Virginia State Corporation Commission
eFiling CASE Document Cover Sheet

Case Number (if already assigned) PUR-2020-00051

Case Name (if known) Ex Parte Electrification of Motor Vehicles

Document Type CMTP

Document Description Summary Comments of Generation180 and the Environmental Law and Community Engagement Clinic

Total Number of Pages 22

Submission ID 19122

eFiling Date Stamp 6/23/2020 10:17:16AM

UNIVERSITY of VIRGINIA

SCHOOL of LAW

Cale Jaffe
Associate Professor of Law, General Faculty
Director, Environmental Law & Community Engagement Clinic

June 23, 2020

VIA ELECTRONIC FILING ONLY

Mr. Joel H. Peck, Clerk
c/o Document Control Center
State Corporation Commission
Tyler Building – First Floor
1300 East Main Street
Richmond, Virginia 23219

RE: Ex Parte: Electrification of Motor Vehicles
Case No. PUR-2020-00051

Dear Mr. Peck:

Enclosed for filing in the above-captioned proceeding are the **Comments of Generation180 and the Environmental Law and Community Engagement Clinic**. This document is being filed in a public version only and is being filed electronically on the Commission's Electronic Document Filing system. If you have any questions regarding this filing, please contact me at (434) 924-4776, or via email at cjaffe@law.virginia.edu.

Regards,

Cale Jaffe
Associate Professor of Law, General Faculty
Director, Environmental Law &
Community Engagement Clinic
University of Virginia School of Law

cc: Wendy Philleo, Generation180
Parties on Service List
Commission Staff

580 Massie Road, Charlottesville, VA 22903-1738 | P 434.924.4776 | E cjaffe@law.virginia.edu
www.law.virginia.edu/jaffe

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION

COMMONWEALTH OF VIRGINIA, *ex rel.*	)	
	)	
STATE CORPORATION COMMISSION	)	
	)	CASE NO. PUR-2020-00051
	)	
	)	
Ex Parte: Electrification of Motor Vehicles	)	

COMMENTS OF GENERATION180 AND
THE ENVIRONMENTAL LAW AND COMMUNITY ENGAGEMENT CLINIC

I. **Introduction.**

Pursuant to the Commission's Order of March 24, 2020, Generation180 and the Environmental Law and Community Engagement Clinic at the University of Virginia School of Law file the following comments on the growth in electric vehicles ("EVs") and implications for the electricity grid in Virginia. We commend the Commission for taking a proactive approach to this issue and in helping prepare for the ongoing boom in the EV market.

Generation180 is a national nonprofit organization, headquartered in Charlottesville, Virginia, that seeks to inspire and equip individuals to take action on clean energy, including the advancement of EV adoption. The organization's "Electrify Your Ride" campaign (https://generation180.org/pathways/electrify-your-ride/), in collaboration with the Green Energy Consumers Alliance and Virginia Clean Cities, educates everyday consumers on the benefits of electric vehicles. The Environmental Law and Community Engagement Clinic at the University of Virginia School of Law combines legal teaching with opportunities for interdisciplinary study, clinical experience, and scholarly inquiry. It is part of the University of Virginia's Program in Law, Communities, and the Environment ("PLACE").

Our comments respond to Questions 1-9, 12, 14 and 16 from the Commission's Order, as follows:

- First, we provide data on the rate of electric vehicle adoption, noting that EVs represent an important and quickly growing segment of the Virginia transportation system.

- Second, we explain how increased adoption of EVs will help the Commonwealth meet its obligations under the Virginia Clean Economy Act ("VCEA"). *See* 2020 Va. Acts 1193-94 (Apr. 11, 2020). Electric vehicles have an important role to play in the VCEA, as expansion of Advanced Metering Infrastructure ("AMI") and the roll out of time-of-use rates will allow EVs to take greater advantage of otherwise dormant grid capacity during off-peak hours. In addition, the dynamic charging capability of EVs allows for capture and storage of otherwise non-dispatchable, intermittent renewable generation. In the future, technologies such as vehicle-to-grid ("V2G") integration may allow EVs to act as a distributed energy storage network that can be drawn upon to alleviate peak demand.

- Third, properly structured incentives for increased adoption of electric vehicles in Virginia will *not* result in cost-shifting to non-electric vehicle owners. Even more, EVs will likely improve grid stability and provide documentable *benefits* to non-EV users. Because EVs can be charged during off-peak hours, broader EV adoption can help stabilize loads and minimize the inefficient spin-up and wind-down of excess capacity.

In sum, the expansion of electric vehicles in Virginia has the potential to accelerate the transition to clean energy under the VCEA while at the same time providing system-wide benefits to non-EV owners. There is no need to fear widespread growth in the EV marketplace. To the contrary, EVs provide value for all Virginians that should be celebrated.

II. Discussion.

A. Existing Development and Projected EV Growth in Virginia; Response to Questions 1 & 2 from the Commission's Order.

In 2019, Generation180 retained a national market research firm to conduct a survey of Virginians to gather data regarding public attitudes about electric vehicles and Virginians' interest in and likelihood of purchasing an electric vehicle. *See* Generation180, *Survey Report: 2019 Electric Vehicles & Virginia Consumer Survey* (included as Attachment A). The survey, which targeted respondents in Northern Virginia, Richmond, Roanoke, and Charlottesville, found that 45% of all respondents were "somewhat" or "very" likely to consider purchasing an electric vehicle within the next two years, but that an even greater percentage, 73%, had a "somewhat" or "very" positive view of electric vehicles generally. The takeaway from these initial data points is clear: the Virginia marketplace is primed for a rapid expansion in EVs.

