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Overview of PJM REC Price Forecasting

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Prepared For:
Dominion Energy Virginia

Prepared by:
ICF Resources, LLC

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PJM Market Background

The PJM power market includes nine states or areas with sizeable Renewable Portfolio Standards (RPS). The standards—in Delaware, Illinois, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, and Washington DC—require an escalating portion of retail sales be met through qualified renewable energy (RE) generation.[1] Additionally, Indiana has voluntary targets.

Load serving entities in the PJM region comply with their relevant RPS obligations via Renewable Energy Credits (RECs), where one credit represents one MWh of qualifying generation. RECs are tradeable and have varying values depending on the state. Many states have multiple types of RECs, including Tier I, Tier II and solar carve-out RECs (or SRECs). Of these, SRECs and Tier I RECs are typically the most valuable. Of the PJM states with mandatory RPS requirements, all but Michigan require that a minimum percent of their load be supplied by solar energy, known as a solar carve-out. More recently, several states in the U.S. have added targets for offshore wind within their renewable goals. Within PJM, Maryland and New Jersey have done so. The current RPS mandates for each PJM state are shown in Exhibit 1.

Exhibit 1: Current State Level RPS Targets

State	Tier I Target	Solar Carve-out	Offshore Wind Buildout
New Jersey	50% by 2030	5.1% by 2021, TBD by 2030	3,500 MW by 2030
Pennsylvania	8% by 2021	0.5% by 2021	N/A
Maryland	50% by 2030	14.5% by 2028	1,568 MW by 2030
Delaware	25% by 2025	3.5% by 2025	N/A
Ohio	8.5% by 2026	N/A	N/A
Washington, D.C.	100% by 2032	10% by 2041	N/A
Illinois[1]	25% by 2026	4 million RECs by 2030	N/A
Michigan[1,2]	15% by 2021	N/A	N/A
North Carolina[1]	12.5% by 2021	0.2% by 2018	N/A

[1] Only part of the state falls within the PJM footprint.

[2] Michigan utilities Consumers and DTE have committed to 25% renewable energy by 2030.

The ICF Forecasting methodology for REC pricing begins with a fundamentals view of the PJM market, through assessing the drivers of supply and demand for RECs. For the 2020 IRP forecast for Dominion Energy Virginia ("Dominion"), ICF has expanded this fundamentals approach to better capture the uncertainty in REC markets by creating a weighted price forecast considering alternate forward looking renewable market scenarios. Below is a discussion of the fundamentals modeling approach, which is used within each of the scenario modeling, followed by a discussion of the RPS sensitivities and weighting methodology used to capture uncertainty.

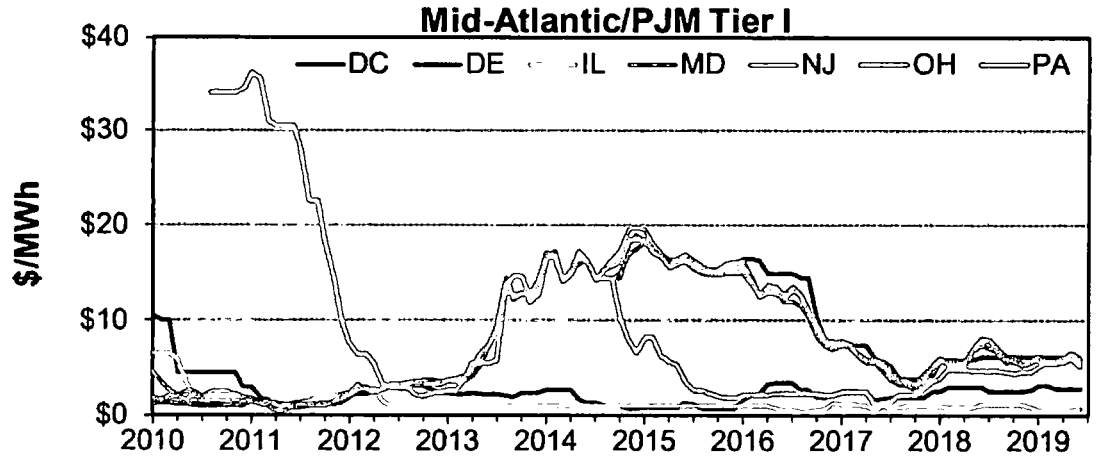
[1] In March 2020 the Virginia General Assembly passed the Virginia Clean Economy Act, mandating 100% clean energy by 2045 for Phase II Utilities and by 2050 for Phase I Utilities. This legislation was not included in the modeling.

ICF Fundamental Modeling for REC pricing

Demand

ICF models the PJM RPS demand using state level RPS requirements and provides a Mid-Atlantic PJM Tier 1 REC price forecast to Dominion. The PJM Tier I trading market is represented by New Jersey, Pennsylvania, Maryland, Delaware, Ohio and D.C. REC markets. Due to overlapping generator eligibility criteria, these states typically coalesce into one REC trading market with similar clearing prices, as shown in Exhibit 2. The Tier I market reflects the RPS demand net of the solar carve-outs, which are supplied in a separate compliance market using SRECs. REC prices typically represent the gap between the costs of a new renewable facility and the revenues they receive from energy and capacity markets.

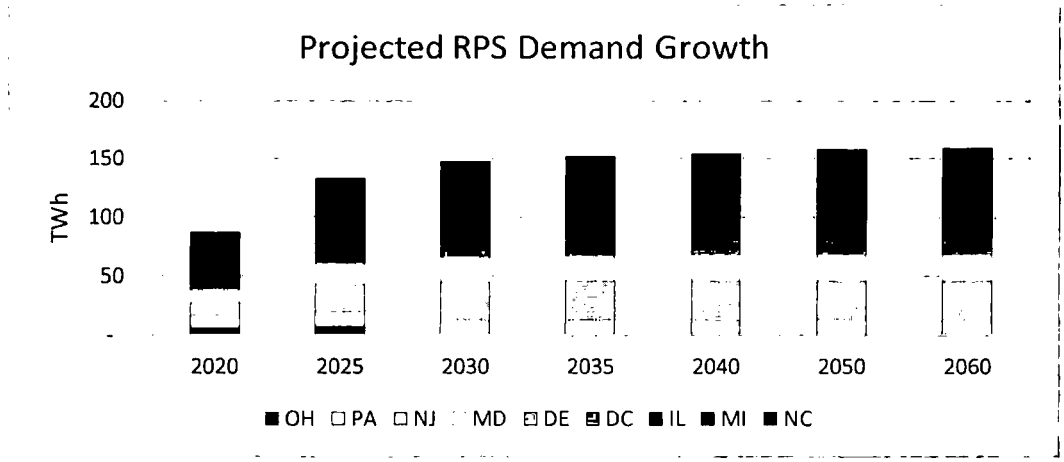
Exhibit 2: Historical PJM Tier I REC Market Trading Prices



Source: Lawrence Berkeley National Labs, U.S. Renewable Portfolio Standards 2019 Annual Status Report.

The demand for PJM Tier I RECs is equal to the retail sales of eligible load-serving entities (LSE) in each state, multiplied by the RPS requirement. In its BAU Case, ICF models fully promulgated renewable portfolio standards (i.e. no proposed or speculative goals are used to establish the BAU case). ICF assumes that once a state reaches its terminal target (see Exhibit 1), the percent target remains flat over time. The latest terminal target within the Mid-Atlantic States is 2032. Beyond the point at which the terminal targets are met, changes in the demand for RECs are driven only by load growth. ICF relies on the PJM 2019 load forecast as the basis for the load growth which is used to determine RPS demand requirements. Exhibit 3 provides the BAU Case RPS demand by state over time.

Exhibit 3: Projected RPS Demand[1] 2020-2050 for PJM States[2]



[1] Demand shown is Tier I net of solar carve-outs.

[2] Demand is shown at a state level; for those states only partially contained within PJM, demand outside the PJM area is included.

Each state also has an Alternative Compliance Payment (ACP) mechanism as part of its RPS program shown in Exhibit 4. ACPs effectively serve as a price ceiling on the market price for RECs and, to some extent, they act as a cap on the market demand for RECs.

Exhibit 4: State Alternative Compliance Payments

State	Tier I ACP
New Jersey	$50/MWh
Pennsylvania	$45/MWh
Maryland[1]	$30/MWh
Delaware[2]	$25/MWh
Ohio	$45/MWh
Washington, D.C.	$50/MWh

1 The MD ACP is $30/MWh in 2019, reduced to $22.35/MWh by 2030.

2 If a Delaware retail electricity supplier has paid the $25/MWh ACP in a previous year, then the ACP increases to $50/MWh for the second deficient year, and $80/MWh for subsequent deficient years.

Supply

ICF's modeling of state level RPS programs specifies generator type eligibility at the program level. Geographic eligibility is also specified at the program level for each RPS program. Banked RECs are also eligible to meet RPS demand (states typically have 3-year REC lifetimes). The current supply of existing eligible resources, as well as all eligible new resources that could be built to meet incremental RPS demand based on the eligibility criteria are reflected in the ICF analysis.

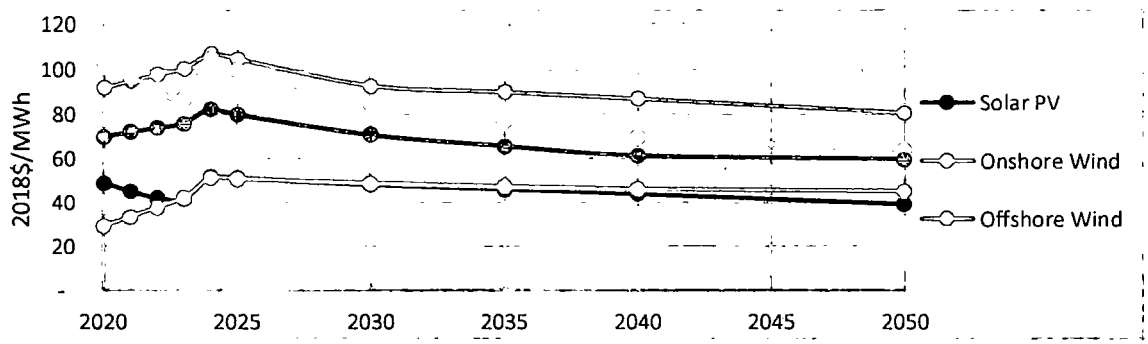
Exhibit 5 illustrates that most PJM Tier 1 RPS programs accept RECs that are generated anywhere within PJM. Some states have limitations on solar eligibility, like New Jersey, and others have more restrictive Tier I eligibility, such as Ohio.

Exhibit 5: PJM State RPS Program Eligibility

State	Tier 1 Geographic Eligibility
NJ	Located or delivered into PJM. Solar must be connected to NJ distribution grid.
MD	Located or delivered into PJM. Solar must be connected to MD distribution grid
PA	Located in PJM. Only in-state solar can meet the solar carve-out.
DE	Located or delivered into PJM. Customer sited resources must be in DE.
DC	Located in PJM. Solar must be located in the District or on a distribution feeder serving the district.
IL	Located in IL or adjoining states per IPA approval based on public interest criteria.
OH	Located or deliverable to OH.
NC	Up to 25% can be met with unbundled out of state RECs.
MI	Located in MI or in the retail electric service territory of a utility recognized by the Michigan PSC.

ICF uses the Integrated Planning Model (IPM®) to determine the least-cost build compliance scenario to supply PJM RPS demand. IPM has a choice of multiple new resource options, including solar, onshore wind, offshore wind and biomass, each with projections for cost and performance defined through 2060. For onshore and offshore wind, multiple technology resource groups are allowed as resource options. These resource groups reflect differing cost and performance characteristics for facilities in a given state. Each resource group has a maximum resource potential that the model can build to before it must turn to a different resource group. As such, IPM can choose the optimal resource mix within a technology option. Exhibit 6 illustrates the annual assumed levelized cost of energy (LCOE) of select new renewable capacity options by vintage. As shown, onshore wind resources reflect the most economic option in the near-term given the ability to take advantage of production tax credits. However, with the phase-out of the production tax credit (PTC) for wind generators, solar becomes more economic after 2025. ICF relies on the National Renewable Energy Lab (NREL) as the source for renewable resource costs over time.

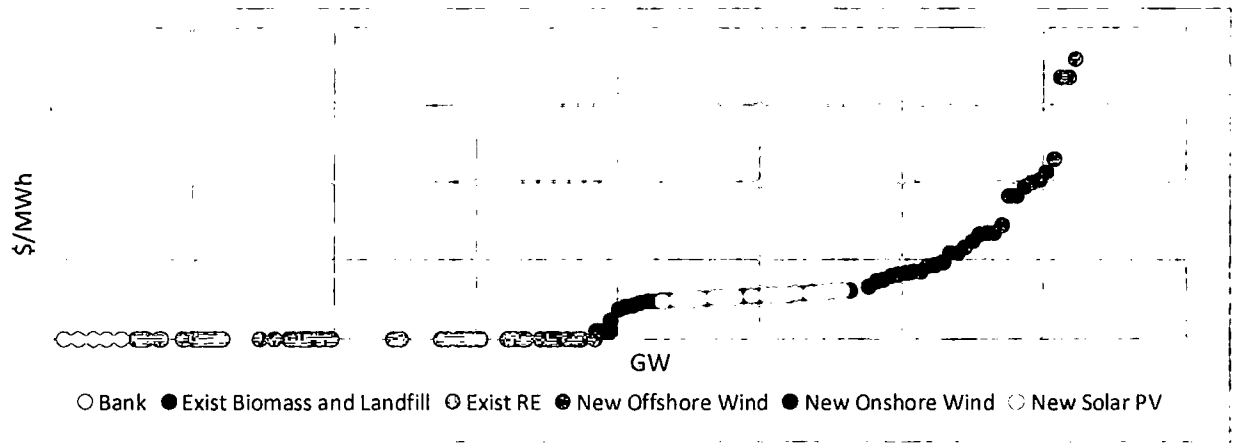
Exhibit 6: Illustrative LCOE for New Renewable Resources in PJM[1,2]



1. Federal tax credits are included with a 4-year safe harbor assumption. Offshore wind is assumed to take the ITC in lieu of the PTC.
2. Storage costs are approximated and do not reflect storage cycles or degradation.

In shortage periods, IPM will determine the appropriate units to build and dispatch resources as needed to meet RPS demand requirements, which are specified at the state level in the model. The cost of supply is based on capital and operating expense assumptions, while the quantity of supply is based on the performance assumptions for resources, which vary by location. The costs of generation capture the capital (including investment return) and fixed operating expenses based on the generator type and location. These costs are reduced by the potential for generation to earn credit for their energy and capacity sales. Exhibit 7 shows an illustrative depiction of the PJM RPS supply curve in IPM for a given year, including the option of using banked RECs. The supply curve varies yearly, as the relative economics of new wind and solar builds change over time due to declining capital costs and the expiration of tax credits.

Exhibit 7: Illustrative PJM RPS Supply Curve



In determining alternatives to build and building the RPS supply curve, IPM further reduces the costs based on the revenue earning capabilities of the facility. That is, IPM simultaneously considers the energy and capacity value for renewable resources against the cost of each resource in order to develop the RPS supply curve utilized within IPM. As such, each facility is evaluated based on its locational costs and revenue expectations.

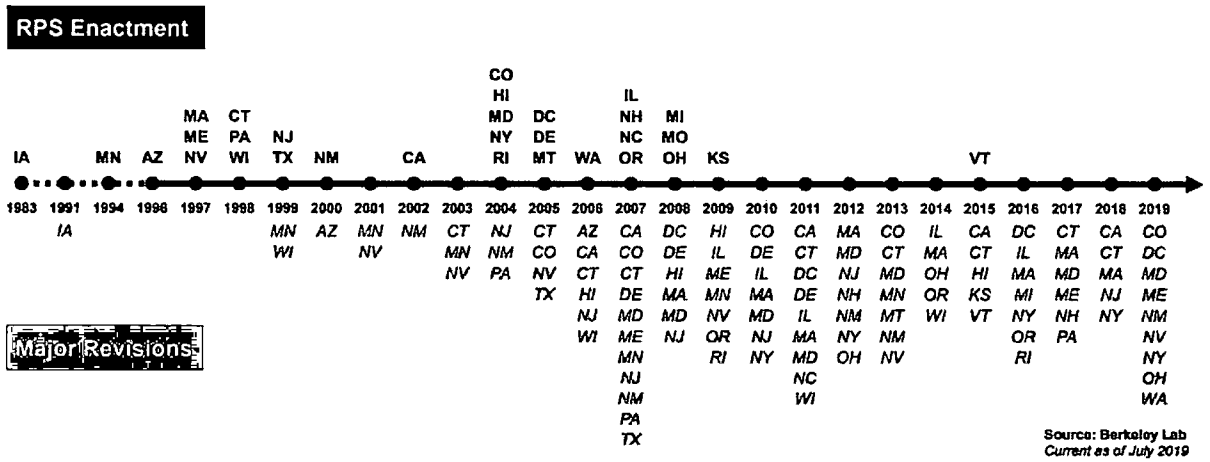
The PJM REC markets are thus modeled dynamically in IPM, with the model selecting the least-cost resource portfolio to meet the RPS demand. The model also considers the bankability of RECs and will temporally shift builds to minimize the cost of RPS compliance. For example, though the market may not need incremental supply in 2020 to serve the REC demand, a facility may be developed early to take advantage of the savings achievable through claiming the PTC credit. Excess credits available can then be banked for use in future years. As such, REC prices reflect the time value of the REC captured through the endogenous banking behavior in IPM.

Sensitivity Case Modeling

While the REC price forecast is estimated based on reference conditions reflecting promulgated policies, there is significant uncertainty in REC markets. Near-constant changes and refinements have defined

renewable portfolio standards since near the inception of such programs. As illustrated in Exhibit 8, states have enacted changes to their RPS policies over time. States in PJM have had frequent changes in their policy goals – for example, Maryland enacted a revision 2017 as shown, and again in 2019.

Exhibit 8: State RPS Revisions



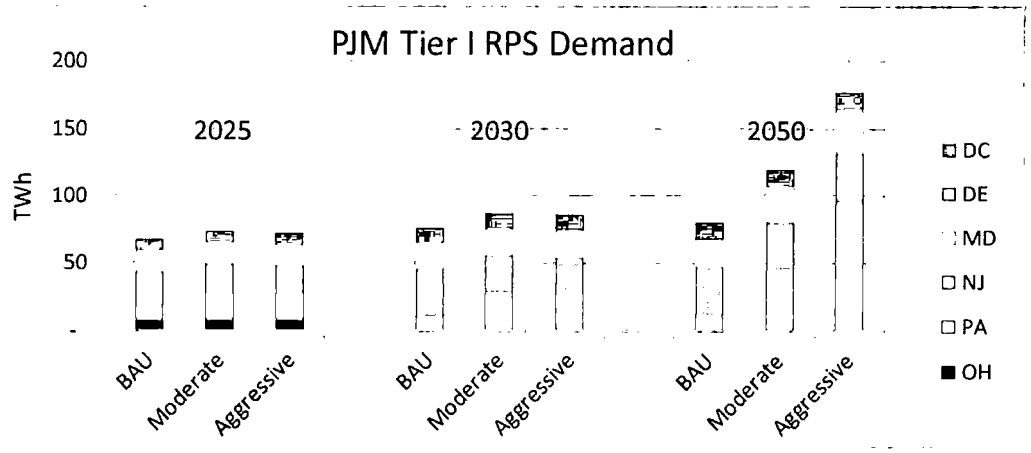
Source: Lawrence Berkeley National Labs, U.S. Renewable Portfolio Standards 2019 Annual Status Report.

Rather than rely on a single point estimate of the REC price for PJM Tier 1, ICF has adopted a methodology to account for uncertainty in the RPS policies. As such, the PJM Tier 1 REC price forecast provided to Dominion reflects a weighted average REC price forecast based on consideration of multiple possible policy outcomes. Specifically, ICF modeled three RPS scenarios to capture the regulatory uncertainty around RPS policies:

- Business As Usual (BAU) Policy Case,
- Moderate Policy Case, and
- Aggressive Policy Case

The BAU Policy Case scenario reflects current policy goals, assuming no changes to established policies over time. The Moderate Policy Case includes states taking partial action in a given direction, while the Aggressive Policy Case reflects more aggressive action taken. Exhibit 9 provides an indication of the relative demand for RECs across the three cases and additional details of each of the cases is provided in Exhibit 10 which indicates overall Tier I RPS requirement for each state, along with relevant solar carve-out requirements and offshore wind (OSW) procurement targets.

Exhibit 9: Scenario RPS Demand Comparison[1]



[1]Demand shown is Tier I net of solar carve-outs.

Exhibit 10: Scenario RPS Assumption Summary

	BAU Policy Case (No Change)	Moderate Policy Case	Aggressive Policy Case
NJ	50% by 2030 Solar: 5.1% by 2021 OSW: 3.5 GW by 2030	50% by 2030, 70% by 2050 Solar: 10% by 2030, 20% by 2050 OSW: 3.5 GW by 2030, 5 GW by 2050	50% by 2030, 85% by 2050 Solar: 15% by 2030, 30% by 2050 OSW: 3.5 by 2030, 6 GW by 2050
PA	8% by 2021 Solar: 0.5% by 2021	30% by 2030, 50% by 2050 Solar: 10% by 2030, 20% by 2050	30% by 2030, 85% by 2050 Solar: 10% by 2030, 30% by 2050
MD	50% by 2030 Solar: 14.5% by 2028 OSW: 1.5 GW by 2030	50% by 2030, 70% by 2050 Solar: 25% by 2050 OSW: 1.5 GW by 2030, 3 GW by 2050	50% by 2030, 85% by 2050 Solar: 30% by 2050 OSW: 1.5 GW by 2030, 4 GW by 2050
DE	25% by 2025 Solar: 3.5% by 2025 OSW: 0	30% by 2030, 50% by 2050 Solar: 5% by 2030, 15% by 2050 OSW: 200 MW by 2030	50% by 2030, 70% by 2050 Solar: 10% by 2030, 30% by 2050 OSW: 200 MW by 2030, 1 GW by 2050
OH	8.5% by 2026	8.5% by 2026	8.5% by 2026
D.C.	100% by 2032 Solar: 10% by 2041	No change No change	No change No change

The final ICF forecast reflects a probability weighted average of the three scenarios that reflects the likelihood of RPS policy changes over time. The probabilities consider the likelihood of specific states acting to change their RPS programs, and on what timeline they may act.

While representative of a broad range of forecast results, these cases do not capture all uncertainty. Elements not addressed include the potential for PTC/ITC extensions, costs and performance improvements for renewables, carbon price risk, market rule changes for storage, technological advances for storage, integration costs, and changes in the value of the electric load carrying capability of facilities.

Case Results

The case used for the RPS policy discussed below is the Virginia in RGGI Case, which includes no assumed federal carbon regulations and assumes that VA links with RGGI. The trends in this case are similar to those in the other cases. The Tax Credit Extension Sensitivity is discussed separately below.

Business as Usual Policy Case

In the BAU Policy Case, BAU RPS targets are modeled, where current mandatory RPS programs stay in place with no changes. This means, for example, that New Jersey's target of 50% by 2030 remains its target through 2060. The resulting BAU Policy Case PJM Tier I REC price is shown in Exhibit 11.

Exhibit 11: BAU Policy Case PJM Tier I REC (2019$/MWh)

$/REC	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040	2050	2060
BAU	7.32	7.41	7.37	7.7	8.71	10.56	12.41	11.07	10.01	8.57	3.2	3.2	3.2	3.2	3.2

In 2020, the Tier I demand net of solar carve-outs is approximately 42 TWh. In the BAU Policy Case, Tier I RPS demand increases to approximately 77 TWh in 2030, an increase of nearly 35 TWh. A significant portion of this Tier I demand is met by mandated offshore wind capacity additions, including 3,500 MW in New Jersey and 1,568 MW in Maryland. These offshore wind projects meet approximately 57% of the incremental Tier I demand between 2020 and 2030. The remaining demand is met by a combination of new wind and solar capacity additions and increased generation from existing dispatchable resources, such as hydro and biomass.

BAU Policy Case Tier I REC prices hover around $7-9/MWh through 2024 as the PJM REC market stays in the relatively balanced state that characterizes the current market. As PTC-subsidized wind builds are removed as a cost-effective compliance option for Tier I RPS compliance, REC prices increase to continue driving new renewable resources in an environment with continued RPS demand increases. While Pennsylvania reaches its final target in 2021, targets in New Jersey, Maryland, Ohio and Delaware all continue increasing.

As such, prices increase through 2026 before declining through 2030. This is due to state-sponsored offshore wind projects beginning to come online in the two states (besides D.C.) that still have increasing RPS demand through 2030. Both New Jersey and Maryland's Tier I RPS demand increases from 2025 to 2030 are completely supplied by their respective offshore wind additions. Thus, by 2030, the PJM Tier I market is fully supplied. With no RPS percentage increases for any PJM state post 2030, the spot market price falls to just the transactional value for a compliance REC, for which ICF has used $3.20/MWh. The $3.20/MWh value is at a premium to voluntary markets due to additional compliance and reporting requirements placed on LSEs.

The Moderate Policy Case

The Moderate Policy Case RPS target assumptions (see Exhibit 10) reflect REC price risk as a result of likely policy changes in the near- and mid-term, particularly those states whose terminal years are reached prior to 2030.

In the Moderate Policy Case, the New Jersey target assumes an increase in the solar carve-out over time, a process that the state BPU is currently undertaking. Beyond the BAU target of 50% by 2030, the

Moderate Policy Case extends the program by 1%/yr, reaching 70% in 2050. The offshore wind mandate increases as well, adding an additional 1,500 MW by 2050.

The Pennsylvania target increases to 30% by 2030, with a 1%/yr increase after that to reach 50% by 2050. The interim 2030 target is based on legislation introduced in the state in 2019, SB 600, which would increase the Tier I target to 30% by 2030 and increase the solar carve-out to 10% by 2030. The 10% by 2030 target is also in line with PA DEP's Solar for the Future Plan, which outlines pathways to 10% solar penetration by 2030.

The Maryland target follows New Jersey in reaching 70% by 2050, with a slightly higher solar carve-out of 25% by 2050, consistent with a higher BAU solar carve-out. For Delaware, the Tier I target increases 1%/yr from the BAU level, and Washington, D.C. remains unchanged from the BAU, since it already has a mandate for 100% renewable energy. Ohio also remains unchanged from the BAU, with a terminal target of 8.5% by 2026.

The Aggressive Policy Case

The Aggressive Policy Case RPS target assumptions (see Exhibit 10) reflect REC price risk as a result of likely policy changes in the mid- and long-term, particularly those states with long-term decarbonization efforts. States are already looking towards decarbonization goals. In New Jersey, Governor Murphy's Executive Order 28 directed the 2019 Energy Master Plan to provide a blueprint towards achieving 100% clean energy by 2050.[2] In Maryland the recently passed SB 516 which increased the state's RPS target to 50% by 2030 also requires an assessment of the costs and benefits of a 100% renewable energy by 2040 goal and the completion of a plan with recommendations for the achievement of that goal.

In the Aggressive Policy Case, the New Jersey, Pennsylvania, Maryland and Delaware targets all reflect an assumption of decarbonization by 2050, but rather than assuming targets of 100% by 2050, ICF has used 85% in acknowledgement of the feasibility constraints that exist in attaining a 100% RPS with status quo technology and transmission assumptions. All solar carve-out and offshore wind targets, where applicable, increase to higher levels than in the Moderate Policy Case by 2050. As in the Moderate Policy Case, Ohio and D.C. targets remain unchanged from the BAU.

