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BOUNDLESS ENERGY

Legal Department

May 1, 2023

By Electronic Filing

The Honorable Bernard J. Logan, Clerk State Corporation Commission Document Control Center Tyler Building, First Floor 1300 East Main Street Richmond, Virginia 23219

Commonwealth of Virginia, *ex rel*. State Corporation Commission *Ex Parte*: Electrification of Motor Vehicles Case No. PUR-2020-00051

Dear Mr. Logan:

The Commission's June 15, 2022 Order Directing the Filing of Transportation Electrification Plans directed Appalachian Power Company to file its transportation electrification plan on or before May 1, 2023. With this letter, Appalachian Power Company files its plan.

Sincerely,

James G. Ritter

cc: William L. Chambliss, Esq. C. Meade Browder, Jr., Esq. Service List

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Appalachian Power Company Transportation Electrification Plan Pursuant to the SCC's June 15, 2022 Order in Case No. PUR-2020-00051

On June 15, 2022, the Virginia State Corporation Commission ("Commission" or "SCC") issued its Order Directing the Filing of Transportation Electrification ("TE") Plans. In compliance with the Commission's Order, Appalachian Power Company ("APCo" or the "Company") hereby submits this filing to the Staff of the Commission.

1. System-level modeling of the need for additional generation capacity that may be required to support transportation electrification in Virginia, as well as its attendant costs, in light of the policy goal of a transition to 100% carbon-free generation fleet by 2050, as required by the Virginia Clean Economy Act;

In a forecast of 100% light duty electric vehicle ("EV") saturation, approximately 2.5

TWh of load is added by 2054. Approximately 80% of this increase is Residential demand. The various light duty EV scenarios reflected a minimal impact on the Company's planning peak load and PJM capacity requirement compared to the Company's 2023 Virginia Clean Economy Act Base Case (the "VCEA Base Case") filed in Commission Case No. PUR-2023-00001. The slight peak load growth from the various light duty EV scenarios over the VCEA Base Case suggests that primary charging of light duty EV's would occur during off-peak hours. This is further discussed in Appendix A Item C. The Company's Renewable Portfolio Standards ("RPS") requirements were updated from the VCEA Base Case to the reflect the increase in energy requirements for the various light duty EV penetration scenarios. Figures 1 and 2 show the modeled incremental impact on peak load, as well as the incremental light duty EV annual energy under the 25%, 50%, and 100% adoption scenarios.



Figure 1: 100% Light Duty EV Saturation Load Forecast



Figure 2: Incremental Annual Light Duty EV Energy

2. An analysis of the impact of transportation electrification on forecasted on-peak and off-peak PJM energy prices, class load shapes, peak load and energy forecasts;

The Company performed an analysis of PJM prices using the Aurora model, which does not separate load by class, at a 100% light duty EV penetration level to determine the impact on energy prices. As reflected in Figure 3 below, PJM energy prices were largely unchanged in the 100% scenario, when compared to the Fundamentals analysis that was recently submitted in the Company's 2023 VCEA Base Case. The impact on projected PJM energy prices was minimal through 2045, as illustrated in Figure 3. After 2045, peak prices were between 1.5% and 6.5% lower due to increased solar generation and battery storage. Off-peak prices did not exhibit significant change.

Because this analysis demonstrated that PJM energy prices were largely unchanged from the base VCEA forecast when including the 100% light duty EV penetration assumption, the Company did not perform separate analyses of PJM prices under the 25% and 50% adoption scenarios as those results would have fallen withing this already tight band.



3. An analysis of the impact of transportation electrification on system reliability and compatibility with the transition to renewable generation envisioned by the Virginia Clean Economy Act;

The Company evaluated the impacts to the distribution, transmission, and generation

systems on reliability. The Company expects electrification to primarily affect the distribution

system only minimally in the next 10-12 years, under all scenarios, based on an assumption that EV adoption rates, while increasing, do not rise to a level over that time period to create widespread system congestion issues. The incremental impacts to the generation requirements are quantified in Appendix A Item C below.

From a transmission perspective, the Company does not anticipate the need to develop additional project solutions to support the load increases associated with light duty EV charging. This is especially true under the assumption the load is equally distributed throughout the Company's service territory, and the light duty EV charging load is expected to occur primarily during off-peak hours. Any load growth throughout the APCo Virginia service territory is built into the load forecast assumptions used for the PJM Regional Transmission Expansion Plan ("RTEP") case build cycle. Any projects driven by these load changes are considered baseline and will proceed through the typical PJM RTEP process. The Company may need to accelerate some future asset health projects, or some minimal acceleration of normal load supporting projects, depending on how quickly the load growth occurs, but no new transmission projects that would specifically result from light duty EV growth are known or anticipated at this time. All supplemental transmission projects follow the established M-3 Process with PJM and both the Needs and Solutions for any given project can be reviewed by stakeholders.

In summary, electrification is not expected to significantly impact the reliability of the grid, but will require incremental investment. The increased energy requirements will necessitate the acquisition of additional renewable generation to maintain compliance with the RPS requirements contained in the VCEA.

