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June 9, 2016

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Richmond, VA 23219

Application of Virginia Electric and Power Company
For approval and certification of electric transmission facilities:
Haymarket 230 kV Double Circuit Transmission Line and 230-34.5 kV Haymarket Substation
Case No. PUE-2015-00107

Dear Mr. Peck:

Enclosed for filing in the above-captioned proceeding, please find an unbound original and one (1) copy of the Public Version of the Rebuttal Testimony, Schedules and Exhibits of Virginia Electric and Power Company (the "Company"). A Confidential (redacted) Version is being filed under seal under separate cover.

The Company would like to alert the Commission that one of its rebuttal witnesses, David C. Lennhoff, may be unavailable during the scheduled evidentiary hearing. The Company will make all efforts to coordinate a solution with other parties should they have cross-examination questions for Mr. Lennhoff.

Please do not hesitate to call if you have any questions in regard to the enclosed.

Highest regards.

Lisa R. Crabtree

Enc.

cc: William H. Chambliss, Esq.

Andrea B. Macgill, Esq. Alisson P. Klaiber, Esq.

Mr. Joel H. Peck, Clerk June 9, 2016 Page 2

> Charlotte P. McAfee, Esq. Vishwa B. Link, Esq. William G. Bushman, Esq. Service List

CERTIFICATE OF SERVICE

I hereby certify that on this 9th day of June 2016, a true and accurate copy of the foregoing filed in Case No. PUE-2015-00107 was hand-delivered or mailed first class, postage pre-paid, to the following:

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Insurance & Utilities Regulatory Section
Office of the Attorney General
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Lead f. Call



Rebuttal Testimony, Exhibits and Schedules of Virginia Electric and Power Company

Before the State Corporation Commission of Virginia

Haymarket 230 kV Double Circuit Transmission Line and 230-34.5 kV Haymarket Substation

Application No. 272

Case No. PUE-2015-00107

Filed: June 9, 2016

Public Volume 1 of 1

Application of Virginia Electric and Power Company For approval and certification of electric transmission facilities: Haymarket 230 kV Double Circuit Transmission Line and 230-34.5 kV Haymarket Substation Case No. PUE-2015-00107

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REBUTTAL INSERT (CONFIDENTIAL)

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WITNESS REBUTTAL TESTIMONY SUMMARY

Witness:

Mark R. Gill

Title:

Consulting Engineer – Electric Transmission Planning

Summary:

Company Witness Mark R. Gill addresses respondent and Staff testimony about the need, electrically, for the proposed Project, and specifically how reliability standards require the Project to support anticipated load growth in the Haymarket area.

Mr. Gill explains that the electric facilities being proposed are necessary for the Company to perform its legal duty to furnish adequate and reliable electric service within its service territory. In this case, a retail electric customer, described in the Application as the "Customer," has requested service for a new data center campus that will create a large block load addition to the Company's distribution system. As further detailed in the Application Appendix, the amount of new load created by the Customer is projected to be approximately 120 MVA, which will exceed the current capacity of the distribution system.

Mr. Gill describes how installing additional transformer and circuit capacity at Gainesville Substation is not feasible due to the limited space available inside the station, and because finding circuit paths to the load area would be problematic and would create operational issues due to the amount of load and line length.

Mr. Gill next corrects several misunderstandings evidenced in the testimony of James Napoli, testifying on behalf of Somerset Crossing Home Owners Association, Inc.

Finally, Company Witness Gill examines the anticipated economic benefits associated with the data center campus to be served by the proposed Haymarket Project.

REBUTTAL TESTIMONY OF MARK R. GILL

ON BEHALF OF

VIRGINIA ELECTRIC AND POWER COMPANY BEFORE THE

STATE CORPORATION COMMISSION OF VIRGINIA CASE NO. PUE-2015-00107

1	Q.	Please state your name, business address and position with Virginia Electric and
2		Power Company ("Dominion Virginia Power" or the "Company").
3	A.	My name is Mark R. Gill, and I am a Consulting Engineer in the Electric Transmission
4		Planning group of the Company. My business address is 701 East Cary Street,
5		Richmond, Virginia 23219.
6	Q.	Have you previously submitted testimony in this proceeding?
7	A.	Yes, I have. I submitted pre-filed direct testimony on behalf of Dominion Virginia Power
8		to the State Corporation Commission of Virginia ("Commission") in this proceeding on
9		November 6, 2015.
10	Q.	What is the purpose of your rebuttal testimony?
11	A.	The purpose of my rebuttal testimony is to address respondent testimony about the need,
12		electrically, for the proposed Project, and specifically how reliability standards require
13		the Project to support anticipated load growth in this area. I will also respond to the
14		testimony and reports filed by Commission Staff ("Staff") on June 2, 2016.
15	Q.	Are you sponsoring any exhibits as part of your rebuttal testimony?
16	A.	Yes. Company Exhibit No, MRG, consisting of Rebuttal Schedules 1-8, was

prepared under my direction and supervision, and is accurate and complete to the best of

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my knowledge and belief.

1	Q.	James Napoli, testifying on behalf of Somerset Crossing Home Owners Association,
2		Inc. ("Somerset"), questions the need for the proposed Project. (Amended Napoli a
3		3-7.) Does Mr. Napoli have any experience in the field of electric transmission and
4		distribution planning, design, or analysis?
5	A.	No, Mr. Napoli stated in response to a Company discovery request that he does not have
6		any experience in the field of electric transmission and/or distribution planning, design,
7		or analysis. (See Rebuttal Schedule 1.)
8	Q.	On page 4 of his testimony, Mr. Napoli states that there is a legitimate question as to
9		whether there is need to construct any route to provide service to the existing and
10		anticipated customer base that is consistent with Prince William County's long-term
11		land use plan. (Amended Napoli at 4.) What is your response?
12	A.	As stated in the Company's application and supporting materials ("Application"), the
13		electric facilities being proposed are necessary for the Company to perform its legal duty
14		to furnish adequate and reliable electric service within its service territory. In this case, a
15		retail electric customer, described in the Application as the "Customer," has requested
16		service for a new data center campus that will represent a large block load addition to the
17		Company's distribution system. As further detailed in the Application Appendix, the
18		amount of new load created by the Customer is projected to be approximately 120 MVA,
19		which will exceed the capacity of the distribution system in the area in 2018.
20		Regarding Mr. Napoli's questioning whether there is a need for the Haymarket
21		Substation "to provide service to the existing customer base and anticipated customer
22		base that is consistent with Prince William County's long-term land use plan," I would
23		like to point out that a review of the "Prince William County Build-Out Analysis as of

December 31, 2014," which is the latest version available from the Prince William County Planning Office website and is dated November 19, 2015, indicates that there is approximately 4.9 million square feet of non-residential development remaining to be built in the Company's service territory that would be served by the Gainesville Substation, and at least approximately 3.6 million square feet of non-residential development remaining to be built in Northern Virginia Electric Cooperative's ("NOVEC") service territory (in the vicinity of the I-66, U.S. 15, and U.S. 29 corridors), with approximately 3.1 million square feet that would also be sourced from the Company's Gainesville Substation. There are also at least 889 residential units remaining to be built in the Company's and NOVEC's service territories described above. The attached spreadsheet (Rebuttal Schedule 2) contains the specific developments from the County's Build-Out Analysis that were used to arrive at the aforementioned totals. It is also clear from the respondent testimony filed in the proceeding that there is still the potential for a great deal of residential and commercial development in the area. See, e.g., Gestl at 2 (explaining that Heritage Hunt has recently leased two commercial pads to be developed and has remaining land available for future development of 7 additional commercial buildings, 86 residential building lots, and 3 commercial pad sites); Fuccillo at 2 (explaining the Prince William County Comprehensive Plan contemplates high density commercial development on Southview's Property of over one million square feet). Further, the Long Range Land Use Map (published January 1, 2016) from the Prince William County 2008 Comprehensive Plan identifies all of the parcels that make up the

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approximately 8.0 million square feet of remaining non-residential development (combined Dominion Virginia Power and NOVEC service territory) that would be served by the Gainesville Substation as being in an "Urban" or "Suburban" land use classification. Also, the Build-Out Analysis report identifies the zoning for each of the parcels, including the parcel that is being developed by the Customer, and they all support – by right – uses that include data centers. It should be further noted that the Board of County Supervisors, at its February 11, 2014 meeting, approved Resolution 14-95 which amended the list of targeted industries for its economic development efforts to include data centers, among others. Consequently, I do not agree with Mr. Napoli's contention that the proposed Project is inconsistent with Prince William County's long-term land use plan.

Q.

Α.

- What are some of the issues if load from the "remaining development," including load from the Customer, is served from the Gainesville Substation and the proposed Project is not constructed?
 - Assuming that additional transformer and circuit capacity could be installed at Gainesville Substation, which is not feasible due to the limited space available inside the station, finding circuit paths to the load area would be problematic and would create operational issues due to the amount of load and line length, as described in Section I.B of the Appendix. Further, in 2018, the projected Gainesville load without the Customer, as shown in Attachment I.B.1 of the Appendix, is 55.8 MVA (26.3 MVA for Transformer ("TX") #1 and 29:5 MVA for TX#4). If the Customer's projected new load of 120 MVA is added to the projected Gainesville load, which is approximately 55.8 MVA, and the projected NOVEC Gainesville Delivery Point load, which is approximately 126.1 MW in

1		2018 based on NOVEC's annual delivery point forecast, this will create direct-connected
2		loads above 300 MW (301.9 MVA) at Gainesville Substation, which could result in a
3		violation of mandatory North American Electric Reliability Corporation ("NERC")
4		Reliability Standards. The 300 MW criteria violation was one of the drivers behind the
5		Company's project to purchase NOVEC's 115 kV Gainesville to Wheeler line, convert it
6		from 115 kV to 230 kV operation, and construct a new 230 kV line between the
7		Company's new Wheeler Switching Station and its new Vint Hill Switching Station,
8		creating a 230 kV Gainesville-Wheeler-Vint Hill network that will relieve loading at
9		Gainesville Substation to below 300 MW. That project was approved by the Commission
10		by Final Order issued on February 11, 2016, in Case No. PUE-2014-00025.
11	Q.	Mr. Napoli, on page 4 of his testimony, states the Company has said that the
12		Customer requires a load of 120 MVA and that once the proposed Project is
13		complete, the total load of Line #124 at full build-out of the Customer's campus, will
14		be 160 MVA. From this he concludes that "Line #124 is perfectly adequate for the
15		current load and indeed, all anticipated future development, if such future
16		development does not include Customer's data center." (Amended Napoli at 4.) Is
17		this a correct statement?
18	A.	No, it is not. Mr. Napoli appears to be drawing an incorrect conclusion based on either a
19		misreading of the Company's Application or by incorrectly attributing certain statements
20		to the Company that do not appear in the Application.
21		Line #124 is an existing 115 kV line that is networked between the Company's
22		Gainesville Substation and Loudoun Switching Station. The only directly-connected load
23		served from Line #124 is NOVEC's Catharpin Delivery Point. There is no loading issue

with Line #124. It is being converted to 230 kV operations for the sole purpose of
providing an appropriate tap point for the proposed Project because additional 230 kV
terminals cannot be accommodated at the Company's Gainesville Substation. The
Company made this point clear in its response to discovery request Staff Set 1-6. (See
Rebuttal Schedule 3.)
Further, Mr. Napoli cites the Company's response to Staff Set 1-10 and incorrectly states
in his testimony that a data center customer is "already being served by Line #124 whose
demand is 19.5 MVA." (Amended Napoli at 4 n.5 (citing the Company's response to
Staff Set 1-10).) The Company's response to Staff Set 1-10 is describing the
geographical area referred to as the "Haymarket Load Area" and explaining how much of
the Customer's existing data center load adjacent to the Haymarket site is served by the
distribution circuits that are sourced from the Company's Gainesville Substation.
Nowhere in the Company's response does it mention Line #124 or describe how the
Gainesville Substation is sourced by the transmission system. (See Rebuttal Schedule 4.)
Details of how the Gainesville Substation is sourced can be found in Section I.B of the
Appendix, where it clearly states that the Company's Gainesville Substation "is sourced
by three 230 kV transmission lines that are underbuilt circuits on the 500 kV Meadow
Brook-Loudoun Line #535 and Morrisville-Loudoun Line #569 that bypass Gainesville
Substation."

1	Q.	Mr. Napoli also testifies regarding a discovery response to Staff regarding NERC
2		and PJM Interconnection, LLC ("PJM") requirements and load limits for radial
3		transmission lines. (Amended Napoli at 5-6.) Do you agree with his interpretation
4		of the question and response?
5	A.	No, I do not agree. On page 4 of his testimony, Mr. Napoli states, "In responding to the
6		Staff's discovery questions regarding necessity, Dominion does not provide clear or
7		adequate answers" (emphasis added), and then proceeds to reference the Company's
8	1	response to discovery request Staff Set 1-13. (See Rebuttal Schedule 5.) However, Mr.
9		Napoli's characterization of the Company's response to the referenced discovery request
10		is simply not accurate.
11		The discovery response Mr. Napoli references, Staff Set 1-13, is subsequent to a previous
12		discovery request issued by Staff, Staff Set 1-12, where Staff questioned the Company's
13		basis for 100 MW being the load limit for a radial transmission line. (See Rebuttal
14		Schedule 6.) The key point being that the 100 MW limit on a radial transmission line is
15		not the same as the load threshold that determines whether a transmission project is
16		needed but, as supported by the Company's NERC-compliant Facility Interconnection
17		Requirements ("FIR") document, is the threshold where a networked transmission source
18		(e.g., double-circuit line) is required. Id. The Company's response to a previous
19		discovery request from Staff, Staff Set 1-11, clarifies the Company's position on the load
20		threshold that is used to help determine whether a transmission solution versus a
21		distribution solution should be considered. (See Rebuttal Schedule 7.)
22		It appears that Mr. Napoli also demonstrates his misunderstanding between the load limit
23		on a radial transmission line and the load threshold that determines when a transmission

project is needed when his testimony cites the Company's response to Staff Set 1-13 and states:

Dominion's response was revealing. It stated that there is no reason it can't change its load requirements, except that Dominion believes: 'that making an exception based entirely on the type of customer (i.e., data centers) or number of customers that make up the 100+ MW load could ultimately reduce reliability and negatively impact economic development, as well as could be inconsistent with the Company's responsibility to provide non-discriminatory service.' Dominion has the burden of proof to demonstrate the need for this Project and 'could be' is simply insufficient.

(Amended Napoli at 4-5 (emphasis in original).) Again, as noted previously, the Company's response to Staff's discovery request Staff Set 1-13 concerns the 100 MW radial line criterion, only this time, instead of inquiring into the Company's basis for the 100 MW threshold referenced in Staff Set 1-12, Staff is asking whether the Company would create a different load limit for radial lines that serve a single customer, such as a data center. (See Rebuttal Schedule 6.) This interrogatory and response have nothing to do with whether a transmission line is needed to serve the load in this area but, rather, addresses whether criteria could be relaxed so that the transmission line could be constructed as a radial line.

As stated in the Company's response to Staff Set 1-13, the Company still believes that making an exception based entirely on the type of customer (*i.e.*, data centers) or number of customers that make up the 100+ MW load could ultimately reduce reliability and negatively impact economic development, as well as could be inconsistent with the Company's responsibility to provide non-discriminatory service. (*See* Rebuttal Schedule 5.) To target data centers for a degraded level of service reliability simply because they are a "single customer" from an Electric Service Agreement perspective discounts the fact that residing within each data center building or campus is tens, hundreds, or even

thousands of the data center operator's customers. This would be analogous to the

Company treating a cooperative delivery point as a "single customer" simply because it is
a single connection point.

Q.

A.

The Company does not believe that the reliability standard for large block load customers should be treated differently than any other customer on the Company's system.

Furthermore, it is worth reiterating what the Company clearly states in Section I.B of the Appendix: "Haymarket Substation will serve Haymarket area customer load in addition to the Customer's load" and that this arrangement will enhance the reliability for customers in the area, both existing and those remaining to be constructed as identified in the County's Build-Out analysis, by providing additional capacity for operational flexibility and reducing circuit length. The catalyst for the Project may have been a new large block load, but the argument that this Project will only benefit one customer is simply incorrect. Company Witness Harrison S. Potter provides additional rebuttal testimony on the local load that will be served by Haymarket Substation upon its construction and operation.

"clearly stated that the economic development is not worth it if the community property values are grossly devalued as a result of this Project" and that "[t]he Town of Haymarket has made the same statement." Do you have any comments? Yes. I do not understand where Mr. Napoli finds the support to make this statement. I read the relevant exhibits cited in his testimony (Exhibits JN-1 and JN-2), which appear to be incorrectly identified, and I could not find in either resolution where it was stated, clearly or otherwise, that the economic development is "not worth it" if property values

On page 5 of his testimony, Mr. Napoli indicates that Prince William County has

are "grossly devalued."	lued."	y ("gross	are	
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2	Q.	On page 5 of his testimony, Mr. Napoli states that "Prince William County has
3		engaged in an extensive analysis of its future development and electricity
4		transmission needs, and, in doing so, explicitly declined to include any of the
5		proposed routes in its long term plan." Do you have any comments?
6	A.	Yes, I have three points that I'd like to make. First, I would like to point out that the map
7		(Exhibit JN-4), cited by Mr. Napoli as evidence of Prince William County's extensive
8		analysis of its future electricity transmission needs, appears only to identify the corridors
9		of transmission lines above 150 kV that existed as of 2008. This map is also described in
10		the Long Range Land Use Plan (Exhibit JN-3) as illustrating "the corridors or routes for
11		the location of existing electric transmission lines of 150 kilovolts or more and designates
12		the corridors that all future electric utility lines of 150 kilovolts or more should follow."
13		Second, I would like to note that the map was updated on July 17, 2012, but it did not
14		include corridors for the Company's 230 kV Cannon Branch-Cloverhill, Cloverhill-
15		Liberty, or Gainesville-Wheeler-Vint Hill transmission lines that have either been
16		constructed or will be constructed.
17		Last, this map, which designates future electric transmission corridors, was created
18		without any input from the Company's Electric Transmission Planning Department, and I
19		therefore question whether the County has conducted any analysis to determine if the
20		existing lines and corridors are adequate to accommodate future growth, particularly if
21		the County intends to continue targeting data centers and the other development I
22		discussed earlier in my testimony.