The resulting REC prices from the Moderate and Aggressive Policy Cases offer a slight upside to the BAU Policy Case REC price forecast through 2030 but provide a more significant upside post 2030. Through 2030, the increases in the Moderate and Aggressive Policy Case Tier I requirements are more than offset by increases in solar and offshore wind carve-outs, as in the BAU scenario. The significant increase in 2050 targets puts upward pressure on REC prices as the more aggressive targets lead to greater incentive to bank allowances for use in later years. Exhibit 12 shows the REC price projections for each Case.

Exhibit 12: Scenario Case REC Prices (2019$/MWh)

$/REC	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040	2050	2060
BAU	7.3	7.4	7.4	7.7	8.7	10.6	12.4	11.1	10.0	8.6	3.2	3.2	3.2	3.2	3.2
Moderate	7.3	7.4	7.6	8.0	9.0	10.9	12.7	11.3	10.2	8.7	3.2	9.8	6.3	4.9	6.3
Aggressive	7.3	7.4	7.6	8.0	9.0	10.9	12.7	11.3	10.2	8.7	3.2	10.2	7.7	9.1	7.5

[2] In June 2019 the Draft 2019 Energy Master Plan was released (https://nj.gov/emp/pdf/Draft%202019%20EMP%20Final.pdf)

Probability Weighted REC Price Projection

Exhibit 13 reflects the risk of policy uncertainty regarding existing PJM RPS programs. Each probability considers the likelihood of specific states within each Case taking action to change their RPS programs, and on what timeline they may act. In the resulting weighted REC price forecast shown in Exhibit 14, ICF weighted each Case together with the probabilities shown in Exhibit 13.

Exhibit 13: Scenario Case Probabilities (%)

Probabilities	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040	2050	2060
BAU	90	80	75	70	65	55	45	35	25	15	5	0	0	0	0
Moderate	5	15	20	25	30	40	47	54	61	68	75	75	70	60	40
Aggressive	5	5	5	5	5	5	8	11	14	17	20	25	30	40	60

Exhibit 14: Virginia in RGGI Case PJM Tier I Weighted REC Price Forecast (2019$/MWh)

$/REC	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040	2050	2060
Weighted	7.3	7.4	7.4	7.8	8.8	10.7	12.6	11.2	10.1	8.6	3.2	9.9	6.7	6.6	7.0

The BAU Policy Case has a high probability in 2020, but it quickly begins to decrease and by 2035 it reaches 0%. This is because of the high rate of change that RPS programs experience; it is highly unlikely that the PJM states will not again revise their RPS programs in the next couple years.

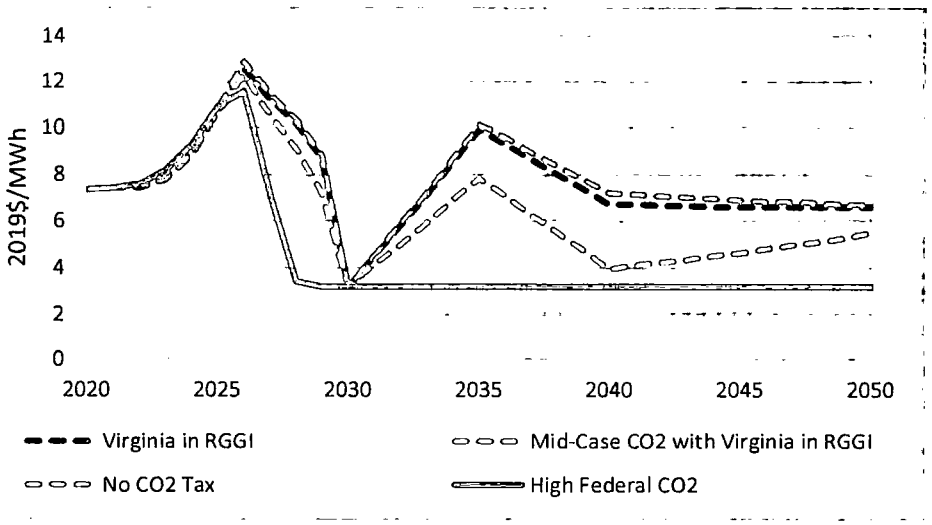
The Moderate Policy Case probability increases quickly, as the likelihood of such near-term changes is high. The probability of the Moderate Policy Case peaks at 75% for 2030-2035 before falling to 40% by 2060. The Moderate Policy Case targets do extend from 2030 to 2050 in all states (except Ohio), so there's a chance that states don't increase all the way to the Aggressive Policy Case 2050 targets.

The Aggressive Policy Case targets focus on the post-2030 period, with minor differences to the Moderate Policy Case prior to 2030. The Aggressive Policy Case is weighted at 5% until 2026, after which it increases to 20% by 2030. By 2060, the likelihood increases to 60%, as current political goals for decarbonization are expected to continue and only get stronger in the future. The offshore wind carve-outs in the Aggressive Policy Case for 2060 may end up being conservative in reality; however, given current costs and industry reliance on state mandates, ICF did not take an aggressive stance on offshore wind additions outside of current state mandates. As such, there's room for offshore wind to play a much large role in meeting long-term RPS targets than it does in this analysis, which would result in lower Tier I REC prices in the long-term, all else equal.

REC Price Projection Comparisons

Differences in REC prices between the cases, both with and without Virginia in RGGI and with various CO2 price assumptions, are largely driven by changes in market revenues due to the CO2 price specification. As shown below, the weighted REC prices from the cases with no assumed federal carbon regulation track closely. The Mid-Case CO2 with Virginia in RGGI and High Federal CO2 Case fall below the prior two cases. The High Federal CO2 Case is below all the other cases due to the higher energy revenues, leading to an earlier and sustained collapse in REC prices.

Exhibit 15: PJM Tier I Weighted REC Price Forecast Comparison (2019$/MWh)



Federal Tax Credit Extension Sensitivity

The Tax Credit Extension Case extends the PTC at 60% of its full value and the ITC at 30% indefinitely. This significantly reduces the cost to build renewables, resulting in a greater renewable capacity buildout and depressed REC prices. Exhibit 16 below shows the REC price forecast for the three RPS scenarios as well as the weighted price. REC prices immediately decline in each of the three RPS scenarios after the forwards period, reaching the floor price in 2028 in all RPS scenarios and remaining there until 2060. In each of these cases, onshore wind and solar are both economic 2028-2060 and do not need incremental revenue support to meet the states' RPS requirements.

Exhibit 16: ICF Tax Extension Case PJM Tier I Weighted REC Price Forecast (2019$/MWh)

$/REC	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040	2050	2060
BAU	7.32	7.41	8.35	6.34	4.06	3.69	3.33	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Moderate	7.32	7.41	8.35	6.34	4.31	4.04	3.68	3.22	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Aggressive	7.32	7.41	8.35	6.34	4.30	4.03	3.66	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
Weighted	7.32	7.41	8.35	6.34	4.15	3.85	3.51	3.21	3.20	3.20	3.20	3.20	3.20	3.20	3.20

Voluntary REC Markets

Outside of the mandated RPS goals of individual states, a voluntary market for renewable supply exists. This market is driven by companies, government agencies, and private consumers who choose to procure renewable energy products for goodwill gained through environmental marketing value, or other purposes outside the RPS policy requirements. Developers with renewable energy projects outside of the eligibility criteria of a state RPS program may find an opportunity to generate additional revenue through the sale of RECs into the voluntary market.

Most voluntary market purchases are unbundled RECs (i.e. not inclusive of energy or capacity), and rely on certification programs that verify that the RECs were generated by an eligible facility and that the

chain of REC custody is fully audited. Voluntary buyers are generally highly interested in where the REC was generated. For example, a buyer in Virginia may be more willing to purchase locally generated RECs then those from far away to maximize the benefit perceived by the local community and stakeholders.

Unlike RPS driven requirements, there is no enforcement of voluntary markets, and hence, the demand is considered a soft demand, motivated by internal drivers rather than external ones. While higher voluntary (Green-e) REC prices are exhibited in ERCOT and some WECC markets, the value of Green-e RECs tend to remain at a lower level on an average basis. Exhibit 17 shows ICF's Green-e REC price forecast.

Exhibit 17: Green-e REC Price Forecast (2019$/MWh)

$/REC	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040	2050	2060
Green-e	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.9	1.0	1.0	1.0

Appendix 4R – Delivered Fuel Data for Plan B

Company Name: Virginia Electric and Power Company

Schedule 18

FUEL DATA

	(ACTUAL)				(PROJECTED)														
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I. Delivered Fuel Price ($/mmBtu)[1]																			
a. Nuclear	0.70	0.67	0.61	0.61	0.60	0.63	0.70	0.70	0.70	0.69	0.70	0.70	0.72	0.73	0.74	0.74	0.75	0.76	0.77
b. Biomass	3.00	3.02	3.09	2.53	2.55	2.58	2.61	2.63	2.66	2.69	2.72	2.75	2.79	2.84	2.89	2.94	3.00	3.05	3.11
c. Coal	2.70	2.94	2.82	1.97	2.09	2.39	2.60	2.66	2.73	2.80	2.87	2.94	3.00	3.08	3.16	3.23	3.31	3.39	3.47
d. Heavy Fuel Oil	6.34	7.28	7.77	11.08	9.91	9.09	8.83	9.42	9.98	10.46	11.10	11.84	12.59	12.89	13.22	13.55	13.89	14.23	14.58
e. Light Fuel Oil[2]	11.73	10.91	14.90	14.90	14.28	13.87	14.31	15.16	15.97	16.69	17.61	18.68	19.75	20.78	21.60	22.26	22.83	23.34	23.83
f. Natural Gas	3.50	4.83	3.44	2.86	3.22	3.33	3.29	3.22	3.32	3.62	3.76	3.86	4.21	4.45	4.54	4.63	4.72	4.81	4.92
II. Primary Fuel Expenses (cents/kWh)[3]																			
a. Nuclear	0.72	0.69	0.63	0.63	0.63	0.66	0.72	0.73	0.73	0.72	0.73	0.73	0.75	0.75	0.76	0.77	0.78	0.79	0.80
b. Biomass	4.25	4.57	4.79	2.81	2.90	2.94	2.99	3.09	3.13	3.16	3.22	3.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c. Coal	2.88	3.02	3.13	1.94	2.05	2.35	2.56	2.63	2.69	2.76	2.83	2.90	2.96	3.04	3.11	3.19	3.27	3.35	3.43
d. Heavy Fuel Oil	7.60	6.15	0.00	10.97	10.07	9.18	8.23	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
e. Light Fuel Oil[2]	16.32	15.83	18.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
f. Natural Gas	2.64	3.34	2.41	1.73	1.87	2.06	2.08	1.98	2.09	2.27	2.36	2.48	2.64	2.78	2.88	2.95	2.94	2.98	3.08
g. NUG[4]	5.28	4.49	4.67	0.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
i. Economy Energy Purchases[5]	3.36	4.88	3.25	2.29	2.36	2.60	2.70	2.63	3.04	3.29	3.29	3.37	3.42	3.64	3.50	3.51	3.92	4.02	3.74
j. Capacity Purchases ($/kW-Year)	52.64	58.12	46.35	31.50	41.45	51.31	52.48	53.50	54.52	55.56	56.64	57.74	58.88	60.04	61.21	62.39	63.59	64.81	66.05

Notes: 1) Delivered fuel price for NAPP (12,900, 3.2% FOB), No. 2 Oil, No. 6 Oil, DOM Zone Delivered Natural Gas are used to represent Coal, Heavy Fuel, Light Fuel Oil and Natural Gas respectively.

2) Light fuel oil is used for reliability only at dual-fuel facilities.

3) Primary Fuel Expenses for Nuclear, Biomass, Coal, Heavy Fuel Oil and Natural Gas are based on North Anna 1, Altavista, Mount Storm 1, Possum Point 5, Possum Point 6, respectively

4) Average of NUGs fuel expenses.

5) Average cost of market energy purchases.

Appendix 5A – Existing Generation Units in Service

Company Name: Virginia Electric and Power Company **Schedule 14a**

UNIT PERFORMANCE DATA

Existing Supply-Side Resources (MW)

Unit Name	Location	Unit Class	Primary Fuel Type	C.O.D.[1]	MW Summer
Altavista	Altavista, VA	Base	Renewable	Feb-1992	51
Bath County 1-6	Warm Springs, VA	Intermediate	Hydro-Pumped Storage	Dec-1985	1,808
Bear Garden	Buckingham County, VA	Intermediate	Natural Gas-CC	May-2011	622
Brunswick	Brunswick County, VA	Intermediate	Natural Gas-CC	May-2016	1,376
Chesapeake CT 1, 4, 6	Chesapeake, VA	Peak	Light Fuel Oil	Dec-1967	39
Chesterfield 5	Chester, VA	Base	Coal	Aug-1964	336
Chesterfield 6	Chester, VA	Base	Coal	Dec-1969	678
Chesterfield 7	Chester, VA	Intermediate	Natural Gas-CC	Jun-1990	197
Chesterfield 8	Chester, VA	Intermediate	Natural Gas-CC	May-1992	195
Clover 1	Clover, VA	Base	Coal	Oct-1995	220
Clover 2	Clover, VA	Base	Coal	Mar-1996	219
Colonial Trail West	Surry, VA	Intermittent	Renewable	Dec-2019	93
Darbytown 1	Richmond, VA	Peak	Natural Gas-Turbine	May-1990	84
Darbytown 2	Richmond, VA	Peak	Natural Gas-Turbine	May-1990	84
Darbytown 3	Richmond, VA	Peak	Natural Gas-Turbine	Apr-1990	84
Darbytown 4	Richmond, VA	Peak	Natural Gas-Turbine	Apr-1990	84
Elizabeth River 1	Chesapeake, VA	Peak	Natural Gas-Turbine	Jun-1992	110
Elizabeth River 2	Chesapeake, VA	Peak	Natural Gas-Turbine	Jun-1992	110
Elizabeth River 3	Chesapeake, VA	Peak	Natural Gas-Turbine	Jun-1992	110
Gaston Hydro	Roanoake Rapids, NC	Intermediate	Hydro-Conventional	Feb-1963	220
Gordonsville 1	Gordonsville, VA	Intermediate	Natural Gas-CC	Jun-1994	109
Gordonsville 2	Gordonsville, VA	Intermediate	Natural Gas-CC	Jun-1994	109
Gravel Neck 1-2	Surry, VA	Peak	Light Fuel Oil	Aug-1970	28
Gravel Neck 3	Surry, VA	Peak	Natural Gas-Turbine	Oct-1989	85
Gravel Neck 4	Surry, VA	Peak	Natural Gas-Turbine	Jul-1989	85
Gravel Neck 5	Surry, VA	Peak	Natural Gas-Turbine	Jul-1989	85
Gravel Neck 6	Surry, VA	Peak	Natural Gas-Turbine	Nov-1989	85
Greensville	Brunswick County, VA	Intermediate	Natural Gas-CC	Dec-2018	1,588
Hopewell	Hopewell, VA	Base	Renewable	Jul-1989	51
Ladysmith 1	Woodford, VA	Peak	Natural Gas-Turbine	May-2001	151
Ladysmith 2	Woodford, VA	Peak	Natural Gas-Turbine	May-2001	151
Ladysmith 3	Woodford, VA	Peak	Natural Gas-Turbine	Jun-2008	161
Ladysmith 4	Woodford, VA	Peak	Natural Gas-Turbine	Jun-2008	160
Ladysmith 5	Woodford, VA	Peak	Natural Gas-Turbine	Apr-2009	160
Lowmoor CT 1-4	Covington, VA	Peak	Light Fuel Oil	Jul-1971	48

Note: (1) Commercial operation date.

Appendix 5A cont. – Existing Generation Units in Service

Company Name: Virginia Electric and Power Company **Schedule 14a**

UNIT PERFORMANCE DATA

Existing Supply-Side Resources (MW)

Unit Name	Location	Unit Class	Primary Fuel Type	C.O.D.[1]	MW Summer
Mount Storm 1	Mt. Storm, WV	Base	Coal	Sep-1965	548
Mount Storm 2	Mt. Storm, WV	Base	Coal	Jul-1966	553
Mount Storm 3	Mt. Storm, WV	Base	Coal	Dec-1973	520
Mount Storm CT	Mt. Storm, WV	Peak	Light Fuel Oil	Oct-1967	11
North Anna 1	Mineral, VA	Base	Nuclear	Jun-1978	838
North Anna 2	Mineral, VA	Base	Nuclear	Dec-1980	834
North Anna Hydro	Mineral, VA	Intermediate	Hydro-Conventional	Dec-1987	1
Northern Neck CT 1-4	Warsaw, VA	Peak	Light Fuel Oil	Jul-1971	47
Possum Point 5	Dumfries, VA	Peak	Heavy Fuel Oil	Jun-1975	623
Possum Point 6	Dumfries, VA	Intermediate	Natural Gas-CC	Jul-2003	573
Possum Point CT 1-6	Dumfries, VA	Peak	Light Fuel Oil	May-1968	72
Remington 1	Remington, VA	Peak	Natural Gas-Turbine	Jul-2000	153
Remington 2	Remington, VA	Peak	Natural Gas-Turbine	Jul-2000	151
Remington 3	Remington, VA	Peak	Natural Gas-Turbine	Jul-2000	152
Remington 4	Remington, VA	Peak	Natural Gas-Turbine	Jul-2000	152
Roanoke Rapids Hydro	Roanoake Rapids, NC	Intermediate	Hydro-Conventional	Sep-1955	95
Rosemary	Roanoke Rapids, NC	Peak	Natural Gas-CC	Dec-1990	165
Scott Solar	Powhatan, VA	Intermittent	Renewable	Dec-2016	11
Solar Partnership Program	Distributed	Intermittent	Renewable	Jan-2012	5
Southampton	Franklin, VA	Base	Renewable	Mar-1992	51
Surry 1	Surry, VA	Base	Nuclear	Dec-1972	838
Surry 2	Surry, VA	Base	Nuclear	May-1973	838
Virginia City Hybrid Energy Center	Virginia City, VA	Base	Coal	Jul-2012	610
Warren	Front Royal, VA	Intermediate	Natural Gas-CC	Dec-2014	1,370
Whitehouse Solar	Louisa, VA	Intermittent	Renewable	Dec-2016	12
Woodland Solar	Isle of Wight, VA	Intermittent	Renewable	Dec-2016	13
Yorktown 3	Yorktown, VA	Peak	Heavy Fuel Oil	Dec-1974	790
Subtotal - Base					7,185
Subtotal - Intermediate					8,263
Subtotal - Peak					4,220
Subtotal - Intermittent					134
Total					19,802

Note: (1) Commercial operation date.

Appendix 5B – Other Generation Units

Company Name: Virginia Electric and Power Company **Schedule 14b**

UNIT PERFORMANCE DATA

Existing Supply-Side Resources (kW)

Unit Name	Location	Primary Fuel Type	kW Summer	Contract Start	Contract Expiration
Non-Utility Generation (NUG) Units[1]					
W. E. Partners II	NC	Biomass	300	3/15/2012	Auto renew
W. E. Partners 1	NC	Biomass	100	4/26/2013	Auto renew
Weyerhaeuser/Domtar	NC	Coal/Biomass	28,400[2]	7/27/1991	Auto renew
3620 Virginia Dare Trail N	NC	Solar	4	9/14/2009	Auto renew
Plymouth Solar	NC	Solar	5,000	10/4/2012	10/3/2027
Dogwood Solar	NC	Solar	20,000	12/9/2014	12/8/2029
HXOap Solar	NC	Solar	20,000	12/16/2014	12/15/2029
Bethel Price Solar	NC	Solar	5,000	12/9/2014	12/8/2029
Jakana Solar	NC	Solar	5,000	12/4/2014	12/3/2029
Lewiston Solar	NC	Solar	5,000	12/18/2014	12/17/2029
Williamston Solar	NC	Solar	5,000	12/4/2014	12/3/2029
Windsor Solar	NC	Solar	5,000	12/17/2014	12/16/2029
510 REPP One Solar	NC	Solar	1,250	3/11/2015	3/10/2030
Everetts Wildcat Solar	NC	Solar	5,000	3/11/2015	3/10/2030
SolNC5 Solar	NC	Solar	5,000	5/12/2015	5/11/2030
Creswell Aligood Solar	NC	Solar	14,000	5/13/2015	5/12/2030
Two Mile Desert Road - SolNC1	NC	Solar	5,000	8/10/2015	8/9/2030
SolNCPower6 Solar	NC	Solar	5,000	11/1/2015	10/31/2030
Downs Farm Solar	NC	Solar	5,000	12/1/2015	11/30/2030
GKS Solar- SolNC2	NC	Solar	5,000	12/16/2015	12/15/2030
Windsor Cooper Hill Solar	NC	Solar	5,000	12/18/2015	12/17/2030
Green Farm Solar	NC	Solar	5,000	1/6/2016	1/5/2031
FAE X - Shawboro	NC	Solar	20,000	1/26/2016	1/25/2031
FAE XVII - Watson Seed	NC	Solar	20,000	1/28/2016	1/27/2031
Bradley PVI- FAE IX	NC	Solar	5,000	2/4/2016	2/3/2031
Conetoe Solar	NC	Solar	5,000	2/5/2016	2/4/2031
SolNC3 Solar-Sugar Run Solar	NC	Solar	5,000	2/5/2016	2/4/2031
Gates Solar	NC	Solar	5,000	2/8/2016	2/7/2031
Long Farm 46 Solar	NC	Solar	5,000	2/12/2016	2/11/2031
Battleboro Farm Solar	NC	Solar	5,000	2/17/2016	2/16/2031
Winton Solar	NC	Solar	5,000	2/8/2016	2/7/2031
SolNC10 Solar	NC	Solar	5,000	1/13/2016	1/12/2031
Tarboro Solar	NC	Solar	5,000	12/31/2015	12/30/2030
Bethel Solar	NC	Solar	4,400	3/3/2016	3/2/2031
Garysburg Solar	NC	Solar	5,000	3/18/2016	3/17/2031
Woodland Solar	NC	Solar	5,000	4/7/2016	4/6/2031
Gaston Solar	NC	Solar	5,000	4/18/2016	4/17/2031
TWE Kelford Solar	NC	Solar	4,700	6/6/2016	6/5/2031
FAE XVIII - Meadows	NC	Solar	20,000	6/9/2016	6/8/2031
Seaboard Solar	NC	Solar	5,000	6/29/2016	6/28/2031
Simons Farm Solar	NC	Solar	5,000	7/13/2016	7/12/2031
Whitakers Farm Solar	NC	Solar	3,400	7/20/2016	7/19/2031
MC1 Solar	NC	Solar	5,000	8/19/2016	8/18/2031
Williamston West Farm Solar	NC	Solar	5,000	8/23/2016	8/22/2031
River Road Solar	NC	Solar	5,000	8/23/2016	8/22/2031
White Farm Solar	NC	Solar	5,000	8/26/2016	8/25/2031
Hardison Farm Solar	NC	Solar	5,000	9/9/2016	9/8/2031
Modlin Farm Solar	NC	Solar	5,000	9/14/2016	9/13/2031

Notes: (1) In operation as of April 1, 2020; generating facilities that have contracted directly with Virginia Electric and Power Company
(2) PPA is for excess energy only typically 4,000 – 14,000 kW.
(3) PPA is for excess energy only typically 3,500 kW.

Appendix 5B cont. – Other Generation Units

Company Name: Virginia Electric and Power Company **Schedule 14b**
UNIT PERFORMANCE DATA
Existing Supply-Side Resources (kW)

Unit Name	Location	Primary Fuel Type	kW Summer	Contract Start	Contract Expiration
Battleboro Solar	NC	Solar	5,000	10/7/2016	10/6/2031
Williamston Speight Solar	NC	Solar	15,000	11/23/2016	11/22/2031
Barnhill Road Solar	NC	Solar	3,100	11/30/2016	11/29/2031
Hemlock Solar	NC	Solar	5,000	12/5/2016	12/4/2031
Leggett Solar	NC	Solar	5,000	12/14/2016	12/13/2031
Schell Solar Farm	NC	Solar	5,000	12/22/2016	12/21/2031
FAE XXXV - Turkey Creek	NC	Solar	13,500	1/31/2017	1/30/2027
FAE XXII - Baker PVI	NC	Solar	5,000	1/30/2017	1/29/2032
FAE XXI -Benthall Bridge PVI	NC	Solar	5,000	1/30/2017	1/29/2032
Aulander Hwy 42 Solar	NC	Solar	5,000	12/30/2016	12/29/2031
Floyd Road Solar	NC	Solar	5,000	6/19/2017	6/18/2032
Flat Meeks- FAE II	NC	Solar	5,000	10/27/2017	10/26/2032
HXNAir Solar One	NC	Solar	5,000	12/21/2017	12/20/2032
Cork Oak Solar	NC	Solar	20,000	12/29/2017	12/28/2027
Sunflower Solar	NC	Solar	16,000	12/29/2017	12/28/2027
Davis Lane Solar	NC	Solar	5,000	12/31/2017	12/30/2032
FAE XIX- American Legion PVI	NC	Solar	15,840	1/2/2018	1/1/2033
FAE XXV-Vaughn's Creek	NC	Solar	20,000	1/2/2018	1/1/2033
TWE Ahoskie Solar Project	NC	Solar	5,000	1/12/2018	1/11/2033
Cottonwood Solar	NC	Solar	3,000	1/25/2018	1/24/2033
Shiloh Hwy 1108 Solar	NC	Solar	5,000	2/9/2018	2/8/2033
Chowan Jehu Road Solar	NC	Solar	5,000	2/9/2018	2/8/2033
Phelps 158 Solar Farm	NC	Solar	5,000	2/26/2018	2/25/2033
Sandy Solar	NC	Solar	5,000	5/30/2018	5/29/2033
Northern Cardinal Solar	NC	Solar	2,000	6/29/2018	6/28/2033
Carl Friedrich Gauss Solar	NC	Solar	5,000	9/10/2018	9/9/2033
Sun Farm VI Solar	NC	Solar	4,975	9/10/2018	9/9/2033
Sun Farm V Solar	NC	Solar	4,975	9/10/2018	9/9/2033
Citizens Hertford	NC	Solar	16,200	6/6/2019	6/5/2029
Camden Dam Solar	NC	Solar	5,000	9/10/2018	9/9/2033
Mill Pond Solar	NC	Solar	5,000	9/10/2018	9/9/2033
Jamesville Road	NC	Solar	5,000	9/10/2018	9/9/2033
North 301	NC	Solar	20,000	12/18/2019	12/17/2029
Five Forks	NC	Solar	20,000	12/23/2019	12/22/2029
Whitehurst PVI Solar	NC	Solar	10,000	3/13/2020	3/12/2035
FAE XXXIII-Grandy	NC	Solar	20,000	3/13/2020	3/12/2030
MeadWestvaco (formerly Westvaco)	VA	Coal/Biomass	140,000	11/3/1982	8/25/2028
Smurfit-Stone Container	VA	Coal/Biomass	48,400[3]	3/21/1981	Auto renew
Brasfield Dam	VA	Hydro	2,800	10/12/1993	Auto renew
Columbia Mills	VA	Hydro	343	2/7/1985	Auto renew
Lakeview (Swift Creek) Dam	VA	Hydro	400	11/26/2008	Auto renew
Banister Dam	VA	Hydro	1,785	9/28/2008	Auto renew
Chapman Dam	VA	Hydro	300	10/17/1984	Auto renew
Burnshire Dam	VA	Hydro	100	7/11/2016	Auto renew
Cushaw Hydro	VA	Hydro	7,500	11/21/2018	11/20/2033
Suffolk Landfill	VA	Methane	3,000	11/4/1994	Auto renew
Alexandria/Arlington - Covanta	VA	MSW	21,000	1/29/1988	1/28/2023
Essex Solar Center	VA	Solar	20,000	12/14/2017	12/13/2037

Notes: (1) In operation as of April 1, 2020; generating facilities that have contracted directly with Virginia Electric and Power Company.
(2) PPA is for excess energy only typically 4,000 – 14,000 kW.
(3) PPA is for excess energy only typically 3,500 kW.