4. For the ten years starting in 2023, an estimated annual bill impact of the generation, transmission, and distribution requirements associated with EV adoption;

The Company performed an analysis for the bill impacts for ten years starting in 2023.

Because of the anticipated timing of distribution and transmission investments, those costs do not affect the rate impact analysis, as only generation investments are anticipated to be needed in the ten-year period starting in 2023. Due to the small impact on peak demand in those ten years, no transmission or distribution investments are anticipated to occur until the mid-2030's that would be a direct result of increased light duty EV adoption. The estimated rate impacts, for selected rate schedules, on an infrastructure basis are shown for each of the 25%, 50%, and 100% light duty EV penetration scenarios are included in Tables 1 through 3 below.

				2:	596	Electric V	ehi	cie Penetri	ntic	on - Infrast	ruq	ture										
				Estima	ted	Monthly I	Rate	e Impacts -	- S	elected Rat	le S	Schedules										
		2022		2023		<u>2024</u>		2025		2026		2027		<u>2028</u>		2029		2030		2031		2032
RS (1.000 kWb)	S	157.04	\$	157.04	S	157.04	s	157.04	\$	157.64	\$	158.27	\$	159.28	\$	164.80	\$	177.69	\$	191.05	\$	196.78
• increase (cumulative)				0.00%	_	0,00%		0.00%		0.38%		0,78%		1,42%		4.94%		13.15%	_	21.65%		25.30
SWS (5,000 kWb)	\$	795.86	s	795.86	s	795.86	s	795,86	s	799,04	s	\$02.38	\$	807.70	s	837.00	s	905.34	s	976.20	s	1,006,58
*= increase (cumulative)				0.00%		0.00%		0.00%		0,40%		0.82%		1.49%		5.17%		13.76%	_	22,66%		26,489
SGS (4,000 kWh)	s	549.64	s	549.64	s	549.64	s	549.64	s	551.53	s	553.51	s	556.66	s	574.03	s	614 54	s	656.54	s	674.55
*• increase (cumulative)	-		_	0.00%	, -	0.00%	Ĩ	0.00%	-	0.34%		0.70%	_	1.28%		4,44%		11.81%	_	19.45%	_	22.739
GS SEC School (75 kW, 30,000 kWh)	s	4 048 30	s	4.048.30	s	4 048 30	s	4.048.30	s	4.067.63	s	4.087.95	5	4.120.32	2	4 298 45	s	4.714.06	2	5.144.99	s	5.329.77
*e increase (cumulative)	•		Ľ.	0.00%		0.00%	Ū.	0.00%	_	0.48%	<u> </u>	0.98%	_	1.78%	_	6.18%	_	16,45%	_	27.09%		31.65
GS SEC Bis Box Store (500 FW) 150 000 KWh)	c	70 840 05		0 830 05	•	70 840 05	•	20 840 05	ç	70 919 56		1044 12	ç	21 210 78	•	07 177 79	•	74 767 73	¢	76 485 61	ç	27 436 83
1. increase (cunsulative)	•	20,040.05		0.00%	_	0.00%		0.00%		0.48%		0.95%		1.7855		6,18%		16.45%	_	27.09%	_	31.65%
					,	63 706 AC		** *** **		*****			Ţ	64 010 77		7.041.46		ce 112 20		** *** **		11 609 00
4. increase (cum,ulative)	3	34.163.40	دد	0.00%	, ³	0.00%	3	0.00%	2	0.67%	3	1.28%	э.	24,010,73	3:	8.06%	3	21.46%	3	35.35%	3	41.30%

 Table 1: 25% Electric Vehicle Penetration Ten Year Rate Impact

				50	196	Electric V	ehi	clo Penetra	ntic	m - Infrast	ານດ	ture										
				Estima	ied	Mouthly F	late	Empacts -	· Se	elected Rat	te S	chechiles										
		2022		2023		2024		2025		2026		2027		2028		2029		2030		2031		2032
RS (1.000 kWb)	S	157.04	S	157.04	\$	157.04	s	157.04	s	157.64	\$	158.27	S	158.30	\$	161.80	\$	174.69	\$	186.03	\$	193.65
 increase (cumulative) 			-	0.00%		0.00%		0.00%		0.38%		0,78%		0.80%		3.03%		11,23%		18.46%		23.31%
SWS (5,000 kWb)	s	795.86	s	795.86	s	795.86	\$	795.86	s	799.04	s	802.38	s	802.52	s	821.08	s	859.42	s	949.58	5	989.98
*s merease (cumulative)	-		_	0.00%		0.00%	-	0,00%		0.40%	-	0.82%	_	0,84%	_	3.17%	_	11.76%	-	19.32%		24.39%
SGS (4 000 HWD)		\$10.61	¢	510 64		10 64	¢	519 64	•	461 67		552 61	•	*** *0		***		£05 10	•	640 76	÷	664 71
sincrease (cumulative)		.45.04	•	0.00%		0.00%	3	0.00%	•	0,34%	1	0,70%	3	0.72%	3	2.72%	3	10.09%	,	16,58%	1	20.94%
GS SEC School (75 kW, 30,000 kWh)	S	4.048.30	S ·	4,048.30	S	4,048.30	s	4,048.30	\$	4.067.63	\$	4.087.95	S	4,088.81	s	4,201.64	S	4,617.24	s	4,983,14	S	5.228.83
*s increase (cumulative)				0.00%		0.00%		0.00%		0.48%		0.98%		1,00%		3.79%		14.05%		23,09%		29.16*1
GS SEC Big Box Store (500 kW, 150,000 kWb)	\$	20,840.05	\$ 29	0.840.05	s	20,840,05	\$ 3	20,840.05	s	20,939.56	5:	21,044.12	\$ 2	21.048.56	\$ 2	1,629,39	\$	23,768.84	s	25.652.44	\$ 2	26,917,19
s increase (cumulative)				0.00%		0.00%		0.00%		0.48%		0.98%		1.00%		3.79%		14.05%		23,095+		29,16%
1 PS PRI (1 X 037 450 (000 F337))	¢	57 785 JK		7 785 46	ç	57 785 16	•	57 785 46	¢	\$1.114.11	•	(1 4 (0 0)		53 474 60		** 101 76	•	67 465 19	¢	68 690 53		77 876 58
sincrease (cumulative)	3.			0.00%	਼ੈ	0.00%	3.	0.00%	1	0.62%	.	1.28%		1.31%		4.94%	3,	18.34%	1	30.13%		38.05%

