (i.e., conflates the two statutes).

Page 49, Paragraph 2, Sentence 1: Change "retail sales and use" to "property"

Page 49, Paragraph 2, Sentence 2: Change "sales taxes on purchases of" to "taxes on"

Page 49, Table 4-1, Title: Change "a" to "two" and "Exemption" to "Exemptions"

Page 49, Table 4-1, Eligibility: Change "Purchase of" to "Possession (for property tax exemption) and purchase (for sales tax exemption) of"

Page 49, Table 4-1, Use of Exemption: Change "installing" to "required"

Page 50, Under Subtitle Achievement of Purpose: How is "high administrative costs" defined? Does this consider an hourly rate for request preparers and DEQ reviewers compared to the exemption received? Per the JLARC report, \$26.59M over 8 years for 86 beneficiaries averages \$309K per beneficiary. Many tax exemption certification requests are only a few pages, and if the definition is clearly met, then the request and DEQ's response may be simple and brief. Other requests may not provide enough information to clearly meet each of the definition's requirements, and the iterative process may continue until all pertinent information is submitted, received, and reviewed.

Page 51, Paragraph 3: This discussion omits the fact that Virginia offers local property tax exemption (the purpose of §58.1-3660, on which DEQ guidance is available), as well as sales and use tax exemption (i.e., §58.1-609.3) provided by TAX after DEQ certifies property under §58.1-3660.

Page 51, Margin Comment 2: §58.1-609.3 appears to have been enacted in 1993. §58.1-3660 was enacted in 1972 and provides a property tax exemption, not a sales and use exemption.

Page 51, Paragraph 5, Sentence 1: See discussion above on “high administrative costs”. Is there any information available indicating that the costs to request certification is actually more than the one-time sales tax exemption and/or the continuous property tax exemptions received?

Page 51, Paragraph 5, Sentence 2: A case-by-case basis allows requests and DEQ staff to spend an appropriate amount of resources based on the complexity of the request. Anecdotally, there are examples of short as well as lengthy processing times.

Page 51, Paragraph 5, Sentence 4: Pursuant to the definition in §58.1-3660, DEQ cannot certify the property prospectively. The language of the statute is in the past tense (i.e., “used,” “constructed,” “reconstructed,” “erected,” “acquired”) and thereby requires DEQ’s approach. §58.1-609.3.9 requires that before the sales tax exemption can apply, the pollution control equipment and facilities be “certified,” which DEQ cannot do before it is “constructed, reconstructed, erected, or acquired.”

Page 51, Paragraph 5, Sentence 5: It is important to note that the property tax exemption is continually provided every year it continues to meet the definition in §58.1-3660, and only a single initial certification is required by the statute. Sales tax by its nature is a very small percentage of project costs, and the timing of sales tax exemption under §58.1-609.3.9 (i.e., post certification) does not change the actual cost of the project.

Page 52, Paragraph 1, Sentence 3: While “passes the cost on to society” may be correct on a macro level, the impact of the lost revenue resulting from the exemptions is borne by the people of the Commonwealth and its localities. The sales tax exemption in §58.1-609.3.9 impacts the Virginia revenue directly once per project, and property tax exemption takes money from the coffers of Virginia localities continually, every year the property continues to meet the definition in §58.1-3660. The funds that are lost by state and local government to the exemptions are either made up from other sources (i.e., other taxpayers), or result in fewer government services being provided to the citizens of the state and localities.

Page 59, Paragraph 3 and Table 4-5: Because the pollution control equipment eligible for the exemption are required by law and regulation, it seems counterintuitive to conclude that all of the one-time sales taxes exempted, and continual property taxes exempted generate positive economic activity. Based on total project costs for locating, constructing, and operating a facility in Virginia, it seems unlikely the relatively small amount of monies recouped by the exemptions contribute significantly to a decision to locate and operate a facility in Virginia.

Page 61, Paragraph 1 and 2: DEQ maintains agency guidance for its staff in each media that process exemption requests, and all DEQ guidance is required to be located on the Virginia Regulatory Town Hall. However, availability of guidance is not the only measure of transparency. DEQ staff work with requesters on a case-by-case basis to address projects that range over a full spectrum of complexity. Off-the-shelf automatic certification would be difficult to address in concise guidance or lists when considerations must be made for each of the provisions within the §58.1-3660 definition (See bulleted list in general comments). However, it is important to note (as JLARC does on Page 49) that the statute itself does exactly that in several instances, providing property tax exemption for the following...