Appendix 5C – Equivalent Availability Factor for Plan B

Company Name: Virginia Electric and Power Company **Schedule 8**

UNIT PERFORMANCE DATA

Equivalent Availability Factor (%)

	(ACTUAL)			(PROJECTED)															
Unit Name	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Altavista	63	75	79	92	90	90	100	100	85	85	85	85	100	-	-	-	-	-	-
Bath County 1-6	90	82	87	91	91	89	89	92	91	91	91	91	91	91	91	91	91	91	91
Battery_Gen1				-	-	-	-	-	-	100	100	100	100	100	100	100	100	100	100
Battery_Gen2				-	-	-	-	-	-	-	100	100	100	100	100	100	100	100	100
Battery_Gen3				-	-	-	-	-	-	-	-	-	100	100	100	100	100	100	100
Battery_Gen4				-	-	-	-	-	-	-	-	-	-	-	-	100	100	100	100
Battery_Gen5				-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	100
Bear Garden	80	85	73	79	77	80	80	82	79	79	79	79	79	79	79	79	79	79	79
Brunswick	82	84	74	81	81	76	85	84	80	80	80	80	80	80	80	80	80	80	80
Chesapeake CT 1, 4, 6	99	94	85	90	90	89	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 5	65	57	47	77	87	84	100	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 6	59	47	51	73	79	84	100	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 7	84	69	78	71	92	80	92	85	87	87	87	87	87	87	87	87	87	87	87
Chesterfield 8	86	75	77	59	92	81	85	92	84	84	84	84	84	84	84	84	84	84	84
Clover 1	88	86	61	83	86	88	86	86	100	-	-	-	-	-	-	-	-	-	-
Clover 2	65	71	75	86	86	88	88	86	100	-	-	-	-	-	-	-	-	-	-
CVOW - Phase 1 (880MW)				-	-	-	-	-	-	35	37	40	39	39	39	40	39	39	39
CVOW - Phase 2 (880MW)				-	-	-	-	-	-	-	35	37	39	39	39	40	39	39	39
CVOW - Phase 3 (880MW)				-	-	-	-	-	-	-	35	37	39	39	39	40	39	39	39
CVOW (Pilot)				-	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Darbytown 1	92	97	89	67	93	85	93	93	90	90	90	90	90	90	90	90	90	90	90
Darbytown 2	93	87	97	94	94	87	71	94	90	90	90	90	90	90	90	90	90	90	90
Darbytown 3	89	97	89	94	94	87	94	94	90	90	90	90	90	90	90	90	90	90	90
Darbytown 4	92	73	93	94	94	87	94	94	90	90	90	90	90	90	90	90	90	90	90
Elizabeth River 1	93	90	90	58	87	94	94	94	90	90	90	90	90	90	90	90	90	90	90
Elizabeth River 2	92	76	75	93	87	94	94	69	90	90	90	90	90	90	90	90	90	90	90
Elizabeth River 3	92	80	94	92	87	94	94	94	90	90	90	90	90	90	90	90	90	90	90
Gaston Hydro	91	91	77	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Generic Brownfield CT				-	-	-	92	92	92	92	92	92	92	92	92	92	92	92	92
Generic Solar PV- (60MW)				-	-	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Generic Solar PV PPA Post 2022				-	-	-	25	25	25	25	25	25	25	25	25	25	25	25	25
Generic Solar PV PPA Pre 2022				-	-	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Generic Storage - Battery (Pilot) -14MW				-	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100
Generic Storage - Battery (Pilot) -16MW	-	-	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Gordonsville 1	77	74	84	77	83	89	79	84	84	84	84	84	84	84	84	84	84	84	84
Gordonsville 2	52	82	83	70	75	84	89	86	85	85	85	85	85	85	85	85	85	85	85
Gravel Neck 1-2	100	95	93	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gravel Neck 3	90	100	95	87	91	94	94	94	90	90	90	90	90	90	90	90	90	90	90
Gravel Neck 4	87	90	95	87	94	91	94	94	90	90	90	90	90	90	90	90	90	90	90
Gravel Neck 5	91	96	95	87	94	94	94	94	90	90	90	90	90	90	90	90	90	90	90
Gravel Neck 6	91	98	97	87	94	91	94	94	90	90	90	90	90	90	90	90	90	90	90

Note: EAF for intermittent resources shown as a capacity factor.

Appendix 5C cont. – Equivalent Availability Factor for Plan B

Company Name: Virginia Electric and Power Company — **Schedule 8**

UNIT PERFORMANCE DATA

Equivalent Availability Factor (%)

	(ACTUAL)			(PROJECTED)														
Unit Name	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Greensville	-	96	73	80	81	79	80	78	79	79	79	79	79	79	79	79	79	79	79
Hopewell	78	83	83	43	88	88	100	100	82	82	82	82	100	-	-	-	-	-	-
Ladysmith 1	85	93	86	90	90	90	79	90	90	90	90	90	90	90	90	90	90	90	90
Ladysmith 2	85	94	86	90	90	90	79	90	90	90	90	90	90	90	90	90	90	90	90
Ladysmith 3	84	74	87	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Ladysmith 4	77	79	87	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Ladysmith 5	83	95	87	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Lowmoor CT 1-4	98	98	99	91	91	91	-	-	-	-	-	-	-	-	-	-	-	-	-
Mount Storm 1	74	76	64	80	82	76	76	87	81	81	81	81	81	81	81	81	81	81	81
Mount Storm 2	81	66	60	70	76	86	86	81	81	81	81	81	81	81	81	81	81	81	81
Mount Storm 3	71	72	54	76	86	76	86	88	82	82	82	82	82	82	82	82	82	82	82
Mount Storm CT	96	79	98	90	90	89	-	-	-	-	-	-	-	-	-	-	-	-	-
New Pump Storage				-	-	-	-	-	-	-	-	-	-	70	70	70	70	70	70
North Anna 1	100	90	93	98	89	91	98	79	91	98	91	84	98	84	91	98	91	91	98
North Anna 2	90	99	88	89	98	91	77	98	91	91	98	91	84	98	84	91	91	98	91
North Anna Hydro	100	100	100	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
Northern Neck CT 1-4	94	99	97	90	90	90	-	-	-	-	-	-	-	-	-	-	-	-	-
Possum Point 5	62	57	69	77	84	100	-	-	-	-	-	-	-	-	-	-	-	-	-
Possum Point 6	75	83	69	60	72	82	84	77	75	75	75	75	75	75	75	75	75	75	75
Possum Point CT 1-6	97	95	100	90	90	90	-	-	-	-	-	-	-	-	-	-	-	-	-
Remington 1	91	94	79	89	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Remington 2	91	87	79	89	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Remington 3	70	89	76	89	90	87	90	90	90	90	90	90	90	90	90	90	90	90	90
Remington 4	83	88	79	89	90	87	90	90	90	90	90	90	90	90	90	90	90	90	90
Roanoke Rapids Hydro	92	90	72	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Rosemary	78	78	85	92	83	96	83	96	90	90	100	100	100	100	100	100	100	100	100
Scott Solar				24	24	24	24	24	24	24	24	23	23	23	23	23	23	23	23
Solar Partnership Program				14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Solar_DG				-	-	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Southampton	68	84	83	92	92	90	100	100	84	84	84	84	100	-	-	-	-	-	-
Surry 1	99	87	89	98	91	91	98	84	84	98	84	91	98	74	91	100	100	100	100
Surry 2	92	89	100	87	91	98	91	84	98	82	84	98	74	91	98	98	100	100	100
US-3 Solar 1				25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
US-3 Solar 2				-	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
US-4 Solar				-	25	25	25	25	25	25	25	26	26	26	26	26	26	26	27
Virginia City Hybrid Energy Center	74	64	55	75	78	78	78	78	77	77	77	77	77	77	77	77	77	77	77
Warren	88	78	80	81	72	81	81	81	79	79	79	79	79	79	79	79	79	79	79
Water Strider				-	25	25	25	26	26	26	26	26	26	26	26	27	27	27	27
Westmoreland_PPA				-	24	25	25	25	25	25	25	25	25	26	26	26	26	26	26
Whitehouse Solar				25	25	24	24	24	24	24	24	24	24	23	23	23	23	23	23
Woodland Solar				25	25	25	25	25	24	24	24	24	24	24	24	24	24	23	23
Yorktown 3	78	74	71	74	81	81	81	100	-	-	-	-	-	-	-	-	-	-	-

Note: EAF for intermittent resources shown as a capacity factor.

Appendix 5D – Net Capacity Factor for Plan B

Company Name: Virginia Electric and Power Company

Schedule 9

UNIT PERFORMANCE DATA

Net Capacity Factor (%)

	(ACTUAL)				(PROJECTED)														
Unit Name	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Altavista	.	61.3	61.0	40.3	53.1	72.5	40.5	4.6	5.9	6.7	5.7	6.0	-	-	-	-	-	-	-
Bath County 1-6	14.2	15.5	12.2	9.6	10.7	10.2	10.1	10.6	9.9	9.8	9.0	8.4	7.3	6.3	7.2	6.6	6.7	6.8	7.5
Battery_Gen1				-	-	-	-	-	-	14.8	13.1	13.7	12.7	12.2	12.2	11.7	12.9	14.2	14.9
Battery_Gen2				-	-	-	-	-	-	-	13.1	13.4	12.6	12.1	12.4	11.9	13.3	14.7	14.6
Battery_Gen3				-	-	-	-	-	-	-	-	-	12.9	11.9	12.2	11.9	12.9	15.0	14.9
Battery_Gen4				-	-	-	-	-	-	-	-	-	-	-	-	11.9	12.6	14.3	15.1
Battery_Gen5				-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.9	15.1
Bear Garden	62.1	74.3	65.3	74.2	65.2	74.6	74.3	76.5	73.1	68.4	66.1	63.5	62.2	62.3	53.2	48.8	50.9	41.8	36.3
Brunswick	67.8	70.0	69.1	77.8	77.5	72.9	81.9	80.7	76.2	73.5	70.0	67.8	65.5	65.9	60.1	55.9	60.5	54.6	49.6
Chesapeake CT 1, 4, 6	0.0	0.7	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 5	43.4	24.1	10.4	12.9	12.8	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 6	31.3	22.5	10.6	9.2	7.5	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 7	89.7	74.4	84.3	65.5	82.2	71.8	80.6	70.0	70.1	62.4	57.1	53.9	49.3	51.8	44.1	39.0	45.3	36.6	31.1
Chesterfield 8	90.2	76.6	74.4	53.0	81.3	71.9	73.9	79.6	67.2	63.2	58.3	55.3	52.3	53.0	46.3	40.9	47.2	39.4	33.1
Clover 1	48.0	38.6	17.3	12.9	13.8	9.9	8.0	8.6	-	-	-	-	-	-	-	-	-	-	-
Clover 2	37.1	37.3	16.1	13.9	13.5	8.9	7.9	8.2	-	-	-	-	-	-	-	-	-	-	-
CVOW - Phase 1 (880MW)				-	-	-	-	-	-	35.3	37.4	39.5	39.4	39.4	39.4	39.5	39.4	39.4	39.4
CVOW - Phase 2 (880MW)				-	-	-	-	-	-	-	35.3	37.4	39.4	39.4	39.4	39.5	39.4	39.4	39.4
CVOW - Phase 3 (880MW)				-	-	-	-	-	-	-	35.3	37.4	39.4	39.4	39.4	39.5	39.4	39.4	39.4
CVOW (Pilot)				-	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8
Darbytown 1	1.9	2.2	2.0	2.7	2.9	2.2	1.7	1.7	1.5	1.3	1.1	1.0	0.9	0.7	0.8	0.6	0.5	0.5	0.3
Darbytown 2	1.8	2.5	2.2	3.5	2.9	2.2	1.1	1.7	1.5	1.3	1.1	1.0	0.9	0.8	0.8	0.6	0.6	0.5	0.3
Darbytown 3	2.7	3.5	1.6	3.5	2.9	2.2	1.9	1.7	1.5	1.3	1.1	1.0	0.9	0.8	0.8	0.6	0.6	0.5	0.4
Darbytown 4	8.7	3.3	2.6	3.5	2.9	2.2	1.7	1.7	1.5	1.3	1.1	1.0	0.9	0.8	0.8	0.6	0.6	0.5	0.3
Elizabeth River 1	3.3	9.1	4.0	1.9	1.6	2.1	2.3	2.2	2.4	2.2	1.3	1.3	0.8	0.3	0.2	0.3	0.2	0.1	0.1
Elizabeth River 2	3.5	8.1	4.6	2.6	1.6	2.0	2.3	2.1	2.4	2.1	1.3	1.2	0.6	0.3	0.2	0.3	0.2	0.1	0.1
Elizabeth River 3	3.2	9.3	1.7	2.6	1.6	2.1	2.3	2.2	2.4	2.1	1.3	1.3	0.7	0.3	0.2	0.3	0.2	0.1	0.1
Gaston Hydro	14.1	24.5	19.1	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Generic Brownfield CT				-	-	-	2.9	2.9	4.4	3.6	2.6	1.9	1.3	0.9	0.3	0.3	0.3	0.1	0.1
Generic Solar PV- (60MW)				-	-	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4
Generic Solar PV PPA Post 2022				-	-	-	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4
Generic Solar PV PPA Pre 2022				-	-	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4
Generic Storage - Battery (Pilot) -14MW				-	-	-	14.2	14.3	13.4	12.1	10.3	9.9	8.9	7.8	8.4	7.3	-	-	-
Generic Storage - Battery (Pilot) -16MW				-	14.8	14.3	14.2	14.3	13.4	12.1	10.3	9.9	8.9	7.8	-	-	-	-	-
Gordonsville 1	14.2	39.7	64.9	55.6	44.4	49.3	34.9	36.5	39.7	32.9	29.2	26.7	22.8	22.1	18.7	15.5	19.3	15.2	11.8
Gordonsville 2	9.6	49.2	61.2	48.1	42.9	48.2	40.1	38.2	38.1	32.6	28.0	26.6	22.5	21.6	18.4	15.4	18.9	15.0	11.5
Gravel Neck 1-2	0.1	0.1	0.0	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gravel Neck 3	3.6	4.8	4.2	3.9	2.9	2.9	2.9	3.3	4.3	3.1	2.5	2.2	1.7	1.4	0.6	0.3	0.3	0.3	0.2
Gravel Neck 4	0.8	1.5	0.3	4.0	3.0	3.0	3.0	3.3	4.3	3.1	2.5	2.3	1.8	1.4	0.7	0.4	0.7	0.6	0.3
Gravel Neck 5	3.3	2.9	4.6	3.9	3.0	3.0	3.0	3.4	4.4	3.1	2.5	2.2	1.8	1.4	0.6	0.4	0.3	0.5	0.3
Gravel Neck 6	0.6	3.1	1.5	4.0	3.0	3.0	3.0	3.3	4.3	3.1	2.5	2.3	1.8	1.4	0.6	0.4	0.7	0.5	0.3

Appendix 5D cont. – Net Capacity Factor for Plan B

Company Name: Virginia Electric and Power Company

Schedule 9

UNIT PERFORMANCE DATA

Net Capacity Factor (%)

	(ACTUAL)				(PROJECTED)														
Unit Name	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Greensville	-	34.8	70.9	77.0	78.2	76.4	77.6	75.1	76.0	75.7	74.2	71.8	70.8	71.0	66.2	63.3	66.7	63.1	59.5
Hopewell	66.0	68.4	64.0	11.7	35.3	59.2	48.2	3.8	4.3	5.3	3.9	4.4	-	-	-	-	-	-	-
Ladysmith 1	9.4	11.3	11.0	9.7	7.0	7.8	8.3	8.7	8.6	6.8	6.0	5.7	5.3	4.9	3.8	3.4	3.2	3.6	1.9
Ladysmith 2	11.1	22.3	8.5	9.8	6.9	7.9	8.3	8.6	8.5	6.8	6.0	5.7	5.2	5.0	3.8	3.6	3.2	3.6	1.9
Ladysmith 3	5.7	9.0	11.7	10.0	7.4	7.9	8.6	8.9	8.7	7.0	6.3	5.9	5.4	5.2	3.9	3.5	3.4	3.9	2.0
Ladysmith 4	9.4	5.5	13.4	9.7	7.2	8.0	8.6	9.0	8.7	7.1	6.3	5.9	5.4	5.1	3.9	3.4	3.4	3.9	2.0
Ladysmith 5	6.5	3.6	3.3	9.8	7.2	8.2	8.6	8.9	8.7	7.0	6.3	6.0	5.5	5.2	3.9	3.5	3.4	3.9	2.0
Lowmoor CT 1-4	0.1	0.7	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mount Storm 1	49.4	43.4	36.8	38.1	41.2	40.6	32.1	31.9	36.8	12.4	11.0	11.3	12.6	14.5	13.8	11.3	9.8	6.7	5.2
Mount Storm 2	58.0	32.2	34.6	38.0	41.3	45.4	38.0	34.3	39.3	13.0	11.8	12.2	13.9	15.5	15.5	12.1	10.8	7.5	6.0
Mount Storm 3	39.1	41.2	25.2	29.2	36.0	32.3	24.8	23.5	30.8	8.1	7.0	7.3	8.1	9.6	7.9	6.7	5.8	3.8	3.1
Mount Storm CT	0.0	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Pump Storage				-	-	-	-	-	-	-	-	-	-	8.4	8.3	7.9	8.0	8.5	8.7
North Anna 1	102.3	91.1	94.5	96.3	87.8	89.2	96.3	77.8	89.0	96.3	88.9	82.9	96.3	82.9	89.0	96.3	88.9	89.0	96.1
North Anna 2	92.3	101.9	90.4	87.5	96.4	89.2	75.7	96.4	88.9	89.1	96.4	88.9	82.9	96.4	82.9	89.1	88.9	96.2	88.5
North Anna Hydro	29.2	26.2	7.0	29.1	29.0	29.0	29.0	29.1	29.0	29.0	29.0	29.1	29.0	29.0	29.0	29.1	29.0	29.0	29.0
Northern Neck CT 1-4	0.2	0.6	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Possum Point 5	0.9	0.8	0.5	6.0	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Possum Point 6	59.1	71.2	56.3	57.0	63.3	76.5	77.8	71.3	66.9	62.4	60.2	57.1	54.8	53.4	48.0	44.9	49.2	43.3	36.5
Possum Point CT 1-6	0.1	0.3	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remington 1	9.9	19.5	6.5	4.7	2.6	3.3	3.7	5.2	5.7	4.9	3.9	3.1	2.7	1.9	1.8	1.1	1.1	0.8	0.8
Remington 2	9.8	16.0	3.8	4.6	2.7	3.3	3.6	5.1	5.6	4.9	3.9	3.1	2.6	1.9	1.9	1.1	1.1	0.8	0.8
Remington 3	10.0	18.8	7.1	5.6	3.0	4.0	4.4	5.4	6.0	5.2	4.2	3.5	2.9	2.0	2.0	1.1	1.2	0.8	0.9
Remington 4	8.6	17.7	4.9	5.6	3.2	3.7	4.6	6.0	6.6	5.2	4.2	3.3	2.7	2.0	1.9	1.4	1.2	0.8	0.8
Roanoke Rapids Hydro	25.7	45.2	36.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5
Rosemary	9.8	2.0	0.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-	-	-
Scott Solar	20.6	13.7	13.9	24.4	24.3	24.2	24.1	23.9	23.8	23.7	23.6	23.5	23.4	23.3	23.1	23.0	22.9	22.8	22.7
Solar Partnership Program	-			13.7	13.7	13.7	13.7	13.7	13.7	13.8	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Solar_DG				-	-	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
Southampton	62.5	70.2	59.4	20.6	35.2	60.1	55.8	3.6	4.1	5.3	3.8	4.5	-	-	-	-	-	-	-
Surry 1	102.4	89.4	90.5	95.9	89.2	88.7	95.9	82.9	82.2	95.9	82.8	88.4	95.9	72.5	88.4	-	-	-	-
Surry 2	94.2	90.7	102.6	85.7	88.7	95.9	88.7	82.3	95.9	80.2	82.2	95.9	72.5	88.4	95.9	95.9	-	-	-
US-3 Solar 1	-			25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
US-3 Solar 2	-			-	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
US-4 Solar	-			-	24.7	24.8	24.9	25.0	25.2	25.3	25.4	25.5	25.7	25.8	26.0	26.1	26.2	26.4	26.5
Virginia City Hybrid Energy Center	62.4	55.4	22.2	5.7	6.8	7.4	7.4	8.0	10.8	7.9	6.7	7.1	7.8	9.4	8.3	6.7	6.2	4.2	3.2
Warren	75.7	69.2	73.1	69.4	53.0	67.5	73.4	75.4	73.6	66.1	62.3	58.5	56.0	56.7	51.9	49.2	52.2	42.8	36.2
Water Strider				-	25.2	25.3	25.4	25.6	25.7	25.8	26.0	26.1	26.2	26.3	26.4	26.6	26.7	26.8	26.9
Westmoreland_PPA				-	24.5	24.6	24.7	24.8	25.0	25.1	25.2	25.3	25.5	25.6	25.7	25.9	26.0	26.1	26.2
Whitehouse Solar	19.9	16.2	23.9	24.7	24.5	24.4	24.3	24.2	24.1	23.9	23.8	23.7	23.6	23.5	23.3	23.2	23.1	23.0	22.9
Woodland Solar	17.8	19.1	21.6	25.1	25.0	24.8	24.7	24.6	24.5	24.4	24.2	24.1	24.0	23.9	23.8	23.6	23.5	23.4	23.3
Yorktown 3	1.1	3.8	0.8	3.0	3.0	3.0	3.0	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 5E – Heat Rates for Plan B

Company Name: Virginia Electric and Power Company

Schedule 10

UNIT PERFORMANCE DATA

Average Heat Rate - (mmBtu/MWh)

	(ACTUAL)				(PROJECTED)														
Unit Name	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Altavista	15.16	15.82	15.18	12.32	12.32	12.32	12.32	12.32	12.32	12.32	12.32	12.32							
Bath County 1-6																			
Battery_Gen1																			
Battery_Gen2																			
Battery_Gen3																			
Battery_Gen4																			
Battery_Gen5																			
Bear Garden	6.54	7.11	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17	7.17
Brunswick	6.96	6.94	6.86	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92
Chesapeake CT 1, 4, 6	16.90	15.27	15.87	18.54	18.54														
Chesterfield 5	10.23	10.30	10.15	9.86	9.86	9.86													
Chesterfield 6	10.25	10.33	10.09	10.14	10.14	10.14													
Chesterfield 7	7.53	7.46	7.23	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33
Chesterfield 8	7.38	7.37	7.32	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25
Clover 1	10.31	10.41	10.61	9.84	9.84	9.84	9.84	9.84											
Clover 2	10.21	10.02	10.34	9.84	9.84	9.84	9.84	9.84											
CVOW - Phase 1 (880MW)																			
CVOW - Phase 2 (880MW)																			
CVOW - Phase 3 (880MW)																			
CVOW (Pilot)																			
Darbytown 1	12.45	12.21	12.33	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04	12.04
Darbytown 2	12.35	12.16	12.20	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03
Darbytown 3	12.36	12.21	11.39	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02	12.02
Darbytown 4	12.43	12.27	12.61	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03	12.03
Elizabeth River 1	12.06	12.36	12.38	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14	12.14
Elizabeth River 2	12.24	12.34	12.61	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15
Elizabeth River 3	12.11	12.38	12.54	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15	12.15
Gaston Hydro																			
Generic Brownfield CT							9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52	9.52
Generic Solar PV- (60MW)																			
Generic Solar PV PPA Post 2022																			
Generic Solar PV PPA Pre 2022																			
Generic Storage - Battery (Pilot) -14MW																			
Generic Storage - Battery (Pilot) -16MW																			
Gordonsville 1	8.60	8.30	8.13	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19	8.19
Gordonsville 2	8.51	8.20	8.32	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18	8.18
Gravel Neck 1-2	17.86	18.14	20.16																
Gravel Neck 3	12.61	12.84	12.96	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35
Gravel Neck 4	13.02	12.79	13.05	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34
Gravel Neck 5	13.09	12.97	13.66	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35	12.35
Gravel Neck 6	12.79	12.79	13.13	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34	12.34

Appendix 5E cont. – Heat Rates for Plan B

Company Name: Virginia Electric and Power Company — **Schedule 10**

UNIT PERFORMANCE DATA

Average Heat Rate - (mmBtu/MWh)

	(ACTUAL)				(PROJECTED)														
Unit Name	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Greensville	-	4.26	6.55	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66
Hopewell	15.98	15.74	16.35	12.10	12.10	12.10	12.10	12.10	12.10	12.10	12.10	12.10							
Ladysmith 1	9.96	10.30	9.84	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
Ladysmith 2	9.70	9.75	9.55	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
Ladysmith 3	9.99	9.95	9.75	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
Ladysmith 4	9.84	10.13	9.60	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
Ladysmith 5	9.98	10.17	9.70	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
Lowmoor CT 1-4	16.86	15.44	16.75	16.76	16.76														
Mount Storm 1	10.16	10.15	10.42	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86
Mount Storm 2	10.05	10.04	10.38	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78	9.78
Mount Storm 3	10.56	10.79	10.60	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19	10.19
Mount Storm CT	16.03	14.18	14.63	20.36	20.36														
New Pump Storage																			
North Anna 1	10.36	10.36	10.33	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
North Anna 2	10.39	10.34	10.34	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42	10.42
North Anna Hydro																			
Northern Neck CT 1-4	16.87	15.44	17.47	16.83	16.83														
Possum Point 5	11.87	11.69	12.43	9.93	9.93														
Possum Point 6	7.18	7.08	7.11	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43	7.43
Possum Point CT 1-6	17.32	15.28	17.03	16.83	16.83														
Remington 1	10.01	9.92	9.82	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48
Remington 2	10.10	10.08	9.98	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48
Remington 3	10.03	9.93	9.85	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48
Remington 4	9.99	10.00	9.89	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48	10.48
Roanoke Rapids Hydro			-																
Rosemary	9.48	10.07	10.82	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76	8.76
Scott Solar																			
Solar Partnership Program																			
Solar_DG																			
Southampton	15.70	16.45	16.63	11.70	11.70	11.70	11.70	11.70	11.70	11.70	11.70	11.70							
Surry 1	10.21	10.24	10.26	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
Surry 2	10.24	10.33	10.26	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31	10.31
US-3 Solar 1																			
US-3 Solar 2																			
US-4 Solar																			
Virginia City Hybrid Energy Center	10.02	10.01	11.67	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39
Warren	6.88	6.85	6.87	6.95	6.96	6.96	6.96	6.95	6.96	6.96	6.96	6.95	6.96	6.96	6.96	6.95	6.96	6.96	6.96
Water Strider																			
Westmoreland_PPA																			
Whitehouse Solar																			
Woodland Solar																			
Yorktown 3	10.86	10.17	9.97	10.15	10.15	10.15	10.15												