The data generated in this Generation180 survey is corroborated by electric vehicle ownership and sales data, which by the close of 2017 already accounted for 11,000 registered vehicles in Virginia. *See* 2018 Va. Energy Plan, at 39 (citing data from Va. Dep't of Motor Vehicles). And ownership numbers are growing at an exponential rate. One data set reports that 6,375 100% Battery Electric Vehicles ("BEVs") and Plug-in Hybrid Electric Vehicles ("PHEVs") were sold in the Commonwealth in 2018, with other reports documenting state plug-in vehicle registrations up to 16,882 by January 1, 2019. *See* EVAdoption, *EV Market Share by*

State, https://evadoption.com/ev-market-share/ev-market-share-state/ (last visited June 19, 2020); EVHub, *State EV Registration Data Dashboard*, https://www.atlasevhub.com/materials/state-ev-registration-data/ (filtered for Virginia data) (last visited June 19, 2020). Additional sales data collected by Generation180 (included as Attachment B) finds that electric vehicle sales in Virginia have grown at an astonishingly high average rate—39% per year—over the last ten years, as shown in Figures 1 and 2, below:

Figure 1: Virginia Electric Vehicle Growth Rate (2009-2019)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	10-Year Avg.
Change in registrations to prior year (%)	24%	20%	14%	(-1%)	72%	46%	28%	79%	31%	65%	56%	39%
Change in registrations to prior year (rate)	1.24	1.20	1.14	(0.99)	1.72	1.46	1.28	1.79	1.31	1.65	1.56	1.40

Figure 2: Virginia Electric Vehicle Registrations (2008 to 2019)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Vehicle Registrations	435	538	643	735	729	1,257	1,837	2,347	4,208	5,518	9,082	14,197

Data was compiled by Generation180 as provided by Virginia DMW and as reported to Virginia DEQ. *See* IHS Markit Industry Report, available at https://ihsmarkit.com/industry/automotive.html (last visited June 22, 2020).

To support the increased ownership of electric vehicles in Virginia, a robust charging infrastructure is in the process of being developed. As of 2018, Virginia boasted 62 direct-current "fast charger" ("DC Fast Charging," "DCFC," or "Level 3") stations, and 396 Level 2 chargers (operating at 240 volts) across the state. *See* 2018 Va. Energy Plan, at 39-40. As part of the U.S. Justice Department's nationwide settlement following the Volkswagen diesel emissions scandal, the Virginia Department of Environmental Quality ("DEQ") has overseen a trust of more than $93 million. *See* Volkswagen Settlement Information, Va. Dep't of Envtl. Quality, available at https://www.deq.virginia.gov/Programs/Air/VWMitigation.aspx (2020).

In dispersing the funds, DEQ has awarded a $14 million contract to the electric-vehicle charging company EVgo (https://www.evgo.com/) to develop a statewide public charging network. DEQ and EVgo have sought to ensure charging accessibility across the Commonwealth, with a goal of increasing the number of DC fast charger stations by more than 370% and Level 2 stations by more than 30%, by 2021. (It remains to be seen whether the coronavirus pandemic will impact the pace of this rollout.) According to the 2018 Virginia Energy Plan, once this EV-charging infrastructure is completed, 95% of Virginia will be within thirty miles of a DC fast charger. *See* 2018 Va. Energy Plan, at 40. Together, the data here represent compelling evidence that electric vehicles are an important and growing segment within the Virginia transportation sector, and that work is already under way through public-private partnerships to prepare for their expanded role in the marketplace.

B. Adoption of EVs Can Help Meet Targets in the Virginia Clean Economy Act; Response to Questions 3, 4, 6-10, and 12 from the Commission's Order.

The Commonwealth of Virginia will need to meet its commitments under the VCEA—moving to a zero-carbon electricity grid by 2045 in Dominion Energy's service territory and 2050 in Appalachian Power's service territory—while simultaneously accommodating increased adoption of electric vehicles on the PJM system. Depending on how Virginia integrates EVs onto the grid, the new technology may actually *help* Virginia achieve the VCEA targets because:

1) AMI technology and time-of-use rates will allow EVs to take advantage of dormant grid capacity during off-peak hours, preventing the need for increased total capacity;

2) The dynamic charging capability of EVs allows for capture and storage of otherwise intermittent, non-dispatchable renewable generation sources like wind and solar; and

3) Emerging technologies such as vehicle-to-grid (V2G) integration will allow EVs to act as a distributed energy storage network that can be drawn upon to alleviate peak demand.