1	Q.	On page 5 of his testimony, Mr. Napoli further questions what he terms as the
2		Company's "upgrade approach." Please clarify the Company's transmission
3		planning with respect to uprating particular lines on the system.
4	A.	Mr. Napoli's testimony appears to be referencing one of the Company's responses to a
5		Staff discovery request, Staff Set 1-6. (See Rebuttal Schedule 3.) Respectfully, I believe
6		that Mr. Napoli has misunderstood the issue being addressed in the Company's response.
7		Staff's interrogatory specifically asks the Company's basis for uprating Line #124 from
8		115 kV to 230 kV for the Project. Mr. Napoli's testimony on page 5 states, "Dominion's
9		response does not focus on a particular need but rather provides a basis for why its
10		infrastructure should be upgraded" (emphasis added). In responding to Staff Set 1-6, the
11		Company stated that converting Line #124 is consistent with the Company's practice of
12		using 230 kV to support demand growth in Northern Virginia and also cited several
13		Commission-approved transmission projects where the Company followed this same
14		approach. Though not specifically included in the Company's discovery response, the
15		following excerpts from the cited cases support the basis for the conversion of Line #124
16		from 115 kV to 230 kV.
17		In the Company's application for the Loudoun-New Road 230 kV project, approved by
18		the Commission by Final Order issued on January 24, 2011 in Case No. PUE-2009-
19		00134, it was stated that,
20 21 22 23 24		[T]he Project will support the orderly development of transmission facilities in the region by establishing a 230 kV source, which is the Company's standard voltage for new transmission lines below 500 kV, to support future demand growth and provide for efficient use of the right-of-way and a cost effective means of addressing long term needs in western

Loudoun, Fauquier and Prince William Counties. 1

Further evidence of this practice can be found in the Company's Cannon Branch-Cloverhill project application, approved by the Commission by Final Order issued on December 21, 2011 in Case No. PUE-2011-00011. Specifically, in Section I.C, the Company did not select Transmission Alternative 2 to construct a new 115 kV line from Cannon Branch Substation:

because the 115 kV transmission system outside of the Line #172/#197 corridor between Gainesville and Cannon Branch Substations is very limited. In the Company's northern region (north of an imaginary eastwest line extending from approximately Cranes Corner Substation to Oak Green Substation to Culpeper) the ratio of 230 kV transmission lines to 115 kV lines is 3:1. Further growth will continue to drive that ratio higher as increased load flows and other system changes force the conversion of 115 kV lines to higher capacity 230 kV lines...creating a new 115 kV transmission corridor to serve this major new block load customer would not be good utility practice.²

Also, in the subsequent Cloverhill-Liberty 230 kV project, approved by the Commission by Final Order issued on April 17, 2013 in Case No. PUE-2012-00065, the Company removed approximately 2.2 miles of 115 kV Line #172 between Gainesville Substation and the new Liberty Switching Station and replaced it with double-circuit 230 kV lines.

Additionally, the Company's recent project to relieve Gainesville Substation by creating 230 kV networked lines between Vint Hill Switching Station, Wheeler Switching Station, and Gainesville Substation, approved by the Commission by Final Order issued on

¹ Virginia Electric and Power Company d/b/a Dominion Virginia Power - For approval and certificates for electric facilities for Loudoun and Prince William Counties: Loudoun-New Road Double Circuit 230 kV Transmission Line and New Road Substation, Case No. PUE-2009-00134, Application at 4 (Dec. 28, 2009).

² Virginia Electric and Power Co. d/b/a Dominion Virginia Power - For approval and certification of electric transmission facilities in Prince William County & City of Manassas: Cannon Branch-Cloverhill 230 kV Transmission Line and Cloverhill substation, Case No. PUE-2011-00011, Appendix at 9 (Feb. 7, 2011).

rebruary 11, 2016 in Case No. PUE-2014-00025, converted approximately 6.2 miles of
115 kV line to 230 kV line between Gainesville Substation and Wheeler Switching
Station, including the conversion of three NOVEC substations (Atlantic, Linton Hall, and
Wheeler) and the removal of a 230-115 kV transformer at Gainesville Substation.
Indeed, in the Northern Virginia planning area, the practice of moving load off the 115
kV system, and converting to 230 kV where appropriate, has been stated in the
Company's Electric Transmission Long Term Plan since at least 2009.
Mr. Napoli's testimony attempts to characterize the cited projects as irrelevant to this
case by describing them, as "replacing a deteriorated line" (Amended Napoli at 6),
"building a new 230 kV line, but with no objections as to necessity" (id.), "inapplicable
case because not an application to construct transmission lines but rather a transfer of
transmission line assets to WMATA" (id.), and "the need for the transmission solution
was unchallenged" (id.). It should also be noted that his description of PUE-2012-00065
as an "inapplicable case because [it was] not an application to construct transmission
lines but rather a transfer of transmission line assets to WMATA" is incorrect. (Id.) Case
No. PUE-2012-00065, as stated above, concerned the construction of a new 230 kV line
between Cloverhill Substation and Liberty Switching Station, in addition to converting
approximately 2.2 miles of 115 kV line to double-circuit 230 kV line

1 Q. On page 7 of his testimony, Mr. Napoli criticizes the level of support provided by the 2 Company in its Application with respect to the need for the Project and states that 3 this case is "lacking any engineering analysis demonstrating that a need for 4 additional infrastructure currently exists. There is no evidence in the record that 5 Dominion's Transmission system has been stress-evaluated under federal and 6 Virginia regulatory requirements or that there has been a significant volume of 7 transmission system overloads due to an overstressed transmission system." What 8 is your response? 9 A. The PJM Regional Transmission Expansion Plan ("RTEP") is developed to meet the 10 transmission needs in the PJM Region according to planning criteria that includes PJM 11 planning procedures, NERC Reliability Standards, Regional Entity reliability principles 12 and standards, and the individual Transmission Owner FERC filed planning criteria, as 13 filed in FERC Form No. 715 and posted on the PJM website. Outcomes of the RTEP 14 process are three types of transmission system upgrades: (1) Baseline upgrades are those 15 that resolve a system reliability criteria violation which can be planning criteria from 16 PJM, NERC, ReliabilityFirst, or transmission owners; (2) Network upgrades are new or 17 upgraded facilities required primarily to eliminate reliability criteria violations caused by 18 proposed generation, merchant transmission, or long term firm transmission service 19 requests; and (3) Supplemental projects are projects initiated by the transmission owner 20 to satisfy local transmission owner criteria. 21 The proposed Project was submitted to PJM as a Supplemental project and was assigned

on pages 1 and 2 of Appendix Section I.A, the Customer's projected load at the

project ID S0918. It was subsequently approved as part of PJM's 2015 RTEP. As stated

22

1		Haymarket Campus is approximately 120 MVA, with the total loading at Haymarket
2		Substation (including the Customer's load) projected to be approximately 160 MVA. As
3		discussed in the Company's response to Staff Set 1-11 (Rebuttal Schedule 7), the
4		Company's FIR document indicates 30 MW as the minimum threshold required for
5		interconnecting with the 230 kV transmission system. The projected Haymarket
6		Substation load, including the Customer's load, is clearly above the required minimum
7		threshold and, as detailed on page 9 of Appendix Section I.B, the existing distribution
8		system is inadequate to serve this amount of load from the Gainesville Substation.
9		This Project is triggered by progress and growth in the Haymarket Load Area,
10		specifically development of a large block load addition. As such, the proposed Project
11		has been identified as a Supplemental project and is used as an input to the RTEP models
12		but it was never designed or proposed as a Baseline upgrade project. However, as I
13		discussed previously, and as identified in the Application Appendix, this Project is
14		necessary to provide adequate and reliable service for the area and is being proposed as a
15		double-circuit loop in order to comply with the Company's NERC-compliant FIR
16		document.
17	Q.	Turning to the Staff, Mr. Joshipura discusses the Project's economic development
18		impacts and notes that tax revenues associated with the Haymarket campus project
19		"will likely have a significant positive impact on Prince William County."
20		(Joshipura Staff Report at 21.) Do you have any comment?
21	A.	Yes, I agree with Mr. Joshipura's observation. The tax revenue benefit to Prince William
22		County is confirmed by a report by the Northern Virginia Technology Council, titled
23		"The Economic and Fiscal Contribution the Data Centers make to Virginia" ("NVTC

Report"). (See Rebuttal Schedule 8.) Specifically, on pages 16 and 17, the NVTC
Report determined that the benefit to cost ratio associated with data centers was 4.3 in
Prince William County in 2014. This means that for every \$1.00 in county expenditures
that the data center sector was responsible for generating in 2014, it provided
approximately \$4.30 in tax revenue to Prince William County.
In addition, the NVTC Report demonstrates, on pages 17 and 18, the opportunity cost to
Prince William County if a data center development did not exist. The NVTC Report
specifically identified an increase in the county's real property tax rate and a reallocation
of state education funding to make up for the lost tax revenue. The NVTC Report also
notes on page 32 that "the data center industry is very capital-intensive and that translates
into a disproportionate amount of property tax revenue, by far the largest source of
revenue for Virginia localities" and that "because data centers pay high wages -
\$105,942 per year on average in 2014 – they also have a disproportionate impact on state
income tax revenue, by far the largest source of revenue for Virginia state government."
(Emphasis added). The NVTC Report also notes, on page 8, that 24 data centers have
been located in Prince William County since 1999, which have added 706 high-wage jobs
and resulted in \$4.3 billion in capital investment.
I also think it is worth noting that while Mr. Joshipura tries to present a balanced
discussion of economic development benefits by mentioning a "possible" negative
economic impact to property owners, he does not seem to factor in the possible negative
economic impact of losing the Haymarket Campus project based on the Staff's position
regarding the customer's potential responsibility for payment of the cost differential
between underground and overhead discussion.

Q.	Staff Concludes, "[T]he Project is needed to provide service to a new customer,
	rather than to enhance overall system reliability, and the Staff notes that without
	the request for service to the Haymarket Campus, the Project would not be
	needed." (Joshipura Staff Report at 22-23.) Staff also states, "if the Commission
	concurs with the Company that since the Project comprises a networked line that
	will eventually be used by other customers, the socialization of the Project's costs
	through the Company's NITS rate is appropriate." (Id.) What is your response?
A.	While it clearly states in Section I.A of the Appendix that the Project is needed to
	"provide service requested by a retail electric service customer," the Appendix also states
	that the Project is needed to "maintain reliable service for the overall growth in the area."
	(See Appendix at 1.) The Company does not dispute Mr. Joshipura's finding that without
	the request for service to the Haymarket Campus the Project would not be needed at this
	time; however, the high likelihood for nearby load growth, as shown in Prince William
	County's own Build-Out Analysis, indicates that the Project would be needed at some
	point in the future to maintain reliable service in the area.
	As to whether the Project comprises a networked line that will eventually be used by
	other customers, the Appendix and various discovery responses in this matter have made
	clear that the Haymarket Substation will serve load other than from the Customer.
	Company Witness Potter addresses the additional local load that will be served
	immediately from the Haymarket Substation in his rebuttal testimony. Further, NOVEC
	had initially expressed an interest in co-locating delivery point ("DP") facilities within
	the Company's proposed Haymarket Substation to help accommodate their load growth
	in the area and resolve operational issues between their Broad Run Substation to the west

1		and their Evergreen Substation to the north. While they have not yet submitted a DP
2		Request to formally start the process, they have indicated in subsequent discussions that a
3		new DP would likely be required in the future.
4		Moreover, as I discussed earlier in my testimony, the remaining non-residential
5		development that would be served by the Gainesville Substation would eventually lead to
6		violation of mandatory NERC Reliability Standards at Gainesville Substation, requiring
7		load relief that could be provided by the Haymarket Substation. Based on these
8		considerations, along with the Project's required interconnection (i.e., double circuit loop
9		in-and-out), I believe there is no question that the Project comprises a networked line.
10	0	Does this conclude your rebuttal testimony?
10	Q.	Does this conclude your reputtar testimony:
11	A.	Yes, it does.

Somerset Crossing Home Owners Association, Inc. Case No. PUE-2015-00107 Virginia Electric and Power Company First Set

The following response to Interrogatory No. 15 of the First Set of Interrogatories and request for Production of Documents Propounded by Dominion Virginia Power received on May 16, 2016 has been prepared under my supervision as it pertains to legal matters.

Todd A. Sinkins

Counsel

Somerset Crossing Home Owners Association

The following response to Interrogatory No. 15 of the First Set of Interrogatories and request for Production of Documents Propounded by Dominion Virginia Power received on May 16, 2016 has been prepared under my supervision as it pertains to factual matters to which I was involved or have knowledge.

James R. Napol

President

Somerset Crossing Home Owners Association

Interrogatory No. 15:

Please identify any and all expertise Mr. Napoli has in the field of electric transmission and/or distribution planning, design, and analysis.

Response:

Mr. Napoli does not have any experience in the field of electric transmission and/or distribution planning, design, and analysis nor has he presented himself as possessing such experience.

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http://gisweb.pwcgov.org/webapps/CountyMapper/	Mapper/					
Prince William County Build-Out Analysis 2014	14					
Non-Residential Inventory						
Case Name	Case Number	Zone	Remaining Sqft District		DVP or NOVEC	Notes
Madison Square	pln2008-00325	pmd	162,200 Brentsville	ville DVP	/P	Rt 29 & Rt 15
Haymarket Crossing	pln2008-00668	pqd	712,239 Gainesville	Π	DVP	north & south of 1-66; n/o Customer
Heritage Hunt - Sims Property	pln2013-00259	pmd	700,000 Gainesville	I —	DVP	e/o Catharpin; between I-66 & Heathcote
Heritage Hunt Commercial	pln2003-00046	pqd	199,450 Gainesville		DVP	Heathcote Blvd
Latsios-Hinnatt-BOCS	rez1979-0039	M-2	169,067 Gainesville		DVP	near I-66 & Rt 29
Midwood	pln2003-00162	pqd	860,724 Gainesville	Г	DVP	
Midwood Center	pln2003-00108	pqd	300,401 Gainesville	П	DVP	
Southview	rez1997-0004	B-1	1,132,560 Gainesville		DVP	northside Rt 55 @ Catharpin Rd
Village Place	pln2002-00139	pmd	650,200 Gainesville	Г	DVP	southside Rt 55 @ Catharpin Rd
TOTAL DVP			4,886,841			
Ballsford	rez19980019	pqd	398,803 Gainesville		NOVEC	GV Ckt 923
Cushing Road	pln2014-00225	M/T	175,500 Gainesville		NOVEC	GV Ckt 923
Hunter at Haymarket	pln2010-00182	(M)	343,146 Brentsville		NOVEC	Rt 15 w/o Somerset; Broad Run Ckt
Libby	rez1981-0015	M-1	405,996 Gainesville		NOVEC	Balls Ford Rd; GV Ckt 923
Westmarket	rez1988-0081	B-1	214,118 Gainesville		NOVEC	Heathcote Blvd & Rt 15; Evergreen Ckt
Wheeler	rez1958-0043	8-1	118,135 Gainesville		NOVEC	GV Ckt 923
Wheeler Smith Wood Solite	rez1969-0021	₹-1	2,012,799 Gainesville		NOVEC	Balls Ford Rd; GV Ckt 923
TOTAL NOVEC			3,668,497			
TOTAL DVP and NOVEC			8,555,338			
Residential Inventory	77.4					
Case Name	Case Number	Zone	Remaining Units District		DVP or NOVEC	Notes
Madison Square	pln2008-00325	PMD	25 Brentsville		DVP	
Village Place		pwd	167 Gainesville		DVP	southside Rt 55 @ Catharpin Rd
Madison Crescent Proffer Amendment	pln2013-00174	PMD	71 Brentsville		DVP/NOVEC	
Haymarket Landing	pln2006-00517	R-4	60 Brentsville		NOVEC	Somerset Crossing
Hunter at Haymarket	\approx	R-4	25 Brentsville		NOVEC	Somerset Crossing & Rt 15
University of Virginia Property	pln2003-00373	SR-1	150 Brentsville		NOVEC	
Villages of Piedmont II		R-4	130 Brentsville		NOVEC	Rt 15 s/o RR
Villages of Piedmont II	pln2011-00359	R-6	261 Brentsville		NOVEC	Rt 15 s/o RR
TOTAL			688			

Virginia Electric and Power Company Case No. PUE-2015-00107 Virginia State Corporation Commission Staff First Set

The following response to Question No. 6 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on March 10, 2016 has been prepared under my supervision.

Mark R. Gill

Consulting Engineer Dominion Virginia Power

Question No. 6

Please provide the Company's basis for uprating Line #124 from 115 kV to 230 kV.

Why is this voltage uprate required for the proposed Project?

a. Provide a list of each network violation that would occur if the Haymarket Project was constructed at the 115 kV level. Provide power flow printouts identifying each violation.

Response:

Converting Line #124 from 115 kV to 230 kV is consistent with the Company's practice of using 230 kV to support demand growth in northern Virginia. This approach was identified and established over multiple approved Company electric transmission projects, including in Case Nos. PUE-2009-00134, PUE-2011-00011, PUE-2012-00065, and PUE-2014-00025. Indeed, since at least 2009, the Company has made consistent efforts in the northern Virginia transmission planning area to move load off the 115 kV system and convert to 230 kV where appropriate because of the dynamic nature of load growth in the area, particularly block load additions.

The voltage uprate is required in order to provide an appropriate tap point for the proposed Project since additional 230 kV terminals cannot be accommodated at the Company's Gainesville Substation. See the Company's response to Question No. 7 of the Staff's First Set.

A formal load flow study of the Haymarket Project constructed at 115 kV has not been performed since serving this amount of new load with 115 kV service, particularly in the northern Virginia area of the Company's territory, is not consistent with the Company's practice

Company Exhibit No Witness: MRG Rebuttal Schedule 3 Page 2 of 2	7. 10. 10.
and does not represent good utility practice. See the Company's response to Question No. 11 of the Staff's First Set.	######################################

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Virginia Electric and Power Company Case No. PUE-2015-00107 Virginia State Corporation Commission Staff First Set

The following response to Question No. 10 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on March 10, 2016 has been prepared under my supervision.

Harrison Potter Engineer III

Dominion Virginia Power

Question No. 10

Describe the geographical area referred to as the "Haymarket Load Area" as defined in the Company's Application.

- a. Does this area include the existing data center currently being served by DC #379 and #695? If so, how much of the current load is associated with the existing data center?
- b. Provide a map of the Haymarket Load Area with each distribution circuit included on the map.

Response:

The Haymarket Load Area includes all distribution customers served by Gainesville Substation along U.S. 29 and SR 55. This area includes the existing data center building served by DC #379 and #695. The existing data center customer demand is 19.5 MVA.

See Attachment Staff Set 1-2 for a map of the Haymarket Load Area.

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Virginia Electric and Power Company Case No. PUE-2015-00107 Virginia State Corporation Commission Staff First Set

The following response to Question No. 13 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on March 10, 2016 has been prepared under my supervision.