Appendix 5F – Existing Capacity for Plan B

Company Name: Virginia Electric and Power Company

Schedule 7

CAPACITY DATA

	(ACTUAL)			(PROJECTED)															
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I. Firm Capacity (MW)[1]																			
a. Nuclear	3,357	3,357	3,357	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349	3,349
b. Biomass[3]	183	183	183	205	211	214	214	214	214	214	214	214	61	61	61	61	61	61	61
c. Coal	4,400	4,400	3,654	3,632	3,626	3,623	2,609	2,609	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170	2,170
d. Heavy Fuel Oil	1,572	1,572	1,559	1,413	1,413	790	790	-	-	-	-	-	-	-	-	-	-	-	-
e. Light Fuel Oil	596	596	584	234	206	206	-	-	-	-	-	-	-	-	-	-	-	-	-
f. Natural Gas-Boiler	543	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g. Natural Gas-Combined Cycle	4,948	5,756	6,293	6,304	6,304	6,304	6,304	6,304	6,304	6,304	6,139	6,139	6,139	6,139	6,139	6,139	6,139	6,139	6,139
h. Natural Gas-Turbine	2,053	2,053	2,051	2,408	2,408	2,408	2,882	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367
i. Hydro-Conventional	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316
j. Pumped Storage & Battery	1,808	1,808	1,808	1,808	1,815	1,815	1,820	1,820	1,820	1,924	2,054	2,054	2,184	2,484	2,478	2,608	2,602	2,732	2,732
k. Renewable	6	6	6	73	147	367	571	810	1,012	1,504	2,215	2,449	2,770	3,125	3,360	3,594	3,827	4,825	5,055
l. Total Company Firm Capacity	19,782	20,047	19,810	19,741	19,793	19,391	18,855	18,788	18,552	19,148	19,824	20,058	20,356	21,011	21,240	21,604	21,831	22,959	23,189
m. Other (NUG)[4]	238	-	-	-	36	137	260	401	523	719	909	1,089	1,319	1,456	1,573	1,759	1,875	2,060	2,175
n. Total	20,020	20,047	19,810	19,741	19,829	19,528	19,114	19,190	19,075	19,867	20,733	21,147	21,675	22,467	22,813	23,363	23,706	25,019	25,364
II. Firm Capacity Mix (%)[2]																			
a. Nuclear	16.8%	16.7%	16.9%	17.0%	16.9%	17.1%	17.5%	17.4%	17.6%	16.9%	16.2%	15.8%	15.4%	14.9%	14.7%	14.3%	14.1%	13.4%	13.2%
b. Biomass[3]	0.9%	0.9%	0.9%	1.0%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.0%	1.0%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%
c. Coal	22.0%	21.9%	18.4%	18.4%	18.3%	18.6%	13.6%	13.6%	11.4%	10.9%	10.5%	10.3%	10.0%	9.7%	9.5%	9.3%	9.2%	8.7%	8.6%
d. Heavy Fuel Oil	7.9%	7.8%	7.9%	7.2%	7.1%	4.0%	4.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
e. Light Fuel Oil	3.0%	3.0%	2.9%	1.2%	1.0%	1.1%	0.0%	-	-	-	-	-	-	-	-	-	-	-	-
f. Natural Gas-Boiler	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
g. Natural Gas-Combined Cycle	24.7%	28.7%	31.8%	31.9%	31.8%	32.3%	33.0%	32.9%	33.0%	31.7%	29.6%	29.0%	28.3%	27.3%	26.9%	26.3%	25.9%	24.5%	24.2%
h. Natural Gas-Turbine	10.3%	10.2%	10.4%	12.2%	12.1%	12.3%	15.1%	17.5%	17.7%	16.9%	16.2%	15.9%	15.5%	15.0%	14.8%	14.4%	14.2%	13.5%	13.3%
i. Hydro-Conventional	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.7%	1.6%	1.7%	1.6%	1.5%	1.5%	1.5%	1.4%	1.4%	1.4%	1.3%	1.3%	1.2%
j. Pumped Storage & Battery	9.0%	9.0%	9.1%	9.2%	9.2%	9.3%	9.5%	9.5%	9.5%	9.7%	9.9%	9.7%	10.1%	11.1%	10.9%	11.2%	11.0%	10.9%	10.8%
k. Renewable	0.0%	0.0%	0.0%	0.4%	0.7%	1.9%	3.0%	4.2%	5.3%	7.6%	10.7%	11.6%	12.8%	13.9%	14.7%	15.4%	16.1%	19.3%	19.9%
l. Total Company Firm Capacity	98.8%	100.0%	100.0%	100.0%	99.8%	99.3%	98.6%	97.9%	97.3%	96.4%	95.6%	94.9%	93.9%	93.5%	93.1%	92.5%	92.1%	91.8%	91.4%
m. Other (NUG)[4]	1.2%	0.0%	0.0%	0.0%	0.2%	0.7%	1.4%	2.1%	2.7%	3.6%	4.4%	5.1%	6.1%	6.5%	6.9%	7.5%	7.9%	8.2%	8.6%
n. Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Notes: 1) Net dependable annual firm capability during peak season.

2) Each item in Section I as a percent of line n (Total).

3) Includes current estimates for renewable capacity by VCHEC.

4) Includes 35% Solar DG and 35% energy storage battery.

Appendix 5G – Energy Generation by Type for Plan B (GWh)

Company Name: Virginia Electric and Power Company — **Schedule 2**

GENERATION

	(ACTUAL)			(PROJECTED)															
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I. System Output (GWh)																			
a. Nuclear	28,683	27,381	27,720	27,928	27,601	27,673	27,199	25,925	27,144	27,556	26,691	27,227	26,498	25,923	27,163	28,612	27,722	28,286	28,242
b. Biomass[1]	1,163	1,196	1,008	355	590	897	686	97	123	121	97	106	43	51	45	37	34	23	18
c. Coal	15,376	12,302	7,177	6,925	7,509	7,027	5,328	5,136	5,775	2,035	1,795	1,875	2,084	2,405	2,241	1,815	1,605	1,090	862
d. Heavy Fuel Oil	141	313	88	633	383	208	86	-	-	-	-	-	-	-	-	-	-	-	-
e. Light Fuel Oil	131	313	35	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
f. Natural Gas-Boiler	163	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
g. Natural Gas-Combined Cycle	26,832	28,500	37,219	40,996	39,496	41,421	43,507	43,048	41,601	39,378	37,654	36,156	34,861	34,999	31,773	29,829	31,925	28,193	25,197
h. Natural Gas-Turbine	1,246	1,888	1,168	1,445	1,012	1,113	1,311	1,576	1,760	1,432	1,158	1,007	843	702	518	425	411	404	240
i. Hydro-Conventional	878	1,577	1,311	612	610	610	610	612	610	610	610	612	610	610	610	612	610	610	610
j. Pumped Storage & Battery	2,240	2,453	1,934	1,523	1,718	1,634	1,633	1,720	1,603	1,926	2,130	2,057	2,202	2,202	2,342	2,552	2,665	3,274	3,446
k. Renewable	102	80	90	444	915	2,294	3,616	5,128	6,423	10,541	17,255	19,258	21,579	23,831	25,355	26,963	28,381	38,709	40,201
l. Total Generation	76,953	76,094	77,750	80,862	79,833	82,877	83,976	83,241	85,039	83,599	87,390	88,298	88,721	90,723	90,048	90,845	93,352	100,588	98,815
m. Purchased Power (NUGs)	4,611	4,289	2,616	-	219	850	1,647	2,544	3,326	4,208	4,988	6,145	7,164	8,027	8,786	9,569	10,294	11,042	11,786
n. Purchased Power (Battery Storage)	-	-	-	-	-	-	-	-	-	181	362	373	547	518	528	693	753	1,061	1,096
o. Purchased Power (Market / PJM)	10,488	14,537	13,552	4,773	7,127	6,347	7,089	9,315	6,747	9,275	7,304	6,949	7,593	7,208	7,998	8,467	7,525	4,272	6,256
p. Total Payback Energy[2]				8	9	12	16	19	22	24	25	24	23	23	23	23	23	23	24
q. Less Pumping Energy	(3,014)	(3,043)	(2,801)	(1,904)	(2,147)	(2,023)	(2,052)	(2,154)	(1,994)	(2,583)	(3,036)	(2,962)	(3,341)	(3,283)	(3,444)	(3,900)	(4,108)	(5,204)	(5,457)
r. Less Other Sales[3]	(1,680)	(225)	(561)	(2,222)	(1,653)	(2,219)	(2,268)	(2,607)	(2,155)	(3,126)	(4,808)	(5,559)	(6,636)	(8,354)	(8,236)	(8,922)	(10,377)	(13,329)	(12,952)
s. Total System Firm Energy Req.	87,359	91,652	90,556	81,510	83,379	85,832	88,392	90,340	90,962	91,554	92,200	93,244	94,047	94,838	95,680	96,752	97,440	98,431	99,544
II. Energy Supplied by Competitive Service Providers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes: (1) Includes current estimates for renewable energy generation by VCHEC.
(2) Payback energy is accounted for in Total Generation.
(3) Includes all sales or delivery transactions with other electric utilities (*e.g.*, firm or economy sales).

Appendix 5H – Energy Generation by Type for Plan B (%)

Company Name: Virginia Electric and Power Company **Schedule 3**

GENERATION

	(ACTUAL)				(PROJECTED)														
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
III. System Output Mix (%)																			
a. Nuclear	32.8%	29.9%	30.6%	34.3%	33.1%	32.2%	30.8%	28.7%	29.8%	30.1%	28.9%	29.2%	28.2%	27.3%	28.4%	29.6%	28.5%	28.7%	28.4%
b. Biomass[1]	1.3%	1.3%	1.1%	0.4%	0.7%	1.0%	0.8%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
c. Coal	17.6%	13.4%	7.9%	8.5%	9.0%	8.2%	6.0%	5.7%	6.3%	2.2%	1.9%	2.0%	2.2%	2.5%	2.3%	1.9%	1.6%	1.1%	0.9%
d. Heavy Fuel Oil	0.2%	0.3%	0.1%	0.8%	0.5%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
e. Light Fuel Oil	0.2%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	-	-	-	-	-	-	-	-	-	-	-	-
f. Natural Gas-Boiler	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
g. Natural Gas-Combined Cycle	30.7%	31.1%	41.1%	50.3%	47.4%	48.3%	49.2%	47.7%	45.7%	43.0%	40.8%	38.8%	37.1%	36.9%	33.2%	30.8%	32.8%	28.6%	25.3%
h. Natural Gas-Turbine	1.4%	2.1%	1.3%	1.8%	1.2%	1.3%	1.5%	1.7%	1.9%	1.6%	1.3%	1.1%	0.9%	0.7%	0.5%	0.4%	0.4%	0.4%	0.2%
i. Hydro-Conventional	1.0%	1.7%	1.4%	0.8%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%
j. Pumped Storage & Battery	2.6%	2.7%	2.1%	1.9%	2.1%	1.9%	1.8%	1.9%	1.8%	2.1%	2.3%	2.2%	2.3%	2.3%	2.4%	2.6%	2.7%	3.3%	3.5%
k. Renewable	0.1%	0.1%	0.1%	0.5%	1.1%	2.7%	4.1%	5.7%	7.1%	11.5%	18.7%	20.7%	22.9%	25.1%	26.5%	27.9%	29.1%	39.3%	40.4%
l. Total Generation	88.1%	83.0%	85.9%	99.2%	95.7%	96.6%	95.0%	92.1%	93.5%	91.3%	94.8%	94.7%	94.3%	95.7%	94.1%	93.9%	95.8%	102.2%	99.3%
m. Purchased Power (NUGs)	5.3%	4.7%	2.9%	0.0%	0.3%	1.0%	1.9%	2.8%	3.7%	4.6%	5.4%	6.6%	7.6%	8.5%	9.2%	9.9%	10.6%	11.2%	11.8%
n. Purchased Power (Battery Storage)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.4%	0.4%	0.6%	0.5%	0.6%	0.7%	0.8%	1.1%	1.1%
o. Purchased Power (Market / PJM)	12.0%	15.9%	15.0%	5.9%	8.5%	7.4%	8.0%	10.3%	7.4%	10.1%	7.9%	7.5%	8.1%	7.6%	8.4%	8.8%	7.7%	4.3%	6.3%
p. Total Payback Energy[2]	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
q. Less Pumping Energy	-3.5%	-3.3%	-3.1%	-2.3%	-2.6%	-2.4%	-2.3%	-2.4%	-2.2%	-2.8%	-3.3%	-3.2%	-3.6%	-3.5%	-3.6%	-4.0%	-4.2%	-5.3%	-5.5%
r. Less Other Sales[3]	-1.9%	-0.2%	-0.6%	-2.7%	-2.0%	-2.6%	-2.6%	-2.8%	-2.4%	-3.4%	-5.2%	-6.0%	-7.1%	-8.8%	-8.6%	-9.2%	-10.6%	-13.5%	-13.0%
s. Total System Firm Energy Req.	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
IV. System Load Factor	57.7%	56.6%	59.0%	60.6%	61.3%	61.0%	61.3%	61.8%	61.6%	61.9%	62.4%	61.8%	61.9%	62.5%	62.1%	62.2%	61.9%	62.0%	62.1%

Notes: (1) Includes current estimates for renewable energy generation by VCHEC.
(2) Payback energy is accounted for in Total Generation.
(3) Includes all sales or delivery transactions with other electric utilities *(e.g.*, firm or economy sales).

Appendix 5I – Solar and Wind Generating Facilities Since July 1, 2018

Project Name	Status	Nameplate (MWac)	In Service Date	Type	Cost Recovery Mechanism
Hollyfield	Operational	17	2018	Company-build	Ring-Fence
Montross	Operational	20	2018	Company-build	Ring-Fence
Puller	Operational	15	2018	Company-build	Ring-Fence
Colonial Trail West	Operational	142	2019	Company-build	RAC
Gloucester	Operational	20	2019	Company-build	Ring-Fence
Spring Grove 1	In Construction	98	2020 (proj)	Company-build	RAC
Sadler	In Construction	100	2020 (proj)	Company-build	RAC
Westmoreland	In Construction	20	2020 (proj)	PPA	Fuel / Base
Rives Road *	In Construction	20	2020 (proj)	PPA	Fuel / Base
Pamplin *	In Construction	16	2020 (proj)	PPA	Fuel / Base
Hickory *	In Construction	32	2020 (proj)	PPA	Fuel / Base
Water Strider	In Construction	80	2020 (proj)	PPA	Fuel / Base
Coastal VA Offshore Wind (CVOW)	In Construction	12	2020 (proj)	Company-build	Base Rate
Grasshopper	In Construction	80	2020 (proj)	Company-build	Ring-Fence
Belcher	In Construction	88	2020 (proj)	Company-build	Ring-Fence
Rochambeau	In Construction	20	2021 (proj)	Company-build	Ring-Fence
Fort Powhatan	In Construction	150	2021 (proj)	Company-build	Ring-Fence
Bedford	In Construction	70	2021 (proj)	Company-build	Ring-Fence
Rocky Forge	In Construction	77	2021 (proj)	Company-build	Ring-Fence
Maplewood	In Construction	120	2022 (proj)	Company-build	Ring-Fence

* Variable pricing based on PJM energy and capacity prices.

Appendix 5J - Potential Unit Retirements

Company Name: Virginia Electric and Power Company — Schedule 19

UNIT PERFORMANCE DATA

Planned Unit Retirements[1]

Unit Name	Location	Unit Type	Primary Fuel Type	Projected Retirement Year	MW Summer	MW Winter
Gravel Neck 1	Surry, VA	CombustionTurbine	Light Fuel Oil	2020	28	38
Gravel Neck GT1					12	
Gravel Neck GT2					16	
Possum Point 5[2]	Dumfries, VA	Steam-Cycle	Heavy Fuel Oil	2021	623	623
Chesapeake CT 1	Chesapeake, VA	CombustionTurbine	Light Fuel Oil	2022	15	20
Chesapeake GT1					15	
Chesapeake CT 2	Chesapeake, VA	CombustionTurbine	Light Fuel Oil	2022	24	33
Chesapeake GT4					12	
Chesapeake GT6					12	
Lowmoor CT	Covington, VA	CombustionTurbine	Light Fuel Oil	2022	48	65
Lowmoor GT1					12	
Lowmoor GT2					12	
Lowmoor GT3					12	
Lowmoor GT4					12	
Mount Storm CT	Mt. Storm, WV	CombustionTurbine	Light Fuel Oil	2022	11	15
Mt. Storm GT1					11	
Northern Neck CT	Warsaw, VA	CombustionTurbine	Light Fuel Oil	2022	47	63
Northern Neck GT1					12	
Northern Neck GT2					11	
Northern Neck GT3					12	
Northern Neck GT4					12	
Possum Point CT	Dumfries, VA	Steam-Cycle	Light Fuel Oil	2022	72	106
Possum Point CT1					12	
Possum Point CT2					12	
Possum Point CT3					12	
Possum Point CT4					12	
Possum Point CT5					12	
Possum Point CT6					12	
Yorktown 3[2]	Yorktown, VA	Steam-Cycle	Heavy Fuel Oil	2023	790	792
Chesterfield 5[2]	Chester, VA	Steam-Cycle	Coal	2023	336	342
Chesterfield 6[2]	Chester, VA	Steam-Cycle	Coal	2023	678	690
Clover 1[2]	Clover, VA	Steam-Cycle	Coal	2025	220	222
Clover 2[2]	Clover, VA	Steam-Cycle	Coal	2025	219	219
Rosemary[2]	Roanoke Rapids, NC	Combine Cycle	Fuel Oil	2027	165	165
Altavista[3]	Altavista, VA	Steam-Cycle	Biomass	2028	51	51
Hopewell[3]	Hopewell, VA	Steam-Cycle	Biomass	2028	51	51
Southampton[3]	Franklin, VA	Steam-Cycle	Biomass	2028	51	51

Notes: (1) Reflects retirement assumptions used for planning purposes, not firm Company commitments.

(2) These units are shown as planned retirements in all Alternative Plans.

(3) These units are shown as planned retirements in Alternative Plans B, C, and D only.

Appendix 5K – Planned Changes to Existing Generation Units

Company Name: Virginia Electric and Power Company

Schedule 13a

UNIT PERFORMANCE DATA[1]

Unit Size (MW) Uprate and Derate

	(ACTUAL)				(PROJECTED)														
Unit Name	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Altavista	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bath County 1-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bear Garden	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brunswick	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesapeake CT 1, 4, 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chesterfield 8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clover 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clover 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Colonial Trail West	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Darbytown 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Darbytown 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Darbytown 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Darbytown 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elizabeth River 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elizabeth River 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elizabeth River 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaston Hydro	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gordonsville 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gordonsville 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gravel Neck 1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gravel Neck 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gravel Neck 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gravel Neck 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gravel Neck 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Greensville																			
Hopewell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ladysmith 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ladysmith 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ladysmith 3																			
Ladysmith 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ladysmith 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lowmoor CT 1-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mount Storm 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mount Storm 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mount Storm 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mount Storm CT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Anna 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Anna 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Anna Hydro	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern Neck CT 1-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Possum Point 5	-	-	-	(183)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Possum Point 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Possum Point CT 1-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remington 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remington 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remington 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remington 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roanoke Rapids Hydro	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosemary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scott Solar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Partnership Program	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Southampton	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surry 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surry 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Virginia City Hybrid Energy Center	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Warren	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Whitehouse Solar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Woodland Solar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yorktown 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: Peak net dependable capability as of this filing. Incremental uprates shown as positive and decremental derates shown as negative.

Appendix 5L – Environmental Regulations

	Constituent	Key Regulation	Final Rule	Compliance Date	Baseline Means of Compliance
AIR	Hg/HAPS	Mercury & Air Toxics Standards (1) (MATS)	12/16/2011	4/16/2017	All affected units compliant
	SO_2	CSAPR (2)	2011	2015/2017	Allowances (In-Sys.; Trading)
		SO_2 NAAQS (75 ppb, 1-hr avg)	6/2/2010	2018	Maintain current % sulfur oil level (3)
	NOx	2008 Ozone Standard (75 ppb)	May 2012	2019	DEQ requiring installation/operation of SNCR by 6/1/2019 to meet RACT or permanent retirement of unit by 6/1/2021 with operational limitations (no SNCR or NOx limit) in the interim. (4) Mutual agreement executed in June 2019 to retire unit by June 2021.
		2015 Ozone Standard (70 ppb)	10/1/2015	2021	Compliance with RACT (as described above)
		CSAPR (5)	2011	2015/2017	Allowances (In-Sys.; Trading)
	CO_2	NSR Permitting for GHGS	5/2010	2011	GHG BACT
		EGU NSPS (New) (6) (Subpart TTTT) Proposed revision	10/23/2015 12/20/2018	Retro to 1/8/2014 Retro to 12/20/2018	Build Gas CC or Install CCS Proposed revision: Build Gas CC or super-critical coal
		EGU NSPS (Modified and Reconstructed) (6) Proposed revision (Subpart TTTT)	10/23/2015 12/20/2018	10/23/2015 12/20/2018	Will need to evaluate on a project-by-project basis.
		Affordable Clean Energy (ACE) (replacement to CPP)	2019	2024/2025	To be determined by state plans. States to establish unit-specific emission performance standards based on identification of best system of emission reductions (BSER) based on unit heat rate improvement potential per EPA-established BSER guidelines.
		Virginia Carbon Regulations or RGGI (7)(20)	2019	2020 with glidepath to 2030	DEQ reproposed and has finalized with starting cap of 28 million tons. Cap reduced about 3%/year through 2030 (19.6 short tons) . Link to regional trading program via use of consignment auction with revenue returned to generators. If VA joins RGGI in future, auction proceeds go back to state (not generators) Compliance with renewables, new gas, possible unit retitrements and allowance purchases (if applicable).
		Federal CO_2 Program (Alternative Federal Legislation)	Uncertain	2026	Expected Price for CO_2
		Exectuive Order 43 (30% of VA gen from RE resources, 100% carbon-free by 2050)	9/16/2019	Plan due 7/1/2020 (19)	The Director of Department of Mines, Minerals and Energy (DMME), in consultation with the Secretary of Commerce and Trade, the Secretary of Natural Resources, and the Director of the Department of Environmental Quality (DEQ), shall develop a plan of action to produce thirty percent of Virginia's electricity from renewable energy sources by 2030 and one hundred percent of Virginia's electricity from carbon-free sources by 2050.
		Virginia Energy Plan; Commonwealth Energy Policy	7/1/2020	2020 - 2045	Sets a goal for VA to reach net zero emissions by 2045 and additionally states: that by 2040 Virginia will have a net zero carbon energy economy for all sectors, including electricity, transportation, building and industrial sectors. Developing energy resources necessary to produce 30 percent of VA's electricity from renewable energy sources by 2030 and 100 percent from VA's electricity carbon-free sources by 2040.
		Virginia Clean Economy Act	7/1/2020	2020 - 2045	VCEA establishes a mandatory portolio standard in VA. There are mandates for significant developments of renewable energy and energy storage resources, as well as retirement of existing carbon-emitting resources. Includes mandatory retirement of certain fossil-generating units: Chesterfield Units 5 & 6 and Yorktown 3 by 2024. Biomass facilities (Altavista, Hopewell, Southampton) by 2028) and shutting down all remaining fossil generating units by 2045. Allows petition for relief from these provisions if electric reliability or security is at risk

Appendix 5L cont. – Environmental Regulations

Constituent		Key Regulation	Final Rule	Compliance Date	Baseline Means of Compliance
WASTE	ASH	CCR's	4/17/2015	4/2018; 2020+	Close landfill & pond due to station closure. Pond and landfill to be excavated and recycled off site. (8)
				6/2018; 2020+	Close all three coal ash ponds by excavating material and placing into new landfill at or adjacent to plant. (8)
				4/2018; 2020+	All five ponds to be closed. A/B/C and E excavated to D. New landfill to be developed for ash in pond D. Continuning to evaluate onsite landfill or offsite recycling. (8)
				6/2019; 2020+	Fly &/or Bottom Ash - Wet to Dry Conversion to include construction and operation of new landfill; Lower and Upper Pond Closure through excavation and hauling to landfill or off site for recycling; construct new treatment ponds. (8)
				2020	Landfill closure (due to coal unit retirements)
				10/2018	Pond retrofit.
				10/2018	Pond retrofit and/or rebuilding.
				TBD	Monitor groundwater and corrective actions, if needed.
WATER	Water 316b	316(b) Impingement & Entrainment (9) (10)	5/19/2014	2016 (16)	316(b) Studies to Determine Compliance Needs and Submit Design & Source Water Body Data
				2019 (11)	
				2020	
				2021	
				2023 (12)	
				2023 (13)	VSDs; Screens; Fish Returns
				2025 (13)	
				2025 (13)	
				2023	Possible Low Capacity Exemption
	Water ELG	Effluent Limitation Guidelines (14)	9/30/2015	12/2023	FGD Water Treatment Facilities
				12/31/2023 (15)	Bottom Ash - Closed Loop Wet System
WILDLIFE	Threatened & Endangered	Atlantic Sturgeon Endangered Species Listing	2/6/2012	2019/2020	Seeking ITP which may contain potential mitigation measures to address impingement and entrainment of Atlantic Sturgeon and impacts to critical habitat. (18)
		Atlantic Sturgeon Critical Habitat Listing	2017	2019-2023 (17)	Thermal discharge studies at CH and SU to determine compliance needs during NPDES permit reissuance.

Appendix 5L cont. – Environmental Regulations

Notes: Compliance assumed January 1 unless otherwise noted.

1) CEC 1-4 retired in 2014. YT 1-2, CH 3-4, MK 1-2 retired in 2019. On 12/28/2018, EPA proposed revisions to MATS Supplemental Finding but proposing to keep MATS in place. MATS went to OMB on 10/4, expecting final rule to be issued first half of 2020.

2) SO_2 allowances decreased by 50% in 2017. Retired units retain CSAPR allowances for 4 years. System is expected to have sufficient SO_2 allowances.

3) SO_2 NAAQS modeling submitted to VDEQ in 11/2016. Modeling shows compliance with the NAAQS. EPA has approved and issued notice indicating NAAQS attainment 8/2017. In March 2019, EPA published final rule retaining 75 ppb 1-hr SO_2 NAAQS. No additional impacts expected.

4) VDEQ issued SOP on 1/31/2019.

5) Final revisions to CSAPR reduced ozone season NOx allowances by ~22% beginning in 2017. Projected to have sufficient allowances even if limits imposed on use of banked Phase I allowances (~ 3.5:1). Retired units retain CSAPR allowances for 4 years. System is expected to have sufficient annual NO_x allowances.

6) 2015 rule under EPA review for possible repeal or replacement rule. EPA published proposed revisions on December 20, 2018.

7) In May 2019, VDEQ issued final rule establishing a cap-and-trade program that allows for linkage to an existing regional trading program (such as RGGI) and includes about a 30% reduction from 2020 levels by 2030 and other allowance pool reduction mechanisms. In 2020, legislation passed the Virginia General Assembly related to RGGI.

8) As a result of the 2019 SB1355 legislation, ash in ponds must be excavated and disposed of in the landfill or taken off site for recycling. Exact timing of start of work at each site TBD.

9) Rule would not apply to Mt. Storm under the assumption that the plant's man-made lake does not qualify as a "water of the U.S."

10) 316(b) studies will be due with discharge permit applications beginning in mid-2018. Installation of 316(b) technology requirements will be based on compliance schedules put into discharge permits.

11) 316(b) information due with permit application by March 2019. VDEQ has concurred with CCRS status for impingement but will grant only limited waivers to other requirements.

12) Assumes permit is issued in 2019 with 316(b) with submittal due 270 days before permit expires.

13) Assumes permit issued with a 4-year compliance schedule. Permit issuance dates: North Anna - Dec 2019, Surry - March 2021, CH - September 2021, PP 3 & 4 - April 2023.

14) Rule does not apply to simple-cycle CTs or biomass units.

15) Assumes June 2023 applicability date included in next permit cycle based on timetable of current reconsideration of ELG rule.

16) 316(b) studies and reports completed and submitted to agency. Permits administratively continued and waiting for BTA determination.