As the Commission is well-aware, PJM Interconnection requires utilities within its system to maintain a reserve margin to ensure grid reliability. For the 2020/2021 delivery year, that margin is 15.5%. *See* 2019 PJM Reserve Requirement Study (Oct. 8, 2019). Reserve margins are calculated based on forecasts of peak demand, which occur during only a handful of hours each day. *See, e.g.*, U.S. Dep't of Energy, Energy Info. Admin., *U.S. Hourly Electric Grid Monitor* (Feb. 21, 2020) (documenting average hourly electric load during a typical day for different regions of the country), https://www.eia.gov/todayinenergy/detail.php?id=42915. Throughout the remainder of the day, especially in the summer months, the grid necessarily experiences excess capacity relative to peak, in addition to excess capacity intentionally installed through the reserve margin. *See id.* Electric vehicles can charge during these off-peak hours when the grid has excess capacity, helping to stabilize or flatten peak loads. In this way, electric vehicles can help delay the need for new increased capacity and costly generation infrastructure.

Research by the Union of Concerned Scientists ("UCS") has explored how EVs can be integrated into the grid without requiring increases in generation capacity. *See* Mike Jacobs & Pete O'Connor, *Charging Smart: Drivers and Utilities Can Both Benefit From Well-Integrated*

Electric Vehicles and Clean Energy (May 2017), https://www.ucsusa.org/resources/charging-smart. The UCS modeled the impacts of smart charging using the Regional Energy Deployment System ("ReEDS"), a long-term capacity-expansion model for the deployment of electric power generation technologies.[1] The authors modeled varying levels of EV adoption in the United States and explored the grid effects of unmanaged charging versus a system of proactively managed charging. When EV charging was unmanaged, UCS researchers found that the loads could increase at peak demand, *but under a managed charging system*—where EVs charged during off-peak or high-renewable hours—there was *no increase to peak demand and no new natural gas generation capacity* was necessary to accommodate EV integration. The UCS conclusions held up under even the most aggressive EV-adoption models.

These findings are buttressed by earlier research from the Rocky Mountain Institute ("RMI"). *See* Garrett Fitzgerald, Chris Nelder, & James Newcomb, *Electric Vehicles as Distributed Energy Resources* (2016), https://rmi.org/wp-content/uploads/2017/04/RMI_Electric_Vehicles_as_DERs_Final_V2.pdf. The RMI found that even in EV adoption scenarios where unmanaged charging could increase peak demand by up to 19%, when the charging is appropriately managed, the increase in peak demand (and required generation capacity) can be reduced to zero. Still other research indicates that if as many as 5 million EVs were newly registered, smart charging that takes advantage of non-peak hours' excess capacity could accommodate the EVs without any increased generation capacity or unserved load. *See* Julia K.Szinai *et al.*, *Reduced Grid Operating Costs and Renewable Energy*

[1] Regional Energy Deployment System ("ReEDS") of the National Renewable Energy Laboratory (NREL). ReEDS is NREL's flagship capacity planning model for the power sector. It simulates the evolution of the bulk power system—generation and transmission—by calculating the cost-optimal mix of technologies to meet demand requirements in two-year increments out to 2050. These simulations provide valuable insight into grid capacity in the present and near future. *See* Regional Energy Deployment System Model, http://www.nrel.gov/analysis/reeds.

Curtailment With Electric Vehicle Charge Management, ENERGY POLICY (Vol. 136, Jan. 2020), https://www.sciencedirect.com/science/article/pii/S030142151930638X.

Charging in off-peak hours can be incentivized through deployment of AMI technology and time-of-use rates. Both Dominion Energy and Appalachian Power currently employ time-of-use rates for electric vehicle owners. *See* Schedule EV, Residential Electric Vehicle Charging (Experimental), Dominion Energy (Apr. 1, 2019); Va. S.C.C. Tariff No. 25, Sheet No. 26-1, Schedule PEV – Experimental, Appalachian Power Co. (Sep. 12, 2019). Dominion Energy, in its most recent demand-side management docket, has proposed additional programs for managing EV-ownership and home charging, including the ability for the utility to remotely reduce EV load "during times of peak system demand throughout the year." *See* Michael Hubbard, S.C.C. Testimony in Case No. PUR-2019-00201, at 16-17. And accelerating the transition to off-peak charging will be aided by the fact that more than 80% of EV charging occurs at home. *See* U.S. Dep't of Energy, Office of Energy Efficiency & Renewable Energy, *Charging at Home,* https://www.energy.gov/eere/electricvehicles/charging-home (last visited June 22, 2020). Electric vehicle owners are already reacting positively to time-of-use incentives according to data collected in a recent Vermont Electric Report. *See* Report to the Vt. State Legislature, *Promoting the Ownership and Use of Electric Vehicles in the State of Vermont*, Vt. Pub. Util. Comm'n (Jun. 27, 2019); *see also* Norma Hutchinson & Lori Bird, *Using Renewables for Electric Vehicle Demand: A Review of Utility Program Designs & Implementation Strategies*, World Res. Inst. (Nov. 2019).

Not only can the grid accommodate the integration of large numbers of electric vehicles, but grid efficiency and capacity might be improved through deployment of V2G technology. V2G seeks to draw upon EV batteries when not otherwise in use to supply power to the grid and leverage EVs as electricity reserves. A proof-of-concept test on V2G technology was conducted more than a decade ago in PJM by researchers at the University of Delaware. *See* Doug Brunner *et al.*, *A Test of Vehicle-to-Grid (V2G) for Energy Storage and Frequency Regulation in the PJM System*, University of Delaware (Jan. 2009), https://www1.udel.edu/V2G/resources/test-v2g-in-pjm-jan09. More legal analysis and practical engineering are warranted on the opportunity to create a decentralized energy storage system through V2G systems. *See* Matthew Hutton & Thomas Hutton, *Legal and Regulatory Impediments to Vehicle-to-Grid Aggregation*, 36 WM. & MARY ENVTL. L. & POL'Y REV. 337 (2012) (noting questions with FERC regulations, issues of EV battery warranties, etc.).