 Table 2: 50% Electric Vehicle Penetration Ten Year Rate Impact

				100 Estimat	194 led	Electric V Monthly I	chi Cat	cle Penetr e Impacts	ati - S	on - Infras elected Re	tru to	cture Schedules										
		2022		2023		2024	-	2025	-	2026		2027		2028		2029		2030		2031		2032
RS (1,000 kWh)	\$	157.04	\$	157.04	s	157.04	s	157.04	s	157.64	\$	158.27	\$	158.30	\$	161.56	s	176.37	S	189.43	\$	198.02
% increase (cumularive)			-	0.00%	_	0.00%	—	0.00%	—	0.38%	—	0.78%	—	0.80%	_	2.87%		12.30%	—	20.62%	—	26.09%
SWS (5.000 kW3)	s	795.86	s	795.86	s	795.86	s	795.86	s	799.04	\$	\$02.38	\$	802.52	\$	819.79	\$	898.31	5	967.61	\$	1,013.17
n increase (cumulative)			_	0.00%	_	0.00%	_	0.00%		0.40%		0.82%	_	0.84%		3.01%		12.87%		21.58%	_	27.30%
SGS (4,000 kWli)	s	\$49,64	s	549.64	\$	549.64	s	549.64	s	551.53	5	553.51	s	553.59	s	563.83	s	610.37	s	651.45	s	678.45
• increase (cumulative)			_	0.00%	_	0.00%	_	0.00%		0.34%	_	0.70%	_	0.72%		2.58%		11.05%		18.52%		23,449
GS SEC School (75 kW, 30,000 kWh)	s	4.048.30	s	4,048.30	s	4,048,30	\$	4,048.30	s	4,067.63	s	4.087.95	s	4,058.81	5	4.193.80	s	4.671.35	s	5,092.78	5	5,369.80
*» increase (cumularive)			_	0.00%	_	0.00%	_	0.00%	_	0.48%	_	0.98%	_	1.00%		3.59%		15.39%		25.80%	_	32.649
GS SEC Big Box Store (500 kW, 150.000 kWh)	s	20.840.05	s :	20,840.05	s	20.840.05	5	20,840.05	s	20,939.56	s	21,044.12	\$1	21,048.56	s :	21.589.02	s	24.047.37	5	26,216.85	5	27.642 92
• increase (cumulative)			_	0,00%	—	0.00%		0.00%6		0.48%	_	0.98%	_	1.00%	_	3.59%	_	15.39%		25.80%	—	32.64%
LPS PRI (1 MfW, 450,000 kWh)	s	52,785,46	S :	52,785,46	s	52,785.46	S.	52,785.46	5	53,114.33	s	53.459.91	s :	53,474.60	s:	55,260.81	s	63,385.75	5	70,555.91	\$	75,269.13
% increase (cumulative)				0.00%	,	0.00%		0.00%		0.6215		1.28%		1.31%		4.69%		20.08%		33.67%		42.591

 Table 3: 100% Electric Vehicle Penetration Ten Year Rate Impact

5. A discussion of the equity provisions included in the transportation electrification plans, such as special provisions for income-qualified customers and high emission communities;

The Company is not proposing any additional TE programs at this time, however,

APCo's affiliate AEP Ohio recently proposed 50% increased incentives on rebates for residential, commercial, and public chargers in low-income areas¹. Additionally, research and development dollars were proposed for transit and school buses. AEP Ohio had previously concluded multi-year pilot programs focused on electric vehicle adoption and incentives. AEP Ohio's service territory includes the Columbus metropolis where EV adoption is substantially ahead of the APCo service territory. When APCo determines the timing is right for expanded TE programs, lessons learned from AEP utility affiliates and peer utilities will be leveraged to build equity provisions into the plan to bring the benefits of TE to customers in Virginia.

6. Anonymized transportation electrification data including the number of electric vehicles enrolled in the utility's managed charging programs and the impacts of those vehicles on system peak electric load;

¹ Ohio Case No. 23-23-EL-SSO.