17) Compliance dates are determined during NPDES permit reissuance process and are expected to be as follows for each facility: SU-2021, CH-2021.

(18) ITP permit addendum to be filed fall 2019. Expect permit in fall 2020.

(19) The Director of DMME shall report monthly to the Secretary of Commerce and Trade on the progress of these efforts and shall submit the final plan to the Governor by July 1, 2020. Commonwealth shall procure at least 30% of the electricity under the statewide electric contract with Dominion Energy Virginia from renewable energy resources by 2022.

(20) HB 981 and SB 1027 authorizes Virginia to join Regional Greenhouse Gas Initiative model.

Appendix 5M – Tabular Results of Busbar

	Capacity Factor (%)										
$/kW-Year	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
CC - 3X1	$ 170	$ 202	$ 234	$ 266	$ 298	$ 330	$ 362	$ 394	$ 426	$ 459	$ 491
CC - 2X1	$ 185	$ 217	$ 250	$ 283	$ 316	$ 348	$ 381	$ 414	$ 447	$ 479	$ 512
CC - 1X1	$ 216	$ 251	$ 285	$ 320	$ 354	$ 389	$ 423	$ 457	$ 492	$ 526	$ 561
CT	$ 64	$ 121	$ 178	$ 235	$ 291	$ 348	$ 405	$ 462	$ 519	$ 576	$ 633
CT (Aero)	$ 126	$ 174	$ 221	$ 269	$ 316	$ 364	$ 411	$ 459	$ 506	$ 554	$ 601
Large Nuclear	$ 1,021	$ 1,031	$ 1,042	$ 1,052	$ 1,063	$ 1,074	$ 1,084	$ 1,095	$ 1,105	$ 1,116	$ 1,126
Nuclear SMR	$ 644	$ 654	$ 664	$ 674	$ 685	$ 695	$ 705	$ 715	$ 725	$ 735	$ 746
Biomass	$ 928	$ 979	$ 1,030	$ 1,082	$ 1,133	$ 1,184	$ 1,235	$ 1,286	$ 1,337	$ 1,388	$ 1,440
Fuel Cell	$ 1,256	$ 1,285	$ 1,315	$ 1,344	$ 1,373	$ 1,403	$ 1,432	$ 1,461	$ 1,491	$ 1,520	$ 1,549
SCPC w/ CCS	$ 1,028	$ 1,109	$ 1,190	$ 1,271	$ 1,352	$ 1,433	$ 1,514	$ 1,595	$ 1,676	$ 1,757	$ 1,838
Solar & CT (Aero)	$ 248	$ 284	$ 321	$ 357	$ 394	$ 430	$ 467	$ 503	$ 539	$ 576	$ 612
Solar [1]				$ 104							
Wind - Onshore [2]					$ 255						
Wind - Offshore [3]					$ 342						
Battery Generic (30 MW) [4]			$ 475								
Pump Storage (300 MW) [4]			$ 841								

(1) Solar has a capacity factor of 25%.

(2) Onshore Wind has a capacity factor of 40%.

(3) Offshore Wind has a capacity factor of 42%.

(4) Batteries and Pump Storage have a capacity factor of 15%.

Appendix 5N – Busbar Assumptions

Nominal $	Heat Rate MMBtu/MWh	Variable Cost [1] $/MWh	Fixed Cost [2] $/kW-Year	Book Life Years	2020 Real $ [3] $/kW
CC - 3X1	6.55	$36.57	$170.21	36	$908
CC - 2X1	6.59	$37.37	$184.69	36	$1,102
CC - 1X1	6.63	$39.36	$216.12	36	$1,492
CT	9.67	$64.94	$63.86	36	$562
CT (Aero)	9.32	$54.25	$126.13	36	$1,107
Large Nuclear	10.50	$12.09	$1,020.53	60	$9,352
Nuclear SMR	10.10	$11.64	$643.75	60	$5,478
Biomass	13.00	$58.37	$928.22	40	$6,694
Fuel Cell	8.54	$33.52	$1,255.81	15	$5,879
SCPC w/ CCS	11.44	$92.55	$1,027.60	55	$9,081
Solar & CT (Aero)	9.32	$41.60	$247.90	35 (Solar) / 36 (CT)	$2,670
Solar	-	-$8.99	$127.36	35	$1,363
Wind - Onshore	-	-$8.89	$286.30	25	$1,926
Wind - Offshore	-	-$8.89	$372.85	25	$2,952
Battery Generic (30 MW)	-	$36.51	$410.69	10	$2,224
Pump Storage (300 MW)	-	$47.66	$757.12	50	$7,541

(1) Variable cost for Biomass, Solar, Solar & Aero CT, Onshore Wind, and Offshore Wind includes value for RECs.
(2) Fixed costs include investment tax credits and gas firm transmission expenses.
(3) Values in this column represent overnight installed cost.

Appendix 5O – Renewable Resources for Plan B

Company Name: Virginia Electric and Power Company

Schedule 11

RENEWABLE RESOURCE GENERATION (GWh)

Resource Type[1]	Unit Name	State	C.O.D.[2]	Build / Purchase / Convert[3]	Life/ Duration[4]	Size MW[5]	(ACTUAL) 2017	2018	2019	2020	(PROJECTED) 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Hydro																									
	Gaston Hydro	NC	Feb-63	Build	60	220	271	472	368	321	320	320	320	321	320	320	320	321	320	320	320	321	320	320	320
	North Anna Hydro	VA	Dec-87	Build	60	1	3	2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Roanoke Rapids Hydro	NC	Sep-55	Build	60	95	211	376	303	288	287	287	287	288	287	287	287	288	287	287	287	288	287	287	287
	Sub-total: NC					315	482	848	671	609	607	607	607	609	607	607	607	609	607	607	607	609	607	607	607
	Sub-total: VA					1	3	2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sub-total: Hydro						316	484	850	672	612	610	610	610	612	610	610	610	612	610	610	610	612	610	610	610
Solar																									
	Solar Partnership Program	VA	2013-2017	Build	20	7	10	4	4	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	8
	Existing NC Solar NUGs	NC					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Existing VA Solar NUGs	VA	2020-2021	Purchase	20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Scott Solar	VA	Dec-2016	Build	35	17	31	21	21	37	37	37	37	36	36	36	36	36	35	35	35	35	35	35	34
	Whitehouse Solar	VA	Dec-2016	Build	35	19	28	32	32	43	43	43	43	42	42	42	42	42	41	41	41	41	40	40	40
	Woodland Solar	VA	Dec-2016	Build	35	20	33	33	33	42	42	42	41	41	41	41	41	41	40	40	40	40	39	39	39
	US-3 Solar 1	VA	2020	Build	35	142	-	-	6	313	310	309	307	306	304	303	301	300	298	297	295	294	292	291	289
	US-3 Solar 2	VA	2021	Build	35	98	-	-	-	-	214	214	212	212	210	209	208	207	206	205	204	203	202	201	200
	US-4 Solar	VA	2021	Build	35	100	-	-	-	-	216	215	215	216	215	215	215	216	215	215	215	216	215	215	215
	Water Strider	VA	2021	Purchase	35	80	-	-	-	-	176	176	176	176	176	176	176	176	176	176	175	176	175	175	175
	Westmoreland_PPA	VA	2021	Purchase	35	20	-	-	-	-	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	Generic Solar PV_PPA	VA	2021-2035	Purchase	35	5,545	-	-	-	-	-	631	1,428	2,325	3,107	3,989	4,769	5,926	6,946	7,808	8,568	9,351	10,076	10,824	11,568
	Generic Solar PV	VA	2021-2035	Build	35	10,375	-	-	-	-	-	1,382	2,708	4,221	5,522	7,009	8,307	9,807	11,863	14,118	15,645	17,213	18,677	20,180	21,676
	Sub-total: NC					0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sub-total: VA					16,423	103	90	96	444	1,090	3,100	5,219	7,629	9,705	12,072	14,146	16,802	19,873	22,987	25,271	27,620	29,804	32,053	34,288
Sub-total: Solar						16,423	103	90	96	444	1,090	3,100	5,219	7,629	9,705	12,072	14,146	16,802	19,873	22,987	25,271	27,620	29,804	32,053	34,288
Wind																									
	CVOW (Pilot)	VA	Jan-21	Build	20	12	-	-	-	-	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
	Generic Wind		2021-2035	Build	20	5,112	-	-	-	-	-	-	-	-	-	2,633	8,053	8,557	8,827	8,827	8,827	8,868	8,827	17,655	17,655
	Sub-total: NC					0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sub-total: VA					5,124	-	-	-	-	44	44	44	44	44	2,676	8,097	8,601	8,871	8,871	8,871	8,912	8,871	17,698	17,698
Sub-total: Wind						5124	-	-	-	-	44	44	44	44	44	2,676	8,097	8,601	8,871	8,871	8,871	8,912	8,871	17,698	17,698
	Total Renewables: NC					315	482	848	671	609	607	607	607	609	607	607	607	609	607	607	607	609	607	607	607
	Total Renewables: VA					21,548	105	92	97	447	1,136	3,148	5,268	7,675	9,752	14,751	22,245	25,405	28,746	31,860	34,144	36,535	38,677	49,753	51,989
Total Renewables						21,863	587	940	768	1,056	1,743	3,754	5,873	8,284	10,359	15,358	22,852	26,015	29,353	32,468	34,752	37,144	39,285	50,361	52,597

Notes: (1) Per definition in Va. Code § 56-576.

(2) Commercial operation date.

(3) Company built, purchased, or converted.

(4) Expected life of facility or duration of purchase contract.

(5) Net summer capacity for hydro, nameplate for solar and wind.

Appendix 5P – Potential Supply-Side Resources for Plan B

Company Name: _____ **Schedule 15b**

UNIT PERFORMANCE DATA

Potential Supply-Side Resources (MW)

Unit Name	Unit Type	Primary Fuel Type	C.O.D.[1]	MW Annual Firm	MW Nameplate
Solar 2022	Intermittent	Solar	2022	319	1,000
Battery Pilot	Storage		2023	6	14
Solar 2023	Intermittent	Solar	2023	330	960
Generic CT	Peak	Natural Gas	2023	485	485
Solar 2024	Intermittent	Solar	2024	381	1,180
Generic CT	Peak	Natural Gas	2024	458	458
Solar 2025	Intermittent	Solar	2025	330	960
Generic Battery	Storage		2026	160	400
Solar 2026	Intermittent	Solar	2026	381	1,180
CVOW - Phase 1	Intermittent	Wind	2026	256	852
Generic Battery	Storage		2027	200	500
Solar 2027	Intermittent	Solar	2027	330	960
CVOW - Phase 2-3	Intermittent	Wind	2027	511	1,704
Solar 2028	Intermittent	Solar	2028	422	1,300
Generic Battery	Storage		2029	200	500
Solar 2029	Intermittent	Solar	2029	495	1,440
Pump Storage	Storage		2029	300	300
Solar 2030	Intermittent	Solar	2030	505	1,540
Solar 2031	Intermittent	Solar	2031	372	1,080
Generic Battery	Storage		2032	200	500
Solar 2032	Intermittent	Solar	2032	372	1,080
Solar 2033	Intermittent	Solar	2033	372	1,080
Generic Battery	Storage		2034	200	500
Solar 2034	Intermittent	Solar	2034	372	1,080
Generic Offshore Wind	Intermittent	Wind	2034	767	2,556
Solar 2035	Intermittent	Solar	2035	372	1,080

Note: (1) Estimated commercial operation date.

Appendix 5Q – Summer Capacity Position for Plan B

Company Name: Virginia Electric and Power Company — Schedule 16

UTILITY CAPACITY POSITION (MW)

	(ACTUAL)				(PROJECTED)														
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing Capacity																			
Conventional	17,620	17,173	17,681	17,544	17,516	16,693	15,662	14,872	14,434	14,434	14,269	14,269	14,116	14,116	14,116	14,116	14,116	14,116	14,116
Renewable NC	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315
Renewable VA	58	58	58	74	74	73	73	73	73	72	72	72	72	71	71	71	71	70	70
Renewable	373	373	373	389	389	388	388	388	388	387	387	387	387	386	386	386	386	385	385
Storage NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Storage VA	1,809	1,809	1,809	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808
Storage	1,809	1,809	1,809	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808	1,808
Total Existing Capacity	19,802	19,355	19,863	19,741	19,713	19,090	17,858	17,068	16,630	16,629	16,464	16,464	16,310	16,310	16,310	16,310	16,309	16,309	16,309
Generation Under Construction																			
Conventional	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable VA	-	-	-	-	74	74	73	73	73	72	72	72	71	71	70	70	70	69	69
Renewable	-	-	-	-	74	74	73	73	73	72	72	72	71	71	70	70	70	69	69
Storage NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Storage VA	-	-	-	-	6	6	6	6	6	6	6	6	6	6	-	-	-	-	-
Storage	-	-	-	-	6	6	6	6	6	6	6	6	6	6	-	-	-	-	-
Total Planned Construction Capacity	-	-	-	-	80	80	80	79	79	79	78	78	78	77	70	70	70	69	69
Generation Under Development																			
Conventional	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable VA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Storage NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Storage VA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Storage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Planned Development Capacity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potential (Expected) New Capacity																			
Conventional	-	-	-	-	-	-	485	970	970	970	970	970	970	970	970	970	970	970	970
Renewable NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable VA	-	-	-	-	-	221	426	665	868	1,360	2,072	2,307	2,628	2,984	3,220	3,454	3,688	4,686	4,917
Renewable	-	-	-	-	-	221	426	665	868	1,360	2,072	2,307	2,628	2,984	3,220	3,454	3,688	4,686	4,917
Storage NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Storage VA	-	-	-	-	-	-	6	6	6	110	240	240	370	670	670	800	784	924	924
Storage	-	-	-	-	-	-	6	6	6	110	240	240	370	670	670	800	784	924	924
Total Potential New Capacity	-	-	-	-	-	221	918	1,641	1,843	2,440	3,282	3,516	3,968	4,624	4,858	5,224	5,452	6,580	6,811
Other (NUG)																			
Conventional	238	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Renewable VA	-	-	-	-	36	137	260	401	523	663	783	963	1,123	1,260	1,377	1,493	1,609	1,724	1,839
Renewable	-	-	-	-	36	137	260	401	523	663	783	963	1,123	1,260	1,377	1,493	1,609	1,724	1,839
Storage NC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Storage VA	-	-	-	-	-	-	-	-	-	56	126	126	196	198	198	198	268	268	336	336
Storage	-	-	-	-	-	-	-	-	-	56	126	126	196	198	198	198	268	268	336	336
Total Other (NUG) Capacity	238	-	-	-	36	137	260	401	523	719	909	1,089	1,319	1,458	1,573	1,759	1,878	2,060	2,175
Unforced Availability	-	-																	
Net Generation Capacity	20,040	19,355	19,863	19,741	19,829	19,528	19,114	19,190	19,075	19,867	20,733	21,147	21,675	22,467	22,813	23,383	23,708	25,019	25,384
Existing DSM Reductions																			
Demand Response	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Conservation/Efficiency	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Existing DSM Reductions[1]	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Approved DSM Reductions																			
Demand Response[3]	69	58	55	63	63	64	64	65	65	65	65	66	66	66	66	66	66	66	66
Conservation/Efficiency[2,3]	109	122	135	129	125	127	136	134	122	113	105	102	101	99	97	95	93	92	93
Total Approved DSM Reductions	178	180	190	191	188	191	201	199	188	179	171	167	167	165	163	160	159	158	158
Proposed DSM Reductions																			
Demand Response[3]	-	-	-	7	27	47	63	77	83	84	85	86	87	88	89	89	90	91	92
Conservation/Efficiency[2]	-	-	-	16	26	45	66	86	114	124	124	124	124	128	129	129	129	129	133
Total Proposed DSM Reductions	-	-	-	23	53	92	129	165	197	208	209	210	211	216	217	218	219	219	224
Unidentified DSM Reductions																			
Demand Response[3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conservation/Efficiency[2]	-	-	-	-	39	87	143	209	276	335	447	408	388	409	422	474	377	358	340
Total Proposed DSM Reductions	-	-	-	-	39	87	143	209	276	335	447	408	388	409	422	474	377	358	340
Total Demand-Side Reductions[1]	180	182	192	216	282	372	475	575	663	724	829	787	768	792	804	854	757	738	725
Net Generation & Demand-side	20,220	19,537	20,055	19,957	20,110	19,900	19,589	19,765	19,738	20,590	21,562	21,934	22,442	23,258	23,616	24,237	24,462	25,757	26,089
Capacity Requirement or PJM Capacity Obligation	19,768	20,548	20,251	20,022	20,218	19,800	20,150	20,398	20,327	20,589	20,598	20,927	21,050	21,219	21,219	21,472	21,818	21,983	22,114
Net Utility Capacity Position	452	(1,010)	(196)	(65)	(107)	99	(560)	(632)	(589)	(8)	965	1,007	1,392	2,040	2,396	2,745	2,645	3,794	3,975

Notes: (1) Existing DSM programs are included in the load forecast.

(2) Efficiency programs are not part of the Company's calculation of capacity.

(3) Actual historical data based upon measured and verified EM&V results. Projected values represent modeled DSM firm capacity.

Appendix 5R – Capacity Position for Plan B

Company Name: Virginia Electric and Power Company **Schedule 4**

POWER SUPPLY DATA

	(ACTUAL)				(PROJECTED)														
	2017	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
I. Capability (MW)																			
1. Summer																			
a. Firm Capacity Capacity[1]	19,802	19,355	19,863	19,741	19,793	19,391	18,855	18,788	18,552	19,148	19,824	20,058	20,356	21,011	21,240	21,604	21,831	22,959	23,189
b. Positive Interchange Commitments[2]	238	-	-	-	36	137	260	401	523	719	909	1,089	1,319	1,456	1,573	1,759	1,875	2,060	2,175
c. Capability in Cold Reserve/ Reserve Shutdown Status[1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d. Demand Response - Existing	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
e. Demand Response - Approved[5]	69	58	55	63	63	64	64	65	65	65	65	66	66	66	66	66	66	66	66
f. Demand Response - Future[5]	-	-	-	7	27	47	63	77	83	84	85	86	87	88	89	89	90	91	92
g. Total Net Summer Capability[4]	20,109	19,413	19,918	19,809	19,917	19,637	19,240	19,330	19,221	20,014	20,881	21,297	21,825	22,618	22,965	23,516	23,860	25,174	25,520
2. Winter																			
a. Firm Capacity Capacity[1]	19,802	19,355	19,863	20,824	20,796	20,176	19,366	19,099	18,660	19,022	19,500	19,502	19,482	19,785	19,781	19,913	19,909	20,808	20,810
b. Positive Interchange Commitments[2]	238	-	-	-	0	1	2	3	5	62	133	134	206	207	208	279	280	351	352
c. Capability in Cold Reserve/ Reserve Shutdown Status[1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d. Demand Response[5]	6	6	6	16	37	58	76	92	100	102	103	104	105	106	107	108	109	110	111
e. Demand Response-Existing[3]	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
f. Total Net Winter Capability[4]	20,046	19,361	19,869	20,840	20,833	20,235	19,444	19,194	18,765	19,186	19,736	19,741	19,793	20,098	20,096	20,300	20,298	21,269	21,272

Notes: (1) Net seasonal capability.

(2) Does not include firm commitments from existing NUGs and estimated solar NUGs.

(3) Included in the winter capacity forecast.

(4) Does not include behind-the-meter generation MW.

(5) Actual historical data based upon measured and verified EM&V results. Projected values represent modeled DSM firm capacity. Values reflective of free-ridership.

Appendix 5S – Construction Forecast for Plan B

Company Name: Virginia Electric and Power Company

Schedule 17

CONSTRUCTION COST FORECAST (Thousand Dollars)

	(PROJECTED)															
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
I. New Traditional Generating Facilities																
a. Construction Expenditures (non-AFUDC)	319,804	326,223	518,290	644,848	436,991	312,115	385,020	381,492	249,784	248,810	216,379	59,406	90	-	-	-
b. AFUDC	674	2,036	3,816	5,129	5,953	7,532	9,001	10,617	11,948	12,999	13,979	6,116	6,241	-	-	-
c. Annual Total	320,478	328,259	522,106	649,976	442,944	319,647	394,021	392,109	261,732	261,809	230,358	65,522	6,331	-	-	-
d. Cumulative Total	320,478	648,736	1,170,843	1,820,819	2,263,763	2,583,411	2,977,432	3,369,541	3,631,273	3,893,083	4,123,441	4,188,962	4,195,293	4,195,293	4,195,293	4,195,293
II. New Renewable Generating Facilities																
a. Construction Expenditures (non-AFUDC)	1,373,964	986,242	1,510,731	1,751,487	2,988,887	3,522,621	2,886,428	2,173,190	1,776,645	1,485,727	1,977,360	1,721,729	3,653,218	4,534,938	1,852,148	-
b. AFUDC	3,619	6,815	8,220	10,995	16,772	17,150	14,149	9,080	11,811	11,693	11,878	14,142	20,266	32,226	5,469	-
c. Annual Total	1,377,583	993,057	1,518,951	1,762,483	2,985,659	3,539,771	2,900,577	2,182,269	1,788,457	1,497,421	1,989,238	1,735,870	3,673,485	4,567,164	1,857,617	-
d. Cumulative Total	1,377,583	2,370,640	3,889,592	5,652,074	8,637,733	12,177,505	15,078,081	17,260,351	19,048,807	20,546,228	22,535,466	24,271,336	27,944,821	32,511,985	34,369,601	34,369,601
III. New Storage Facilities																
a. Construction Expenditures (non-AFUDC)	80,059	31,873	48,798	40,065	773,117	1,082,325	1,076,455	569,975	1,251,422	147,334	56,572	851,006	-	882,437	-	732,024
b. AFUDC	169	265	435	491	2,206	6,810	8,975	8,287	13,041	11,677	-	2,760	-	2,862	-	2,374
c. Annual Total	80,227	32,138	49,234	40,556	775,323	1,089,135	1,085,430	578,261	1,264,463	159,011	56,572	853,765	-	885,299	-	734,398
d. Cumulative Total	80,227	112,365	161,599	202,156	977,478	2,066,613	3,152,043	3,730,304	4,994,767	5,153,778	5,210,350	6,064,115	6,064,115	6,949,414	6,949,414	7,683,812
IV. Other Facilities																
a. Transmission	921	885	885	723	751	751	751	751	751	751	751	751	751	751	751	751
b. Distribution	1,134	1,250	1,408	1,350	1,248	1,129	1,121	1,118	1,115	831	831	831	831	831	831	831
c. Energy Conservation & DR	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
d. Other																
e. AFUDC	44	56	50	45	47	47	47	47	47	47	47	47	47	47	47	47
f. Annual Total	2,116	2,191	2,344	2,117	2,046	1,926	1,919	1,915	1,913	1,629	1,629	1,629	1,629	1,629	1,629	1,629
g. Cumulative Total	2,116	4,307	6,650	8,768	10,814	12,740	14,659	16,574	18,486	20,115	21,744	23,372	25,001	26,630	28,258	29,887
V. Total Construction Expenditures																
a. Annual	1,780,404	1,355,645	2,092,635	2,455,133	4,205,972	4,950,479	4,381,947	3,154,555	3,316,564	1,919,869	2,277,797	2,656,788	3,681,444	5,454,092	1,859,246	736,027
b. Cumulative	1,780,404	3,136,049	5,228,684	7,683,817	11,889,789	16,840,268	21,222,215	24,376,770	27,693,334	29,613,203	31,891,000	34,547,786	38,229,230	43,683,322	45,542,567	46,278,594
VI. % of Funds for Total Construction Provided from External Financing	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix 6A – Description of Active DSM Programs

Air Conditioner Cycling Program

Branded Name:	Smart Cooling Rewards
State:	Virginia & North Carolina
Target Class:	Residential
VA Program Type:	Peak-Shaving
NC Program Type:	Peak-Shaving
VA Duration:	2010 – 2045
NC Duration:	2011 – 2045

Program Description:

This Program provides participants with an external radio frequency cycling switch that operates on central air conditioners and heat pump systems. Participants allow the Company to cycle their central air conditioning and heat pump systems during peak load periods. The cycling switch is installed by a contractor and located on or near the outdoor air conditioning unit(s). The Company remotely signals the unit when peak load periods are expected, and the air conditioning or heat pump system is cycled off and on for short intervals.

Program Marketing:

The Company uses business reply cards, online enrollment, and call center services.

Non-Residential Distributed Generation Program

Branded Name:	Distributed Generation
State:	Virginia
Target Class:	Non-Residential
VA Program Type:	Demand-Side Management
VA Duration:	2012 – 2045

Program Description:

As part of this Program, a third-party contractor will dispatch, monitor, maintain and operate customer-owned generation when called upon by the Company at anytime for up to a total of 120 hours per year. The Company will supervise and implement the Non-Residential Distributed Generation Program through the third-party implementation contractor. Participating customers will receive an incentive in exchange for their agreement to reduce electrical load on the Company's system when called upon to do so by the Company. The incentive is based upon the amount of load curtailment delivered during control events. When not being dispatched by the Company, the generators may be used at the participants' discretion or to supply power during an outage, consistent with applicable environmental restrictions.

Program Marketing:

Marketing is handled by the Company's implementation vendor.

Appendix 6A cont. – Description of Active DSM Programs

Income and Age Qualifying Home Improvement Program

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2015 – 2045
NC Duration:	2016 – 2045

Program Description:

This Program provides income and age-qualifying residential customers with energy assessments and direct install measures at no cost to the customer.

Program Marketing:

The Company markets this Program primarily through weatherization assistance providers and social services agencies.

Small Business Improvement Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2016 – 2045
NC Duration:	2017 – 2045

Program Description:

This Program provides eligible small businesses an energy use assessment and tune-up or re-commissioning of electric heating and cooling systems, along with financial incentives for the installation of specific energy efficiency measures. Participating small businesses are required to meet certain connected load requirements.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events. Because these programs are implemented using a contractor network, customers will enroll in the program by contacting a participating contractor. The Company utilizes the contractor network to market the programs to customers as well.

Appendix 6A cont. – Description of Active DSM Programs

Non-Residential Prescriptive Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2017 – 2045
NC Duration:	2018 – 2045

Program Description:

This Program provides an incentive to eligible non-residential customers not otherwise eligible or who choose not to participate in the Company's Small Business Improvement Program. The Program offers incentives for the installation of energy efficiency measures such as Refrigerator Evaporator Fans (Reach-in and Walk-in Coolers and Freezers), Commercial ENERGY STAR Appliances, Commercial Refrigeration, Commercial ENERGY STAR Ice Maker, Advanced Power Strip, Cooler/Freezer Strip Curtain, HVAC Tune-Up, Vending Machine Controls, Kitchen Fan Variable Speed Drives and Commercial Duct Testing and Sealing.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events. Because these programs are implemented using a contractor network, customers will enroll in the program by contacting a participating contractor. The Company utilizes the contractor network to market the programs to customers as well.

Residential Appliance Recycling Program

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2019 – 2045
NC Duration:	2020 – 2045

Program Description:

This Program provides incentives to eligible residential customers to recycle specific types of qualifying freezers and refrigerators that are of specific of age and size. Appliance pick-up and proper recycling services are included.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events.

Appendix 6A cont. – Description of Active DSM Programs

Residential Efficient Products Marketplace Program

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2019 – 2045
NC Duration:	2020 – 2045

Program Description:

This Program provides eligible residential customers an incentive to purchase specific energy efficient appliances with a rebate through an online marketplace and through participating retail stores. The program offers rebates for the purchase of specific energy efficient appliances, including lighting efficiency upgrades such as A-line bulbs (prior to 2020), reflectors, decoratives, globes, retrofit kit and fixtures, as well as other appliances such as freezers, refrigerators, clothes washers, dehumidifiers, air purifiers, clothes dryers, and dishwashers.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events.