C. Greater EV Adoption Will Not Shift Costs to Non-Electric Vehicle Owners; Response to Questions 5, 14, and 16 from the Commission's Order.

Widespread EV adoption will not have detrimental effects on non-EV owners for several reasons. First, and most obviously, EV owners will pay for the additional electricity they consume under current rates. Indeed, the introduction of a new consumer electronic product does not generally raise concerns of cost-shifting for the simple and obvious reason that the "early adopters" of the technology pay for the electricity consume. That was true with the popularization of microwave ovens in the 1970s, personal computers in the 1980s, and flat screen TVs in the 1990s. In this respect, EVs are no different.

Even more, EVs can provide unique *benefits* to non-EV users. This is true because increased EV adoption can result in more stable loads on the electric grid throughout the day. As stated above, utility capital investments are made based on peak demand forecasts and a utility's total capital is not actively generating electricity at all times. *See* 2019 PJM Reserve Requirement Study (Oct. 8, 2019). As a result, utilities are bringing power-generation plants on- and off-line throughout the day. As generation units spin-up and wind-down, they operate inefficiently relative to their steady-state operating conditions. *See* Mike Jacobs & Pete O'Connor, *Charging Smart: Drivers and Utilities Can Both Benefit From Well-Integrated Electric Vehicles and Clean Energy* (May 2017), https://www.ucsusa.org/resources/charging-smart. This inefficiency results in increased costs for electricity customers. Electric vehicle charging represents a flexible grid load that can be used to help flatten the electric demand curve, making the system more efficient and cost-effective. Most importantly, when electric vehicles eliminate these inefficiencies, the benefits are dispersed across the entire grid. The UCS research referenced earlier, which modeled EV adoption and grid effects, found that in scenarios of high EV adoption and well-managed charging, the grid experienced *lower* average electricity prices by 0.4%. *See* Jacobs, at 20.

These findings have been corroborated by Synapse Energy Economics, a nationally respected firm whose clients have included the U.S. Department of Energy and at least eleven different public service commissions at the state level. *See* Synapse Energy Economics, *Clients: Federal Government*, https://www.synapse-energy.com/about-us/clients/federal-government (last visited June 22, 2020); Synapse Energy Economics, *Clients: State Government*, https://www.synapse-energy.com/about-us/clients/state-government (last visited June 22, 2020). In a 2018 report focused on EVs in Pennsylvania, Synapse found that if EV charging occurs when the grid is underutilized, utility revenues will increase without any commensurate increases in cost (since the generation capacity already exists). *See* Melissa Whited, *et al.*, *Driving Transportation Electrification Forward in Pennsylvania: Considerations for Effective Transportation Electrification Ratemaking* (Sept. 26, 2018), http://www.synapse-energy.com/sites/default/files/PA-EV-Rates-Report-18-021.pdf. These savings can and should be dispersed as a benefit to all customers regardless of whether that customer owns an EV.

III. Conclusion.

Generation180 and the Environmental Law and Community Engagement Clinic commend the Commission for its proactive efforts in preparing for an expansion in electric vehicle adoption. Electric vehicles are already an important sector of the Virginia transportation industry, and their value will grow exponentially over the coming years. With effective charging strategies, the transition to electric vehicles can help Virginia meet its obligations under the VCEA, help avoid the construction of new carbon-emitting generation resources, and provide benefits for all ratepayers including non-EV owners.

Respectfully Submitted,

Cale Jaffe (VSB #65581)[2]
Environmental Law and Community Engagement Clinic
University of Virginia School of Law
580 Massie Road
Charlottesville, VA 22903
Tel: (434) 924-4776
cjaffe@law.virginia.edu

Wendy Philleo
Executive Director, Generation180
107 1st Street South, Suite A
Charlottesville, VA 22902

DATED: June 23, 2020

[2] Edward Dallin Seguine, University of Virginia Law, Class of 2022, contributed significantly to the research and writing of these comments.

Attachment A

Generation180, *Survey Report:*

2019 Electric Vehicles & Virginia Consumer Survey

Generation180

Electrify Your Ride VA

Survey Report: 2019 Electric Vehicles & Virginia Consumer Survey

Overview

This report highlights the key findings from a survey designed to explore perceptions of electric vehicles among Virginia residents. This survey was conducted online from August 23–27, 2019, using a sample and platform provided by the national market research firm Dynata. The following analysis is based on a sample of 325 Virginians age 25 and older with college degrees and household incomes >$75,000/year, and targeted residents of Fairfax County (144 responses / 44%), Richmond metro area (101 responses / 31%), Roanoke metro area (63 responses / 19%), and Charlottesville metro area (17 responses / 5%), and has a 95% confidence level and a margin of error +/- 5.5%. These demographic criteria were selected to roughly correspond with that of potential EV buyers (according to recent national data). Survey analysis was conducted by an independent researcher specializing in environmental science at the University of Virginia.