As of March 2023, the Company has approximately 100 customers enrolled on our pilot residential PEV tariff, Schedule P.E.V. Enrolled customers average approximately 400 kWh's per month for EV charging. Nearly 95% of the charging is done Off-Peak. The average savings per customer is \$9.55 per month compared to if EV charging would have been performed on the standard residential rate. The average monthly savings are lower for plug in hybrid drivers than for full electric drivers because their batteries are smaller, meaning they charge less on the lower off-peak rate, and they use gasoline to meet a percentage of their driving needs.

When compared to DOE load shape data for all Virginia and West Virginia EV drivers², whose charging patterns are more variable, we can see that this Time of Use ("TOU") rate is working as intended for the customers who use it. Figures 4 and 5 illustrate a comparison of these load shapes.

Though the results from program participants are highly encouraging, the approximately 100 customers on the tariff represent a participation rate of 3% of registered EVs within APCo's Virginia service territory. Although the enrollment numbers are currently low, the results from the customers using the program are significant and the Company proposed making this Experimental rate schedule permanent in its Triennial filed March 31, 2023. The Company will explore methods to reduce barriers to participation in this highly effective program. For TOU rates to be effective at a system level as EVs increase in market share, more customers need to participate.

² Alternative Fuels Data Center: Electric Vehicle Infrastructure Projection Tool (EVI-Pro) Lite (energy.gov)



Figure 4: Residential EV TOU Participant Charging Patterns



Figure 5: Virginia EV Driver Charging Patterns³

³ Id.

7. Additional modeling and an analysis of how the utilities' transportation electrification plans complement private sector efforts;

The Company is not proposing a specific TE plan at this time. However, the Company's affiliate, AEP Ohio's recently filed TE plan⁴ was designed to complement, not compete, with private sector efforts. Relevant program components include per port incentives on level 2 and DC Fast charging, proposed waiver of Contributions in Aid of Construction ("CIAC") for chargers in locations that are beneficial to the grid, funding for education and outreach to educate customers on the benefits of EVs and serving as the provider of last resort if gaps are identified in the charging network that the private market is unwilling or unable to fill.

Additionally, two AEP affiliates (in Ohio⁵ and Oklahoma⁶) have approved non-demand tariffs for DC Fast charging to give providers more predictable billing while still appropriately recovering ratepayer costs to serve.

8. An analysis of federal grants and other funding opportunities to defray ratepayer costs.

AEP is closely monitoring federal grants, tax incentives, and other funding opportunities to defray ratepayer costs related to electric transportation. AEP and APCo have had multiple conversations with Virginia Department of Transportation ("VDOT"), the agency administering the federal National Electric Vehicle Infrastructure ("NEVI") funds, to share lessons learned in other states. At this time, APCo does not anticipate directly applying for NEVI or other federal funds to install chargers. This will allow the private market to develop charging networks in our

⁵ January 2023 AEP_OhioTariffUpdate.pdf (aepohio.com)

⁴ Id.

⁶https://www.psoklahoma.com/lib/docs/ratesandtariffs/Oklahoma/PSO%20Electric%20Vehicle%20Rate%20Schedu les%20Feb%202022.pdf

territory. As the market develops, the company may apply for federal funds to fill gaps that the market has not yet filled.

Beyond NEVI, AEP is examining other federal opportunities to defray ratepayer costs for grid improvements that may be necessary in the coming years due to a variety of factors, which include an increase in EVs. Additionally, AEP and APCo have signed letters of support for various stakeholders applying for federal grants to expand charging throughout Appalachia. The Company is waiting on the results of those proposals but looks forward to working with stakeholders to expand access to charging.

Appendix A

As suggested in the Stakeholder Group Report, transportation electrification plans shall address:

A. The current state and forecasted near-term future state (e.g., over the next five years) of transportation electrification deployment in the utility's service territory, including for light-duty, medium-duty, and heavy-duty vehicles.

As of December 31, 2022 there are 3,655 light duty plug-in vehicles registered in the Company's Virginia territory. Of these, 2,139 are fully electric, and 1,516 are plug in hybrids. Our forecast, created prior to Infrastructure Investment and Jobs Act, the Inflation Reduction Act, and other significant federal and state policy decisions, lays out three growth scenarios through 2030: high, low, and base. In the high growth scenario, the forecast anticipates approximately 40,000 EVs on our system by 2030. In the low growth, that number is closer to 10,000 EVs. Since this forecast was developed in 2020, the actual registrations have trended higher than the baseline projection, but lower than the high growth scenario.

The Company's forecasting team relies on information from sources such as the Electric Power Research Institute ("EPRI") to produce its forecasts. When updated information is made available, the Company plans to update its EV forecast to include medium and heavy duty ("M/HD") EVs as well as updated light duty scenarios stemming from state and federal policy changes and more recent automaker electrification timelines. Figure 6 shows AEP's forecast of light duty EV adoptions in APCo Virginia's service territory.