Mark R. Gill

Consulting Engineer
Dominion Virginia Power

Question No. 13

Would NERC or PJM requirements prohibit the Company from amending its Transmission Planning Criteria to create a different load limit for radial transmission lines that are needed for a line extension to serve a single customer, such as a data center? If the Company is prohibited from developing such criteria, please provide the document(s) that serve as the basis for that prohibition. If the Company is not prohibited from developing such criteria, please detail whether the Company will develop a different criteria for such scenarios or if it will not develop such criteria, the reasons it won't.

Response:

The Company is not prohibited from amending its Transmission Planning Criteria. As discussed in the Company's response to Question No. 12(c) of the Staff's First Set, the Company conducted a survey through the North American Transmission Forum to learn how peer TOs facilitate expansion of radial transmission lines and accommodate direct connection of load to networked transmission lines. The results of that survey were the basis for the Company adding the MW per mile exposure criteria for radial lines. In fact, the Company regularly reviews its Transmission Planning Criteria and makes adjustments where appropriate to support "prudent utility practices" in order to provide and maintain a reliable and resilient transmission system for the specific geographic area and customer base served.

The 100 MW radial criterion has been evaluated on multiple occasions and the Company maintains that this threshold is appropriate regardless of the number or type of customers served. The objective of the criterion is to establish a reasonable and standardized level of service expectation for large MW loads to prevent extended duration outages for the loss of a transmission source. Typically, it is extremely difficult or impossible to restore radially-fed loads at or above this threshold exclusively through distribution circuit ties. Additionally, the

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Company believes that making an exception based entirely on the type of customer (i.e., data centers) or number of customers that make up the 100+ MW load could ultimately reduce reliability and negatively impact economic development, as well could be inconsistent with the Company's responsibility to provide non-discriminatory service.

The number of customers or meters comprising a load does not correspond to the level of system reliability impacts that would occur should a loss of service event occur. In its application of its transmission planning criteria, the Company does not distinguish between a single block load customer and a cooperative delivery point serving thousands of residential customers, as an example.

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Virginia Electric and Power Company Case No. PUE-2015-00107 Virginia State Corporation Commission Staff First Set

The following response to Question No. 12 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on March 10, 2016 has been prepared under my supervision as it pertains to transmission planning.

Mark R. Gill

Consulting Engineer Dominion Virginia Power

The following response to Question No. 12 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on March 10, 2016 has been prepared under my supervision as it pertains to legal matters.

Charlotte P. McAfee

Senior Counsel

Dominion Virginia Power

Question No. 12.

What is the basis of the Company's selection of 100 MW as the limit for radial transmission lines?

- a. Has NERC provided any guidance relative to what utilities should utilize as the load limit for radial transmission lines? If so, please provide.
- b. Has PJM provided any guidance relative to what utilities should utilize as the load limit for radial transmission lines? If so, please provide.
- c. Provide the load limits for radial transmission lines for other utilities within PJM.

Response:

The complete set of NERC Reliability Standards referenced in this response is available at www.nerc.com/pa/Stand/Pages/default.aspx.

a. There are no NERC-specified limits on radial transmission line loading. The purpose of the NERC Facility Connection ("FAC") standards is to avoid adverse impacts on reliability by requiring each Transmission Owner ("TO") to establish facility connection and performance requirements in accordance with FAC-001, and that the TO's and endusers meet and adhere to the established facility connection and performance requirements in accordance with FAC-002.

Specifically, FAC-001-2 requirement R1 requires the TO to document and make available the Facility Interconnection Requirements, and FAC-002-2 requirement R1.1.2 requires the Planning Coordinator (here PJM), the TO (here Dominion Virginia Power), and the end-users to adhere to the TO planning criteria and Facility Interconnection Requirements. The Company maintains the Facility Interconnection Requirements document, including the Company's Transmission Planning Criteria, to meet the mandatory NERC FAC requirements. Section C.2.6 of the Company's Transmission Planning Criteria limits loading on a radial feed in excess of 100 MW. Additionally, the practice of requiring the TOs to develop and adhere to requirements is consistent with other NERC Reliability Standards.

For example, the NERC Transmission System Planning Performance Requirements set forth in TPL-001-4 require that transmission system planning performance requirements must be established to develop a Bulk Electric System ("BES") that will operate reliably over a broad spectrum of system conditions and contingency events. Although the TPL standard identifies some of the categories of performance metrics that must be set—thermal, voltage, and cascading, for example—NERC does not define those metrics, instead leaving the Planning Coordinator (here PJM) and TO to specify the metrics that best meet the needs of their specific geographic area. NERC does, however, mandate that Dominion Virginia Power and PJM adhere to the established TO criteria in order to avoid being subjected to penalties.

- b. PJM has not provided any guidance regarding radial transmission line loading; however, as indicated above, the NERC standards require PJM to follow and adhere to the TO criteria.
- c. The Company objects to this request to the extent that it seeks publicly-available information maintained by other TOs and/or available from PJM and would require original work. Notwithstanding and subject to the foregoing objection, the Company provides the following response.

In 2014, as part of its planning criteria review process, the Company conducted a survey through the North American Transmission Forum to learn how peer TOs facilitate expansion of radial transmission lines and accommodate direct connection of load to networked transmission lines. The Company presented the results of that survey to its stakeholders, which included cooperatives and municipalities, on October 16, 2014. That presentation is included as Attachment Staff Set 1-12. As noted in Attachment Staff Set 1-12, among the peer utilities having a "maximum load" criteria for radial lines, there was only one utility with a higher criteria (120 MW) than the Company, with the others

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at 70, 60, 50, 30, or 20 MW. This survey was also the basis for the Company adding the	6 3
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Virginia Electric and Power Company Case No. PUE-2015-00107 Virginia State Corporation Commission Staff First Set

The following response to Question No. 11 of the First Set of Interrogatories and Requests for Production of Documents Propounded by the Virginia State Corporation Commission Staff received on March 10, 2016 has been prepared under my supervision.

Mark R. Gill

Consulting Engineer
Dominion Virginia Power

ma R. Due

Question No. 11

In justifying its need for the Project, the Company states that "...prudent utility practice would prevent building additional distribution circuits to feed the Customer long-term." Additionally, the Company utilizes Section G of its Transmission Planning Criteria which recommends the general use of transmission facilities for "[a]ll loads and generation over 20 MW." Please describe the basis for this practice in detail, including the rationale for the 20 MW threshold. Specifically, relate this practice to the Haymarket Project.

Response:

See Section I.B of the Appendix (n. 9 at p. 8) for the FERC definition of "prudent utility practices."

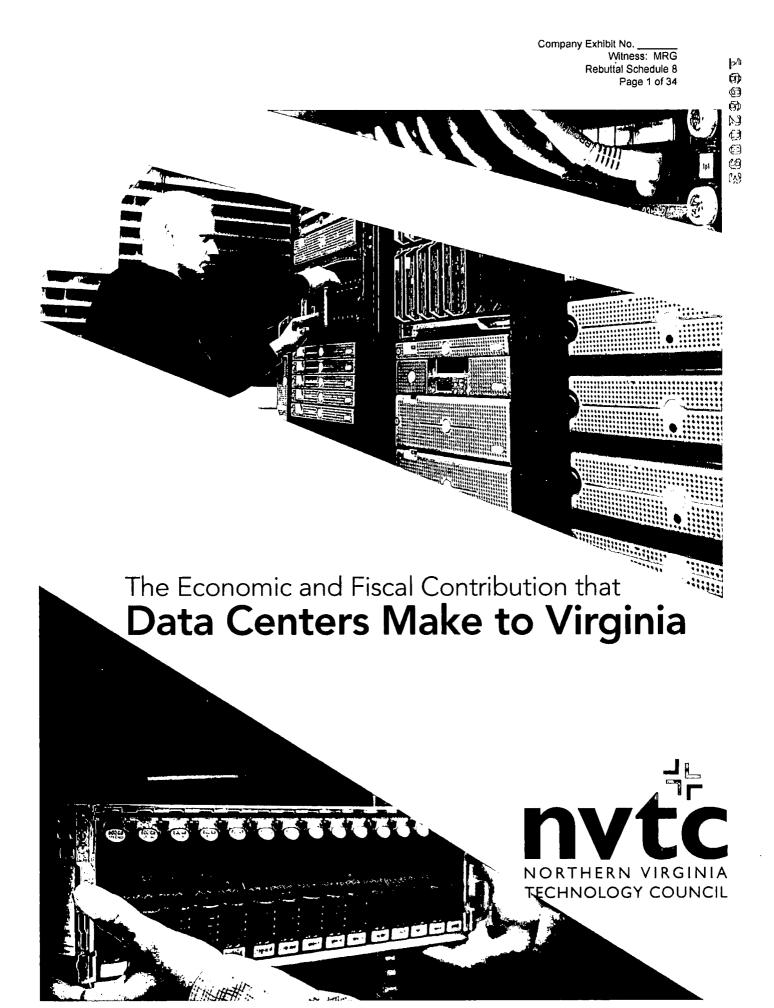
In addition, Section G of the Company's Transmission Planning Criteria states that "transmission facilities may be used... when the use of distribution feeders is not practicable" and "generally, the use of transmission facilities should be considered for the following conditions" which include "all loads over 20 MW" and "remote locations where distribution facilities are not adequate." The Company's Transmission Planning Criteria are now provided in Section 6 of the NERC FAC-001-2 mandatory Facility Interconnection Requirements ("FIR") document which is available at www.dom.com/library/domcom/pdfs/electric-transmission/facility-connection-requirements.pdf.

The 20 MW threshold is considered a *minimum* load level within the ten-year planning horizon that must be met as a condition for interconnecting to the transmission system. The 20 MW threshold is applied to 115 kV and 138 kV transmission lines and increases to 30 MW as the *minimum* threshold required for interconnecting with the 230 kV transmission system. Interconnection of loads below these levels will be permitted if the reliability of distribution

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alternatives is clearly inferior and costs exceed those associated with a transmission-voltage interconnection. The approximately 120 MVA of new load projected for the Customer's Haymarket Campus (160 MVA for the proposed Haymarket Substation at full build-out) clearly exceeds the minimum 30 MW threshold for interconnecting with the 230 kV transmission system.



Acknowledgements

ABOUT NVTC

The Northern Virginia Technology Council (NVTC) is the membership and trade association for the technology community in Northern Virginia. As the largest technology council in the nation, NVTC serves about 1,000 companies from all sectors of the technology industry, as well as service providers, universities, foreign embassies, nonprofit organizations and governmental agencies. Through its member companies, NVTC represents about 300,000 employees in the region. NVTC is recognized as the nation's leader in providing its technology community with networking and educational events; specialized services and benefits; public policy advocacy; branding of its region as a major global technology center; initiatives in targeted business sectors and in the international, entrepreneurship, workforce and education arenas; the NVTC Foundation, a 501(c)(3) nonprofit charity that supports the NVTC Veterans Employment Initiative and other priorities within Virginia's technology community; and The Entrepreneur Center @NVTC, which mentors new technology entrepreneurs. NVTC's Data Center & Cloud Infrastructure Committee provides a clear, consistent, collective and compelling voice for promoting the interests of our growing data center, cloud and critical infrastructure community in an effort to contribute to the long-term growth and prosperity of the industry.

Visit NVTC at: www.nvtc.org.

We would like to acknowledge and thank the following sponsors of this report:





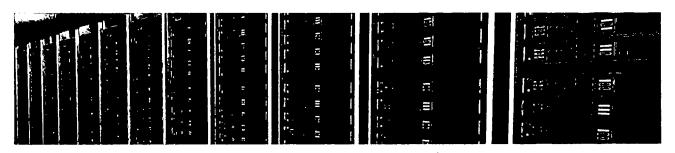






Report prepared by:





EXECUTIVE SUMMARY

This report assesses the economic and fiscal contribution that data centers make to the Commonwealth of Virginia. The principal findings from that assessment are as follows:

- 1) Data centers are a critical part of the infrastructure that supports the modern economy, not only in the technology sector, but in advanced manufacturing, entertainment, finance, healthcare, information, retail, telecommunications, and almost every other sector of the economy as well.
- 2) Although Virginia's data center industry is largely concentrated in Northern Virginia, this industry has broad geographic economic development potential:
 - While 71 percent of statewide employment in this industry is located in Northern Virginia, 11 percent is in Central Virginia, 11 percent is in Hampton Roads, 4 percent is in Southern Virginia, 2 percent in Southwestern Virginia, and 1 percent in the Valley.
 - Southern Virginia, an area of the state that has been devastated by employment losses in manufacturing and the tobacco industry, is home to Microsoft's \$1.3 billion data center in Mecklenburg County, the east coast hub for Microsoft's online services, and soon to be expanded to a \$1.7 billion facility.
 - DP Facilities announced just this fall that it would be opening a 65,000 square foot data center in Wise County in Southwestern Virginia, an area of the state that has been hard hit by employment losses in the coal mining industry.

3) Data centers are a high-performing industry:

- The data center industry insulated some Virginia localities from the "double dip" that the state experienced as a result, first of the "Great Recession" of 2007-09, and then the federal sequester in 2013.
- In the last year, statewide employment in the data center industry grew 6.7 times faster than the norm across all industries.
- In the last year, statewide wages in this sector, already 140 percent higher than the statewide average, grew 9.3 times faster than the norm across all industries.
- The pool of highly skilled workers the data center industry employs also feeds the talent pipeline for other
 fast growing, high wage industries such as Architectural, Engineering, and Related Services; Computer
 Systems Design and Related Services; Management, Scientific, and Technical Consulting; Scientific
 Research and Development Services; and Telecommunications.

4) Data centers generate significant tax revenue:

- The data center industry is very capital-intensive and that translates into a disproportionate amount of property tax revenue, by far the largest source of revenue for Virginia localities.
- In 2014, the benefit/cost ratio for the data center industry was 9.5 in Loudoun County and 4.3 in Prince William County. This means that for every \$1.00 in county expenditures that the *Data Processing*, *Hosting*, and *Related Services* sector was responsible for generating in 2014, it provided approximately \$9.50 in tax revenue to Loudoun County, and approximately \$4.30 in tax revenue to Prince William County.
- Because data centers pay high wages \$105,942 per year on average in 2014 they also have a
 disproportionate impact on state income tax revenue, by far the largest source of revenue for Virginia
 state government.
- This disproportionate fiscal impact places downward pressure on Virginia tax rates, thereby improving the state's overall business climate, which has suffered in recent years causing Virginia to fall from its traditional top slot in most national business climate indexes.





5) Data centers have a big overall economic impact:

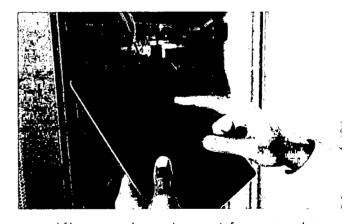
- In 2014, the total statewide economic impact attributable to the data center industry was approximately 36,043 jobs, \$2.7 billion in wages, \$8.6 billion in economic output, and \$298.9 million in state and local tax revenue.
- At a regional level, in 2014 the data center industry was responsible for generating approximately:
 - 21,995 jobs, \$2.0 billion in wages, and \$5.7 billion in economic output in Northern Virginia;
 - 3,974 jobs, \$225.2 million in wages, and \$885.9 million in economic output in Central Virginia;
 - 3,333 jobs, \$185.9 million in wages, and \$731.7 million in economic output in Hampton Roads; and
 - 1,002 jobs, \$40.8 million in wages, and \$196.0 million in economic output in Southern Virginia.

6) Data center industry investment decisions are increasingly sensitive to states' tax regimes:

- In 2009, in response to the loss of a \$1 billion Apple data center to North Carolina, Virginia enacted a sales and use tax exemption for data center purchases of computer equipment.
- Virginia's sales and use tax exemption for data center purchases of capital equipment is much like the exemption Virginia has extended to the similarly capital-intensive manufacturing sector for many years.
- The current sales and use tax exemption for data centers is scheduled to sunset in 2020.
- When Virginia enacted its data center sales and use tax exemption in 2009, only seven other states offered such incentives. Today, over half of all states offer incentives for data centers.
- Seven of those 27 data center incentives were enacted in 2015 alone and most states now offer incentives that are more competitive than Virginia's.
- Since 2012 when Virginia last revised its data center sales and use tax exemption, a third of the states offering such incentives have reduced their eligibility criteria to be more attractive to smaller data centers.
- If Virginia is to avoid the fate of Washington state, home of Microsoft, which has seen billions of dollars of data center investment migrate to neighboring Oregon because of the uncertainty generated by its "off again on again off again" approach to data center incentives, it will need to maintain its competitive position in the data center market.

INTRODUCTION

This report assesses the economic and fiscal contribution that data centers make to the Commonwealth of Virginia. Just as the industrial revolution of the late 18th century made the manufacturing sector the driving force for economic development at the time, the technological revolution of the late 20th century has made the technology sector the driving force for economic development in the modern economy. An important difference between the two, however, is that where the industrial revolution was largely confined to the manufacturing sector, the technological revolution has been ubiquitous and has driven and connected innovations in almost every sector of the



economy, including advanced manufacturing. Data centers and fiber networks are the core infrastructure that facilitates those connections and makes them possible. As a result, it is not an exaggeration to say that they have become the backbone of the modern economy.

The remainder of the report is divided into four sections. The Data Center Sector Profile section provides a profile of the data center sector in Virginia and details recent trends in that sector. The Contribution of Data Centers to Virginia's Economy section identifies and quantifies some of the more salient contributions that the data center sector makes to Virginia's economy. The Role of Incentives section discusses the role that state tax incentives are playing in the deployment of data centers in Virginia and across the United States. Finally, the Conclusion section provides a brief conclusion and summary of our findings.



DATA CENTER SECTOR PROFILE

In this section, we provide a general profile of the data center sector in Virginia. The data used to create that profile were provided by the Virginia Economic Development Partnership (VEDP) and cover private sector employment in the *Data Processing, Hosting, and Related Services* sector as defined by the U.S. Bureau of Labor Statistics. The regional aggregations of those data used in this section are based on the six sub-state regions employed by VEDP and are geographically depicted in the Virginia state map shown in Figure 1.

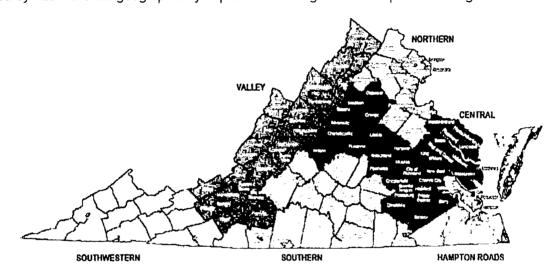


Figure 1: Virginia Economic Development Partnership Sub-state Regions

In 2014, private sector employment in *Data Processing, Hosting, and Related Services* accounted for 12,533 jobs statewide in Virginia. Figure 2, depicts the regional distribution of that employment. As these data indicate, the largest proportion of employment in this sector (71 percent) was located in Northern Virginia. However, it is important to realize that employment in this sector was also broadly distributed across other regions of the Commonwealth. Central Virginia and Hampton Roads accounted for 11 percent each of sector employment in 2014, while Southern Virginia (home to Microsoft's Boydton data center campus, the east coast hub for Microsoft's online services) accounted for 4 percent, Southwest Virginia 2 percent, and the Valley 1 percent.