Key Findings at a Glance

The survey reveals a number of findings of interest to parties with direct or indirect interest in driving the electric vehicle market forward and electrifying Virginia's transportation sector:

- **Nearly three-quarters of respondents had a positive view of electric vehicles.** When asked, "Given what you know, what is your perception of EVs?", 73% responded as having a "somewhat" or "very" positive view of electric vehicles.
- **45% of respondents would be likely to consider buying an EV.** 45% responded "somewhat" or "very" likely (assuming they were in the market for a new car within the next two years).
- **Support for Virginia's transition from fossil fuels to clean energy is strong.** When asked, "How important is it to you that Virginia reduce its dependence on fossil fuels and transition to clean energy?", 73% of respondents said it was "somewhat" or "very" important.
- **Similarly, nearly three-quarters of these Virginians support state-level EV incentives.** 73% of respondents "strongly support" or "support" Virginia offering an EV incentive.
- **Savings on fueling costs is the biggest motivator to purchasing an EV.** Of the benefits presented, "savings on gasoline costs" ranked #1, with 82% of respondents reporting it would make them "much more" or "somewhat more" likely to purchase an electric vehicle. "Better for the environment" and "ability to apply for a tax credit" were both cited as the second highest benefits to purchasing an EV at 70%.
- **Availability/proximity of charging stations and higher up-front costs,** at 70% and 62% respectively, are perceived as the top two barriers to purchasing an electric vehicle. This highlights the opportunity for public education around: 1) the range of the latest EV models and prevalence of home-charging, and 2) the lower cost of ownership of new EV models.

Topline Results

Q1. Do you currently lease or own an electric vehicle or plug-in hybrid vehicle?

- Yes 9.2%
- No 90.7%

Q2. How much have you seen, read, or heard about electric vehicles?

- A lot 17.8%
- Some 53.5%
- Not much 26.2%
- Nothing at all 2.5%

Q3. Given what you know about electric vehicles, what perception do you have of them?

- Very positive 28.6%
- Somewhat positive 44%
- Somewhat negative 13.2%
- Very negative 3.4%
- Neutral 10.8%

Q4. Assuming you were in the market for a new car within the next two years or so, how likely would you be to consider buying or leasing a plug-in electric vehicle?

- Very likely 16.3%
- Somewhat likely 28.6%
- Not very likely 30.8%
- Not at all likely 20.3%
- Neutral 4.0%

Q5_1 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Better for the environment**

- Much more likely 29.5%
- Somewhat more likely 40.3%
- No difference 26.2%
- Somewhat less likely 1.5%
- Much less likely 2.5%

Q5_2 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Savings on gasoline costs**

- Much more likely 38.2%
- Somewhat more likely 44.0%
- No difference 16.9%

- Somewhat less likely 0.3%
- Much less likely 0.6%

Q5_3 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Convenience of re-powering**

- Much more likely...20.3%
- Somewhat more likely...32.0%
- No difference 23.7%
- Somewhat less likely 14.8%
- Much less likely 9.2%

Q5_4 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Ability to apply for tax credit**

- Much more likely... 25.8%
- Somewhat more likely...44.3%
- No difference 26.8%
- Somewhat less likely 1.8%
- Much less likely 1.2%

Q5_5 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Quantity of car choices across electric car models**

- Much more likely..17.5%
- Somewhat more likely...32.4%
- No difference 34.3%
- Somewhat less likely 10.8%
- Much less likely 5.0%

Q5_6 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Unavailability or distance of charging stations**

- Much more likely...7.4%
- Somewhat more likely...9.5%
- No difference 12.9%
- Somewhat less likely 34.5%
- Much less likely 35.7%

Q5_7 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Duration of recharging**

- Much more likely...9.2%
- Somewhat more likely... 14.5%
- No difference 20.6%
- Somewhat less likely 37.5%
- Much less likely 18.2%

Q5_8 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Higher up-front car costs**

- Much more likely..4.9%
- Somewhat more likely..9.2%
- No difference 23.7%
- Somewhat less likely 38.2%
- Much less likely 24.0%

Q5_9 Do each of the following factors make you more likely, less likely, or make no difference at all when thinking about purchasing an electric vehicle? - **Fewer model options compared to gas-powered cars**

- Much more likely.. 3.1%
- Somewhat more likely.. 7.1%
- No difference 33.2%
- Somewhat less likely 38.5%
- Much less likely 18.2%

Q6. As you may know, some states offer incentives for buyers and leasers of electric vehicles. Do you support or oppose Virginia offering such an incentive?

- Strongly support 32.0%
- Support... 40.9%
- Oppose... 8.0%
- Strongly oppose 4.6%
- Neutral 14.5%

Q7. In 2017, Virginians spent over $33 million dollars per day on imported gasoline and diesel. How important is it to you that Virginia reduce its dependence on fossil fuels and transitions to clean energy?