Figure 6: AEP Forecast of Light Duty EV Growth in APCo VA

	<u>2020</u>	<u>2021</u>	<u>2022</u>
Actual High	1,639 1 714	2,465 2 449	3,655 3 855
Base	1,588	2,113	3,171
Table 4: AEP Projections	vs Actu	al EV R	egistrations in APCo VA

B. Investments and programs that the utility expects to implement in the near term (five years) to accommodate the forecasted transportation electrification by that point in time. In presenting these investments and programs, the utility should include the following:

At this time the Company is not proposing an expansion of its TE plans. However, its affiliate in Ohio recently filed a robust TE plan. Other AEP companies are several years into pilot TE plans.⁷ The Company is examining what is working well in other jurisdictions, what can/should be effectively replicated for our Virginia customers, and what enhancements or changes should be considered for Virginia.

⁷ See Ohio Public Utility Commission, Case No. 20-0585-EL-AIR and Case No. 23-0023-EL-SSO; Indiana Utility Regulatory Commission, Cause No. 45235; and Michigan Public Service Commission, Case No. U-20359.

Because the Company is not proposing a TE plan at this time, the Company cannot describe

program-specific impacts included in Appendix A Items b and d, as outlined in the

Commission's Order directing this filing. However, the Company understands and agrees with

the criteria and elements needed in future TE plans. Most of these elements are common to those

included in TE plans AEP has filed in other jurisdictions. Their inclusion in this order provides

needed clarity and insight into what the Commission and stakeholders are looking for in future

electrification plans. Plan-specific elements are:

- i. A description of how the utility worked with customers and stakeholders to design and refine the proposal prior to filing
- ii. How the proposed investment or program is appropriately tailored to the target use cases, vehicle types, applications, customer segments, and investment levels per customer segment;
- iii. An assessment of the costs and benefits of the proposal, including the expected costs and benefits to participants, non-participant ratepayers, the electrical system, and society.
 Pilot proposals may not require a full cost benefit analysis in cases where the pilot is designed to build an understanding of the costs and benefits; and
- iv. For pilot proposals, identify what the utility expects to learn from the pilot and include a list of metrics that should be used to evaluate whether the pilot should be expanded to a full program.
- i. How ET investments and programs, as a package, would impact the following:
 - 1. Total ratepayer rates and costs;
 - 2. Grid management and more efficient use of the grid;
 - 3. Utilization of increased generation from renewable energy resources;
 - 4. Overall fuel costs for vehicles;
 - 5. Access to transportation electrification for low-income and medium-income communities;
 - 6. Achievement of the energy storage targets established in subsection E of statute 56-585.5 of the Code of Virginia;
 - 7. Greenhouse gas emissions and air quality, including for low income and mediumincome communities;
 - 8. Workforce and economic development opportunities; and
 - 9. Customer education and awareness of the benefits of transportation electrification.
- ii. How private (e.g., non-utility) efforts may support those investments and programs;
- iii. How smart growth policies can complement or enhance those investments and programs;
- iv. How those investments and programs would support low-income, minority, and rural communities;

- v. How those investments and programs would integrate and work together with existing and future policies and programs, to meet the needs of various customer segments;
- vi. How those investments and programs would enable on-street charging for homeowners and residential renters without dedicated parking and for city streets;
- vii. The level of investment for different offerings, differentiated by customer segment;
- C. Investments that the utility would need to implement to help increase the development of transportation electrification to the following specified levels in its service territory:

AEP's analysis found that, overall, an increase in light duty EV penetration will have minimal impact on peak load planning, as illustrated above in Figure 1. A more significant driver is the increased annual energy associated with the proliferation of light duty EVs. The analysis reflects that increasing solar resource additions are sufficient in meeting the RPS requirements through the late 2040's for the 25% and 50% light duty EV penetration scenarios. Incremental wind resources are added in the late 2040's as the RPS requirements increase due to higher light duty EV penetration. In the 100% light duty EV scenario, the higher RPS energy requirement reflects an accelerated need for higher energy rich renewable resources like wind as early as 2030. The solar resources additions in the 100% light duty EV scenario continue to reflect addition amounts similar to the VCEA Base Case.

		NPV o Lifetime Re	f EV Plan Incre venue Require	mental ments (\$M)
	Portflio A	25% EV	50% EV	100% EV
Utility NPV 2023-2032 (\$M)	9,287	8	3	21
Utility NPV 2033-2042 (\$M)	8,190	114	224	342
Utility NPV 2043-2052 (\$M)	7,095	180	332	505
NPV of End Effects beyond 2052 (\$M)	9,997	291	493	677
TOTAL Utility Cost, Net Present Value (\$M)	34,569	593	1,053	1,544

Table 5: Incremental NPV of EV Plan

Tables 6, 7, 8, and 9 show the resource additions that were included in the VCEA Base Case scenario, as well as incremental resource additions under the 25%, 50%, and 100% light duty EV penetration scenarios. These resource additions were modeled by the Company using the same Plexos model and resource assumptions that were used for the Company's VCEA filing. Tables 6, 7, 8, and 9 do not reflect incremental REC purchases that are made to meet RPS requirements under the various light duty EV adoption scenarios.