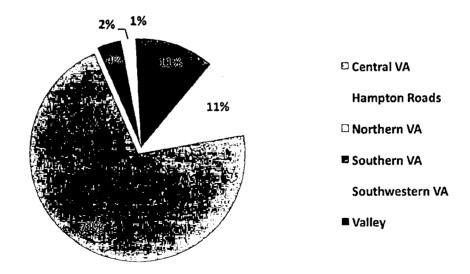
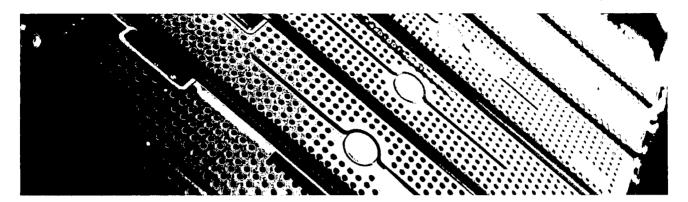


Figure 2: Regional Distribution of Private Sector Employment in Data Processing, Hosting, and Related Services in Virginia in 2014¹



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Figures 3 and 4 provide additional detail on private sector employment trends in *Data Processing*, *Hosting*, and *Related Services* from 1990 through 2014. As the data depicted in Figure 3 indicate, sector employment in Northern Virginia was relatively stable over this period. Employment peaked at just under 9,000 jobs between 1997 and 2004, then declined between 2004 and 2012, but has since escalated rapidly, coming in at 8,642 jobs in 2014.

Figure 4 provides similar data for the other sub-state regions within Virginia. As these data show, sector employment in Central Virginia peaked at 2,048 jobs in 2007 and has since declined, falling to 1,362 jobs in 2014. In Hampton Roads, employment grew rapidly until 2006 when it peaked at 2,042 jobs, but has since declined, falling to 1,352 jobs in 2014. In Southern Virginia, employment hovered around 500 jobs for most of the period and came in at 440 jobs in 2014. In Southwestern Virginia, employment was stable for most of the period but escalated sharply in 2011 and came in at 253 jobs in 2014. While in the Valley, employment peaked at 643 jobs in 1994 and has generally declined since, falling to 102 jobs in 2014.

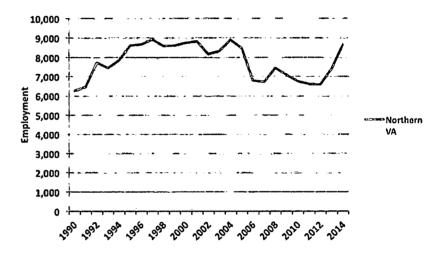


Figure 3: Data Processing, Hosting, and Related Services Private Sector Employment – 1990 to 2014²

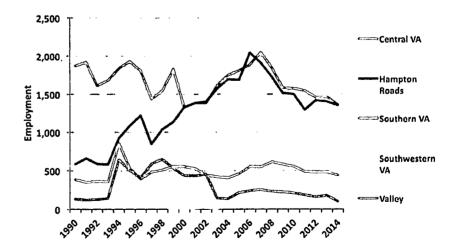


Figure 4: Data Processing, Hosting, and Related Services Private Sector Employment – 1990 to 2014³



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One of the more defining characteristics of the Data Processing, Hosting, and Related Services sector is that it is an extremely capital-intensive industry that has become ever more capital-intensive over time. What that means is that it has a high capital to labor ratio and typically employs a relatively small group of highly skilled, and highly paid, individuals. As a result, in and of themselves, employment trends are not necessarily the best measure of this industry's economic footprint within Virginia. For that reason, Figures 5 through 8 take a look at trends in two other important metrics - number of locations and wages.

Figure 5 depicts the trend in number of private sector data center locations in Northern Virginia between 1990 and 2014. As these data indicate, that number showed consistent growth until 2009 when it peaked at 357. Growth has since leveled off and came in at 334 locations in 2014. Figure 6 provides a similar look at the other sub-state regions within Virginia. As this graph shows, growth in number of locations escalated rapidly in Central Virginia and, to a lesser extent, in Hampton Roads before peaking in 2008-2009, but has since declined, falling to 103 locations in Central Virginia and 55 in Hampton Roads in 2014. Growth in Southern Virginia, Southwestern Virginia and the Valley followed a similar, if less pronounced, trajectory. These regions were respectively home to 29, 12, and 24 locations in 2014.

Finally, Figures 7 and 8 turn to what is one of the most prominent characteristics of the Data Processing, Hosting, and Related Services sector, which is that it pays very high wages, and those wages have grown rapidly over time (as will be demonstrated in the next section, at a rate that far outstrips the average growth rate for wages across all industry sectors). As shown in Figure 7, between 1990 and 2014 the average annual wage in this sector in Northern Virginia grew from \$37,867 to \$121,688, a 221 percent, or more than three-fold, increase.

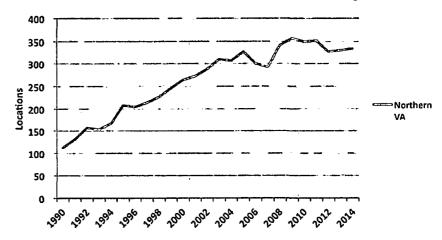


Figure 5: Data Processing, Hosting, and Related Services Private Sector Locations – 1990 to 2014⁴

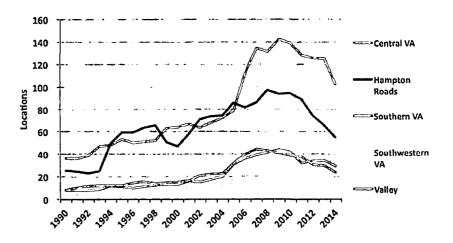


Figure 6: Data Processing, Hosting, and Related Services Private Sector Locations – 1990 to 2014⁵

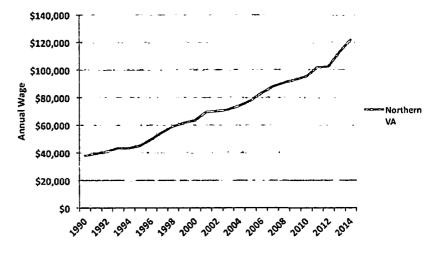


Figure 7: Data Processing, Hosting, and Related Services Private Sector Average Annual Wages – 1990 to 2014

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Rebuttal Schedule 8

Figure 8 provides comparable data for the other sub-state regions within Virginia. As these data indicate, wage growth in these regions followed a similar, if in some cases less direct, path. Between 1990 and 2014, average annual wages in the Data Processing, Hosting, and Related Services sector increased by 258 percent in Central Virginia, 104 percent in Hampton Roads, 227 percent in Southern Virginia, 210 percent in Southwestern Virginia, and 285 percent in the Valley.

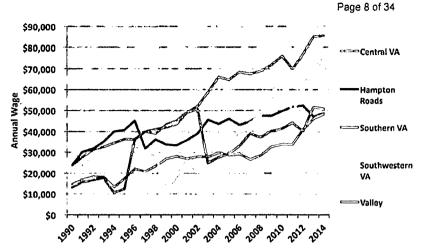


Figure 8: Data Processing, Hosting, and Related Services Private Sector Average Annual Wages – 1990 to 2014⁷

CONTRIBUTION OF DATA CENTERS TO VIRGINIA'S ECONOMY

In this section, we identify and quantify some of the more salient contributions that the data center sector makes to Virginia's economy.

Broad Geographic Economic Development Potential

In no small part because of its status as a major Internet hub, proximity to Washington D.C., and access to a highly skilled workforce, Northern Virginia is home to the largest concentration of private sector *Data Processing*, *Hosting*, *and Related Services* employment and locations in Virginia, and one of the largest in the U.S. However, as demonstrated in Figure 2 in the previous section, it is important to keep in mind that this sector is well represented in other regions of the Commonwealth as well.

Moreover, one of the trends that has manifested itself in recent years is that as Northern Virginia continues to become ever more congested, and that congestion continues to drive up the cost of land acquisition, there is a spillover effect that is leading to greater data center development in other localities within the state. One example of this trend is in Prince William County, which did not see its first data center project until 1999, but has since had 24 data center projects locate within the county. Those projects brought 706 high wage jobs to the county and resulted in \$4.3 billion in capital investment.⁸

Other examples notably include areas of the state that have been devastated by employment losses in traditional industries. For example, DP Facilities announced just this fall that it would be opening a 65,000 square foot data center in Wise County in Southwestern Virginia, an area of the state that has been hard hit by employment losses in the coal mining industry? Another example is in Mecklenburg County, in Southern Virginia, an area of the state that has been devastated by employment losses in its manufacturing and tobacco industries, as well as the closure of the Mecklenburg Correctional Center in 2012. Mecklenburg County is now home to Microsoft's \$1.3 billion Boydton data center campus, the east coast hub for Microsoft's online services, and soon to be expanded to a \$1.7 billion facility.¹⁰







More generally, Figure 9 depicts the top ten localities in Virginia in terms of cumulative VEDP job announcements in the *Data Processing, Hosting, and Related Services* sector for the period from January 1, 1990 through December 1, 2015, while Figure 10 provides comparable data for cumulative VEDP investment announcements. What these data clearly demonstrate is that, although Northern Virginia is well represented in these rankings, many other regions of Virginia are as well.

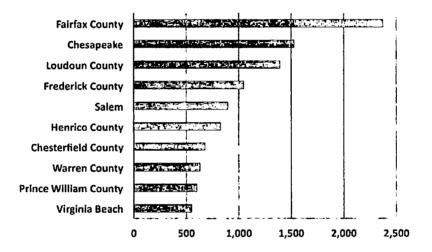


Figure 9: Top 10 Localities for Cumulative VEDP Job Announcements in Data Processing, Hosting, and Related Services – January 1, 1990 through December 1, 2015"

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Figure 10: Top 10 Localities for Cumulative VEDP Investment Announcements in Data Processing, Hosting, and Related Services – January 1, 1990 through December 1, 2015¹²



High Performance Sector

Another key characteristic of the Data Processing, Hosting, and Related Services sector is that it is a high performance sector in terms of both employment and wage growth. Figure 11 presents the most recent one-year (first quarter of 2014 to first quarter of 2015) and five-year (first quarter of 2010 to first quarter of 2015) growth rates for statewide private sector employment in this industry and compares them to the comparable growth rates for total statewide employment across all industry sectors. As these data show, in terms of one-year growth rates, statewide employment in Data Processing, Hosting, and Related Services grew 6.7 times faster than the norm across all industries, while in terms of five-year growth rates, statewide employment in Data Processing, Hosting, and Related Services grew 2.5 times faster than the norm across all industries.

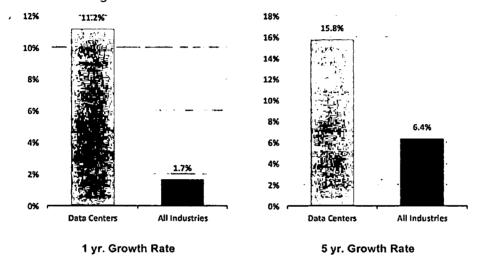


Figure 11: Statewide Growth in Data Processing, Hosting, and Related Services Private Sector Employment Relative to Total Private Employment across all Industries¹³

Figure 12 provides a similar comparison for one-year and five-year growth rates in average private sector weekly wages. In terms of one-year growth rates, the statewide average weekly wage in *Data Processing*, *Hosting*, and *Related Services* grew 9.3 times faster than the norm across all industries, while in terms of five-year growth rates, the statewide average weekly wage in *Data Processing*, *Hosting*, and *Related Services* grew 4.0 times faster than the norm across all industries. It also bears notice that in the first quarter of 2015, the statewide average private sector weekly wage in *Data Processing*, *Hosting*, and *Related Services* (\$2,569 per week) was 2.4 times greater than the average private sector weekly wage across all industries (\$1,067 per week).

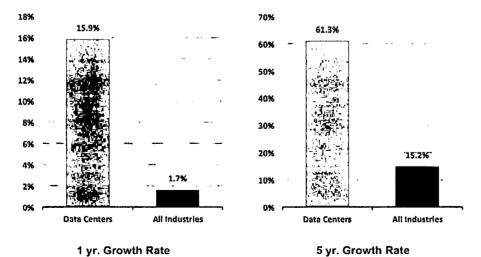


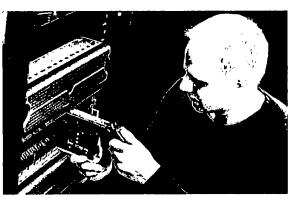
Figure 12: Statewide Growth in Data Processing, Hosting, and Related Services Private Sector Average Weekly Wages Relative to the Average Weekly Wage across all Industries¹⁴



In short, Virginia's Data Processing, Hosting, and Related Services sector is a fast growing sector, that pays high wages, and those wages are rising at a rate that far outstrips the norm for Virginia's economy. The latter is an important point from the state's perspective, not only because it fosters broader economic prosperity, but because Virginia is much more dependent on individual income tax as a revenue source than most states. In 2014, Virginia derived 68 percent of its overall revenue collections from individual income tax, while the norm across all states was closer to 42 percent that year.¹⁵

In addition, Virginia's *Data Processing, Hosting, and Related Services* sector is generally a high performer even relative to other states' *Data Processing, Hosting, and Related Services* sectors. If we use the same metrics to compare Virginia's performance in this sector to that of other states and the District of Columbia, what we find is that Virginia ranks:

- 15th in terms of one-year sector employment growth (4th in terms of sector growth benchmarked against each states' total employment growth),
- 32nd in terms of five-year sector employment growth (33rd in terms of sector growth benchmarked against each states' total employment growth),
- 9th in terms of one-year sector average weekly wage growth (2nd in terms of sector growth benchmarked against each states' total wage growth), and
- 9th in terms of five-year sector average weekly wage growth (5th in terms of sector growth benchmarked against each states' total wage growth).¹⁶



Although, it bears notice that Virginia's relative performance in terms of recent one-year employment growth in this sector (15th among the states) was a significant improvement over its longer period five-year employment growth (32nd among the states).

Reduces Economic Risk

Traditionally, Virginia enters a recession later than the country as a whole, is less adversely affected than the country as a whole, and comes out of the recession sooner than the country as a whole. In that regard, the Great Recession of 2007 impacted the state about as one would expect. Where things went wrong, however, was during the "recovery."

Figure 13 compares the yearover-year change in total private sector employment in Virginia to that of the U.S. as a whole from January of 2008 through March of 2015. Any point above the zero line in this graph indicates positive year-over-year employment growth, while any point below the zero line indicates a decline in year-over-year employment. This graph clearly shows the impact of the "Great Recession of 2007" as employment growth moved into negative territory in early 2008, bottomed out in late 2009, and did not move back into positive territory until late 2010. Although, as these data indicate, throughout that period Virginia continued to do better than the nation as a whole.

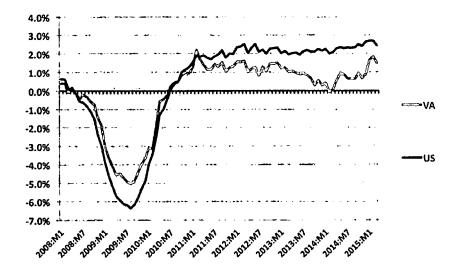


Figure 13: Year-over-Year Change in Private Sector Employment – January 2008 to January 2015¹⁷



 ¹⁵Data Source: Virginia Employment Commission. One year growth rates encompass the period from 2014:Q1 to 2015:Q1, while five year growth rates encompass the period from 2010:Q1 to 2015:Q1.
 ¹⁶Data Source: U.S. Bureau of Labor Statistics. One year growth rates encompass the period from 2013 to 2014, while five year growth rates encompass the period from 2009 to 2014.
 ¹⁷Data Source: U.S. Bureau of Economic Analysis.

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However, starting in mid-2011 that situation changed and Virginia started under-performing the nation as a whole. Moreover, in 2013 that divergence in trend became much more acute. That shift has generally been attributed to the effect of the 2013 federal sequester, which had a disproportionately large negative impact on Department of Defense contracting expenditures, which in turn had a disproportionately large negative impact on Northern Virginia's *Professional and Business Services* sector (in 2013, federal government expenditures in national defense fell to 91 percent of their 2009 level, and have continued to fall since, dropping to 86 percent of their 2009 level in the third quarter of 2015). And because Northern Virginia accounts for more than a third of total employment in Virginia, as goes Northern Virginia, so goes the state.

The significant and unusual negative impact that this turn of events had on Virginia led many to realize that, to reduce its economic risk profile, the Commonwealth needed to rebalance its economic portfolio and reduce its dependence on federal government expenditures. Among those who came to this conclusion was Governor Terry McAuliffe, whose announced economic strategy in his New Virginia Economy plan made clear that, "Virginia must take action now to catalyze the growth of the private, nonpublic dependent components of its economy."

In this regard, it is instructive to note that not all of Nothern Virginia was equally affected by the sequester. Figure 14 depicts the year-over-year change in total private sector employment in the Northern Virginia localities of the City of Alexandria, Arlington County, and Fairfax County from the first quarter of 2008 through the first quarter of 2015. The general characteristics of these trend lines are quite similar to the earlier trend line for Virginia as a whole. In both cases, they demonstrate the significant negative impact of both the "Great Recession of 2007" and the federal sequester of 2013.

Figure 15 presents comparable year-over-year change in total private sector employment data for the Northern Virginia localities of Loudoun County and Prince William County. Although these trend lines are similar to the others in regard to the impact of the "Great Recession of 2007," they are noticeably dissimilar when it comes to the federal sequester of 2013. Quite plainly - unlike the City of Alexandria, Arlington County, and Fairfax County -Loudoun County and Prince William County did not experience a contemporaneous decline in total private sector employment during the federal sequester of 2013.