- Coal, oil and gas production and waste disposal
- Forestry and other vegetative waste products
- Landfill gas recovery [and related energy production]
- Property used to generate solar and wind energy

... *"whether or not such property has been certified to the Department of Taxation by a state certifying authority"*. (Note that in general these categories of equipment and facilities arguably might not meet §58.1-3660's primary purpose test for tax exemption.)

Page 62, Paragraph 1, Sentence 5: DEQ appreciates that JLARC recognizes the limits of DEQ's statutory authority for certification in its comment to the General Assembly that certification prior to construction would require an amendment to the Code.

Ms. Ellen J. Miller
June 5, 2019
Page Six

Again, DEQ appreciates the opportunity to comment on this and all drafts prepared by JLARC for reporting to the Governor and the General Assembly of Virginia. Please contact Michael Dowd if you have any questions.

Sincerely,

A handwritten signature in black ink that reads "David K. Paylor". The signature is written in a cursive style with a large, looped initial "D".

David K. Paylor

cc: Hal Greer
Mike Dowd
Jeff Steers

June 10, 2019

Mr. Hal E. Greer, Director
Joint Legislative Audit & Review Commission
919 East Main Street, Suite 2101
Richmond, VA 23219

Re: VEDP response to sections 1 (data center incentives) and 2 (semiconductor manufacturing incentives) of the draft JLARC report, *Data Center and Manufacturing Incentives*

Dear Mr. Greer:

Thank you for providing an opportunity for us to comment on sections 1 (data center incentives) and 2 (semiconductor manufacturing incentives) of the Joint Legislative Audit & Review Commission's (JLARC's) draft report, *Data Center and Manufacturing Incentives*.

We agree with the draft report's finding that the availability of data center sales and use tax exemptions is among the top few site-selection considerations for data centers. Indeed, we believe that Virginia's data center sales and use tax exemption has been a major contributor to the Commonwealth's success in becoming one of the largest, most attractive markets in the world for data center investment. The General Assembly's relatively recent action to extend the sunset of the data center sales and use tax exemption program to 2035 further solidified Virginia's competitive position in the marketplace.

We further agree with the draft report's finding that states have offered very large incentive packages to attract semiconductor manufacturing facilities, as such projects are among the most coveted economic development opportunities due to their large job counts, high wages, technology-intensive processes, and large capital investment levels.

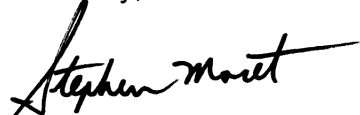
We generally are comfortable with all of the recommendations in the draft report that pertain to data centers and the Major Employment and Investment Project Approval Commission (i.e., recommendation nos. 1-5). With respect to recommendation no. 3, it would be important to design the disclosure requirement to protect confidential location and investment information associated with individual data centers (e.g., the General Assembly could require site-specific data submitted to VEDP and TAX to be aggregated at the GO Virginia region level for any public reporting).

I want to thank JLARC for the work it has done to markedly increase the sophistication of its return-on-investment (ROI) analyses (including in particular "but-for" estimates) for incentives to better reflect varying levels of impact that incentives can have based on their size, design, and eligibility standards (e.g., whether a competitive situation is required). Even so, I think it is important to acknowledge that such ROI analyses with estimated "but-for" assumptions rarely can be performed with precision (by JLARC, VEDP, or any third party) because the inputs into the full decision framework used by each firm (e.g., how they weight various factors) typically are unknown. Accordingly, the actual ROI levels of the various incentive programs could be materially higher (or lower) than what is depicted in the report.

Mr. Greer
Page 2 of 2

As usual, we appreciated the professionalism of JLARC staff during the project, as well as compliment your team on its thoughtful work and recommendations. We also appreciated how well the draft report captured important nuances about both of the referenced industry sectors.

Sincerely,

A handwritten signature in black ink that reads "Stephen Moret". The signature is written in a cursive style with a long, sweeping underline.

Stephen Moret
President & CEO



JLARC.VIRGINIA.GOV

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