	VCE	EA Base C	ase	
	Namepla	ite Capac	ity (MW)	
	Energy Storage	Solar	Wind	SMR
41 192023	- A (0) - H	· · · · · ·		2
2024	0	0	0	0
2025".	<u>O</u>	0.4	i i Out	0 -
2026	25	0	0	0
- 22C.27/	25	0	0.5	
2028	25	200	0	0
2 <u>002</u> 9	50.		月	
2030	100	800	0	0
2/613	-1150° F	1400	4 4 =0 / · ·	
2032	200	1,700	0	0
240,333	250	1,900	0	F
2034	300	2,450	0	0
75-2055	4001-	2,900		0
2036	450	3,200	0	0
2037/	1 5225	3.2501-1	e	· 14 · 0
2038	1,250	3,350	0	0
2039	1.250	3,900		
2040	1,550	4,500	0	1,200
2%0411	1,825	5,050,~+		111200
2042	1,825	5,150	0	1,200
20213	1,850	- 15,150		1.01,200,
2044	1,850	5,200	75	1,200
	1,200	× 51,500		Jui 51/2003-1
2046	1,800	5,500	450	1,200
213)41.11	1,075,	-5,900	600 -	2,400
2048	1,050	6,150	675	2,400
7 F 22(3)4.9)	1,050	6,150	15675	12/400
2050	950	6,600	675	2,400
205.	- 875	 7,050	678	2400
2052	875	7,050	750	2,400

Table 6: VCEA Base Case Resource Additions

25% Ligh	nt Duty EV	/ Plan Na	meplate	Capacity
Increas	se/(Decrea	ase) over	VCEA Bas	se Case
	Energy Storage	Solar	Wind	SMR
2023	Q		V-1120 VE	
2024	0	0	0	0
220225	(0)	3 1 10 3 7 4	9-45-60-60-	944 0
2026	0	0	0	0
204A	0, 117	Contraction of the second		体的创作主义
2028	0	(150)	0	0
2020		501	1.105	11-07-4-7
2030	0	100	0	0
	V 1.0.5 V	- 100 - T	0+	Ū.
2032	0	50	0	0
21033 <u>8</u> - c	0	200.11	n . 0. wes	01-2
2034	25	50	0	0
2085	111001171			• •
2036	125	50	0	0
2092		RENOTION	, 	0
2038	(25)	50	0	0
2039	50 S			
2040	(50)	100	0	0
F. 1204		100 131	0	0
2042	(25)	100	0	0
1- 2004BA			3 - O 2 - K	o T
2044	(25)	100	75	0
		1 2006	1 Z 5-1 3	ڹ ڣڹؠۦڹ؋ؚؿۦڹۣؖۿؚؚؚ ^ڹ
2046	(100)	500	150	0
20%		N: 11000 - 1	1504	0
2048	0	(150)	225	0
17 20/19)			10/300 IC	0
2050	25	0	300	0
2351		014	300017	0
2052	(25)	0	450	0
·				

Table 7: Incremental Resource Additions under the 25% light duty EV penetration case

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50% Ligh	nt Duty E\	/ Plan Na	meplate	Capacity
Increas	e/(Decre	ase) over	VCEA Bas	se Case
	Energy Storage	Solar	Wind	SMR
2023	0	Sele O w	170	
2024	0	0	0	
2/02/5	(i), U	0	04-54	
2026	0	0	0	0
2027	0	0		
2028	0	(200)	0 51.215=7187=25460 %;	0
240.2%				
2030	0	(50)	0	0
A 22030				
2032		(150)	0	
2024		150		
2034 553 5655 55				
2026		(50)		C 이 전 전 11년 11년 11년 11년 11년 11년 11년 11년 11년
2050				
2038	(25)	400	0 0	
2036		450		
2040	(50)	350		0
12043		3000	75-1	
2042	(25)	200	75	0
8-20430		≥ 3 200 - 	75 10 1	.
2044	(50)	150	225	0
22074-3		100	12257	h 110 - 1
2046	(100)	450	300	0
2041		11000		
2048	(25)	(150)	525	0
20419			-1.675N-C	
2050	0	(150)	675	0
205 f			750141	
2052	(25)	0	675	0

Table 8: Incremental Resource Additions under the 50% light duty EV penetration case

100% Lig	ght Duty E'	V Plan Na	meplate	Capacity
Increa	se/(Decrea	ase) over	VCEA Bas	e Case
	Energy Storage	Solar	Wind	SMR
2023	0		马利亚王斯	
2024	0	0	0	0
r⊾ 2 (0)2(5)	O Charles	(). 		
2026	0	0	0	0
2027	Ø	©		
2028	0	(200)		0
·····2029>	© 1			M = 0
2030	0	(150)	150	0 Sectored and the sectored a
2031-1-1	10		7 1 150 17	27 204 53
2032	0	(100)	150	
2033	0		-117115077111	
2034	0	0	150	0
4 4 2035	0		K-150	
2036	0	100	150	0
XXX 20374 X		50	14.7150¥.14	· • • • 0 • • • •
2038		300	150	0
- 2039	0	<u>3</u> 50	1150	
2040	0	350	150	0
204	0-/	-500	41 - 1503 - 1	
2042		550	150	╡ ╔╴╝╴╸ ┙┙┙╝╴╴╸
F-F2043		: -5:50	22547	
2044	150	500	375 ≫-≞≪ 394 ⊒352	
2012/04/5	<u>, 1150</u>	400 11		0.00
2046	150	650	450	
2047/	150	250	5255	
2048	300		675 	
2(04)9	375	0	900	
2050	375	(150)	975	0
1 2051	450	i de la companya de En companya de la comp	975	0
2052	450	(150)	1,050	0