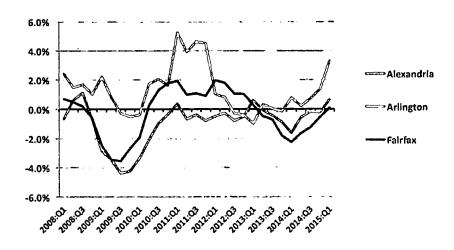


Figure 14: Year-over-Year Change in Private Sector Employment – First Quarter of 2008 to First Quarter of 2015¹⁹

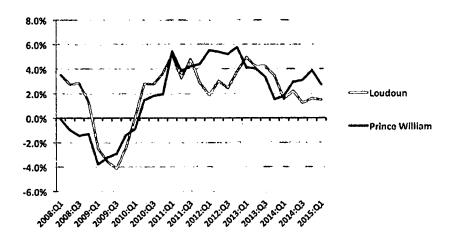


Figure 15: Year-over-Year Change in Private Sector Employment – First Quarter of 2008 to First Quarter of 2015²⁰



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Although it is beyond the scope of this report to comprehensively assess why Loudoun County and Prince William County were not adversely impacted by the 2013 federal sequester in the same way that other Northern Virginia localities were, one likely reason has to do with differences in the relative significance of their Data Processing, Hosting, and Related Services sectors. Figure 16 highlights one of those key differences by depicting each of these localities' five-year growth rates for private sector employment in Data Processing, Hosting, and Related Services.

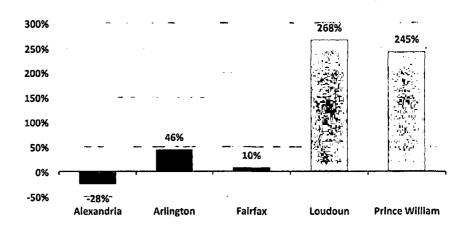


Figure 16: Five-Year Growth in Data Processing, Hosting, and Related Services Private Sector Employment²¹



Drives Technology Cluster Development

In the modern economy, one of the key resources that drives economic location decisions is access to a skilled workforce and this is particularly true of technology firms for which human capital is often their most critical resource need. As a result, technology industries with similar workforce requirements tend to cluster together to take advantage of a common workforce pool, in the same way that manufacturers often cluster together to take advantage of a common natural resource.

Table 1 lists ten key occupations in Virginia's Data Processing, Hosting, and Related Services sector that collectively account for almost half of all employment in that industry. These data are taken from an industry staffing matrix produced by the Virginia Employment Commission and reflect estimated statewide industry-level staffing patterns in 2014.

Occupation	% of Industry Employment
Computer and Information Systems Managers	2.8%
Computer Operators	1.8%
Computer Programmers	0.9%
Computer Systems Analysts	10.8%
Computer User Support Specialists	8.4%
Information Security Analysts	2.7%
Management Analysts	4.1%
Network and Computer Systems Administrators	7.0%
Software Developers, Applications	2.9%
Software Developers, Systems Software	3.1%
TOTAL	44.4%

Table 1: Ten Key Occupations in Virginia's Data Processing, Hosting, and Related Services Sector²²



Based on that same staffing matrix, Table 2 lists the top ten industries in Virginia, in addition to Data Processing, Hosting, and Related Services, that employ a large proportion of individuals in these ten specific occupations. Table 2 also lists the statewide average private sector weekly wage for each of these industries as of the first quarter of 2015, and then compares that wage to the average private sector weekly wage across all industries that quarter. What these data clearly indicate is that the industries that most heavily rely on the same workforce pool as Data Processing, Hosting, and Related Services are, like that sector, very high paying industries. More specifically, they pay wages that range from 159 percent to 275 percent above the prevailing statewide wage.

The question remains, however, whether there is anything other than theory to indicate that these industries actually do tend to cluster together to take advantage of a common workforce pool. Table 3 provides the answer to that question. Focusing on Northern Virginia, where the largest concentration of private sector employment in Data Processing, Hosting, and Related Services in Virginia is located, Table 3 lists the regional employment, and the regional employment location quotient, for the ten industries listed in Table 2, along with Data Processing, Hosting, and Related Services. A location quotient measures the size

Industry	Average Weekly Wage	As % of Average Wage across All Industries
Architectural, Engineering, and Related Services	\$1,845	173%
Computer Systems Design and Related Services	\$2,271	213%
Credit Intermediation and Related Activities	\$1,898	178%
Insurance Carriers and Related Activities	\$1,695	159%
Management of Companies and Enterprises	\$2,938	275%
Management, Scientific, and Technical Consult	\$2,009	188%
Other Information Services	\$2,864	268%
Scientific Research and Development Services	\$2,135	200%
Software Publishers	\$2,779	260%
Telecommunications	\$2,644	248%

Table 2: Top Ten Industries Employing the Occupations Listed in Table 1 Statewide (exclusive of *Data Processing, Hosting, and Related Services*)²³

Industry	Regional Employment in 2015:Q1	Employment Location Quotient
Architectural, Engineering, and Related Services	26,995	1.6
Computer Systems Design and Related Services	105,246	2.2
Credit Intermediation and Related Activities	22,868	1.0
Data Processing, Hosting, and Related Services	8,781	2.2
Insurance Carriers and Related Activities	7,503	0.5
Management of Companies and Enterprises	25,056	1.0
Management, Scientific, and Technical Consulting	51,656	2.3
Other Information Services	2,315	1.9
Scientific Research and Development Services	13,582	1.8
Software Publishers	3,430	2.1
Telecommunications	14,968	1.8

Table 3: Employment Location Quotients for Top Ten Industries Listed in Table 2 and Data Processing, Hosting, and Related Services in Northern Virginia²⁴



²³Data Source: Virginia Employment Commission.

of an industry's employment footprint in an area relative to what one would otherwise expect based on the statewide norm. If the location quotient is greater than 1.0, that indicates that the industry's employment footprint is larger than would be expected, and if it is less than 1.0 that indicates it is smaller than would be expected.

As the data presented in Table 3 indicate, seven of the ten industries listed in Table 2 have an employment footprint in Northern Virginia that is larger than one would expect based on the statewide norm – in most cases, twice the size of what one would expect. In addition, it is also important to note that in combination these seven industries and Data Processing, Hosting, and Related Services employ a very large number of people within the region – collectively they accounted for 226,973 jobs in Northern Virginia in the first quarter of 2015, or nearly a quarter of total private sector employment in the region. In short, these data are consistent with the hypothesis that Data Processing, Hosting, and Related Services sector is a high paying industry that makes a region more attractive to other high paying industries that must draw from the same highly skilled workforce pool.

Drives Large Capital Investment

One of the observations that was made earlier in this report is that Data Processing, Hosting, and Related Services is a very capital-intensive sector, and that high capital to labor ratio means that it typically employs a relatively small number of highly skilled and highly paid individuals. Another aspect of this sector's capital intensity, however, is that it is responsible for very large capital investments. Figure 17 depicts VEDP investment announcements in Data Processing, Hosting, and Related Services for the period from January 1, 1990 through December 1, 2015. As these data demonstrate, since 2009 those investment announcements have averaged \$1.3 billion per year and reached a high of \$2.0 billion in 2014.

Figure 18 provides an additional perspective on these Data Processing, Hosting, and Related Services investment data by presenting them as a percentage of total VEDP Investment announcements over the same period. As these data clearly demonstrate, particularly since 2009, that proportion is very high - ranging from 32 percent of total statewide investment announced in 2012 to 56 percent of total statewide investment announced in 2010. Moreover, just as the high wages paid by this sector have a large positive impact on the state's largest source of tax revenue (individual income tax), as will be shown in the next portion of this section, this disproportionately high level of capital investment has a large positive impact on localities' largest source of tax revenue (property tax).

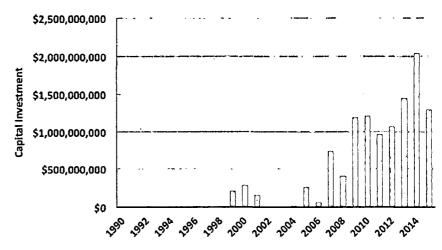


Figure 17: VEDP Investment Announcements for Data Processing, Hosting, and Related Services – January 1, 1990 through December 1, 2015²⁵

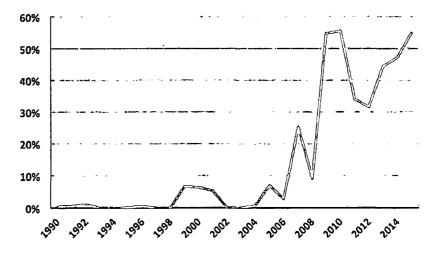


Figure 18: VEDP Investment Announcements for Data Processing, Hosting, and Related Services as a Proportion of Total Investment Announcements – January 1, 1990 through December 1, 2015²⁶



Enhances Business Climate

As alluded to above, because Data Processing, Hosting, and Related Services is a very capital-intensive sector, it has a disproportionately positive impact on localities' largest source of tax revenue (property tax). But what might not be immediately obvious from that relationship is that this also places downward pressure on overall tax rates, thereby improving not only the locality's business climate and economic attractiveness, but the state of Virginia's as well.

BENEFIT/COST RATIO

In this portion of the section, we evaluate the benefit/cost ratio that the *Data Processing, Hosting, and Related Services* sector provides to localities. To accomplish that task we focus on Loudoun County and Prince William County, home of the most significant concentrations of *Data Processing, Hosting, and Related Services* activity in Northern Virginia. Another reason for using these counties as an example is that we are able to take advantage of fiscal impact data provided by county personnel to better quantify the local fiscal benefit associated with this sector. Importantly, those data include fiscal impact assessments for both enterprise data centers that are owned and occupied by a single entity, and co-location data centers that lease space to one or more tenants.²⁷ According to these data, the estimated fiscal impact of data center facilities in 2014 was approximately \$104.2 million in Loudoun County, and \$11.5 million in Prince William County.²⁸

On the other side of the ledger, to quantify the fiscal cost that the *Data Processing, Hosting, and Related Services* sector imposed on Loudoun County and Prince William County in 2014, we rely on data from the Virginia Department of Education on local elementary and secondary education expenditures per student, and data from the Virginia Auditor of Public Accounts on local non-education expenditures per county resident. Through this approach, we focus on the largest costs that any business imposes on a local government, which are the cost associated with providing primary and secondary education, and other county services, to the employees of that business.

Table 4 details the calculations used to produce our estimates of the primary fiscal cost that the Data Processing, Hosting, and Related Services sector imposed on Loudoun County and Prince William County in 2014. As shown in Table 4, we estimate those costs to have been approximately \$10.9 million in Loudoun County and \$2.7 million in Prince William County. As shown in Table 5, when we combine those estimates of fiscal cost with the respective \$104.2 million and \$11.5 million estimates of fiscal benefit,

	Loudoun County	Prince William County
County Employment in Data Processing, Hosting, and Related Services in 2014 ²⁹	1,558	348
Students per Employee ³⁰	0.49	0.73
Per Student County Education Expenditures ³¹	\$8,616	\$4,664
Total Education Costs ³²	\$6,638,061	\$1,179,090
County Residents per Employee ³³	2.28	3.59
Per Resident Non-Education County Expenditures ³⁴	\$1,202	\$1,206
Total Non-Education Costs ³⁸	\$4,273,771	\$1,508,424
TOTAL COSTS ³⁶	\$10,911,832	\$2,687,514

Table 4: Estimate of Total Fiscal Cost Imposed by the *Data Processing*, Hosting, and Related Services Sector in 2014

³⁶Derived as total education costs and total non-education costs.



²⁷The authors would like to express their profound gratitude to Buddy Rizer, Executive Director for Economic Development for Loudoun County, Robert S. Wertz, Jr., Commissioner of the Revenue for Loudoun County; Erin McLellan, Executive Director of the Department of Management and Budget Director for Loudoun County; Jeffrey Kaczmarek, Executive Director of the Department of Economic Development for Prince William County; and their staffs for their assistance in developing and providing data without which this portion of our analysis would not have been possible.

²⁸It is important to note that data for Prince William County do not include business personal property tax payments for leased equipment.

²⁹Data Source: Virginia Employment Commission.

³⁰Data Source: Virginia Department of Education and Virginia Employment Commission. Derived by dividing total county elementary and secondary school enrollment in 2014 by total county employment in 2014.

³¹Data Source: Virginia Department of Education.

 $^{^{}J2}$ Derived as county employment in Data Processing, Hosting, and Related Services, times students per employee, times per student county education expenditures.

³³Data Source: U.S. Census Bureau and Virginia Employment Commission. Derived by dividing total county population in 2014 by total county employment in 2014.

³⁴Data Source: Virginia Auditor of Public Accounts.

³⁵ Derived as county employment in Data Processing, Hosting, and Related Services, times county residents por employee, times per resident county non-education expenditures.

we are able to determine that the benefit/cost ratio associated with the *Data Processing*, *Hosting*, and *Related Services* sector was 9.5 in Loudoun County and 4.3 in Prince William County in 2014. This means that for every \$1.00 in county expenditures that the *Data Processing*, *Hosting*, and *Related Services* sector was responsible for generating in 2014, it provided approximately \$9.50 in tax revenue to Loudoun County, and approximately \$4.30 in tax revenue to Prince William County.

Locality	Estimated Fiscal Benefit ³⁷	Estimated Fiscal Cost	Benefit/Cost Ratio
Loudoun County	\$104,200,000	\$10,911,831	9.5
Prince William County	\$11,500,000	\$2,687,514	4.3

Table 5: Estimated Benefit/Cost Ratio Associated with the *Data Processing*, Hosting, and Related Services Sector in 2014

OPPORTUNITY COST

One of the most useful concepts in economics is the concept of opportunity cost – what is the cost of not doing something. Or in this case, what would have been the cost to these localities if their *Data Processing, Hosting, and Related Services* sectors had not existed in 2014. The obvious answer is that they would not have received the estimated \$115.7 million in county tax revenue that this sector provided in 2014 and that in order to maintain county expenditures at the same level, that revenue would have had to come from other sources. The two most likely sources would have been: 1) additional education funding from the state triggered by the negative impact that this loss in tax base would have had on the formula Virginia uses to allocate education funding to localities, and 2) an increase in each county's real property tax rate.

On average, the state of Virginia funds 55 percent of primary and secondary education expenditures, and localities are required to locally fund the remaining 45 percent.³⁸ But, that local funding percentage is adjusted up or down based on each locality's "ability to pay" as measured by a "composite index" formula that takes into account the locality's property tax base, adjusted gross income, and taxable retail sales. Of these three factors, property tax base receives the highest weight (50 percent) and, therefore, has the largest influence on the final calculation.³⁹

The most recent composite index for Loudoun County was 0.5497 and for Prince William County 0.3848.⁴⁰ If we recalculate those indexes to take into account the loss of tax base implied by the \$115.7 million loss in tax revenue that would have occurred if the *Data Processing*, *Hosting*, and *Related Services* sector had not existed in these localities, those indexes fall to 0.5190 and 0.3817 respectively. As shown in Table 6, according to our estimates, this means that the state would have had to reallocate \$15.5 million in state education funding away from other Virginia localities to provide \$13.7 million in additional formula-driven funding to Loudoun County and \$1.8 million in additional funding to Prince William County. To put this number in perspective, \$15.5 million is larger than the state funded portion of 46 county school budgets in Virginia in 2014.

Locality	Revenue Loss	State Education Funding Off-Set	Required Additional Revenue from Real Property Tax
Loudoun County	\$104,200,000	\$13,700,000	\$90,500,000
Prince William County	\$11,500,000	\$1,800,000	\$9,700,000

Table 6: Estimated Additional Revenue Required to Compensate for loss of Data Processing, Hosting, and Related Services Sector in 2014 by Source





³⁷Data Source: Loudoun County and Prince William County.

³⁸Data Source: In actuality, however, baseline local funding percentages are typically higher than 45 percent because of local initiatives.

³⁹Data Source: Virginia Department of Education. The actual formula weights each locality's property tax base by 0.5, adjusted gross income by 0.4, and taxable retail sales by 0.1. Each metric is then divided by school population and total population and those per capita figures are divided by the average across all localities to determine ability to pay. The per capita figures are then themselves weighted with each per capita school population metric receiving a weight of 0.66 and each per capita population metric receiving a weight of 0.33. ⁴⁰Data Source: Virginia Department of Education.

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The remaining \$100.2 million in lost tax revenue would likely have been made up through increased property taxes (by far the largest source of revenue for most localities). Figure 19 depicts our estimate of the increase in Loudoun County's and Prince William County's real property tax rates that would have been required to generate this \$100.2 million in lost tax revenue. As shown, Loudoun County's real property tax rate would have likely had to increase from \$1.135 per \$100 of assessed value to \$1.326 (a 17 percent increase) and Prince William County's would likely had to increase from \$1.122 per \$100 of assessed value to \$1.145 (a 2 percent increase).

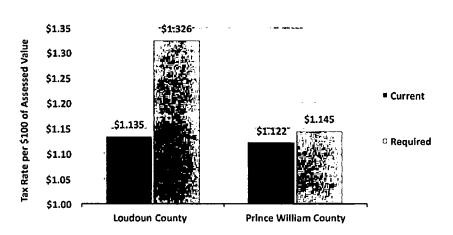


Figure 19: Estimated County Real Property Tax Rates with and without the Data Processing, Hosting, and Related Services Sector

EFFECT ON BUSINESS CLIMATE

In the not too distant past, Virginia typically scored at or near the top of most business climate rankings. In recent years, however, the state has lost significant ground relative to other states. Between 2010 and 2014, Virginia slipped from 2nd to 4th in Forbes' "Best States for Business" ranking, 2nd to 8th in CNBC's "America's Top States for Business" ranking, 2nd to 12th in the U.S. Chamber of Commerce's "Enterprising States" Ranking, 4th to 11th in Chief Executives' "Best and Worst States for Business" ranking, 4th to 10th in Site Selection Magazine's "Business Climate" ranking, and 2nd to 5th in Business Facilities' "Ranking Report." In most cases, these declines were largely driven by the Commonwealth's recent lackluster employment growth. But tax rates, and particularly property tax rates, have also played a role.



In the Tax Foundation's "2015 State Business Tax Climate Index," Virginia's overall state business tax climate was ranked 27th among the states, down from 23rd as recently as 2012. The primary reason for the Commonwealth's low ranking, was that it was ranked in the bottom half of the states with regard to individual income tax, unemployment insurance tax, and property tax rates.

In 2015, the Tax Foundation also published the "Location Matters" report that performed a more comprehensive assessment of state tax climate from the perspective of seven specific types of industries. Among those seven were capital-intensive manufacturing and labor-intensive manufacturing. According to the Tax Foundation's analysis, Virginia ranked:

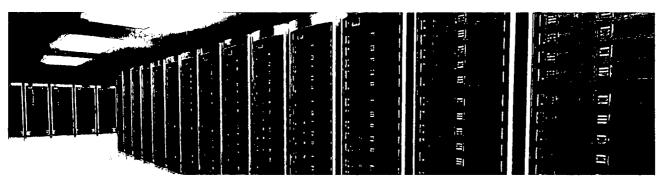
- 20th among the states for mature capital-intensive manufacturers, and 49th among the states for new capital-intensive manufacturers (only Maryland was ranked worse than Virginia); and
- 2nd among the states for mature labor-intensive manufacturers, and 36th among the states for new labor-intensive manufacturers.