Residential Home Energy Assessment Program

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2019 – 2045
NC Duration:	2020 – 2045

Program Description:

This Program provides qualifying residential customers with an incentive to install a variety of energy saving measures following completion of a walk-through home energy assessment. The energy saving measures include replacement of existing light bulbs with LED bulbs, heat pump tune-up, duct insulation/sealing, fan motors upgrades, installation of efficient faucet aerators and showerheads, water heater turndown, replacement of electric domestic hot water with heat pump water heater, heat pump upgrades (ducted and ductless), and water heater and pipe insulation.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events. Because this program is implemented using a contractor network, customers will enroll in the program by contacting a participating contractor. The Company utilizes the contractor network to market the programs to customers as well.

Appendix 6A cont. – Description of Active DSM Programs

Non-Residential Lighting Systems & Controls Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2019 – 2045
NC Duration:	2020 – 2045

Program Description:

This Program provides qualifying non-residential customers with an incentive to implement more efficient lighting technologies that can produce verifiable savings. The Program promotes the installation of lighting technologies including but not limited to LED based bulbs and lighting control systems.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events. Because this program is implemented using a contractor network, customers will enroll in the program by contacting a participating contractor. The Company utilizes the contractor network to market the programs to customers as well.

Non-Residential Heating and Cooling Efficiency Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2019 – 2045
NC Duration:	2020 – 2045

Program Description:

This Program provides qualifying non-residential customers with incentives to implement new and upgrade existing high efficiency heating and cooling system equipment to more efficient HVAC technologies that can produce verifiable savings.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events. Because this program is implemented using a contractor network, customers will enroll in the program by contacting a participating contractor. The Company utilizes the contractor network to market the programs to customers as well.

Appendix 6A cont. – Description of Active DSM Programs

Non-Residential Window Film Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2019 – 2045
NC Duration:	2020 – 2045

Program Description:

This Program provides qualifying non-residential customers with incentives to install solar reduction window film to lower their cooling bills and improve occupant comfort.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events. Because this program is implemented using a contractor network, customers will enroll in the program by contacting a participating contractor. The Company utilizes the contractor network to market the programs to customers as well.

Non-Residential Small Manufacturing Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2019 – 2045
NC Duration:	2020 – 2045

Program Description:

This Program provides qualifying non-residential customers with incentives for the installation of energy efficiency improvements, consisting of primarily compressed air systems measures for small manufacturing facilities.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events. Because this program is implemented using a contractor network, customers will enroll in the program by contacting a participating contractor. The Company utilizes the contractor network to market the programs to customers as well.

Appendix 6A cont. – Description of Active DSM Programs

Non-Residential Office Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	2019 – 2045
NC Duration:	2020 – 2045

Program Description:

This Program provides qualifying non-residential customers with incentives for the installation of energy efficiency improvements, consisting of recommissioning measures at smaller office facilities.

Program Marketing:

The Company uses a number of marketing activities to promote its approved DSM programs, including but not limited to: direct mail, bill inserts, web content, social media, and outreach events. Because this program is implemented using a contractor network, customers will enroll in the program by contacting a participating contractor. The Company utilizes the contractor network to market the programs to customers as well.

Residential Customer Engagement Program

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Re-Proposed
NC Duration:	Future

Program Description:

This Program provides educational insights into the customer's energy consumption via a Home Energy Report (on-line and/or paper version). The Home Energy report is intended to provide periodic suggestions on how to save on energy based upon analysis of the customer's energy usage. Customers can opt-out of participating in the program at any time.

Appendix 6A cont. – Description of Active DSM Programs

Residential Smart Thermostat Program (DR)

Target Class:	Residential
VA Program Type:	Demand Response
NC Program Type:	Demand Response
VA Duration:	Re-Proposed
NC Duration:	Future

Program Description:

All residential customers who are not already participating in the Company's DSM Phase I Smart Cooling Rewards Program and who have a qualifying smart thermostat would be offered the opportunity to enroll in the peak demand response portion of the Program. Demand Response will be called by the Company during times of peak system demand throughout the year and thermostats of participating customers would be gradually adjusted to achieve a specified amount of load reduction while maintaining reasonable customer comfort and allowing customers to opt-out of specific events if they choose to do so.

Residential Smart Thermostat Program (EE)

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Re-Proposed
NC Duration:	Future

Program Description:

This Program provides an incentive to customers to either purchase a qualifying smart thermostat and/or enroll in an energy efficiency program, which helps customers manage their daily heating and cooling energy usage by allowing remote optimization of their thermostat operation, and provides specific recommendations by e-mail or letter that customers can act on to realize additional energy savings. The Program is open to several thermostat manufacturers, makes, and models that meet or exceed the Energy Star requirements and have communicating technology. Rebates for the purchase of a smart thermostat are provided on a one-time basis; incentives for participation in remote thermostat management are provided on an annual basis. For those customers who are enrolled in thermostat management, additional energy-saving suggestions based on operational data specific to the customer's heating and cooling system are provided to the customer at least quarterly.

Appendix 6B – Approved Programs Non-Coincidental Peak Savings for Plan B (kW) (System Level)

Programs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Air Conditioner Cycling Program	53,826	53,826	53,826	53,826	53,826	55,522	57,611	58,468	56,259	53,826	53,826	53,826	53,826	53,826	53,826	53,826
Residential Low Income Program	4,077	4,077	4,077	4,077	4,039	3,509	2,233	1,436	795	192	0	0	0	0	0	0
Residential Lighting Program	19,434	9,766	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Lighting Program	9,158	6,821	2,410	86	67	0	0	0	0	0	0	0	0	0	0	0
Commercial HVAC Upgrade	668	668	668	668	668	655	495	193	0	0	0	0	0	0	0	0
Non-Residential Energy Audit Program	4,720	3,687	803	392	0	0	0	0	0	0	0	0	0	0	0	0
Non-Residential Duct Testing and Sealing Program	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029	121,029
Non-Residential Distributed Generation Program	9,463	9,463	10,514	10,514	11,566	11,608	11,650	11,681	11,713	11,744	11,776	11,807	11,839	11,870	11,902	11,934
Residential Bundle Program	18,876	14,987	13,139	13,114	12,835	11,135	9,823	8,577	8,325	7,129	5,768	3,977	1,413	832	259	0
Residential Home Energy Check-Up Program	4,685	4,685	4,685	4,659	4,381	2,681	1,369	125	0	0	0	0	0	0	0	0
Residential Duct Sealing Program	1,555	1,555	1,555	1,555	1,555	1,555	1,555	1,555	1,555	1,555	1,553	1,526	1,413	832	259	0
Residential Heat Pump Tune Up Program	5,736	1,847	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Heat Pump Upgrade Program	6,900	6,900	6,900	6,900	6,900	6,900	6,900	6,897	6,770	5,575	4,215	2,451	0	0	0	0
Non-Residential Window Film Program	7,122	7,122	7,122	7,122	6,660	5,484	4,381	2,006	268	24	0	0	0	0	0	0
Non-Residential Lighting Systems & Controls Program	59,716	59,716	59,716	58,711	53,744	38,257	23,583	13,085	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043
Non-Residential Heating and Cooling Efficiency Program	30,512	30,512	30,512	30,512	30,512	30,512	30,512	30,512	30,512	30,476	29,373	21,046	14,111	6,604	1,193	0
Income and Age Qualifying Home Improvement Program	2,510	2,862	3,214	3,566	3,918	4,153	4,179	4,206	4,231	4,256	4,280	4,674	4,462	4,380	4,404	4,425
Residential Appliance Recycling Program	1,762	1,762	1,762	1,528	860	0	0	0	0	0	0	0	0	0	0	0
Small Business Improvement Program	22,829	24,701	25,190	25,691	26,202	26,461	26,592	26,720	26,844	26,965	27,076	28,618	28,590	27,150	27,262	27,372
Residential Retail LED Lighting Program (NC only)	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651
Non-Residential Prescriptive Program	7,591	9,145	9,893	10,042	10,250	10,304	10,380	10,455	10,527	10,598	10,668	10,736	10,803	10,869	10,934	10,999
Residential Efficient Products Marketplace Program	176,553	265,923	363,458	469,989	475,487	480,906	486,283	491,480	496,455	501,300	506,035	510,665	515,175	519,604	523,959	528,257
Residential Customer Engagement Program	19,648	18,958	17,653	16,436	15,302	19,648	18,958	17,653	16,436	15,302	19,648	18,958	17,653	16,436	15,302	19,648
Non-Residential Lighting Systems & Controls Program	3,296	4,389	5,576	6,764	6,863	6,925	6,988	7,049	7,108	7,166	7,223	7,278	7,333	7,387	7,441	7,494
Residential Appliance Recycling Program	1,215	2,084	2,989	3,916	4,331	4,380	4,428	4,440	4,521	4,565	4,608	4,650	4,691	4,731	4,770	4,809
Non-Residential Heating and Cooling Efficiency Program	10,232	17,054	23,875	30,697	36,894	37,392	37,732	38,069	38,240	38,716	39,028	39,335	39,478	39,934	40,227	40,516
Non-Residential Window Film Program	718	1,194	1,639	1,902	1,424	1,257	1,268	1,279	1,472	1,298	1,308	1,317	1,517	1,337	1,347	1,356
Residential Home Energy Assessment Program	896	1,906	4,411	3,957	4,828	4,885	4,940	4,995	5,047	5,098	5,147	5,195	5,243	5,289	5,334	5,378
Residential Smart Thermostat Management Program (DR)	12,308	37,375	53,941	69,556	81,985	82,919	83,846	84,742	85,600	86,436	87,252	88,049	88,828	89,592	90,343	91,084
Residential Smart Thermostat Management Program (EE)	581	1,755	2,798	3,787	4,751	5,207	5,266	5,324	5,380	5,433	5,486	5,537	5,587	5,636	5,683	5,731
Non-Residential Office Program	1,729	2,950	4,170	5,390	6,382	6,443	6,503	6,564	6,625	6,682	6,738	6,793	6,847	6,900	6,952	7,003
Non-Residential Small Manufacturing Program	1,466	2,444	3,421	4,399	4,516	4,557	4,598	4,639	4,678	4,716	4,754	4,791	4,827	4,863	4,898	4,933
Total	603,587	717,826	829,458	959,322	980,991	974,801	964,932	956,253	949,761	950,644	958,715	956,966	950,946	945,963	944,759	953,489

Note: Values reflective of free-ridership.

Appendix 6C– Approved Programs Coincidental Peak Savings for Plan B (kW) (System Level)

Programs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Air Conditioner Cycling Program	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826	53,826
Residential Low Income Program	2,344	2,344	2,344	2,344	2,191	1,839	1,051	842	273	50	0	0	0	0	0	0
Residential Lighting Program	10,398	3,152	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Lighting Program	9,154	5,328	1,335	86	36	0	0	0	0	0	0	0	0	0	0	0
Commercial HVAC Upgrade	668	668	668	668	668	582	339	88	0	0	0	0	0	0	0	0
Non-Residential Energy Audit Program	4,523	2,248	628	214	0	0	0	0	0	0	0	0	0	0	0	0
Non-Residential Duct Testing and Sealing Program	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595	7,595
Non-Residential Distributed Generation Program	9,025	9,483	10,076	10,514	11,127	11,590	11,832	11,868	11,700	11,731	11,763	11,794	11,826	11,857	11,889	11,920
Residential Bundle Program	13,347	9,699	7,965	7,926	7,413	6,701	6,064	5,748	5,284	4,498	3,532	2,275	1,326	781	243	0
Residential Home Energy Check-Up Program	2,236	2,236	2,235	2,186	1,583	971	334	27	0	0	0	0	0	0	0	0
Residential Duct Sealing Program	1,458	1,458	1,458	1,458	1,458	1,458	1,458	1,458	1,458	1,458	1,457	1,432	1,326	781	243	0
Residential Heat Pump Tune Up Program	5,381	1,733	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Heat Pump Upgrade Program	4,272	4,272	4,272	4,272	4,272	4,272	4,272	4,261	3,825	3,041	2,075	843	0	0	0	0
Non-Residential Window Film Program	5,211	5,211	5,211	5,211	4,873	4,012	3,205	1,468	187	18	0	0	0	0	0	0
Non-Residential Lighting Systems & Controls Program	34,310	34,310	34,310	33,805	28,074	18,903	11,277	5,589	3,472	3,472	3,472	3,472	3,472	3,472	3,472	3,472
Non-Residential Heating and Cooling Efficiency Program	7,058	7,058	7,058	7,058	7,058	7,058	7,058	7,058	7,058	6,999	5,816	4,074	2,378	859	125	0
Income and Age Qualifying Home Improvement Program	983	1,121	1,256	1,387	1,535	1,598	1,608	1,617	1,626	1,634	1,638	1,617	1,588	1,580	1,585	1,592
Residential Appliance Recycling Program	1,744	1,744	1,744	1,513	788	0	0	0	0	0	0	0	0	0	0	0
Small Business Improvement Program	13,336	15,213	15,513	15,820	16,135	16,314	16,394	16,473	16,549	16,624	16,692	16,689	16,668	16,706	16,777	16,845
Residential Retail LED Lighting Program (NC only)	755	755	755	755	755	755	755	755	755	755	755	755	755	755	755	755
Non-Residential Prescriptive Program	5,899	7,152	7,742	7,856	7,979	8,064	8,123	8,182	8,238	8,294	8,348	8,401	8,454	8,506	8,557	8,607
Residential Efficient Products Marketplace Program	1,673	2,850	3,740	4,931	5,483	5,546	5,608	5,669	5,728	5,785	5,840	5,894	5,947	5,999	6,050	6,100
Residential Customer Engagement Program	15,236	14,701	13,689	12,745	11,866	15,236	14,701	13,689	12,745	11,866	15,236	14,701	13,689	12,745	11,868	15,236
Non-Residential Lighting Systems & Controls Program	2,947	4,952	6,448	7,845	8,615	8,894	8,772	8,850	8,925	8,998	9,070	9,140	9,210	9,278	9,346	9,412
Residential Appliance Recycling Program	1,124	2,041	2,959	3,877	4,287	4,336	4,384	4,396	4,476	4,519	4,562	4,603	4,644	4,683	4,722	4,761
Non-Residential Heating and Cooling Efficiency Program	2,040	3,922	5,805	7,688	8,518	8,597	8,674	8,751	8,825	8,897	8,968	9,038	9,107	9,175	9,241	9,307
Non-Residential Window Film Program	496	949	1,402	1,855	2,054	2,073	2,092	2,111	2,128	2,145	2,163	2,180	2,198	2,213	2,229	2,245
Residential Home Energy Assessment Program	1,765	4,471	9,388	13,174	14,721	14,891	15,059	15,223	15,380	15,533	15,681	15,827	15,969	16,106	16,244	16,378
Residential Smart Thermostat Management Program (DR)	7,190	26,931	47,038	63,049	76,808	82,530	83,460	84,369	85,243	86,088	86,912	87,717	88,503	89,273	90,030	90,775
Residential Smart Thermostat Management Program (EE)	286	1,065	1,868	2,614	3,282	3,573	3,614	3,653	3,691	3,727	3,763	3,798	3,832	3,865	3,898	3,930
Non-Residential Office Program	454	874	1,294	1,713	1,898	1,916	1,933	1,950	1,966	1,983	1,998	2,014	2,029	2,044	2,059	2,074
Non-Residential Small Manufacturing Program	755	1,451	2,148	2,845	3,152	3,181	3,210	3,238	3,266	3,292	3,319	3,344	3,370	3,395	3,420	3,444
Total	214,130	230,883	253,836	279,027	280,735	286,209	280,434	272,603	268,847	268,331	270,949	268,756	266,384	264,717	263,928	268,276

Note: Values reflective of free-ridership.

Appendix 6D – Approved Programs Energy Savings for Plan B (MWh) (System Level)

Programs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Air Conditioner Cycling Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Low Income Program	10,435	10,435	10,435	10,435	9,827	7,512	4,811	2,861	1,322	257	0	0	0	0	0	0
Residential Lighting Program	111,791	36,179	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Lighting Program	80,617	36,203	9,453	567	258	0	0	0	0	0	0	0	0	0	0	0
Commercial HVAC Upgrade	4,732	4,719	4,719	4,719	4,732	4,152	2,484	676	0	0	0	0	0	0	0	0
Non-Residential Energy Audit Program	35,976	18,719	5,087	1,810	0	0	0	0	0	0	0	0	0	0	0	0
Non-Residential Duct Testing and Sealing Program	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567	80,567
Non-Residential Distributed Generation Program	118	1,136	133	690	381	707	1,393	887	860	707	762	1,412	1,415	1,419	1,423	1,427
Residential Bundle Program	49,096	43,799	41,162	40,788	35,979	28,684	22,258	18,845	17,065	14,056	10,371	5,631	1,743	1,050	329	0
Residential Home Energy Check-Up Program	22,584	22,584	22,577	22,212	17,403	10,109	3,683	307	0	0	0	0	0	0	0	0
Residential Duct Sealing Program	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,910	1,878	1,743	1,050	329	0
Residential Heat Pump Tune Up Program	7,937	2,640	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Heat Pump Upgrade Program	16,663	16,663	16,663	16,663	16,663	16,663	16,663	16,826	15,173	12,143	8,461	3,752	0	0	0	0
Non-Residential Window Film Program	5,598	5,598	5,598	5,598	5,234	4,308	3,442	1,572	211	19	0	0	0	0	0	0
Non-Residential Lighting Systems & Controls Program	203,441	203,441	203,441	200,683	168,998	114,803	68,666	34,535	20,588	20,588	20,588	20,588	20,588	20,588	20,588	20,588
Non-Residential Heating and Cooling Efficiency Program	34,035	34,035	34,035	34,035	34,035	34,035	34,035	34,035	34,035	33,797	28,895	20,334	12,234	4,720	735	0
Income and Age Qualifying Home Improvement Program	10,240	11,725	13,210	14,695	16,180	16,942	17,043	17,142	17,237	17,329	17,383	17,238	16,998	16,927	16,965	17,066
Residential Appliance Recycling Program	11,484	11,484	11,484	10,034	5,368	0	0	0	0	0	0	0	0	0	0	0
Small Business Improvement Program	72,728	84,085	85,739	87,433	89,185	90,215	90,659	91,094	91,517	91,929	92,304	92,252	92,039	92,215	92,565	92,971
Residential Retail LED Lighting Program (NC only)	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269	7,269
Non-Residential Prescriptive Program	14,949	18,142	19,713	20,011	20,316	20,537	20,688	20,837	20,982	21,123	21,261	21,398	21,531	21,663	21,793	21,922
Residential Efficient Products Marketplace Program	128,674	205,013	290,431	383,696	430,667	435,634	440,546	445,355	449,977	454,442	458,799	463,054	467,211	471,282	475,278	479,215
Residential Customer Engagement Program	50,810	49,025	45,649	42,503	39,570	50,810	49,025	45,649	42,503	39,570	50,810	49,025	45,649	42,503	39,570	50,810
Non-Residential Lighting Systems & Controls Program	14,217	24,407	31,857	39,307	42,860	43,275	43,686	44,051	44,425	44,790	45,148	45,499	45,845	46,186	46,522	46,855
Residential Appliance Recycling Program	7,221	13,263	18,304	25,346	26,216	28,535	26,851	28,915	29,456	29,743	30,023	30,296	30,563	30,824	31,081	31,334
Non-Residential Heating and Cooling Efficiency Program	9,095	18,245	27,395	36,546	41,366	41,747	42,124	42,497	42,858	43,211	43,556	43,898	44,230	44,560	44,884	45,205
Non-Residential Window Film Program	2,033	3,887	5,761	7,626	8,454	8,532	8,609	8,685	8,758	8,830	8,901	8,970	9,038	9,106	9,172	9,237
Residential Home Energy Assessment Program	9,326	21,478	35,892	49,014	55,565	56,206	56,840	57,461	58,058	58,634	59,197	59,746	60,283	60,808	61,324	61,832
Residential Smart Thermostat Management Program (DR)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Smart Thermostat Management Program (EE)	1,594	6,244	11,660	16,433	21,075	23,444	23,708	23,967	24,217	24,457	24,692	24,921	25,145	25,364	25,580	25,792
Non-Residential Office Program	5,212	10,387	15,562	20,737	23,397	23,613	23,827	24,037	24,241	24,440	24,636	24,828	25,017	25,203	25,387	25,569
Non-Residential Small Manufacturing Program	3,521	6,896	10,270	13,645	15,262	15,402	15,542	15,679	15,812	15,941	16,069	16,194	16,317	16,439	16,559	16,677
Total	944,780	966,362	1,025,820	1,154,187	1,184,781	1,136,731	1,086,055	1,048,517	1,031,979	1,031,669	1,041,229	1,033,118	1,023,685	1,018,683	1,017,641	1,034,336

Note: Values reflective of free-ridership.

Appendix 6E – Approved Programs Penetrations for Plan B
(System Level)

Programs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Air Conditioner Cycling Program	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000	85,000
Residential Low Income Program	12,743	12,743	12,743	12,743	11,312	7,192	4,856	2,653	853	0	0	0	0	0	0	0
Residential Lighting Program	2,243,150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Lighting Program	2,057	749	21	21	0	0	0	0	0	0	0	0	0	0	0	0
Commercial HVAC Upgrade	127	127	127	127	127	99	40	0	0	0	0	0	0	0	0	0
Non-Residential Energy Audit Program	1,437	305	154	17	0	0	0	0	0	0	0	0	0	0	0	0
Non-Residential Duct Testing and Sealing Program	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694	4,694
Non-Residential Distributed Generation Program	9	9	10	10	11	11	11	11	11	11	11	11	11	11	11	11
Residential Bundle Program	88,903	78,921	75,993	74,424	54,722	39,866	24,610	22,975	19,680	15,987	11,172	5,004	3,336	1,153	278	0
Residential Home Energy Check-Up Program	52,963	52,963	52,932	51,363	31,661	16,805	1,549	0	0	0	0	0	0	0	0	0
Residential Duct Sealing Program	3,853	3,853	3,853	3,853	3,853	3,853	3,853	3,853	3,853	3,853	3,845	3,737	3,336	1,153	278	0
Residential Heat Pump Tune Up Program	22,879	2,597	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential Heat Pump Upgrade Program	19,208	19,208	19,208	19,208	19,208	19,208	19,208	19,122	15,827	12,134	7,327	1,267	0	0	0	0
Non-Residential Window Film Program	476,780	476,780	476,780	476,780	423,759	326,638	269,410	37,778	3,913	0	0	0	0	0	0	0
Non-Residential Lighting Systems & Controls Program	4,674	4,674	4,674	4,556	3,302	2,056	1,165	473	473	473	473	473	473	473	473	473
Non-Residential Heating and Cooling Efficiency Program	422	422	422	422	422	422	422	422	422	416	299	204	98	18	0	0
Income and Age Qualifying Home Improvement Program	30,294	34,794	39,294	43,794	48,294	48,602	48,907	49,202	49,485	49,760	50,029	50,291	50,548	50,799	51,046	51,290
Residential Appliance Recycling Program	14,072	14,072	14,072	10,866	3,131	0	0	0	0	0	0	0	0	0	0	0
Small Business Improvement Program	4,145	4,228	4,313	4,400	4,489	4,512	4,534	4,556	4,577	4,598	4,618	4,638	4,658	4,677	4,697	4,716
Residential Retail LED Lighting Program (NC only)	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497	334,497
Non-Residential Prescriptive Program	2,336	2,792	2,834	2,877	2,921	2,943	2,964	2,985	3,006	3,026	3,045	3,065	3,084	3,102	3,121	3,139
Residential Efficient Products Marketplace Program	5,284,607	7,959,658	10,879,110	14,067,818	14,232,435	14,394,619	14,555,576	14,711,134	14,860,043	15,005,051	15,146,784	15,285,084	15,420,379	15,552,950	15,683,298	15,811,937
Residential Customer Engagement Program	287,500	277,400	258,300	240,500	223,900	287,500	277,400	258,300	240,500	223,900	287,500	277,400	258,300	240,500	223,900	287,500
Non-Residential Lighting Systems & Controls Program	998	1,364	1,730	2,096	2,116	2,135	2,154	2,173	2,191	2,209	2,226	2,243	2,260	2,277	2,293	2,309
Residential Appliance Recycling Program	15,589	25,089	34,589	44,089	44,595	45,093	45,588	46,066	46,523	46,959	47,404	47,829	48,245	48,652	49,053	49,448
Non-Residential Heating and Cooling Efficiency Program	1,050	1,750	2,450	3,150	3,179	3,208	3,237	3,266	3,292	3,319	3,345	3,371	3,396	3,421	3,446	3,471
Non-Residential Window Film Program	202,350	336,300	470,250	604,200	609,825	615,383	620,912	626,306	631,524	636,640	641,671	646,613	651,477	656,270	661,006	665,695
Residential Home Energy Assessment Program	41,387	76,407	110,455	144,863	146,558	148,228	149,886	151,488	153,021	154,514	155,974	157,396	158,791	160,156	161,496	162,823
Residential Smart Thermostat Management Program (DR)	6,808	20,673	29,836	38,473	45,348	45,865	46,378	46,873	47,348	47,810	48,261	48,702	49,133	49,555	49,971	50,381
Residential Smart Thermostat Management Program (EE)	9,071	27,173	40,828	54,200	68,569	67,326	66,080	68,808	69,504	70,183	70,846	71,493	72,125	72,745	73,355	73,957
Non-Residential Office Program	128	210	294	378	382	385	388	392	395	398	401	405	408	411	414	418
Non-Residential Small Manufacturing Program	105	175	245	315	318	321	324	327	329	332	335	337	340	342	345	347
Total	9,184,931	9,780,706	12,883,715	16,255,310	16,351,906	16,466,596	16,550,833	16,460,375	16,581,082	16,689,785	16,898,586	17,028,752	17,151,253	17,271,705	17,392,392	17,592,105

Note: Values reflective of free-ridership.

Appendix 6F – Description of Proposed Programs

Residential Electric Vehicle EE/DR Program

State:	Virginia & North Carolina
Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Residential Electric Vehicle Program would provide an incentive to customers to purchase a qualifying charger for their electric vehicle and who agree to enroll in the demand response ("DR") component of the proposed program. Customers who receive an incentive for the purchase of the qualifying chargers must also participate in the DR component of the program. Demand response would be called by the Company during times of peak system demand throughout the year and vehicle chargers enrolled in the Program would be activated by remote control to temporarily reduce load. Customers can opt-out of specific events if they choose to do so.

Residential Electric Vehicle Peak Shaving Program

State:	Virginia & North Carolina
Target Class:	Residential
VA Program Type:	Peak Shaving
NC Program Type:	Peak Shaving
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Residential Electric Vehicle Peak Shaving Program is for customers who already have a qualifying Level 2 charger and wish to participate in the demand response component only (no purchase incentive).

Appendix 6F cont. – Description of Proposed Programs

Residential Energy Efficiency Kits Program

State:	Virginia & North Carolina
Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Residential Energy Efficiency Kits Program would provide residential customers with newly connected homes the opportunity to receive Welcome Kits. The Welcome kit will initially include a Tier I advanced power strip and an educational insert informing customers about opportunities to manage their energy use and how to opt into receiving additional free measures by going online to the program website or calling the program hotline. To receive the additional measures, customers will have to confirm their address and account status and answer a few questions to confirm the measures will be of value in producing electric energy savings in the home. Additionally, customers will receive educational materials on proper use of each measure, energy use in general, and energy savings available through other Company DSM programs.