- Very important 36.6%
- Somewhat important...36.3%
- Not very important...10.8%
- Not at all important 5.8%
- Neutral 10.5%

Attachment B

Virginia EV Sales Data collected by Generation180

Virginia Electric Vehicles

FIPS	Jurisdiction	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
51001	ACCOMACK	6	6	8	14	14	25	43	73	79	92	8	10
51003	ALBEMARLE	5	9	10	10	15	26	42	48	85	101	183	298
51510	ALEXANDRIA	8	7	9	11	9	17	26	51	126	195	319	452
51005	ALLEGHANY	-	-	-	-	-	-	-	-	-	1		1
51007	AMELIA	-	-	-	-	-	-	1	1	1	1	1	2
51009	AMHERST	-	-	-	-	1	-	3	5	6	8	11	12
51011	APPOMATTOX	-	-	-	-	-	-	-	-	-	-		3
51013	ARLINGTON	9	9	11	9	17	54	87	107	251	321	592	873
51015	AUGUSTA	2	3	7	7	7	10	13	16	16	24	23	33
51017	BATH	-	-	1	-	-	1	2	3	3	7	2	1
51019	BEDFORD COUNTY	2	3	2	3	1	4	4	15	15	20	32	41
51021	BLAND	-	-	1	-	-	1	2	2	2	1	1	1
51023	BOTETOURT	-	-	-	-	-	1	2	2	5	6	10	19
51520	BRISTOL	-	-	-	-	-	-	-	1	-	1	1	4
51025	BRUNSWICK	-	-	-	-	-	-	-	-	-	-		-
51027	BUCHANAN	-	-	-	-	-	-	-	-	-	-		-
51029	BUCKINGHAM	-	-	-	-	-	1	1	1	-	1	4	5
51530	BUENA VISTA	-	-	-	-	-	-	-	-	-	2		-
51031	CAMPBELL	-	-	-	-	2	1	1	2	3	5	8	11
51033	CAROLINE	3	4	4	2	2	2	3	2	1	4	7	8
51035	CARROLL	2	3	2	3	4	3	3	5	3	5	8	12
51036	CHARLES CITY	-	-	-	-	-	1	1	1	1	1	1	3
51037	CHARLOTTE	-	-	-	-	1	1	1	1	1	1	1	1
51540	CHARLOTTESVILLE	3	4	8	8	10	12	17	18	28	49	84	119
51550	CHESAPEAKE	10	7	14	14	11	23	30	38	63	76	115	172
51041	CHESTERFIELD	14	13	20	16	5	16	21	43	83	114	213	357
51043	CLARKE	1	1	1	1	6	9	8	7	7	13	16	26
51570	COLONIAL HEIGHTS	2	2	1	1	-	-	-	1	-	2	3	7
51580	COVINGTON	-	-	-	-	-	-	-	-	-	-	20	-
51045	CRAIG	-	-	-	-	-	-	-	-	-	-		1
51047	CULPEPER	2	2	2	2	1	3	2	7	10	16		35
51049	CUMBERLAND	-	-	-	-	-	-	-	-	-	-		1
51590	DANVILLE	-	-	1	1	3	4	4	5	11	14	11	12
51051	DICKENSON	-	3	1	1	1	-	-	-	1	1	1	1
51053	DINWIDDIE	-	1	1	1	1	2	4	4	3	2	2	5
51595	EMPORIA	-	-	-	-	-	-	-	-	-	-	1	-
51057	ESSEX	-	-	-	1	2	2	2	1	1	1	1	1
51600	FAIRFAX CITY	3	1	3	3	3	6	11	21	28	36	366	213
51059	FAIRFAX COUNTY	49	71	76	96	104	288	495	691	1,426	1,773	2854	4,721
51610	FALLS CHURCH	1	2	1	1	-	7	8	13	24	33	68	105
51061	FAUQUIER	7	8	6	7	7	12	14	19	35	41	74	117
51063	FLOYD	-	-	-	-	-	1	2	2	4	4	4	10
51065	FLUVANNA	2	4	5	3	3	3	5	3	5	6	14	23
51620	FRANKLIN CITY	-	-	-	2	2	1	1	1	1	-		1
51067	FRANKLIN COUNTY	2	1	2	2	3	3	4	5	8	8	10	16
51069	FREDERICK	9	6	4	5	4	8	8	7	8	13	35	60
51630	FREDERICKSBURG	2	4	5	3	2	7	11	11	9	11	19	35
51640	GALAX	-	-	2	3	4	3	3	3	3	2	3	1
51071	GILES	-	-	-	-	1	1	1	1	-	-		4
51073	GLOUCESTER	3	2	2	1	-	1	1	-	1	4	6	7
51075	GOOCHLAND	3	3	3	3	2	3	7	7	19	25	44	59
51077	GRAYSON	-	-	1	1	1	2	2	1	3	3	2	2
51079	GREENE	2	2	2	2	-	-	-	2	5	7	8	8
51081	GREENSVILLE	-	-	-	-	-	-	-	-	-	-		1
51083	HALIFAX	-	1	1	2	2	2	1	1	1	2	3	5
51650	HAMPTON	8	8	10	10	10	15	20	16	28	28	31	61
51085	HANOVER	12	11	13	14	5	10	10	17	26	36	60	96
51660	HARRISONBURG	2	4	4	4	4	5	7	6	9	12	21	29
51087	HENRICO	31	36	31	43	23	33	49	71	118	188	352	543
51089	HENRY	-	1	2	3	2	1	2	2	5	4	5	7
51091	HIGHLAND	-	-	-	-	-	-	-	-	-	-	1	1
51670	HOPEWELL	-	-	-	-	-	-	2	2	2	2	1	5
51093	ISLE OF WIGHT	1	2	2	3	5	8	8	6	8	10	10	16
51095	JAMES CITY	1	-	3	4	3	8	11	11	21	43	71	109
51097	KING AND QUEEN	-	-	-	-	-	-	-	-	-	-		-
51099	KING GEORGE	4	4	4	5	4	5	6	5	6	9	11	17
51101	KING WILLIAM	-	-	-	-	-	-	-	-	1	2	3	2
51103	LANCASTER	2	1	1	1	-	2	2	1	1	6	8	17
51105	LEE	-	-	1	1	1	2	3	3	3	1	3	4
51678	LEXINGTON	-	-	3	8	9	11	10	11	12	13	8	5
51107	LOUDOUN	16	12	16	12	20	82	159	227	484	670	1447	2,423
51109	LOUISA	3	4	6	7	4	5	6	6	9	15	21	36
51111	LUNENBURG	-	-	1	1	1	1	-	-	-	-		1
51680	LYNCHBURG	-	-	-	-	1	3	7	13	12	13	17	30
51113	MADISON	1	1	1	-	-	-	-	1	-	1	1	4
51683	MANASSAS	5	5	4	4	4	5	4	7	15	23	27	46