In explaining why Virginia was ranked so much more poorly for new firms as opposed to mature firms, and capital-intensive industries as opposed to labor-intensive industries, the Tax Foundation made clear that Virginia's, "high property taxes on equipment drive tax burdens on some firms, with a particularly dramatic effect on new operations." Later focusing more succinctly on new operations, they went on to say that new firms experience, "heavy property tax burdens due to the state's tax on equipment, which is more than double the national average." 43



⁴²Tax Foundation and KPMG, "Location Matters: The State Tax Costs of Doing Business," 2015.

⁴³Tax Foundation and KPMG, "Location Matters: The State Tax Costs of Doing Business," 2015, p.70.



These findings are of particular relevance to the capital-intensive *Data Processing*, *Hosting*, *and Related Services* sector in two ways. First, they point to the important role that property taxes play in general in business attraction and retention. As we have demonstrated, because the *Data Processing*, *Hosting*, *and Related Services* sector provides such a high benefit-cost ratio to localities it enables them to maintain lower overall property tax rates than would otherwise be the case. This fosters a more favorable business climate for all businesses.

Second, these findings make clear that Virginia is already at a significant competitive disadvantage relative to other states in regard to property taxes on equipment specifically. This is of particular significance to the *Data Processing*, *Hosting*, and *Related Services* sector, as these firms are not only extremely capital-intensive, but also must generally replace their capital equipment on an unusually short three to four year cycle. As a result, any further exacerbation of Virginia's already significant competitive disadvantage in regard to taxes on capital equipment could have a disproportionately negative impact on the *Data Processing*, *Hosting*, and *Related Services* sector specifically.

ECONOMIC AND FISCAL IMPACT

In this section, we quantify the economic and fiscal contribution that the *Data Processing*, *Hosting*, and *Related Services* sector makes to the Commonwealth of Virginia as a whole, and to the six sub-state regions employed by VEDP and identified earlier in this report individually.

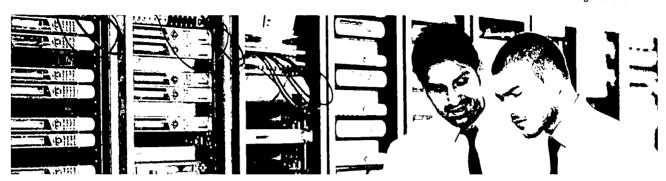
Method

To empirically evaluate the statewide and regional economic and fiscal impact attributable to the *Data Processing*, *Hosting*, *and Related Services* sector, we employ a commonly used regional economic impact model called IMPLAN.⁴⁴ The IMPLAN model uses regional and national production and trade flow data to construct region- and industry-specific economic multipliers and uses these multipliers to quantify economic impact. For purposes of this analysis, we have further customized these internal IMPLAN assumptions based on proprietary data provided by a sub-set of Virginia data center firms to ensure that the specific model specifications we use reflect actual conditions within Virginia's Data *Processing*, *Hosting*, *and Related Services* sector as closely as possible.

Economic multipliers measure the ripple effects that an expenditure has as it makes its way through the economy. For example, as when data centers purchase goods and services – or when data center employees use their salaries and wages to make household purchases – thereby generating income for someone else, which is in turn spent, thereby becoming income for yet someone else, and so on, and so on. Through this process, one dollar in expenditures generates multiple dollars of income. The mathematical relationship between the initial expenditure and the total income generated is the economic multiplier. The economic result of these ripple effects is called indirect impact when it refers to business to business transactions, and induced impact when it refers to household (employee) to business transactions.

In the analysis that follows, we also provide estimates for four categories of impact. The first is employment, or the number of jobs that are created. The second is labor income, or the salaries and wages associated with those jobs. The third is economic output, or the total amount of economic activity that is created in the economy. The fourth is fiscal impact, or the total tax dollars that are generated by that economic activity.





Results

VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services sector had on the state of Virginia as a whole in 2014, we employ the following assumptions:

- Statewide employment in this sector was 12,533 in 2014.⁴⁵
- Employer expenditures for employee health and dental insurance were \$104,894,790 in 2014.46

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 7. As these data indicate, in addition to directly providing 12,533 jobs, \$1.4 billion in associated wages and salaries, and \$4.3 billion in statewide economic output in 2014, the Data Processing, Hosting, and Related Services sector was also responsible for generating the following second round indirect and

induced economic activity within Virginia: 1) 23,510 additional full-time-equivalent jobs, 2) \$1.2 billion in additional associated labor income, and 3) \$4.3 billion in additional economic output. In combination, this means that the Data Processing, Hosting, and Related Services sector's total 2014 economic impact on Virginia was: 1) 36,043 jobs, 2) \$2.7 billion in labor income, and 3) \$8.6 billion in economic output.47 Finally, this economic activity was also responsible for generating a total of \$298.9 million in state and local tax revenue and \$644.1 million in federal tax revenue, for a total fiscal impact of \$943.0 million in 2014.

First F	Round Direct Econon	nic Activity					
	Employment	Labor Income	Output				
Total First Round Activity	12,533	\$1,444,536,630	\$4,297,692,492				
Second Round Indirect and Induced Economic Activity							
	Employment	Labor Income	Output				
Operations	22,118	\$1,132,568,787	\$4,140,597,851				
Health Services	1,392	\$106,781,405	\$203,601,146				
Total Second Round Activity*	23,510	\$1,239,350,192	\$4,344,198,997				
Total, Direct, I	ndirect, and Induced	Economic Activity					
	Employment	Labor Income	Output				
TOTAL Economic Activity*	36,043	\$2,683,886,822	\$8,641,891,489				
	Total Fiscal Activi	lty					
	State and Local	Federal	Total				
TOTAL Fiscal Impact	\$298,897,212	\$644,118,050	\$943,015,262				

^{*}May not sum due to rounding

Table 7: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Sector on Virginia in 2014



⁴⁵Data Source: Virginia Employment Commission

⁴⁶Estimated based on proprietary data provided by a sub-set of Virginia data centers.

⁴⁷It is important to note that this estimate of total economic impact is based on Data Processing, Hosting, and Related Services operations only. Due to a lack of data availability, it does not include expenditures for capital construction or capital equipment purchases. As demonstrated in Figure 16 of this report, those expenditures are in many years quite substantial. As a result, the economic and fiscal impact assessments presented in this report should be considered highly conservative.

NORTHERN VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services sector had on Northern Virginia in 2014, we employ the following assumptions:

- Regional employment in this sector was 8,642 in 2014.⁴⁸
- Employer expenditures for employee health and dental insurance were \$83,068,701 in 2014.

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 8. As shown, in addition to directly providing 8,642 jobs, \$1.2 billion in associated wages and salaries, and \$3.2 billion in regional economic output in 2014, the Data Processing, Hosting, and Related Services sector was also responsible for generating the following second round indirect and induced economic activity within Northern Virginia: 1) 13,353 additional full-time-equivalent jobs, 2) \$814.0 million in additional

associated labor income. and 3) \$2.6 billion in additional economic output. In combination, this means that the Data Processing, Hosting, and Related Services sector's total 2014 economic impact on Northern Virginia was: 1) 21,995 jobs, 2) \$2.0 billion in labor income, and 3) \$5.7 billion in economic output.50 Finally, this economic activity was also responsible for generating a total of \$180.2 million in state and local tax revenue and \$457.5 million in federal tax revenue, for a total fiscal impact of \$637.7 million in 2014.

First I	Round Direct Econon	nic Activity	
	Employment	Labor Income	Output
Total First Round Activity	8,642	\$1,168,494,947	\$3,165,265,933
Second Round	Indirect and Induced	d Economic Activity	
	Employment	Labor Income	Output
Operations	12,386	\$730,504,291	\$2,425,437,679
Health Services	967	\$83,529,712	\$149,707,907
Total Second Round Activity*	13,353	\$814,034,003	\$2,575,145,586
Total, Direct, I	ndirect, and induced	Economic Activity	
	Employment	Labor Income	Output
TOTAL Economic Activity*	21,995	\$1,982,528,950	\$5,740,411,519
	Total Fiscal Activi	ity	
	State and Local	Federal	Total
TOTAL Fiscal Impact	\$180,232,968	\$457,499,264	\$637,732,232

May not sum due to rounding

Table 8: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Sector on Northern Virginia in 2014



⁴⁸Data Source: Virginia Employment Commission

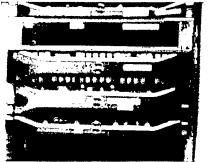




⁴⁹Estimated based on proprietary data provided by a sub-set of Virginia data centers.

⁵⁰It is important to note that this estimate of total economic impact is based on Data Processing, Hosting, and Rolated Services operations only. Due to a lack of data availability, it does not include expenditures for capital construction or capital equipment purchases. As demonstrated in Figure 16 of this report, those expenditures are in many years quite substantial. As a result, the economic and fiscal impact assessments presented in this report should be considered highly conservative.





CENTRAL VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the *Data Processing*, *Hosting*, and *Related Services* sector had on Central Virginia in 2014, we employ the following assumptions:

- Regional employment in this sector was 1,362 in 2014.⁵¹
- Employer expenditures for employee health and dental insurance were \$9,198,462 in 2014.52

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 9. As these data demonstrate, in addition to directly providing 1,362 jobs, \$98.1 million in associated wages and salaries, and \$398.1 million in regional economic output in 2014, the *Data Processing*,

Hosting, and Related Services sector was also responsible for generating the following second round indirect and induced economic activity within Central Virginia: 1) 2,612 additional full-time-equivalent jobs, 2) \$127.1 million in additional associated labor income, and 3) \$487.7 million in additional economic output. In combination, this means that the Data Processing, Hosting, and Related Services sector's total 2014 economic impact on Central Virginia was: 1) 3,974 jobs, 2) \$225.2 million in labor income, and 3) \$885.9 million in economic output.53 Finally, this economic activity was also responsible for generating a total of \$31.7 million in state and local tax revenue and \$59.4 million in federal tax revenue, for a total fiscal impact of \$91.2 million in 2014.

First F	Round Direct Econon	nic Activity	
	Employment	Labor Income	Output
Total First Round Activity	1,362	\$98,095,334	\$398,105,309
Second Round	Indirect and Induce	d Economic Activity	
	Employment	Labor Income	Output
Operations	2,484	\$117,432,816	\$469,004,636
Health Services	128	\$9,685,900	\$18,741,321
Total Second Round Activity*	2,612	\$127,118,716	\$487,745,957
Total, Direct, I	ndirect, and induced	Economic Activity	
	Employment	Labor Income	Output
TOTAL Economic Activity*	3,974	\$225,214,050	\$885,851,266
	Total Fiscal Activ	ity	
	State and Local	Federal	Total
TOTAL Fiscal Impact	\$31,737,286	\$59,432,219	\$91,169,505

^{*}May not sum due to rounding.

Table 9: Estimated Economic and Fiscal Impact of the *Data Processing*, Hosting, and Related Services Sector on Central Virginia in 2014



⁵¹Data Source: Virginia Employment Commission

⁵² Estimated based on proprietary data provided by a sub-set of Virginia data centers.

^{5,3}It is important to note that this estimate of total economic impact is based on *Data Processing*, *Hosting*, and *Related Services* operations only. Due to a lack of data availability, it does not include expenditures for capital construction or capital equipment purchases. As demonstrated in Figure 16 of this report, those expenditures are in many years quite substantial. As a result, the economic and fiscal impact assessments presented in this report should be considered highly conservative.

HAMPTON ROADS

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services sector had on Hampton Roads in 2014, we employ the following assumptions:

- Regional employment in this sector was 1,352 in 2014.⁵⁴
- Employer expenditures for employee health and dental insurance were \$5,194,995 in 2014.55

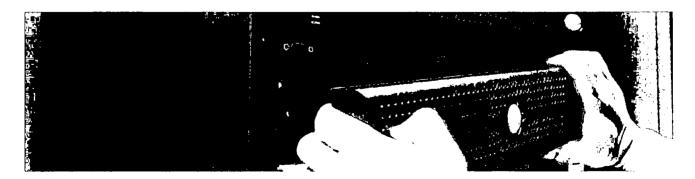
By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 10. As these data indicate, in addition to directly providing 1,352 jobs, \$101.1 million in associated wages and salaries, and \$399.5 million in regional economic output in 2014, the Data Processing, Hosting, and Related Services sector was also responsible for generating the following second round indirect and induced economic activity within Hampton Roads: 1) 1,981 additional full-time-equivalent jobs, 2) \$84.8

million in additional associated labor income, and 3) \$332.2 million in additional economic output. In combination, this means that the Data Processing, Hosting, and Related Services sector's total 2014 economic impact on Hampton Roads was: 1) 3,333 jobs, 2) \$185.9 million in labor income, and 3) \$731.7 million in economic output.56 Finally, this economic activity was also responsible for generating a total of \$23.6 million in state and local tax revenue and \$44.3 million in federal tax revenue, for a total fiscal impact of \$68.0 million in 2014.

First F	Round Direct Econon	nic Activity		
	Employment	Labor Income	Output	
Total First Round Activity	8,642	\$1,168,494,947	\$3,165,265,933	
Second Round	Indirect and Induced	d Economic Activity		
	Employment	Labor Income	Output	
Operations	12,386	\$730,504,291	\$2,425,437,679	
Health Services	967	\$83,529,712	\$149,707,907	
Total Second Round Activity*	13,353	13,353 \$814,034,003		
Total, Direct, I	ndirect, and induced	Economic Activity	·	
	Employment	Labor Income	Output	
TOTAL Economic Activity*	21,995	\$1,982,528,950	\$5,740,411,519	
	Total Fiscal Activ	lty		
	State and Local	Federal	Total	
TOTAL Fiscal Impact	\$180,232,968	\$457,499,264	\$637,732,232	

^{*}May not sum due to rounding

Table 10: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Sector on Hampton Roads in 2014



⁵⁴Data Source: Virginia Employment Commission



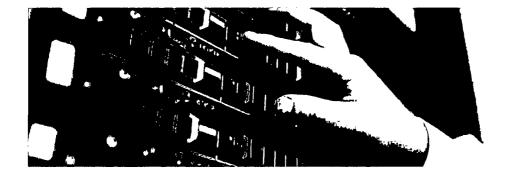


⁵⁵Estimated based on proprietary data provided by a sub-set of Virginia data centers.

⁵⁶It is important to note that this estimate of total economic impact is based on Data Processing, Hosting, and Related Services operations only. Due to a lack of data availability, it does not include expenditures for capital construction or capital equipment purchases. As demonstrated in Figure 16 of this report, those expenditures are in many years quite substantial. As a result, the economic and fiscal impact assessments presented in this report should be considered highly conservative.

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SOUTHERN VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services sector had on Southern Virginia in 2014, we employ the following assumptions:

- Regional employment in this sector was 440 in 2014.⁵⁷
- Employer expenditures for employee health and dental insurance were \$1,680,720 in 2014.58

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 11. As shown, in addition to directly providing 440 jobs, \$20.2 million in associated wages and salaries, and \$115.4 million in regional economic output in 2014, the Data Processing, Hosting, and

Related Services sector was also responsible for generating the following second round indirect and induced economic activity within Southern Virginia: 1) 562 additional full-time-equivalent jobs, 2) \$20.6 million in additional associated labor income, and 3) \$80.7 million in additional economic output. In combination, this means that the Data Processing, Hosting, and Related Services sector's total 2014 economic impact on Southern Virginia was: 1) 1,002 jobs, 2) \$40.8 million in labor income, and 3) \$196.0 million in economic output.59 Finally, this economic activity was also responsible for generating a total of \$6.3 million in state and local tax revenue and \$10.3 million in federal tax revenue, for a total fiscal impact of \$16.6 million in 2014.

First 6	Round Direct Econon	nic Activity		
	Employment	Labor Income	Output	
Total First Round Activity	440	\$20,215,052	\$115,350,433	
Second Round	Indirect and Induced	d Economic Activity		
	Employment	Labor Income	Output	
Operations	540	\$19,127,405	\$77,956,548	
Health Services	22	\$1,441,001	\$2,723,177	
Total Second Round Activity*	562	\$20,568,406	\$80,679,725	
Total, Direct, I	ndirect, and induced	Economic Activity		
	Employment	Labor Income	Output	
TOTAL Economic Activity*	1,002	\$40,783,458	\$196,030,158	
	Total Fiscal Activi	ity		
	State and Local	Federal	Total	
TOTAL Fiscal Impact	\$6,299,908	\$10,255,682	\$16,555,590	

^{*}May not sum due to rounding.

Table 11: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Sector on Southern Virginia in 2014



⁵⁷Data Source: Virginia Employment Commission

⁵⁰Estimated based on proprietary data provided by a sub-set of Virginia data centers.

⁵⁹It is important to note that this estimate of total economic impact is based on Data Processing, Hosting, and Related Services operations only. Due to a lack of data availability, it does not include expenditures for capital construction or capital equipment purchases. As demonstrated in Figure 16 of this report, those expenditures are in many years quite substantial. As a result, the economic and fiscal impact assessments presented in this report should be considered highly conservative.

SOUTHWESTERN VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services sector had on Southwestern Virginia in 2014, we employ the following assumptions:

- Regional employment in this sector was 253 in 2014.60
- Employer expenditures for employee health and dental insurance were \$1,496,028 in 2014.61

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 12. As shown, in addition to directly providing 253 jobs, \$7.9 million in associated wages and salaries, and \$62.0 million in regional economic output in 2014, the *Data Processing, Hosting, and Related Services* sector was also responsible for generating the following second round indirect and induced economic activity within Southwestern Virginia: 1) 246 additional full-time-equivalent jobs, 2) \$9.4 million in additional

associated labor income, and 3) \$35.0 million in additional economic output. In combination, this means that the Data Processing, Hosting, and Related Services sector's total 2014 economic impact on Southwestern Virginia was: 1) 499 jobs, 2) \$17.3 million in labor income, and 3) \$96.9 million in economic output.62 Finally, this economic activity was also responsible for generating a total of \$2.8 million in state and local tax revenue and \$4.4 million in federal tax revenue, for a total fiscal impact of \$7.2 million in 2014.