Table 9: Incremental Resource Additions under the 100% light duty EV penetration case

- viii. Whether or not the following specific types of utility transportation electrification investments and programs would be included, and for which customer segments they would be offered:
 - 1. Distribution investments: Improvements to the distribution grid that are necessary to accommodate transportation electrification broadly;

Distribution level investments will be evaluated and proposed as needed. In the near-medium term, these investments would likely not fall in the TE plan but would be considered routine distribution investments as necessary for load growth in general. The distribution system investment necessary to address load growth driven by EV load will ultimately depend on where EV adoption actually occurs across the Company's service territory. Improvements will likely consist of upgrades to service transformers, various feeder equipment upgrades and substation transformer capacity increases. Based on some very high-level assumptions about how quickly adoption may occur, the Company expects to incur minimal costs during the first ten years under all scenarios. In the years 2034-2045, the Company expects to spend approximately \$135 million in the 100% adoption scenario. However, in order to better assess this in the future, the Company is actively developing a load forecasting model to support more detailed analysis of where EV adoption is most likely to occur across the service territory. Because light duty EV load is not separate from any other type of load, the Company will continue to evaluate and plan for distribution needs more wholistically.

2. Utility investments in charging stations: Direct utility investment in electric vehicle charging stations, with a focus on underserved markets, including multi-unit dwellings, low-income communities, rural communities, workplaces, heavy-duty vehicle electrification, and highway corridors;

In some of AEP's other service territories, APCo's affiliate Operating Companies do have programs focused on offering customer rebates on EV charging in underserved markets such as multi-unit dwellings, highway corridors, and workplaces. Additionally, some of these programs have supplementary incentives for chargers installed in low-income areas. APCo will evaluate these programs to determine the need/viability for Virginia.

3. Utility investments in make-ready infrastructure: Electric grid infrastructure upgrades and improvements on both sides of the meter to ensure that sites are "ready"" for the installation of charging stations. Encourage greater attention on investing in infrastructure for multi-unit dwellings, public and workplace charging sites, and for medium- and heavy-duty fleets. Consider the potential of energy storage technologies to optimize these investments;

Charging installations are currently eligible for our standard CIAC program, whereby the Company shares a percentage of the cost of new service upgrades with the customer. AEP Ohio has filed a program that would allow the full cost of utility make-ready costs to be covered by the rate-base if the charger is in a location that is deemed beneficial to the grid. None of AEP's current programs cover costs on the customer's side of the meter. This is illustrated in Figure 7 below. Currently the Company operates under scenario 1. Expanding utility responsibility to "both sides of the meter" would be an expansion of our current policy.

Regarding potential energy storage technologies, the Company's affiliate utility in Oklahoma has three battery integrated DC fast chargers on its system. Though these chargers are more expensive to purchase, there are limited scenarios in which battery integration can lower the overall project cost – particularly in capacity constrained areas. The Company will consider the inclusion of energy storage in certain scenarios.

The Company is open to exploring the viability of these types of programs for Virginia.



Figure 7: Common Ownership Models for EV Charging⁸

4. Utility rebates for charging: Utility rebates for chargers, which could require subscribing to a time-of-use or off-peak rate;

APCo Virginia currently offers rebates for Energy Star rated Level 2 residential chargers as a component of one of its Commission-approved energy efficiency programs. However, at this time, rebate eligibility is not contingent upon the customer subscribing to a TOU or off-peak rate. As mentioned previously, the PEV rate schedule is proving effective with 95% of charging events occurring off-peak. Although APCo is not proposing an expansion of this program at this time, it may be expanded as the EV market grows in southwest Virginia.

5. Utility rebates for vehicles: Utility rebates to lower the upfront cost of electric vehicle purchases until electric vehicles reach cost parity with conventional vehicles. Higher rebates should be offered to underserved markets, including low-income and rural communities;

⁸ Charging Forward: A Toolkit for Planning and Funding Rural Electric Mobility Infrastructure, US Dept of Transportation, February 2022, page 45, available at: <u>https://www.transportation.gov/sites/dot.gov/files/2022-01/Charging-Forward_A-Toolkit-for-Planning-and-Funding-Rural-Electric-Mobility-Infrastructure_Feb2022.pdf</u>

No other AEP operating companies offer this type of rebate. The priority has been reducing the cost of charging infrastructure, not vehicles. With the availability of federal tax incentives and the prices of EVs declining, vehicle rebates are not currently being considered by the Company.