Residential Home Retrofit Program

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Residential Home Retrofit Program would target high users of electricity within the Company's Virginia service territory with an incentive to conduct a comprehensive and deep whole house diagnostic home energy assessment by BPI certified whole house building technicians. The diagnostic-driven audit will typically take between 2 ½ and 4 hours depending on home size, and will include: visual inspection of all areas of the home including attic and crawl spaces; blower door testing of envelope leakage; duct blaster equivalent testing of ducting system if present; line logger testing of major appliances; thermal imaging where required; physical measurements of key spaces and insulation levels; and efficiency determinations of major equipment.

Appendix 6F cont. – Description of Proposed Programs

Residential Manufactured Housing Program

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Residential Manufactured Housing Program would provide residential customers in manufactured housing with educational assistance and an incentive to install energy efficiency measures. The auditor will perform a walk-through audit covering the envelope and all energy systems in the home, paying particular attention to the condition of DHW and HVAC systems, levels of insulation, and the condition of belly board. The contractor will be required to use the Program's energy analysis software to collect required data to perform energy calculations and generate a detailed report showing projected energy and potential cost savings specific to each customer's home. The intuitive audit software calculates and captures measure level savings values, which produces a consumer-friendly report outlining energy savings recommendations. The auditor will review the findings and recommendations of the complete report with the homeowner. The auditor will utilize a user-friendly audit software that calculates and captures measure-level savings values and produces a consumer-friendly report that clearly outlines additional energy savings recommendations. The auditor will review the findings and recommendations of the complete report with the homeowner.

Residential New Construction Program

Target Class:	Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Residential New Construction Program will provide incentives to home builders for the construction of new homes that are ENERGY STAR certified by directly recruiting existing networks of homebuilders and Home Energy Rating System ("HERS") Raters to build and inspect ENERGY STAR Certified New Homes. ENERGY STAR certification requires that homes be efficient at the system level instead of a menu-based offering. ENERGY STAR certification of new homes involves a whole-house set of standards that ensure homes are at least 15% more efficient than a home built to state-level minimum codes. Key components include: Shell improvements, HVAC performance, proper ventilation requirements (supports healthy indoor environments in certified homes) and durability (proper weather sealing, flashing details, site and foundation details). Participating homes must submit an energy model developed using Ekotrope or REM/Rate energy modeling software, along with a copy of the home's ENERGY STAR certificate (both provided by the rater) in order to qualify for an incentive.

Appendix 6F cont. – Description of Proposed Programs

Residential/Non-Residential Multifamily Program

Target Class:	Residential/Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Multifamily Program is designed to encourage investment in both residential and commercial *(i.e.,* common spaces) service aspects of multifamily properties. The Program design is based on a whole building approach where the implementation vendor will identify as many cost-effective measure opportunities as possible in the entire building (both residential and commercial meter) and encourage property owners to address the measures as a bundle. This approach provides one-stop-shop programming for multifamily property owners with solutions to include direct install-in-unit measures and incentives for prescriptive efficiency improvements. The Program will identify, track and report residential (in-unit) and commercial (common space) savings separately according to the account type.

Non-Residential Midstream EE Products Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Non-Residential Midstream EE Products Program consists of enrolling equipment distributors into the Program through an agreement to provide point-of-sales data in an agreed upon format each month. These monthly data sets will contain, at minimum, the data necessary to validate and quantify the eligible equipment that has been delivered for sale in the Company's service territory. In exchange for the data sets, the distributor will discount the rebate-eligible items sold to end customers. This Program aims to increase the availability and uptake of efficient equipment for the Company's non-residential customers.

Appendix 6F cont. – Description of Proposed Programs

Non-Residential New Construction Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Non-Residential New Construction Program would provide qualifying facility owners with incentives to install energy efficient measures in their new construction project. Program engineers will determine what potential energy efficiency upgrades are of interest to the owner and feasible within their budget. These measures coupled with basic facility design data will be analyzed to determine the optimized building design. This in-depth analysis will be performed using building energy simulation models, which will allow for "bundles" of measures to be tested for potential energy savings gains from interactive effects. The results will be presented to the facility owner to determine which measures are to be installed. Program design building types modeled include small offices, medium offices, stand-alone retail, and outpatient health care.

Small Business Improvement Enhanced Program

Target Class:	Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Small Business Improvement Enhanced Program would provide small businesses an energy use assessment and tune-up or re-commissioning of electric heating and cooling systems, along with financial incentives for the installation of specific energy efficiency measures. Participating small businesses would be required to meet certain size and connected load requirements.

House Bill 2789 Program (Heating and Cooling/Health and Safety Component)

Target Class:	Residential/Non-Residential
VA Program Type:	Energy Efficiency
NC Program Type:	Energy Efficiency
VA Duration:	Proposed
NC Duration:	Future

Program Description:

The Heating and Cooling/Health and Safety Component of Virginia House Bill 2789 requires that a petition be submitted for a program for income qualifying, elderly and disabled individuals. This component would offer incentives for the installation of measures that reduce residential heating and cooling costs and enhance the health and safety of residents, including repairs and improvements to home heating and cooling systems and installation of energy-saving measures in the house, such as insulation and air sealing.

Appendix 6G – Proposed Programs Non-Coincidental Peak Savings for Plan B (kW) (System Level)

Programs	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Non-Residential Midstream EE Products	0	0	1,741	4,274	6,973	9,672	12,371	13,567	13,686	13,802	13,916	14,027	14,136	14,243	14,349	14,453	14,557
Non-Residential New Construction	0	0	221	790	1,953	3,738	5,603	6,633	6,692	6,750	6,806	6,862	6,916	6,968	7,021	7,073	7,124
Residential EE Kits	0	0	2,494	4,987	7,480	9,974	12,467	12,607	12,742	12,871	12,996	13,119	13,239	13,356	13,471	13,584	13,695
Residential Home Retrofit	0	0	415	1,339	2,570	4,216	5,984	6,765	6,839	6,910	6,978	7,045	7,110	7,174	7,236	7,298	7,358
Residential Manufactured Housing	0	0	467	1,494	2,614	3,840	5,157	5,743	5,805	5,865	5,924	5,980	6,036	6,090	6,143	6,195	6,246
Multifamily Program	0	0	2,198	6,320	11,411	16,501	21,592	23,873	24,128	24,374	24,611	24,843	25,070	25,291	25,508	25,721	25,931
HB 2789 HVAC Component	0	0	6,690	13,380	23,002	31,848	31,848	31,848	31,848	31,848	31,848	31,848	31,848	31,848	31,848	31,848	31,848
Residential New Construction	0	0	2,325	5,770	9,645	13,842	18,157	20,085	20,304	20,514	20,718	20,916	21,110	21,299	21,484	21,668	21,846
Non-Residential Small Business Improvement Enhanced	0	0	784	2,339	3,894	5,530	7,251	8,622	8,699	8,774	8,847	8,918	8,988	9,057	9,125	9,192	9,258
Residential Electric Vehicle EE/DR	0	0	803	1,895	3,566	6,063	9,731	9,849	9,954	10,055	10,153	10,249	10,343	10,435	10,524	10,612	10,700
Residential Electric Vehicle Peak Shaving	0	0	134	244	412	664	1,034	1,045	1,056	1,067	1,077	1,088	1,098	1,107	1,117	1,126	1,135
Total	0	0	18,272	42,832	73,520	105,889	131,198	140,838	141,755	142,832	143,875	144,895	145,893	146,869	147,827	148,769	149,698

Note: Values reflective of free-ridership.

Appendix 6H – Proposed Programs Coincidental Peak Savings for Plan B (kW) (System Level)

Programs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Non-Residential Midstream EE Products	0	1,550	4,207	6,865	9,522	12,179	13,356	13,474	13,588	13,699	13,809	13,916	14,022	14,126	14,229	14,331
Non-Residential New Construction	0	129	544	1,420	2,850	4,510	5,228	5,275	5,319	5,363	5,406	5,448	5,489	5,530	5,570	5,610
Residential EE Kits	0	432	1,172	1,913	2,653	3,393	3,726	3,766	3,805	3,843	3,880	3,916	3,951	3,985	4,019	4,052
Residential Home Retrofit	0	306	1,203	2,536	4,161	5,907	6,678	6,750	6,820	6,888	6,954	7,018	7,081	7,143	7,203	7,263
Residential Manufactured Housing	0	274	1,071	2,158	3,285	4,411	4,912	4,965	5,017	5,066	5,115	5,162	5,209	5,254	5,298	5,342
Multifamily Program	0	1,891	6,187	11,234	16,282	21,329	23,582	23,834	24,077	24,311	24,540	24,764	24,983	25,197	25,407	25,615
HB 2789 HVAC Component	0	1,208	3,279	5,350	6,213	6,213	6,213	6,213	6,213	6,213	6,213	6,213	6,213	6,213	6,213	6,213
Residential New Construction	0	1,934	5,384	9,075	13,025	17,085	18,899	19,105	19,303	19,494	19,681	19,863	20,041	20,216	20,387	20,556
Non-Residential Small Business Improvement Enhanced	0	1,816	4,930	8,043	11,156	14,270	15,649	15,787	15,920	16,051	16,179	16,305	16,429	16,551	16,671	16,790
Residential Electric Vehicle EE/DR	0	344	1,059	2,109	3,692	6,029	7,199	7,277	7,353	7,426	7,497	7,566	7,634	7,700	7,766	7,830
Residential Electric Vehicle Peak Shaving	0	60	151	262	427	673	796	804	813	821	829	838	844	851	858	865
Total	0	9,943	29,187	50,966	73,265	95,999	106,238	107,251	108,228	109,176	110,102	111,008	111,896	112,766	113,623	114,467

Note: Values reflective of free-ridership.

Appendix 6I – Proposed Programs Energy Savings for Plan B (MWh) (System Level)

Programs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Non-Residential Midstream EE Products	0	2,348	6,392	10,435	14,478	18,522	20,322	20,502	20,675	20,845	21,011	21,175	21,336	21,494	21,651	21,805
Non-Residential New Construction	0	564	2,437	6,415	12,961	20,663	24,255	24,468	24,676	24,879	25,078	25,273	25,465	25,654	25,841	26,026
Residential EE Kits	0	4,539	12,882	21,226	29,569	37,913	41,971	42,429	42,870	43,295	43,710	44,115	44,512	44,899	45,280	45,655
Residential Home Retrofit	0	1,033	4,137	8,803	14,492	20,630	23,471	23,727	23,973	24,210	24,442	24,669	24,890	25,107	25,320	25,530
Residential Manufactured Housing	0	1,037	4,147	8,457	12,932	17,407	19,513	19,726	19,931	20,128	20,321	20,510	20,694	20,874	21,051	21,225
Multifamily Program	0	5,776	19,341	35,454	51,568	67,881	75,245	76,035	76,796	77,533	78,252	78,955	79,643	80,317	80,980	81,633
HB 2789 HVAC Component	0	3,005	9,459	15,913	19,362	19,362	19,362	19,362	19,362	19,362	19,362	19,362	19,362	19,362	19,362	19,362
Residential New Construction	0	3,467	9,948	16,883	24,302	31,943	35,557	35,945	36,318	36,678	37,030	37,373	37,708	38,037	38,359	38,677
Non-Residential Small Business Improvement Enhanced	0	5,742	16,023	26,303	36,583	46,863	51,659	52,114	52,557	52,988	53,411	53,827	54,236	54,639	55,037	55,431
Residential Electric Vehicle EE/DR	0	117	374	751	1,319	2,158	2,623	2,652	2,678	2,706	2,732	2,757	2,782	2,806	2,830	2,854
Residential Electric Vehicle Peak Shaving	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	27,629	85,140	150,640	217,566	283,143	313,979	316,961	319,838	322,625	325,350	328,017	330,629	333,191	335,711	338,197

Note: Values reflective of free-ridership.

Appendix 6J – Proposed Programs Penetrations for Plan B
(System Level)

Programs	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Non-Residential Midstream EE Products	0	0	300	600	900	1,200	1,500	1,513	1,527	1,539	1,552	1,564	1,576	1,588	1,600	1,611	1,623
Non-Residential New Construction	0	0	20	70	170	320	470	474	478	482	486	490	494	498	501	505	508
Residential EE Kits	0	0	30,000	60,000	90,000	120,000	150,000	151,677	153,298	154,850	156,361	157,838	159,279	160,689	162,070	163,429	164,769
Residential Home Retrofit	0	0	900	2,900	5,400	8,400	11,400	11,527	11,651	11,769	11,883	11,996	12,105	12,212	12,317	12,421	12,522
Residential Manufactured Housing	0	0	1,000	3,200	5,600	8,000	10,400	10,516	10,628	10,736	10,841	10,943	11,043	11,141	11,237	11,331	11,424
Multifamily Program	0	0	10,100	25,825	41,550	57,275	73,000	73,799	74,571	75,311	76,033	76,738	77,427	78,101	78,762	79,412	80,054
HB 2789 HVAC Component	0	0	8,800	17,600	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400
Residential New Construction	0	0	4,250	8,798	13,664	18,870	24,076	24,345	24,605	24,854	25,097	25,334	25,565	25,792	26,013	26,231	26,447
Non-Residential Small Business Improvement Enhanced	0	0	675	1,350	2,025	2,700	3,375	3,405	3,435	3,464	3,492	3,519	3,546	3,573	3,599	3,625	3,651
Residential Electric Vehicle EE/DR	0	0	1,100	2,596	4,884	8,304	13,328	13,477	13,621	13,759	13,893	14,024	14,153	14,278	14,401	14,521	14,640
Residential Electric Vehicle Peak Shaving	0	0	101	184	311	501	780	789	797	805	813	821	828	836	843	850	857
Total	0	0	57,246	123,123	190,904	251,970	314,729	317,924	321,012	323,970	326,851	329,668	332,417	335,107	337,744	340,336	342,895

Note: Values reflective of free-ridership.

Appendix 6K - Future Undesignated EE Coincidental Peak Savings for Plan B (kW) (System Level)

Programs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
GTSA/VCEA Reductions	0.00	39,000.00	87,000.00	143,000.00	209,000.00	276,000.00	335,000.00	447,000.00	408,000.00	388,000.00	409,000.00	422,000.00	474,000.00	377,000.00	358,000.00	340,000.00

Appendix 6L - Future Undesignated EE Energy Savings for Plan B (MWh) (System Level)

Programs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
GTSA/VCEA Reductions	-	190,920	544,938	899,006	1,266,768	1,607,767	1,962,001	2,316,233	2,509,660	2,479,532	2,479,532	2,479,532	2,511,743	2,413,919	2,293,536	2,173,774
Total	0	190,920	544,938	899,006	1,266,768	1,607,767	1,962,001	2,316,233	2,509,660	2,479,532	2,479,532	2,479,532	2,511,743	2,413,919	2,293,536	2,173,774

Appendix 6M – Rejected DSM Programs

Program
Non-Residential HVAC Tune-Up Program
Energy Management System Program
ENERGY STAR® New Homes Program
Geothermal Heat Pump Program
Home Energy Comparison Program
Home Performance with ENERGY STAR® Program
In-Home Energy Display Program
Premium Efficiency Motors Program
Residential Refrigerator Turn-In Program
Residential Solar Water Heating Program
Residential Water Heater Cycling Program
Residential Comprehensive Energy Audit Program
Residential Radiant Barrier Program
Residential Lighting (Phase II) Program
Non-Residential Refrigeration Program
Cool Roof Program
Non-Residential Data Centers Program
Non-Residential Curtailable Service
Non-Residential Custom Incentive
Enhanced Air Conditioner Direct Load Control Program
Residential Programmable Thermostat Program
Residential Controllable Thermostat Program
Residential Retail LED Lighting Program (VA)
Residential New Homes Program
Voltage Conservation
Residential Home Energy Assessment
Non-Residential Re-commissioning Program
Non-Residential Compressed Air System Program
Non-Residential Strategic Energy Management
Non-Residential Agricultural EE
Non-Residential Telecommunication Optimization

DNV·GL

National Comparison Analyses

Virginia Electric and Power Company

Section 1: Fuel Source for Generation

The generation mix of a state can be a significant determinant of its electricity cost. Figures 1 and 2 compare Virginia's generation mix with the rest of the country. Virginia's primary source of electricity generation is natural gas, followed by nuclear. This mix is most similar to that of Louisiana and New Jersey. Connecticut, Mississippi, and Rhode Island also have energy generation mixes that may be comparable to Virginia.

Figure 1: Electricity generation mix, as fraction of total

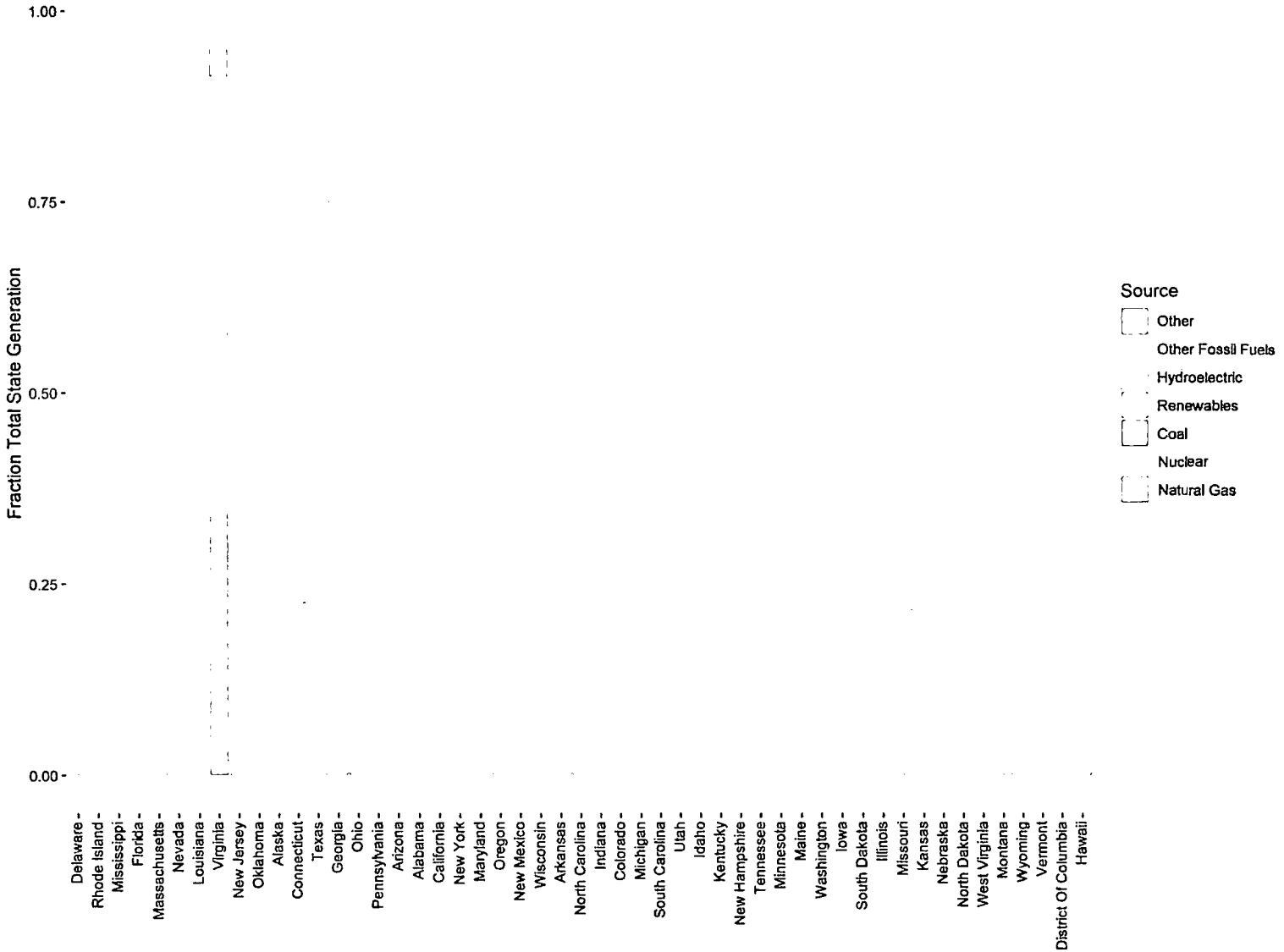
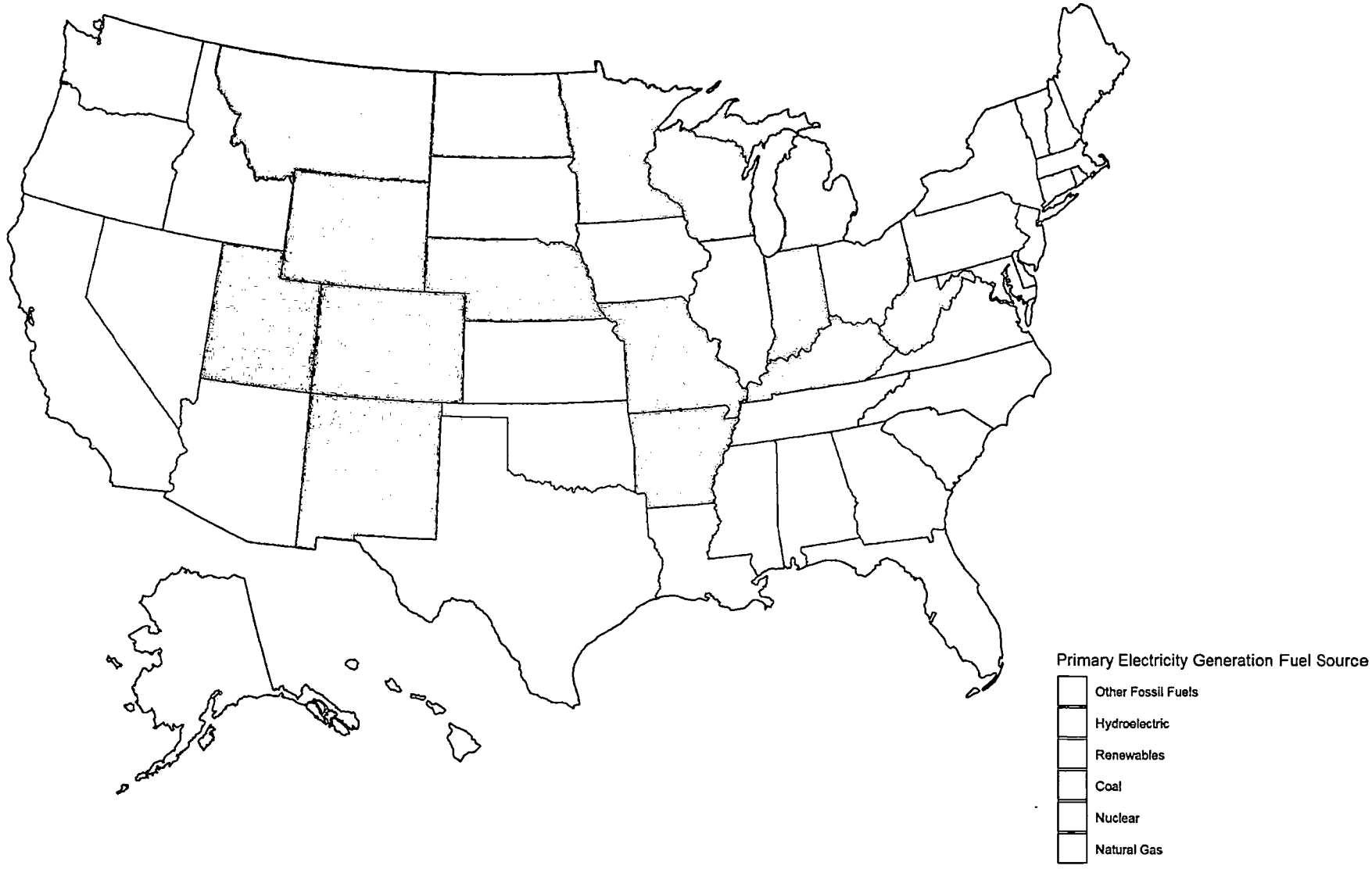


Figure 2: Map of the primary generation fuel source in each state



Section 2: Other Metrics

Variation in electricity bills between states depends in part on the prevalence of electric heating and cooling equipment, cooling and heating loads, and housing size.