First F	Round Direct Econon	nic Activity		
	Employment	Labor Income	Output	
Total First Round Activity	253	\$7,928,073	\$61,967,253	
Second Round	Indirect and Induced	d Economic Activity		
	Employment	Labor Income	Output	
Operations	227	\$8,180,814	\$32,662,259	
Health Services	19	\$1,182,734	\$2,288,656 \$34,950,915	
Total Second Round Activity*	246	\$9,363,548		
Total, Direct, I	ndirect, and induced	Economic Activity		
	Employment	Labor Income	Output	
TOTAL Economic Activity*	499	\$17,291,621	\$96,918,168	
	Total Fiscal Activi	ity		
	State and Local	Federal	Total	
TOTAL Fiscal Impact	\$2,770,507	\$4,388,600	\$7, 159,107	

^{*}May not sum due to rounding.

Table 12: Estimated Economic and Fiscal Impact of the *Data Processing*, Hosting, and Related Services Sector on Southwestern Virginia in 2014



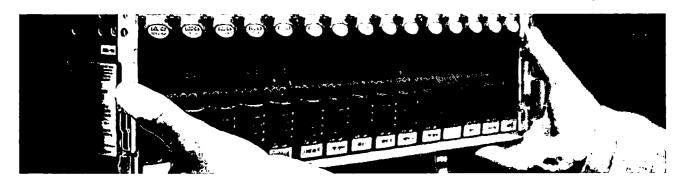
⁶⁰Data Source: Virginia Employment Commission



⁶¹Estimated based on proprietary data provided by a sub-set of Virginia data centers.

⁶²It is important to note that this estimate of total economic impact is based on *Data Processing*, *Hosting*, *and Related Services* operations only. Due to a lack of data availability, it does not include expenditures for capital construction or capital equipment purchases. As demonstrated in Figure 16 of this report, those expenditures are in many years quite substantial. As a result, the economic and fiscal impact assessments presented in this report should be considered highly conservative.

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VALLEY

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services sector had on Valley in 2014, we employ the following assumptions:

- Regional employment in this sector was 102 in 2014.63
- Employer expenditures for employee health and dental insurance were \$\$407,262 in 2014.64

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 13. As shown, in addition to directly providing 102 jobs, \$5.9 million in associated wages and salaries, and \$28.1 million in regional economic output in 2014, the *Data Processing*, Hosting, and

Related Services sector was also responsible for generating the following second round indirect and induced economic activity within the Valley: 1) 150 additional full-time-equivalent jobs, 2) \$6.1 million in additional associated labor income, and 3) \$22.3 million in additional economic output. In combination, this means that the Data Processing, Hosting, and Related Services sector's total 2014 economic impact on the Valley was: 1) 252 jobs, 2) \$12.0 million in labor income, and 3) \$50.4 million in economic output.65 Finally, this economic activity was also responsible for generating a total of \$1.6 million in state and local tax revenue and \$2.9 million in federal tax revenue, for a total fiscal impact of \$4.5 million in 2014.

First F	Round Direct Econon	nic Activity		
	Employment	Labor Income	Output	
Total First Round Activity	102	\$5,856,080	\$28,070,838	
Second Round	Indirect and Induced	d Economic Activity		
	Employment	Labor Income	Output	
Operations	145	\$5,726,153	\$21,561,532	
Health Services	6	\$380,623	\$738,827	
Total Second Round Activity*	150	\$6,106,776	\$22,300,359	
Total, Direct, I	ndirect, and induced	Economic Activity	-	
	Employment	Labor Income	Output	
TOTAL Economic Activity*	252	\$11,962,856	\$50,371,197	
	Total Fiscal Activ	ity		
	State and Local	Federal	Total	
TOTAL Fiscal Impact	\$1,603,264	\$2,873,715	\$4,476,979	

^{*}May not sum due to rounding.

Table 13: Estimated Economic and Fiscal Impact of the *Data Processing*, Hosting, and Related Services Sector on the Valley in 2014



⁶³Data Source: Virginia Employment Commission

⁶⁴Estimated based on proprietary data provided by a sub-set of Virginia data centers.

⁶⁵It is important to note that this estimate of total economic impact is based on *Data Processing*, *Hosting*, and *Related Services* operations only. Due to a lack of data availability, it does not include expenditures for capital construction or capital equipment purchases. As demonstrated in Figure 16 of this report, those expenditures are in many years quite substantial. As a result, the economic and fiscal impact assessments presented in this report should be considered highly conservative.

ROLE OF INCENTIVES

Data center location choices generally depend on several main factors: electricity availability and price, fiber availability and capacity, real estate price, water availability, exposure to environmental risks (earthquake, hurricane, etc.), skilled labor availability, and taxes. In the short run, it is difficult for a location to change most of those factors. However, taxes are the easiest to affect, and the enactment and updating of state tax incentives often has a significant impact on data center location decisions.

The Virginia Data Center Incentive

In 2009, Apple decided to build a \$1 billion data center in Maiden, NC instead of Virginia. 66 Both states had vied for the facility. 67 But after Apple indicated that it was leaning toward a Virginia location 68, the North Carolina legislature enacted tax incentives to secure the Apple facility. 69 In response to that loss, the Virginia General Assembly voted unanimously to make data center facilities eligible for a sales and use tax exemption on computer equipment if they met certain criteria, which included \$150 million in new investment and 50 new jobs that paid wages that were 50 percent above the prevailing local wage (that job requirement was reduced to 25 in economically disadvantaged areas). Shortly after that incentive became effective, Microsoft announced its intention to build its Boydton data center campus, the east coast hub for Microsoft's online services, in Mecklenburg County.

In 2010, Virginia legislators expanded the definition of qualified equipment to include servers, routers, generators, chillers and other enabling hardware. Then in 2012, the incentive was amended again to allow co-location data center facilities to aggregate the capital investment and new job requirements of the data center owner and its tenants. These updates were enacted to keep Virginia competitive in the data center location market. However, these incentives are scheduled to expire on June 30, 2020.

Incentives Vary Among States and are Often Updated

Before Virginia enacted its data center incentive in 2009, only seven states had incentives. Today 27 states have incentives that are specifically targeted at attracting data centers. Figure 20 provides a map of the U.S. in which these states are shaded in red, while the intensity of the color indicates how recently each state took action relating to the incentive.

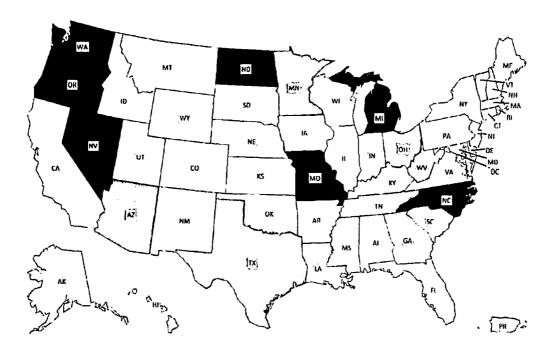


Figure 20: States Offering Data Center Incentives in December 2015 (darker shading indicates more recent adoption)





^{6/}http://www.data-centerknowledge.com/archives/2010/02/05/virginia-nc-battling-for-microsoft-data-center/

whttp://www.data.centerknowledge.com/archives/2009/07/07/how-apple-played-the-incentive-game/

⁴⁸http://www.data-centerknowledge.com/archives/2010/02/05/virginia-nc-battling-for-microsoft-data-center/

Table 14 provides additional details on the data center incentives offered by each state. This list is arranged chronologically by year of enactment or most recent revision. When one reviews this list, several things stand out:

- 2015 and 2012 were both significant years, as seven states enacted or revised their incentives in each of those years.
- Since 2012 when Virginia last revised its incentive, a third of the states offering incentives have reduced their eligibility criteria to be more attractive to smaller data centers.
- Since 2013, no state (except for Texas) has set the threshold investment for incentive eligibility higher than \$100 million.

Virginia's incentives are no longer as attractive as they were when they were last updated in 2012. Most states have established eligibility criteria for their incentives that are less restrictive than Virginia's \$150 million investment criteria to enable them to better target smaller facilities. In addition, as incentives have become more pervasive, the data center industry is becoming more sensitive to whether a state has incentives or not when making location, expansion, and equipment replacement decisions.

State	Year Enacted or Revised	Latest Version of Incentive
Michigan ⁷²	2015	As a whole the data centers in Michigan must add 400 new jobs by 2022 and a total of 1,000 new jobs by 2026
Missouri ⁷³	2015	Sales tax exemption for \$25 million in investment in three years plus ten new jobs paying 150 percent of the average state wage
Nevade ⁷⁴	2015	Partial sales and property tax reductions for ten years on \$25 million in investment, plus ten jobs paying average state wage, plus healthcare in five years, or for 20 years on \$100 million in investment plus 50 jobs paying average state wage plus health care
North Carolina ⁷⁵	2015	Sales and use tax exemption for equipment and electricity for \$75 million in investment
North Dakota ⁷⁸	2015	Sales tax exemption on equipment through 2020 for the first four data centers of 16,000 sq. ft. approved by the state
Oregon ⁷⁷	2015	Data centers exempted from central tax assessment
Washington ⁷⁸	2015	Sales and use tax exemption for 100K sq. ft. building in rural county
Arizona ⁷⁹	2013	Sales and use tax exemption for up to 20 years for \$50 million in investment within five years in the two largest counties or for \$25 million in investment within five years outside of the two largest counties
Ohio ⁸⁰	2013	Sales tax exemption on \$100 million in investment in three years plus \$1.5 million per year in payroll
Texas ⁸¹	2013	Sales and use tax exemption for \$200 million in investment and 20 jobs paying 120 percent of average local wage
Alabama ⁸²	2012	Sales and use tax exemption for ten years for up to \$200 million in investment within ten years, for 20 years for \$200 million to \$400 million in investment within ten years, or for 30 years for over \$400 million in investment within 20 years plus 20 new jobs in each category
Indiana ⁶³	2012	Property tax exemptions for \$10 million in investments in high- technology districts paying employees 125 percent of the average county wage
Louisiana ⁸⁴	2012	Single sales factor permitted for up to 40 years for approved data centers with more than 50 percent of sales outside the state
Minnesota ⁸⁵	2012	Sales tax exemption for 20 years for \$30 million in investment in four years on 25,000 sq. ft.
Nebraska ⁸⁸	2012	Complex tiered scheme of incentives beginning with a partial sales tax refund and investment and compensation credits for \$3 million in investment plus 30 new jobs paying 60 percent of the average state wage

Table 14: State Incentives Specifically for Data Centers71

⁸⁶http://www.revenue.nebraska.gov/incentiv/Summary.pdf



⁷⁰States that only offer general business incentives for which data centers could qualify for are not included in this list.

⁷⁾ This table differs from a similar table circulated by the Associated Press.

²²http://www.mlive.com/lansing-news/index.ssf/2015/12/michigan_house_senate_approve.html

⁷³http://www.missouripartnership.com/Portals/0/PDF/Data%20Center%20Sales%20Tax.pdf

⁷⁴http://www.diversilynevada.com/documents/Summary_Data_Center_Tax_Abatement_FY2016.pdf

[&]quot;http://www.ncga.state.nc.us/Sessions/2015/Bills/House/PDF/H117v7.pdf

⁷⁶http://www.nd.gov/Tax/genpubs/business-incentives.pdf?20151216184102

[&]quot;http://www.bendbulletin.com/localstate/3008035-151/data-center-bill-took-a-perilous-path-before#

⁷⁸http://dor.wa.gov/docs/pubs/incentives/taxincentivesoverview_web.pdf

[/]Phttp://www.azcommerce.com/incentives/computer-data-center-program

athttp://archives.legislature.state.oh.us/BillText130/130_SB_243_EN_N.pdf

⁸¹http://comptroller.texas.gov/taxinfo/data_centors/

⁸²http://revenue.alabama.gov/taxincentives/incentivesum.pdf

⁸³http://www.in.gov/legislative/bills/2012/SE/SE0302.1.html

^{#4}http://revenue.louisiana.gov/Publications/Isls(2012).pdf #5http://mn.gov/deed/business/linancing-business/tax-credits/data-center-credit/

w

Company Exhibit No. Witness: MRG Rebuttal Schedule 8 Page 29 of 34



State	Year Enacted or Revised	Latest Version of Incentive
South Carolina ⁸⁷	2012	Sales and electricity tax exemption for \$50 million in investment within five years and 25 jobs paying 150 percent of average
Virginia ⁸⁸	2012	Sales and use tax exemption for \$150 million in investment and 50 jobs paying 150 percent of average local wage (or 25 jobs in rural or high unemployment areas)
Wyoming ⁸⁹	2011	Sales and use tax exemption on infrastructure and computer equipment for \$5 million in investment with \$2 million in one year; sales and use tax exemption on cooling and power equipment for \$50 million in investment
Mississippi ⁹⁰	2010	Sales tax exemption for \$50 million in investment plus 50 new jobs paying 150 percent of the average state wage
Utah ⁹¹	2010	Sales and use tax exemption on equipment with at least 3 years of useful life used to operate a web search portal as described in NAICS 518112
Kentucky ⁹²	2009	Refund of taxes paid on purchase and operation of \$100 million of equipment
West Virginia ⁹³	2009	Sales and use tax exemption and 95 percent reduction in property tax no limit
lowa ⁹⁴	2007	Partial refund of sales taxes paid on power for \$1 million to \$10 million in investment in three years; partial refund of sales taxes paid on equipment and power for \$10 million to \$200 million in investment in six years; sales and property tax exemption on equipment and power for \$200 million in investment in six years
Tennessee ⁹⁵	2007	Tax credit for construction materials for \$250 million in investment and 25 jobs paying 150 percent of average state wage and 79 percent electricity tax reduction
Georgia ⁹⁶	2005	Sales and use tax exemption in any year with a \$15 million in investment in that year
New York ⁹⁷	2000	Sales and compensating use tax exemption on equipment in high-security facilities providing uninterrupted access and continuous traffic management for customers' web pages
Oklahoma ⁹⁸	1993	Sales tax refund on data processing equipment used by establishments with 80 percent annual gross revenue from outside of the state

Table 14: State Incentives Specifically for Data Centers⁷¹





⁸⁷http://sccommerce.com/sites/default/files/all/business_incentives_2012.pdf

⁸⁰ http://law.lis.virginia.gov/vacode/58.1-609.3/

⁴⁹http://wyomingbusiness.org/program/incentives/1241

⁹⁰https://www.mississippi.org/assets/incentives/sales-and-use-tax-exemption-data-centers.pdf

^{*}Ihttps://trackbill.com/bill/ut-sb61-sales-and-use-tax-exemption-for-a-web-search-portal/378574/

⁹²http://revenue.ky.gov/NR/rdonlyres/5743DCF0-C96C-4806-9CFA-55BD3E1887F3/0/KYTaxAlertOctober2009.pdf

⁹³http://www.wvcommerce.org/business/industries/data centers/default.aspx

⁹⁴http://iowascreativecorridor.com/files/Data%20Center%20Iowa%20Legislation%20Summary.pdf

⁹⁵http://treasury.state.tn.us/ecd/BD_tax_incentives.html

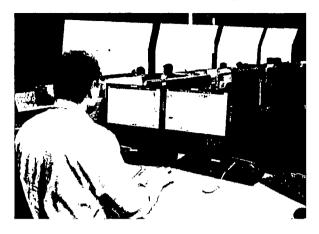
^{*}http://dor.georgia.gov/sites/dor.georgia.gov/files/related_files/document/LATP/Guide/2015%20EXEMPTION%20CHART.pdf
*/https://www.tax.ny.gov/pdf/memos/sales/m00_7s.pdf

⁹⁸http://okcommerce.gov/wp-content/uploads/2015/06/Oklahoma_Business_Incentives_and_Tax_Guide.pdf

Company Exhibit No. _____ Witness: MRG Rebuttal Schedule 8 Page 30 of 34

Data Centers Follow Incentives

Tax incentives have become a critical component of the competition between states for data centers. Moreover, as Microsoft's Boydton campus illustrates, incentives can be particularly helpful in luring data centers to less developed rural communities. In Wyoming, the least populated state in the union, Randy Bruns, director of Cheyenne LEADS, has stated that without the state's data center incentives it would be at a 4 percent to 6 percent tax disadvantage relative to Colorado, Nebraska or Utah.⁹⁹ The Wyoming incentive was instrumental in securing a \$250 million expansion of Microsoft's Cheyenne data center campus in February of 2015, bringing the company's total investment in the facility to \$750 million.



South Carolina lawmakers have also attempted to position their state to more aggressively compete in the data center market. After losing a \$450 million Facebook data center to North Carolina, South Carolina revised their data center incentive in May 2015 to lower the required amount of investment and to exempt data centers from taxes on electricity as well as sales taxes on equipment. State Representative Phyllis Henderson (R-Greenville) stated,

The main piece of this legislation is because of North Carolina. We were just losing projects right and left to them.¹⁰⁰

In addition, the competition between Virginia and North Carolina did not end with North Carolina beating out Virginia for the Apple facility in 2009, and Virginia beating out North Carolina for the Microsoft facility in 2010. In September 2015, North Carolina lowered its investment criteria for its data center incentive and provided a tax exemption for data center purchases of electricity to better compete with Virginia, and to better target multi-tenant co-location facilities that typically provide a larger number of total jobs.¹⁰¹

Most recently, the state of Michigan enacted data center incentives on December 16, 2015. Those incentives enabled Michigan to beat out New York in a competition for a new \$5 billion Switch data center in Grand Rapids. The Switch facility is expected to provide 1,000 jobs and will be the largest data center in the eastern half of the U.S. 102

Washington state's experience with data center incentives is also illustrative, but in a different way. Washington is home to Microsoft's corporate headquarters in Redmond. In December 2007, Washington's Attorney General ruled the state's data center incentives invalid. Microsoft and Yahoo immediately halted construction on data center facilities in rural Quincy, Washington, and Microsoft subsequently chose to move its Windows Azure cloud computing service to another state. 103 Facebook and Amazon also cited state and local taxes as an important consideration in their decisions to construct new data center facilities in neighboring Oregon. 104

Washington's data center incentives were legislatively re-enacted in April 2010, sparking a construction boom and up to \$2 billion in new private investment in the state. ¹⁰⁵ But, in June 2011 the incentives were allowed to lapse, which once again halted data center growth in Washington and drove a \$1 billion investment boom in nearby Oregon as Adobe, Apple, ¹⁰⁶ Fortune Data Centers ¹⁰⁷ and NetApp ¹⁰⁸ all announced that they would be building data centers there rather than Washington. In May 2012, Washington again re-enacted their data center incentives ¹⁰⁹, only to fail to reauthorize them during the 2014 legislative session ¹¹⁰. Microsoft subsequently cited that lack of reauthorization as a motivating factor in its decision to build a new \$1.1 billion data center in West Des Moines, lowa rather than Washington. ¹¹¹ Washington then re-enacted its data center incentives yet again in July 2015. ¹¹²

¹¹²http://wiredre.com/data-center-tax-incentives-extended-in-washington-state/



[&]quot;http://trib.com/news/local/putting-cheyenne-on-the-data-center-map/article_856c306f-9050-58a6-ad35-5cafb3b32e17.html

manttp://www.thestate.com/news/politics-government/article14403305.html

¹⁰¹ http://www.data-centerknowledge.com/archives/2015/10/01/north-carolina-makes-data-center-tax-breaks-easier-to-get/

[/]ahttp://www.freep.com/story/money/business/michigan/2015/11/16/data-center-switch-steelcase-grand-rapids-pyramid/75896236/

mhttp://www.data.centerknowledge.com/archives/2010/02/01/group-pushes-for-change-in-washington-state/

¹⁶⁴http://www.greenbiz.com/news/2010/05/05/states-use-tax-incentives-lure-data-centers

http://washingtonstatewire.com/blog/data-center-fumble-costs-jobs-in-washington-state-and-maybe-big-money/

tashttp://www.data-centerknowledge.com/archives/2012/02/21/apple-confirms-plans-for-oregon-data-center/

http://www.data-centerknowledge.com/archives/2011/10/21/fortune-expands-to-portland-oregon/

nttp://www.data.centerknowledge.com/archives/2011/10/17/digital-realty-to-build-netapp-facility-in-oregon/
http://washingtonstatewire.com/blog/data-center-fumble-costs-jobs-in-washington-state-and-maybe-big-money/

¹¹⁰¹¹¹http://blogs.seattletimes.com/opinionnw/2014/04/28/new-microsoft-data-center-in-iowa-offers-a-billion-clollar-losson/



Incentives Positively Impact Employment and Wages

As mentioned earlier, data center incentives do not just benefit the data center owners, operators and tenants. Incentives also benefit employees and the states and communities where the employees work and live. Compared to traditional manufacturing or large retail facilities, data center facilities do not directly employ large numbers of employees. However, when placed in the context of the general weakness of job growth in the U.S. economy in recent years, the data center industry has proven to be stronger at creating jobs than the rest of the U.S. economy. Between 2013 and 2014, total employment across all industries in the U.S. grew by 2.3 percent. ¹¹³ In contrast, employment at data centers in the U.S. grew by 4.2 percent over the same period. ¹¹⁴ In other words, between 2013 and 2014, the data center industry added jobs over 80 percent faster than the U.S. economy as a whole.