6. Time-of-use or electric vehicle tariffs: Special tariffs that can support electric vehicle adoption, reduce operating and maintenance costs, and encourage electric vehicle charging during times that maximize grid benefits. Request that utilities provide details on how they will design rate structures and provide customer education to encourage high subscription rates;

The Company currently offers a residential PEV rate schedule and is open to expanding these to other rate classes such as fleet and multifamily but is not proposing to do so at this time. Commercial general service customers can participate in the Company's Time of Day rate schedules which can accommodate vehicle charging and offer lower off-peak rates. As discussed previously, the Company will explore ways to increase customer participation in our current residential PEV rate schedule.

7. Managed charging programs: Deploying managed charging programs {i.e., direct load control) where it makes geographical sense to do so (e.g., there may be greater barriers in rural areas due to broadband limitations). In designing programs, ensure there is a way for customers to opt out of demand response events;

The Company's Energy Efficiency stakeholder group recently approved an EV Charging Demand Response concept. This was proposed by APCo as a potential managed charging pilot program. The Company expects to issue an RFP in the second quarter of 2023. This pilot will be included in the Company's 2023 Energy Efficiency filing only if proposals are received that are cost effective and meet the requirements of an Energy Efficiency pilot program. 8. Commercial tariffs: Special tariffs for direct current fast chargers that encourage charging station development and utilization while encouraging customer charging during times that maximize grid benefits and reduce operating and maintenance costs;

It is the Company's opinion that these types of rates are generally not a good fit for DC Fast charging ("DCFC"). Customers utilizing DC Fast chargers may not have the flexibility to shift their charging time. While two other AEP companies currently offer DCFC rates (Public Service Company of Oklahoma and AEP Ohio), these are aimed at demand charge reduction, not load shifting. While there are many benefits to the grid that can be derived from EV charging, encouraging customers to utilize fast chargers based on grid needs generally does not lead to a good customer experience. These types of rates are generally better suited for residential and fleet applications.

9. Public transit electrification: Investments to support airport, port, and truck stop electrification infrastructure and to help mass transit agencies accelerate bus electrification;

The Company has two Public Authority ("PA") tariff options for EV charging:

- 1. Standalone PEV service which mirrors the General Service TOD PA rate.⁹
- 2. Sub-metered option that is similar to the Residential PEV tariff.¹⁰

Additionally, customers may use existing TOU rate schedules such as our GS-TOD and LGS-TOD tariff which are available to any non-PA customers taking Standard Service. While not EV specific, these two tariffs can be used for any standalone charging service if the customer is interested in a lower off-peak rate to charge their fleet of EV's.

⁹ PUBLIC AUTHORITY TARIFF NO. 18 RIDER P.E.V. P.A. Exhibit A, Pages 45-46 (Plug-In Electric Vehicle Charging - Public Authority).

Several of the Company's sister utilities in the AEP family have programs to support public transit electrification. These programs include rebates for school and transit buses.

Though these types of programs are not currently being proposed, the Company is open to

exploring them for Virginia.

Additionally, though not part of a formal TE plan, APCo employees have approached schools in the Company's service territory to promote the EPA electric school bus funding. The Company is proud that 60 of the 81 electric school buses funded through this program in 2022 will be in its service territory. Since the announcement, APCo has provided technical assistance to schools as they begin to think though implementation of their fleet electrification plans.

10. Car-share and ride-share programs: Charging infrastructure and incentives to support the conversion of car-share and ride-share vehicles to electric and to educate riders when they are riding in an electric vehicle. Greater focus on providing services in underserved communities (e.g., rural, low-income, environmental justice) should be encouraged;

The Company will consider these types of programs for its customers but currently does not have experience with incentivizing charging infrastructure specifically for rideshare programs.

11. Research and development: Examples might include pilot programs to research vehicle-to-grid applications, charging behavior, optimal siting of charging locations, co-location of electric vehicles with distributed energy resources and associated impacts to the distribution grid, etc.;

The Company's affiliate utility in Ohio has proposed a Research and Development budget in

its recently filed TE Plan. The Company will consider evaluating TE Research and Development

opportunities for Virginia.

12. Fleet advisory services: Assistance provided to fleets to understand fleet needs and develop rates that assist them in their efforts to electrify. Identify charging needs and whether they will require grid upgrades. Partner with the appropriate state

agency (e.g., Virginia Department of Energy) to navigate procurement of electric vehicles for the fleet; and

The Company is currently a part of a collaborative project with several utilities across the United States looking at how utilities can best serve fleets. Fleet electrification is rapidly increasing in importance as the availability of electric medium and heavy-duty vehicles continues to grow.

13. Customer education & outreach: Robust marketing, communication, and outreach efforts to educate customers about electric vehicles, including partner rewards and recognition, ride and drive, workplace ""pop-up"" events, etc. Build an understanding of perceptions among customers and develop education and outreach programs to overcome skepticism.

Other AEP companies have proposed robust education and outreach programs. As EVs scale beyond early adopters, these types of programs will increase in importance. Educating customers on EV charging programs and tariffs that can benefit them personally, as well as benefit the grid will be a key function of utilities. Though not currently proposed in this plan, the Company is working to expand staffing for these types of efforts and uses current staff to conduct outreach on available grant funding, create and post social media videos, and host ride and drive events.

CERTIFICATE OF SERVICE

I hereby certify that on this 1st day of May 2023 a true copy of the foregoing Report of

Appalachian Power Company was delivered by electronic mail to the following:

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