51685	MANASSAS PARK	-	1	2	2	2	3	5	3	5	6	7	16
51690	MARTINSVILLE	-	-	-	-	-	1	2	2	2	-		1
51115	MATHEWS	-	-	-	-	-	-	-	-	-	1	3	4
51117	MECKLENBURG	-	1	1	1	1	1	-	1	1	2	5	6
51119	MIDDLESEX	2	4	4	4	3	6	6	5	5	6	6	7
51121	MONTGOMERY	4	7	7	16	24	28	29	29	35	53	57	83
51125	NELSON	-	1	1	1	1	1	1	2	5	6	15	25
51127	NEW KENT	3	2	2	2	1	2	3	2	3	6	13	21
51700	NEWPORT NEWS	1	1	2	4	7	19	14	22	24	33	49	74
51710	NORFOLK	21	23	24	28	25	32	46	53	92	122	115	147
51131	NORTHAMPTON	-	-	5	5	9	8	8	4	7	8	3	5
51133	NORTHUMBERLAND	1	1	1	2	1	-	1	2	2	4	7	7
51720	NORTON	-	1	1	1	1	1	-	-	-	1		-
51135	NOTTOWAY	-	-	-	-	-	-	1	1	3	3	3	3
51137	ORANGE	2	1	2	2	1	2	4	4	6	10	19	24
51139	PAGE	-	-	1	2	1	2	2	1	2	2	5	4
51141	PATRICK	2	3	3	4	1	1	-	-	1	1	1	1
51730	PETERSBURG	3	3	3	3	2	3	3	3	6	5	4	3
51143	PITTSYLVANIA	-	1	3	2	2	2	2	3	1	5	4	4
51735	POQUOSON	-	-	1	2	3	2	5	2	8	9	10	11
51740	PORTSMOUTH	2	4	3	4	5	7	8	10	20	23	20	26
51145	POWHATAN	1	1	1	2	1	1	2	3	5	6	11	15
51147	PRINCE EDWARD	2	2	2	2	1	-	-	-	1	1	2	4
51149	PRINCE GEORGE	2	2	1	1	1	1	2	2	1	3	5	11
51153	PRINCE WILLIAM	33	35	31	31	21	59	88	96	186	265	507	855
51155	PULASKI	-	1	1	2	2	1	2	3	3	4	2	7
51750	RADFORD	-	1	1	1	1	1	2	3	3	4	6	7
51157	RAPPAHANNOCK	-	-	-	-	-	-	-	-	3	4	7	11
51760	RICHMOND CITY	26	25	20	18	13	22	29	33	59	78	139	218
51159	RICHMOND COUNTY	-	-	-	-	-	-	1	2	3	2	2	5
51770	ROANOKE CITY	3	5	7	7	7	9	10	11	14	32	40	57
51161	ROANOKE COUNTY	2	4	4	4	5	7	4	7	20	20	34	60
51163	ROCKBRIDGE	1	1	2	2	4	3	2	4	4	6	5	10
51165	ROCKINGHAM	2	4	8	9	9	10	9	10	22	24	34	55
51167	RUSSELL	-	-	-	-	1	2	2	4	2	3	4	3
51775	SALEM	2	2	2	2	3	2	4	5	9	13	15	22
51169	SCOTT	-	-	1	-	-	-	-	-	-	-		1
51171	SHENANDOAH	2	2	2	1	-	2	3	1	2	6	12	15
51173	SMYTH	2	4	2	3	4	3	5	5	4	3	1	1
51175	SOUTHAMPTON	1	1	3	1	-	-	-	-	-	-	78	1
51177	SPOTSYLVANIA	6	5	4	5	2	8	10	12	21	33		122
51179	STAFFORD	8	7	6	6	4	15	27	30	52	65	113	200
51790	STAUNTON	-	1	-	-	-	-	3	4	2	5	8	11
51800	SUFFOLK	2	3	3	5	4	7	10	9	20	20	33	54
51181	SURRY	-	-	-	-	-	-	-	-	1	1	1	3
51183	SUSSEX	-	-	-	-	-	1	1	2	1	1		1
51185	TAZEWELL	2	2	2	2	2	1	-	3	2	-	1	4
51810	VIRGINIA BEACH	41	75	111	134	161	170	230	249	326	399	271	406
51187	WARREN	3	3	3	3	3	3	4	4	8	11	9	21
51191	WASHINGTON	1	3	3	5	5	4	4	5	6	7	13	20
51820	WAYNESBORO	-	1	6	5	4	4	4	1	2	2	4	11
51193	WESTMORELAND	2	2	4	7	5	4	3	4	4	5	6	12
51830	WILLIAMSBURG	1	4	5	7	6	7	11	14	16	16	15	18
51840	WINCHESTER	4	3	3	3	3	4	5	5	6	12	17	28
51195	WISE	-	1	2	3	3	1	1	1	2	2	1	3
51197	WYTHE	7	10	16	16	15	15	9	6	6	6	4	5
51199	YORK	-	3	2	4	2	6	7	7	19	24	49	81
TOTAL		435	538	643	735	729	1,257	1,837	2,347	4,208	5,518	9,082	14,197