Moreover, incentives appear to be effective at encouraging employment and wage growth in states' data center sectors. As shown in Figure 21, between 2013 and 2014 data center employment in states with incentives grew at an annual rate of 5.3 percent, as compared to 3.1 percent in states without incentives - this means employment grew about 70 percent faster in states with incentives than in those without. Similarly, between 2013 and 2014 average wages in data centers in states with incentives grew at an annual rate of 6.1 percent, as compared to 4.0 percent in states without incentives - this means wages grew over 50 percent faster in states with incentives than in those without.

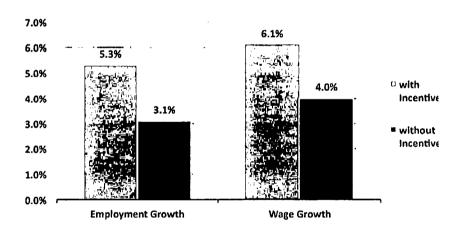
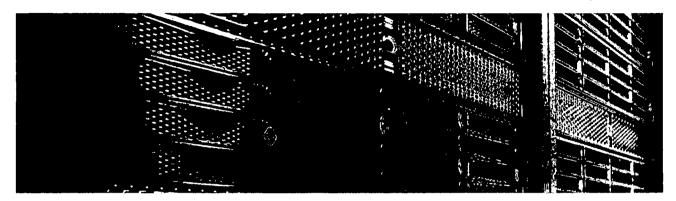


Figure 21: Employment and Wage Growth in the Data Center Sector between 2013 and 2014¹¹⁵

Witness: MRG Rebuttal Schedule 8 Page 32 of 34



CONCLUSION

Data centers are a critical part of the infrastructure that supports the modern economy, not only in the technology sector, but in advanced manufacturing, entertainment, finance, healthcare, information, retail, telecommunications, and almost every other sector of the economy as well. Although Virginia's Data Processing, Hosting, and Related Services sector is largely concentrated in Northern Virginia, it is important to realize that this sector is well represented in other areas of the Commonwealth as well. Among those other areas, is rural Mecklenburg County in Southern Virginia, home to Microsoft's \$1.3 billion data center in Mecklenburg County, the east coast hub for Microsoft's online services, and soon to be expanded to a \$1.7 billion facility.

The Data Processing, Hosting, and Related Services sector is also a very high performing sector that has insulated some Virginia localities from the "double dip" that the state experienced as a result of the "Great Recession of 2007" and the federal sequester in 2013. In the most recent four quarters, employment in this sector grew 6.7 times faster than the statewide norm across all industries, and wages, already 140 percent higher than the statewide average, grew 9.3 times faster than the statewide norm across all industries. Moreover, the pool of highly skilled workers that this industry employs also feeds the talent pipeline for other fast growing, high wage industries such as Architectural, Engineering, and Related Services; Computer Systems Design and Related Services; Management, Scientific, and Technical Consulting; Scientific Research and Development Services; and Telecommunications.

The Data Processing, Hosting, and Related Services sector is also a very capital-intensive industry, which makes it a high performer in terms of the tax revenue it provides as well. First, because that disproportionate investment in capital equipment translates into a disproportionate amount of property tax revenue, by far the largest source of revenue for Virginia localities. As an example, our analysis has shown that the benefit/cost ratio for this sector was 9.5 in Loudoun County in 2014, and 4.3 in Prince William County. This means that for every \$1.00 in county expenditures that the Data Processing, Hosting, and Related Services sector was responsible for generating in 2014, it provided approximately \$9.50 in tax revenue to Loudoun County, and approximately \$4.30 in tax revenue to Prince William County.

Second, because as a very capital-intensive industry the Data Processing, Hosting, and Related Services sector pays unusually high wages - \$105,942 a year on average in 2014 - and this has a disproportionate impact on state income tax revenue, by far the largest source of revenue for Virginia state government. Importantly, as we have also demonstrated, this disproportionate fiscal impact places downward pressure on Virginia tax rates, thereby improving the state's overall business climate, which has suffered in recent years causing Virginia to fall from its traditional top slot in most national business climate indexes.

Our analysis has also shown that the Data Processing, Hosting, and Related Services sector has a large overall economic impact. Statewide, we estimate that total economic impact was approximately 36,043 jobs, \$2.7 billion in wages, \$8.6 billion in economic output, and \$298.9 million in state and local tax revenue in 2014. At a regional level, in 2014 the Data Processing, Hosting, and Related Services sector was responsible for approximately: 1) 21,995 jobs, \$2.0 billion in wages, and \$5.7 billion in economic output in Northern Virginia; 2) 3,974 jobs, \$225.2 million in wages, and \$885.9 million in economic output in Central Virginia; 3) 3,333 jobs, \$185.9 million in wages, and \$731.7 million in economic output in Hampton Roads; and 4) 1,002 jobs, \$40.8 million in wages, and \$196.0 million in economic output in Southern Virginia.







Finally, our analysis has shown that investment decisions in the Data Processing, Hosting, and Related Services sector are increasingly sensitive to state tax regimes. In 2009, in response to the loss of a \$1 billion Apple data center to North Carolina, Virginia enacted a sales and use tax exemption for data center purchases of computer equipment. This exemption is much like the sales and use tax exemption Virginia has extended to the similarly capital-intensive manufacturing sector for many years. However, the exemption for data centers is scheduled to sunset in 2020.

When Virginia enacted its data center sales and use tax exemption in 2009, only seven other states offered such incentives, today over half of all states do. Moreover, seven of those 27 data center incentives were enacted in 2015 alone and most states now offer incentives that are more competitive than Virginia's. If Virginia is to avoid the fate of Washington state, home of Microsoft, which has seen billions of dollars of data center investment migrate to neighboring Oregon because of the uncertainty generated by its "off again on again off again" approach to data center incentives, it will need to maintain its competitive position in the data center market.





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WITNESS REBUTTAL TESTIMONY SUMMARY

Witness: Harrison S. Potter

<u>Title</u>: Engineer III – Distribution System Planning

Summary:

Company Witness Harrison S. Potter addresses respondent and Staff testimony about the need for the proposed Project, and specifically how and when the Company's current distribution system would be inadequate for anticipated load growth.

Mr. Potter first explains that the Company and Staff are in agreement that a distribution solution is not feasible to serve the expected load growth in the Haymarket area. He next outlines the current state of the transmission and distribution system in the area, and details how the addition of the proposed Haymarket Substation, upon operation, will benefit all customers in the Haymarket Load Area.

Finally, Company Witness Potter details when existing distribution capacity will be unable to serve anticipated load growth, and how the planned energization of the Haymarket Substation will serve that growth.

REBUTTAL TESTIMONY OF HARRISON S. POTTER ON BEHALF OF

VIRGINIA ELECTRIC AND POWER COMPANY BEFORE THE

STATE CORPORATION COMMISSION OF VIRGINIA CASE NO. PUE-2015-00107

1	Q.	Please state your name, business address and position with Virginia Electric and
2		Power Company ("Dominion Virginia Power" or the "Company").
3	A.	My name is Harrison S. Potter, and I am an Engineer III in the Distribution System
4		Planning Department of the Company. My business address is 701 East Cary Street,
5		Richmond, Virginia 23219.
6	Q.	Have you previously submitted testimony in this proceeding?
7	A.	Yes. I submitted pre-filed direct testimony on behalf of Dominion Virginia Power to the
8		State Corporation Commission of Virginia ("Commission") in this proceeding on
9		November 6, 2015.
10	Q.	What is the purpose of your rebuttal testimony?
11	A.	The purpose of my rebuttal testimony is to address respondent testimony about the need
12		for the proposed Project, and specifically how and when the Company's current
13		distribution system would be inadequate for anticipated load growth. I will also respond
14		to the testimony and reports filed by Commission Staff ("Staff") on June 2, 2016.
15	Q.	Are you sponsoring any exhibits as part of your rebuttal testimony?
16	A.	Yes. Company Exhibit No, HSP, consisting of Rebuttal Schedule 1, was prepared
17		under my direction and supervision, and is accurate and complete to the best of my
18	•	knowledge and belief.

1	Q.	James Napoli, testifying on behalf of Somerset Crossing Home Owners Association,
2		Inc. ("Somerset"), questions the need for the proposed Project and stated that there
3		is no evidence the proposed transmission line is necessary in order for Prince
4		William County to continue to have reliable electric service. (Amended Napoli at 6.)
5		Can you please outline the current state of the transmission and distribution system
6		in the area of the proposed Project?
7	A.	Yes. The Haymarket Load Area (which encompasses the area west of Route 29 and
8		paralleling Route 50 and Heathcote Boulevard as illustrated on my Rebuttal Schedule 1)
9		is currently served by three 34.5 kV distribution circuits ("DC"), sourced by the
10		Company's Gainesville substation, which is located approximately six miles to the east of
11		the Project. Of these three circuits, DC#379 currently serves residential and commercial
12		load along Heathcote Boulevard; DC#695 serves residential and commercial load along
13		State Route ("SR") 55; and DC#378 serves residential and commercial load along U.S.
14		29 with a overbuild section along SR 55. DC#378, DC#379, and DC#695 are all serving
15		as bridging circuits to data center facilities that at full ramp will load the circuits to their
16		thermal operating limits.
17		The arrangement described above with load centers at the end of fully loaded distribution
18		circuits complicates the ability for the Company to effectively operate its system.
19		Throughout the year, the Company is required to switch load from one source to another
20		during planned and unplanned outage events. During unplanned outage events such as a
21		car hitting a pole, fallen trees, or lightning, the Company typically operates in a "switch-
22		before-fix" method to restore as many customers as possible in a timely manner. In a
23		"switch-before-fix" method, the Company switches load from the affected circuit to an

adjacent circuit with capacity to quickly restore lights to as many customers as possible.

Unfortunately, with the three DC's loaded to capacity, which will occur around 2017, the Company will have to utilize the "fix-before-restore" method, which will increase the timeframe of each service outage. With a "fix-before-restore" method, the Company is forced to repair the damaged circuit before customer service can be restored because adjacent circuits do not have capacity to handle additional load. Moreover, in the event the Company needs to take planned outages for maintenance operations, connecting new customers, or other purposes, existing customers in the Haymarket Load Area may experience extended outage times due to the lack of available capacity on the circuits in the load area that they otherwise would have not experienced.

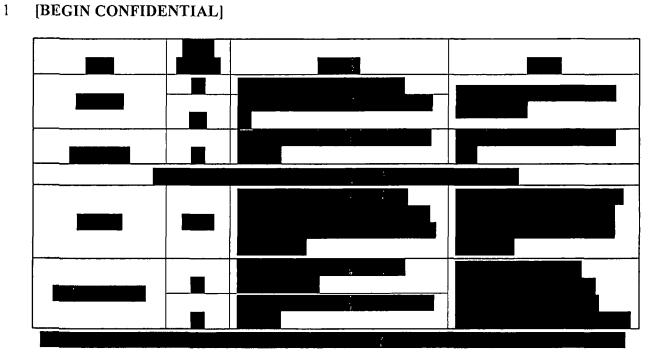
Q. What load growth is the Company expecting and when?

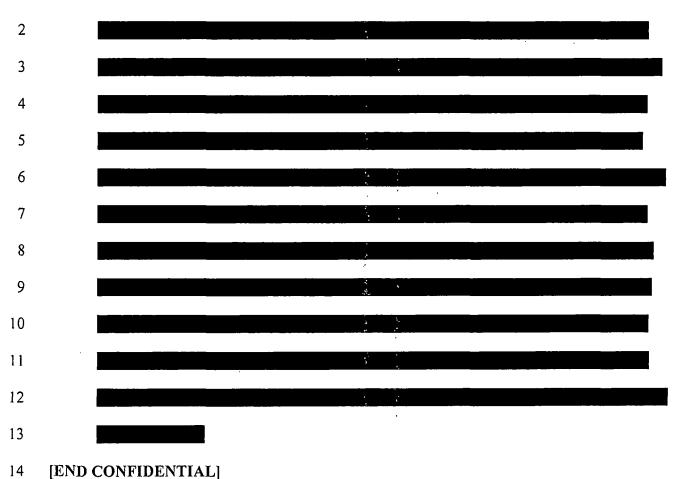
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The Company expects to see typical non-data center load growth, block load growth from an existing data center facility as well as an anticipated ramp-schedule for the three new buildings on the Customer's data center campus ("Customer Campus"). The below Confidential table summarizes the Company's understanding of the anticipated ramp schedule as communicated by the Customer for the load at the Customer's Campus, as well as the additional customer load the Company anticipates serving through the proposed Haymarket Substation. As stated in the Company's Appendix, the total load at the Customer's Campus is projected to be approximately 120 MVA, consisting of three buildings. The proposed new electric transmission facilities must be in service by June of 2018 to serve the Customer's new development.

[BEGIN CONFIDENTIAL]





[END CONFIDENTIAL]

1	Q.	Besides the Customer's load, what other existing local load will be served
2		immediately upon the operation of the Haymarket Substation?
3	A.	Upon operation of the substation, the Company will install an additional 34.5 kV DC in
4		Haymarket Substation that will feed Company distribution customer's west of Route 15.
5		The new DC will feed 456 customers including Haymarket Village Center and the
6		Novant Health Haymarket Medical Center for a total of approximately 5.5 MVA as is
7		reflected above.
8		While the new DC will regularly serve all customers west of Route 15, upon operation of
9		the substation the Company will install two automated loop schemes or restoration
10		schemes that will restore commercial and residential load (over 2,800 customers)
11		currently being served by DC#379 and DC#695 in under two minutes during certain
12		outage scenarios. These schemes will decrease the outage time per event and give the
13		Company operational flexibility.
14		These initial plans are not meant to imply that the Company will not leverage Haymarket
15		Substation to serve customers east of Route 15. Future load growth close to Gainesville
16		Substation may require the Company to serve customers near U.S. 29 from Haymarket
17		Substation. The Company has additional room in Haymarket Substation to install a third
18		230-34.5kV 84MVA transformer to support future load growth.
19	Q.	What are the circumstances in which a new transformer would be added to the
20		Haymarket Substation?
21	A.	The Company would add a third transformer to the Haymarket Substation if new load
22		growth in the Haymarket Load Area requires additional transformer capacity, the

Company is no longer able to support the contingency loss of either Haymarket 84 MVA
230-34.5kV transformer from off-site bridging circuits, or other operational reasons
deemed necessary to ensure reliable service.

Q. Could Dominion Virginia Power serve the load growth anticipated in the Haymarket Load Area without the proposed Project?

Q.

A.

A.

No. The existing distribution infrastructure is not adequate to serve a block load of this magnitude from the Company's existing Gainesville Substation. Specifically, DC#379 and DC#695 currently tie outside of an existing data center block load that is currently ramping up and is effectively using all of the remaining capacity that these two circuits can provide. Additionally, DC#378 will feed the first new building on the Customer's Campus, effectively using all of the remaining capacity of this circuit. As I indicated above, the site plan includes the construction of two additional buildings, and the Company's distribution infrastructure simply does not have the capacity to serve these additional buildings.

On page 6 of his report, Staff Witness Neil Joshipura indicates, "Staff agrees with the Company that a distribution solution is not feasible due to the large amount of projected load to be supplied to the Customer." Do you have any comments?

Yes. Aside from the fact that we have reached the same conclusion regarding need, I would like to point out that Mr. Joshipura also notes earlier in the Staff Report, on page 5, that, "According to the Company, the Haymarket Substation would serve surrounding area load ("Haymarket Load Area") in addition to the [Customer's] Campus." He later acknowledges that the three existing distribution circuits presently in place to serve the Customer's Campus "would remain in place to serve existing load, future load, and

provide contingency support for customers within the Haymarket Load Area, including the [Customer's] Campus."

However, to clarify, the three distribution circuits that are to remain in place would be sectionalized from the Gainesville Substation source via circuit-ties, with a portion of their existing load being re-fed from the Haymarket Substation. This means that the length of the Gainesville circuits will be reduced, thereby reducing exposure to environmental detriments for the remaining customers, while the customers being fed from the new Haymarket circuits will also benefit from a closer source and reduced exposure. The circuit-ties would be used to provide contingency support for the loss of either the Gainesville or Haymarket Substations. These details are important to mention since they may not have been readily apparent in the Company's Application and supporting materials, but clearly further evidence that the proposed Haymarket Substation will be used to serve more than just one customer and will provide reliability benefits to all customers in the Haymarket Load Area.

15 Q. Does this conclude your rebuttal testimony?

16 A. Yes, it does.