Source: Virginia Annual Vehicle Registration Data provided by Virginia DMV to Virginia DEQ each year.

Virginia Public Electric Charging Stations												
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
TOTAL	-	1	4	47	140	212	274	358	458	547	564	614

Source: Virginia Clean Cities inventory and US DOE Alternative Fuels Data Center (e.g. VCC 2017 Alternative Transportation Fuels Report, January 2018)

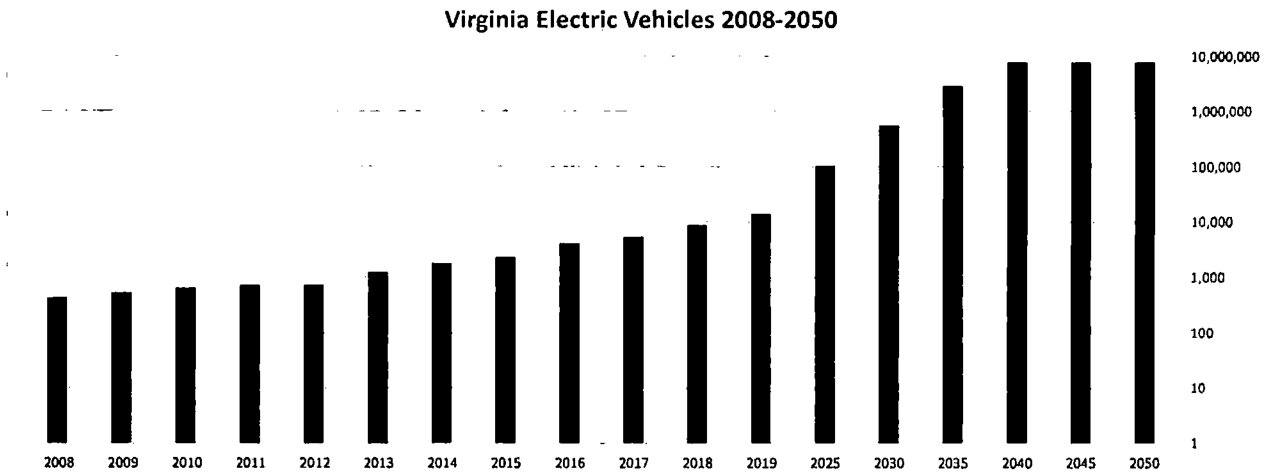
VIRGINIA HISTORICAL ELECTRIC VEHICLE GROWTH

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Avg. Growth
GROWTH	24%	20%	14%	-1%	72%	46%	28%	79%	31%	65%	56%	39%
GROWTH RATE	1.237	1.195	1.143	0.992	1.724	1.461	1.278	1.793	1.311	1.646	1.563	1.395

FUTURE PROJECTED ELECTRIC VEHICLE POPULATION in VIRGINIA

Assuming the historical EV growth rate in Virginia from 2008 to 2019 continues through 2050.

	2025	2030	2035	2040	2045	2050
Projected EV Registrations	104,566	552,141	2,915,487	8,000,000	8,000,000	8,000,000



CERTIFICATE OF SERVICE

I hereby certify that the following have been served with a true and accurate copy of the foregoing by U.S. mail, postage prepaid:

Vishwa B. Link
McGuireWoods LLP
Gateway Plaza
800 East Canal Street
Richmond, Virginia 23219

Paul E. Pfeffer
Dominion Resources Services, Inc.
Law Department, RS-2
120 Tredegar Street
Richmond, Virginia 23219

Noelle J. Coates
AEP Service Corporation
3 James Center
1051 E. Cary Street, # 1100
Richmond, Virginia 23219

James R. Bacha,
AEP Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

Robert M. Conroy
Allyson K. Sturgeon
LG&E and KU Energy LLC
220 West Main Street
Louisville, Kentucky 40202

Ashley Macko
William H. Chambliss
Office of General Counsel
Virginia State Corporation Commission
P.O. Box 1197
Richmond, Virginia 23218

C. Meade Browder, Jr.
Division of Consumer Counsel
Office of the Virginia Attorney General
202 N. 9th Street, Eighth Floor
Office of the Attorney General
Richmond, Virginia 23219-3424

DATED: June 23, 2020

Cale Jaffe, University of Virginia School of Law