Space heating represents a large proportion of many consumers' total energy use. The use of electricity for heating varies widely across regions. Among electrically heated homes, some types of equipment are more efficient than others. Table 1 shows the percentage of different fuels used for home heating in ten Census divisions. Virginia is part of the South Atlantic division that includes Delaware, Maryland, West Virginia, North Carolina, South Carolina, Georgia, Florida, and the District of Columbia. Table **12** shows the mix of different heating equipment by Census division. Table 3 shows the mix of different electric heating equipment by Census division. The South Atlantic division has a large fraction of homes heated by electricity compared to the more northern parts of the country. Of those South Atlantic customers who use electric heat, most use either electric central warm-air furnaces or electric heat pumps. The South Atlantic division also has a larger fraction of homes without heating equipment, as compared to the other regions. Relatively fewer customers in the South Atlantic use central warm-air furnaces for heat, and relatively more use heat pumps when compared to other areas.[1]

Table 1: Space heating equipment by fuel source by Census division

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain North	Mountain South	Pacific
Natural gas	37.5%	60.4%	72.9%	66.3%	27.2%	27.8%	37.7%	78.6%	46.5%	48.0%
Electricity	8.9%	14.9%	19.9%	21.7%	55.7%	62.5%	52.9%	14.3%	37.2%	31.3%
Fuel oil/kerosene	39.3%	16.9%	N/A	N/A	3.4%	N/A	N/A	N/A	N/A	N/A
Propane	7.1%	2.6%	5.0%	8.4%	3.4%	6.9%	3.6%	2.4%	N/A	2.2%
Wood	7.1%	3.9%	1.7%	3.6%	2.1%	N/A	1.4%	N/A	N/A	3.9%
Some other fuel[3]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Do not use heating equipment	N/A	N/A	N/A	N/A	8.1%	N/A	3.6%	N/A	4.7%	14.5%

[1] https://www.eia.gov/consumption/residential/data/2015/, tables HC6.7 and HC6.8

Table 1: Saturation of heating equipment types by Census division

	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain North	Mountain South	Pacific
Central warm-air furnace	57.1%	48.7%	77.3%	73.5%	46.8%	51.4%	68.1%	78.6%	58.1%	51.4%
Heat pump	N/A	4.5%	3.9%	4.8%	26.4%	26.4%	9.4%	N/A	18.6%	7.3%
Steam or hot water system	23.2%	29.2%	6.1%	8.4%	3.0%	N/A	N/A	7.1%	N/A	1.7%
Built-in electric units	N/A	7.8%	8.8%	6.0%	8.5%	8.3%	6.5%	N/A	4.7%	10.1%
Built-in oil or gas room heater	5.4%	3.2%	N/A	N/A	1.3%	5.6%	2.9%	N/A	N/A	4.5%
Portable electric heaters	N/A	N/A	N/A	N/A	3.0%	5.6%	5.8%	N/A	N/A	3.4%
Heating stove burning wood	5.4%	2.6%	1.1%	3.6%	1.7%	N/A	N/A	N/A	N/A	2.8%
Built-in pipeless furnace	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.2%
Fireplace	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.1%
Some other equipment	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Do not use heating equipment	N/A	N/A	N/A	N/A	8.1%	N/A	3.6%	N/A	4.7%	14.5%

Table 2: Electric heating equipment mix

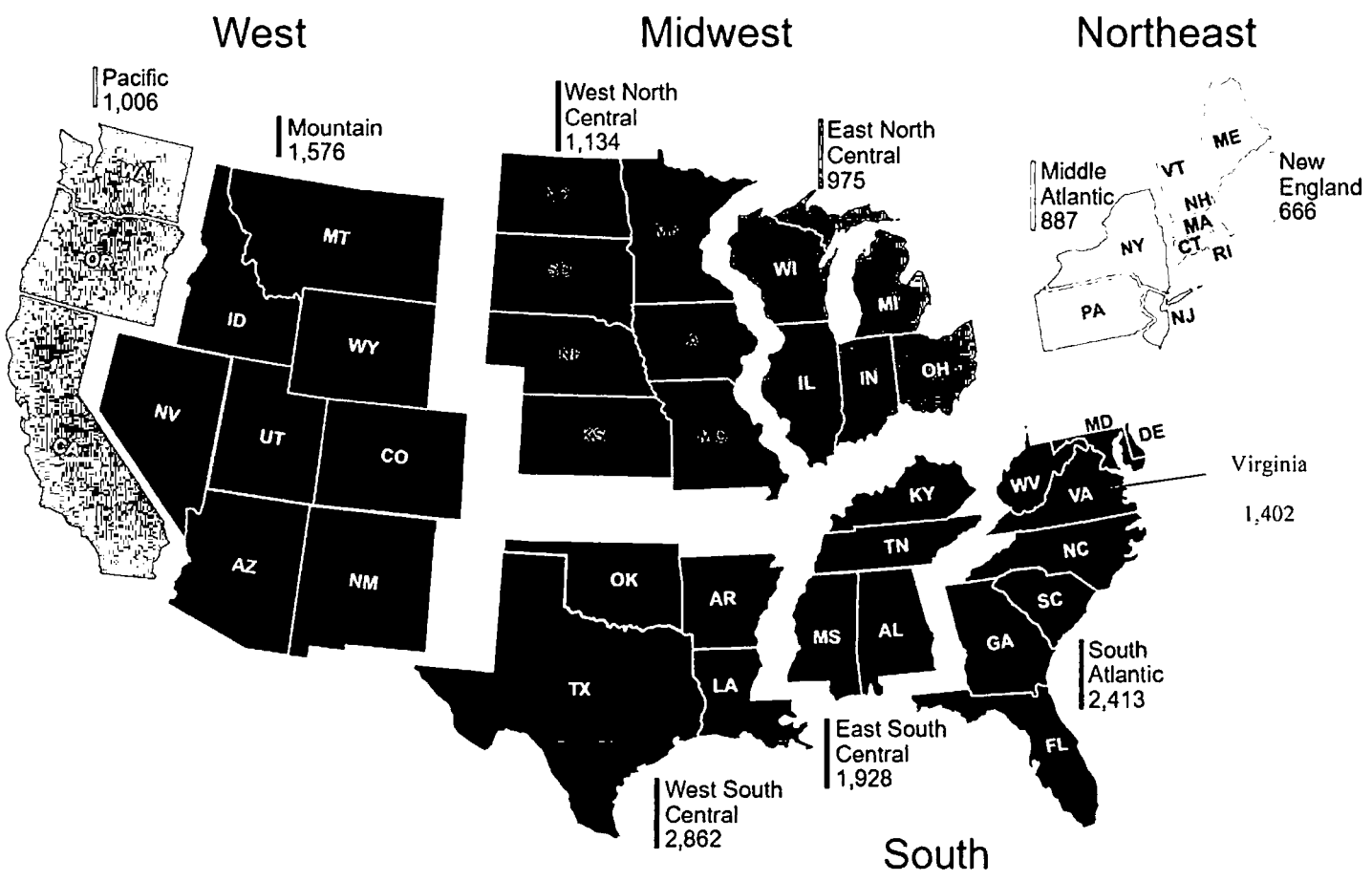
		New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain North	Mountain South	Pacific
Fraction of Homes Heated by Electricity		8.9%	14.9%	19.9%	21.7%	55.7%	62.5%	52.9%	14.3%	37.2%	31.3%
Fraction Electric-Heated Homes Using:	Central warm-air furnace	N/A	13.0%	33.3%	44.4%	35.9%	40.0%	60.3%	50.0%	37.5%	33.9%
	Heat pump	N/A	26.1%	16.7%	16.7%	42.7%	37.8%	15.1%	N/A	43.8%	21.4%
	Built-in electric units	N/A	52.2%	44.4%	27.8%	15.3%	13.3%	12.3%	N/A	12.5%	32.1%
	Portable electric heaters	N/A	N/A	N/A	N/A	5.3%	8.9%	11.0%	N/A	N/A	10.7%
	Some other equipment	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Climate is also a key driver of customers' electricity bills. Heating degree days ("HDD") and cooling degree days ("CDD") are often used as proxies for cooling and heating load. It also measures how much the daily temperature diverges from a base temperature (below 65° Fahrenheit for heating and above the 65° Fahrenheit for cooling). Virginia's annual cooling and heating degree days in 2019 were near the US average. In 2019, Virginia had 1,401 CDD compared to the national average of 1,453 CDD and 3,998 HDD compared to the national average of 4,377 HDD.[2]

However, the number of HDD and CDD vary widely across US regions. See Figures 3 and 4. We added Virginia's 2018 CDD and HDD to the maps for comparison.

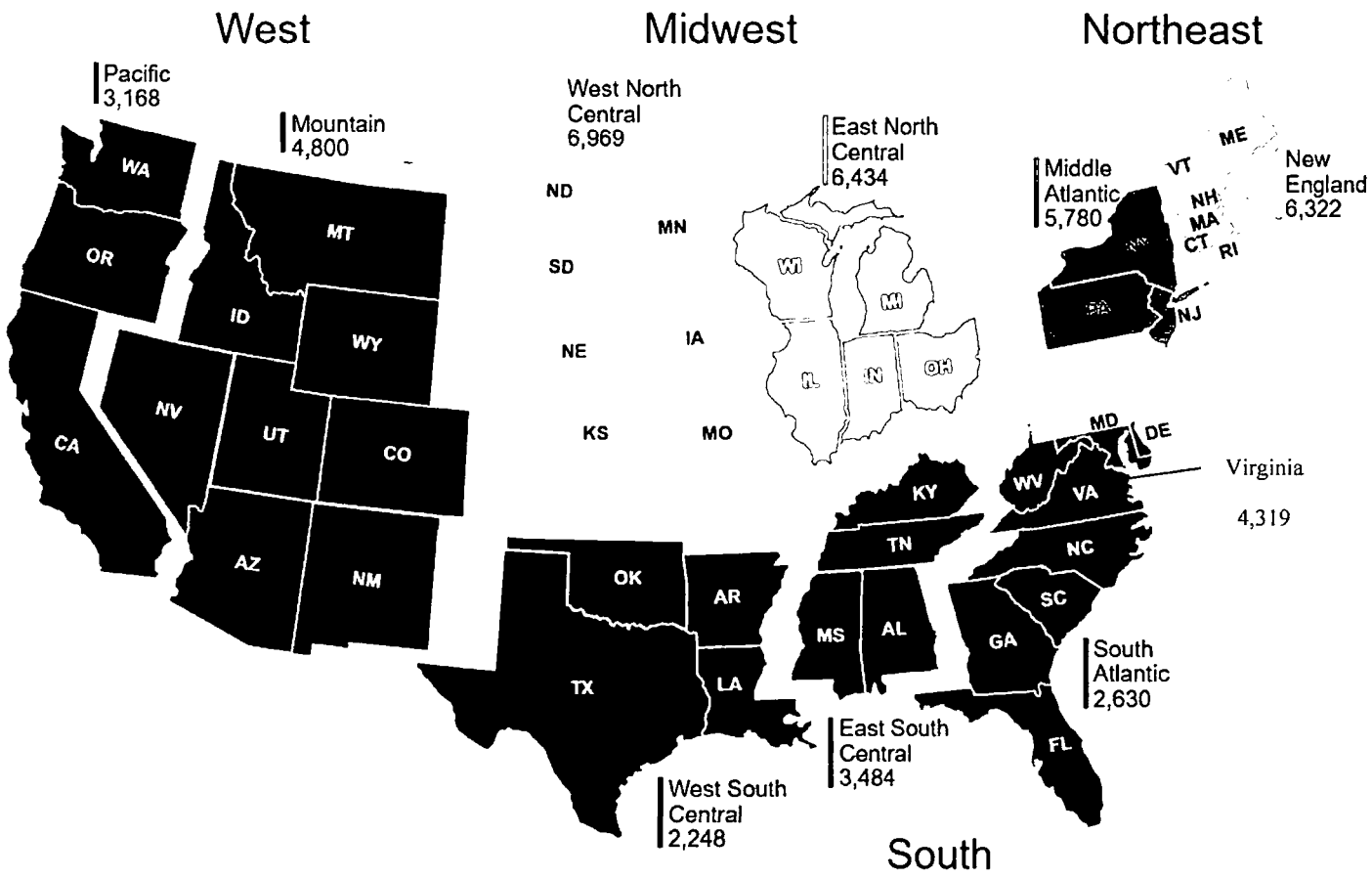
[2] NNDC Climate Data Online, National Climatic Data Center, U.S. Department of Commerce. https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp

Figure 3: Cooling degree days by Census division in 2018



Note: Population-weighted degree days. Pacific division includes Alaska and Hawaii.
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.10, December 2019

Figure 4: Heating degree days by Census division in 2018



eia Note: Population-weighted degree days. Pacific division includes Alaska and Hawaii.
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.9, December 2019

(https://www.eia.gov/energyexplained/units-and-calculators/degree-days.php)

Housing size also affects electricity bills – larger houses require more energy to cool, heat, light, etc. Table 4 shows how housing average square footage varies across the U.S. The South Atlantic division's average home size falls generally in the middle of other Census divisions. The South Atlantic heats fewer square feet/house and cools more square feet/house in comparison to most other parts of the country.[3]

Table 4: Average home size

	Average Square Footage per Housing Unit		
	Total	Heated	Cooled
All homes	2,008	1,754	1,375
New England	2,186	1,861	783
Middle Atlantic	2,055	1,765	1,100
East North Central	2,250	2,051	1,563
West North Central	2,338	2,024	1,758
South Atlantic	1,999	1,669	1,615
East South Central	1,870	1,625	1,393
West South Central	1,873	1,725	1,592
Mountain North	2,171	2,037	1,294
Mountain South	1,844	1,755	1,427
Pacific	1,689	1,405	947

[3] EIA, https://www.eia.gov/consumption/residential/data/2015/#squarefootage, Table HC10.9

Appendix 7A – List of Transmission Lines Under Construction

Line Terminals	Line Voltage (kV)	Target Date	Location
Sandlot 230 kV Delivery - DEV	230	Mar-20	VA
Freedom Substation (Redundant 69 kV Facility	69	Mar-20	VA
Fork Union Substation – New Substation	115; 230	Apr-20	VA
Line #548 Valley Switching Station Fixed Series Capacitors replacement	500	Apr-20	VA
Line #547 Lexington Substation Fixed Series Capacitors Replacement	500	Apr-20	VA
Line #211 and #228 Chesterfield to Hopewell Partial Rebuild	230	May-20	VA
Line #217 Chesterfield-Lakeside Rebuild	230	May-20	VA
Line #86 Partial Rebuild Project	115	May-20	VA
Line #2199 Remington to Gordonsville– New 230 kV Line	230	May-20	VA
Skippers - New 115 kV Switching Station	115 kV	May-20	VA
Gordonsville Transformer #3 Replacement	230/115	May-20	VA
Idylwood - Convert Straight Bus to Breaker-and-a-Half	230	May-20	VA
Line #549 Dooms to Valley Rebuild	500	Jun-20	VA
Line #76 and #79 Yorktown to Peninsula Rebuild	115	Oct-20	VA
Columbia Tap- CVEC	115	Oct-20	VA
Dawson's Crossroads – Delivery Point (HEMC)	115	Nov-20	NC
Clarksville Tap Line 193 Rebuild	115	Dec-20	VA
Winters Branch – New Substation	230	Dec-20	VA
Line #154 Twittys Creek to Pamplin Rebuild	115	Dec-20	VA
Line #112 Fudge Hollow to Low Moor Rebuild	138	Dec-20	VA
Line #231 Landstown to Thrasher Rebuild	230	Dec-20	VA
Line #101 Mackeys to Crewswell Rebuild	115	Dec-20	NC
Buttermilk 230 kV Delivery	230	Dec-20	VA
Perimeter 230 kV DP – NOVEC	230	Dec-20	VA
Evergreen Mills 230 kV Delivery	230	May-21	VA
Clover Substation – New 500 kV STATCOM	500	May-21	VA
Ladysmith 2nd 500-230 kV transformer	500/230	May-21	VA
Farmwell – 230 kV Delivery	230	May-21	VA
Line #274 Pleasant View to Beaumeade Rebuild	230	Jun-21	VA
Line #2176 Gainesville to Haymarket and Line #2169 Haymarket to Loudoun – New 230 kV Lines and New 230 kV Substation	230	Jul-21	VA
Rawlings Switching Station New 500 kV STATCOM	500	Sep-21	VA
Line #65 Norris Bridge Rebuild	115	Dec-21	VA
Line #49 New Road to Middleburg – Rebuild	115	Dec-21	VA
Line #127 Buggs Island to Plywood Rebuild	115	Dec-21	VA
Line #16 Great Bridge to Hickory and Line #74 Chesapeake Energy Center to Great Bridge Partial Rebuild	115	Dec-21	VA
Line #120 Dozier-Thompson Corner Partial Rebuild	115	Dec-21	VA
New Switching Station to Retire Line #139 Everetts to Windsor DP	115	Dec-21	NC
Line #2008 Partial Rebuild and Line #156 Retirement	115; 230	Dec-21	VA
Line #550 Mt. Storm to Valley Rebuild	500	Dec-21	WV– VA
Mt. Storm - I/S GIS	500	May-22	WV
Line #43 Staunton to Harrisonburg – Rebuild	115	Jun-22	VA
Line #247 Suffolk Swamp Rebuild	230	Dec-22	VA– NC
Line #2175 Idylwood to Tyson's – New 230 kV Line	230	Dec-22	VA

Note: see Appendix 3D for North Carolina line capacity levels.

DOMINION ENERGY VIRGINIA'S INTEGRATED DISTRIBUTION PLANNING WHITE PAPER

1.0 INTRODUCTION

A major trend over the last 10-plus year period in the electric power industry has been the development of renewable generation, especially photovoltaic ("PV") and wind generation. Since 2008, wind generation capacity in the U.S. has experienced a compound annual growth rate ("CAGR") of approximately 19%, while PV has seen an approximately 61% CAGR. The Company expects these renewable energy growth trends to continue as customers demand more carbon free forms of energy. An important sub-trend is the growth of distributed energy resources ("DERs")—resources connected to the distribution system. According to the Energy Information Administration ("EIA"), the growth in U.S. of clean DERs (*e.g.*, hydroelectric, wind, PV) from 2009 through 2017 has been approximately 23%. The Company has experienced an approximately 43% DER growth rate on its system during that same timeframe, primarily in the form of PV systems. A subset of the EIA data for non-net metered PV DER experienced a CAGR of approximately 48% nationwide. This trend is expected to continue given the expected efficiency improvements and cost reductions in PV technology.

Along with this increase in distributed generation resources interconnected to the distribution system, other trends continue to develop, including the addition of high-energy electric vehicle charging, the adoption of energy storage, and a change in customer energy usage patterns driven by AMI-enabled time-varying rates. Utility planners must continue to adapt their skills, tools, and processes to integrate these new challenges into the electric energy infrastructure planning landscape. No longer is grid planning based only on load growth and the static impact during peak usage periods on the distribution grid. Now, planners must also anticipate new supply-side and demand-side resources in the form of DERs, understand the dynamic impact to the grid, and examine how DERs can provide non-traditional solutions to traditional grid challenges, such as line overloads and voltage deviations. To that end, historical distribution planning methods must change to an integrated distribution planning process.

The Company defines integrated distribution planning ("IDP") as a process to address the capacity, reliability, and DER integration needs of the distribution grid using traditional solutions as well as new solutions offered by customer-owned DER and other non-traditional technologies. IDP also accounts for uncertainties introduced by the dynamic nature of variables impacting grid operation, shifting results and associated decisions from deterministic to probabilistic outcomes. True IDP requires changes in planner's skills, technologies and tools used, and processes. Throughout, trained professionals are vital to fully leverage the technologies and optimize the processes and emerging tool sets. Technologies and communications systems that provide visibility into the distribution grid to the customer premises level are foundational to enabling integrated distribution planning. Processes and tools must then be developed to incorporate the data gathered, including advanced distribution modeling and analysis tools that consider a range of possible futures where varying levels of DER and emerging technologies are adopted on different parts of the distribution system.

This white paper provides an overview of the Company's current planning process, highlights the limitations of the current process, and sets forth the initial steps the Company plans to take to transition toward integrated distribution planning.

2.0 CURRENT DISTRIBUTION PLANNING

The Company's current distribution planning occurs through three distinct processes: (i) distribution capacity planning; (ii) distribution reliability planning; and (iii) DER interconnection. Together, these efforts result in a plan designed to address customer needs to ensure safe, reliable, and cost-effective electric service using traditional utility solutions.

2.1 Current Distribution Capacity Planning

2.1.a Overview of the Current Capacity Planning Process

The purpose of distribution capacity planning is to evaluate grid utilization during seasonal peak loading conditions based on projected load growth, identifying any necessary improvements to the distribution system needed to satisfy thermal and voltage criteria as the demands placed on the distribution infrastructure change over time. Figure 2.1 provides an overview of the current process.

Figure 2.1: Current Distribution Planning Process

	Inputs	Modeling & Analysis	Alternatives Evaluation	Outputs
CAPACITY PLANNING	• Historical seasonal peak loads • Historical and projected growth • Interval data at T to D transition point only • Utility scale DER contribution removed • No visibility of net metering DER • Steady state load and voltage criteria	• Static analysis for peak loading • Manual feeder-by-feeder analysis • Only steady state system analysis performed • DER not included in model • Loading allocated based on modeling assumptions	• Traditional mitigation alternatives: equipment upgrades/additions • Solutions optimized for cost / load growth and system impact	Multi-year Work Plan

2.1.b Current Distribution Load Growth Forecasting

The historical distribution capacity planning process centers around assessing current and anticipated constraints on the distribution grid associated with forecasted seasonal peak load conditions. Therefore, the Company annually develops a six-year summer and winter peak load forecast (for the next 5 years and for the 10th year into the future) for each of the approximately 1,800 feeders currently on the Company's system. These forecasts are assembled based on historical data measured at the feeder head (*i.e.*, the point of demarcation between the transmission and distribution systems) and information acquired through discussions with (and formal requests from) current and future customers. Examples of the information used to develop the forecast are historical load growth trends, planned new housing developments, new high-rise buildings, information regarding data center expansions or additions and commercial and industrial development. This information is then used by the Company's distribution planners to update feeder-level load growth projections. Generally, load growth forecasting is not location specific beyond information regarding block load additions that are known in the short term (*e.g.*, a new big box retail store under construction). Of note, there are no inputs related to customer-level usage patterns or DER and emerging technology penetration growth included in this current forecasting process. Traditional static capacity planning focuses on the system's summer and winter peak conditions, studying the traditional "worst case scenarios." Based on this focus, the current load growth forecasting utilizes only peak customer demand and removes DER to ensure the grid will remain reliable under these conditions.

2.1.c Current Distribution Capacity Planning

The current distribution capacity planning process is conducted on an annual basis and evaluates the adequacies of each of the Company's distribution feeders under the forecasted annual summer and winter peak load conditions over the planning period. The primary measurable input to this is currently limited to data collected at the feeder head. This evaluation is performed under normal operations and first contingency (N-1) conditions. Normal operations are defined as seasonal peak load conditions under normal distribution system configuration. First contingency (N-1) conditions are defined as situations that simulate the loss of a single distribution substation transformer during seasonal peak loading conditions.

Under both normal and first contingency conditions, distribution planners use computer modeling tools to identify if and when violations of capacity planning criteria are projected to occur on a particular feeder, feeder component or distribution substation transformer. Using feeder head data, the model approximates the expected loading along a feeder and all of its components based on engineering assumptions. The typical engineering limitations examined are conductor, transformer or equipment thermal limits (ampacity), and high or low voltage.

Once the timing and type of violations are determined on any given feeder component or substation transformer, the next step is to identify what grid mitigation solutions are necessary to correct the violation. Mitigation solutions may include re-configuration of the feeder, the addition or replacement of equipment (*e.g.*, capacitors, transformers, protection devices), replacing conductor with larger conductor (*i.e.*, reconductoring), or adding an entirely new substation or feeder. These all are considered traditional solutions.

2.2 Current Distribution Reliability Planning

2.2.a Overview of the Current Reliability Planning Process

The purpose of reliability planning is to identify causes of service interruptions and risks to the grid, and to develop cost-effective and prudent solutions to improve overall grid performance and customer experience. Figure 2.2 provides an overview of the current process.

Figure 2.2: Current Distribution Reliability Planning

	Inputs	Modeling & Analysis	Alternatives Evaluation	Outputs
RELIABILITY PLANNING	• Historical performance data focused on blue sky days • Multiple levels of analysis o System metrics o Feeder level o Responsive to specific customers	• Root cause analysis • Manual feeder-by-feeder analysis • Specific asset health testing and assessment • Manual mitigation modeling to predict improvement	• Traditional mitigation alternatives • Solutions optimized for cost, reliability and risk	Annual Work Plan

2.2.b Current Distribution Reliability Planning

Reliability planning is based on data analytics of service outage information. The Company maintains a historical database of service outages that includes the when, where, and why associated with each service outage generated by the Company's outage management system ("OMS"). This data is analyzed to identify areas of the distribution system that have exhibited reliability performance issues, including root causes. For repeat outages on the same feeder or

feeder section, the Company evaluates the cause to determine if there is a pattern to these outages. Depending on this pattern, the Company can devise mitigation measures to improve feeder performance. If, for example, lightning strikes have caused excessive amounts of outages in a specific area, the Company can mitigate future outages through the use of additional surge arresters for lightning protection, or investigate if grounding is within its operating specifications and physically improve the grounding system if it does not meet the operating specification. Another example of mitigation measures is to recondition poorly performing feeders by repairing defects and restoring the feeder to current construction standards.

This data examination process is conducted by the Company on a continual basis. The findings are gathered and used to support reliability improvement investment decisions.

2.3 DER Generation Interconnection Process

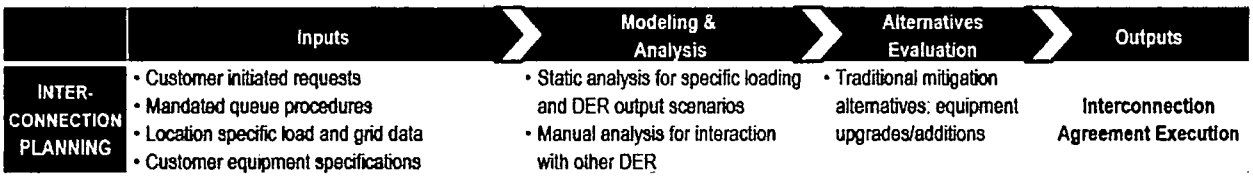
The Company's DER generation interconnection process requires the customer to request to export energy directly onto the distribution grid. Which interconnection process DER customers must follow depends upon (i) whether the DER customer opts to sell its output wholesale to PJM Interconnection, LLC ("PJM") or to the Company; and (ii) whether the DER customer elects to interconnect directly to distribution infrastructure as a small electrical generator or behind the customer's meter via net energy metering.

DER requests involving wholesale market participation requests are submitted to PJM. PJM administers the processing of the interconnection requests to its queue and coordinates the interconnection study process, as applicable, with the Company. The Company administers all other generator interconnection requests under the appropriate state jurisdictional procedures.

2.3.a Small Electrical Generator Interconnection Process

The interconnection process for small electric generators is administered in accordance with the Commission's Regulations Governing Interconnection of Small Electrical Generators, 20 VAC 5-314-10 *et seq.* The Commission initiated a rulemaking proceeding in September 2018 to possibly revise these regulations, Case No. PUR-2018-00107. The proceeding remains pending. A high level view of this current interconnect process is provided in Figure 2.3.a.

Figure 2.3.a: Overview of DER Small Electrical Generator Interconnection Process



The Company must study the interconnection of all generation that operates in parallel with the electric grid to identify if grid modifications are needed to accommodate the proposed interconnection while maintaining safe and reliable operation of the grid for all customers. Under the governing standards, the interconnection customer submitting the request is responsible for the costs to study the impact of the DER on the distribution system and for the costs to modify the grid to accommodate the proposed generation.

The Company's technical study process for utility-scale solar systems ensures that the output of the renewable generator does not result in thermal overload conditions or voltage deviations outside of an acceptable bandwidth on any feeder component or substation transformer to which the PV generator interconnects. The fault current contribution of the generator is also analyzed for its potential impact to the grid. The study is a static analysis based on the ability of the PV system to operate at full-rated output during daylight hours, with secondary consideration of inverter-based DERs to provide grid support for this injection or absorption of reactive power. Based on current grid visibility and control limitations, the Company has asked a small percentage of the generators to apply a fixed power factor setting, other than unity, for voltage support as a secondary measure.

DER interconnection requests have grown significantly over the past several years. Currently there are 28 utility-scale solar generation sites totaling 275 MW interconnected to the Company's electric distribution system in Virginia. As of August 1, 2019, there are 22 interconnection requests totaling 225 MW with executed interconnection agreements that are in the construction process, and 114 requests totaling 1,584 MW that are at some level of evaluation under the state jurisdictional procedures.

2.3.b Net Energy Metering Interconnection Process

If a renewable DER is proposing to offset a portion of a customer's own load, the customer may be eligible to apply for net energy metering. Net metering is administered in accordance with the Commission's Regulations Governing Net Energy Metering, 20 VAC 5-315-10 *et seq.* The Commission initiated a proceeding in August 2019 to amend these regulations consistent with new legislation, Case No. PUR-2019-00119. The proceeding remains pending.

The technical study process for net energy metering is currently a more simplified approach than the process for small electrical generators given the much smaller DER system size. The simplified approach ensures that the interconnecting system does not create an adverse thermal or voltage issue. Any necessary system upgrades (if any) are included in the Company's current base rate structure.

The Company has seen a dramatic growth rate in net metering interconnections, with a clear trend showing concentrated growth in certain geographic areas. Figures 2.3.b.1 and 2.3.b.2 show the total number of net metering customers for the top 10 office locations, as well as the growth in net metering by office since January 1, 2018.

Figure 2.3.b.1: Local Office Totals

Office Name	Cust	MW
Chalottesville	835	8.9
Alexandria	642	4.7
Blue Ridge	385	4.4
Richmond	352	3.1
Leesburg	269	2.7
Fairfax	324	2.3
Norfolk	100	2.1
Midlothian	201	2.1
East Richmond	258	2.0
Springfield	284	1.8
All Others	2,427	20.0
Total	**6,077**	**53.9**

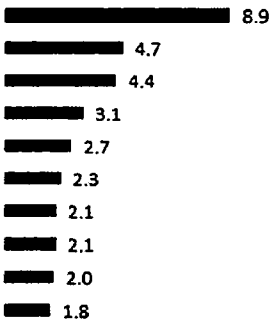
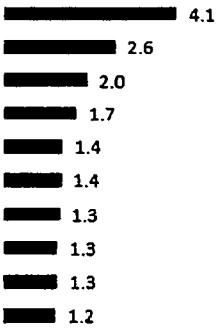


Figure 2.3.b.2: Local Office Growth Since January 1, 2018

Office Name	Cust	MW
Chalottesville	407	4.1
Blue Ridge	196	2.6
Alexandria	282	2.0
Norfolk	60	1.7
Midlothian	131	1.4
Fairfax	184	1.4
Springfield	194	1.3
Richmond	161	1.3
Gloucester	66	1.3
Peninsula	190	1.2
All Others	1,480	11.9
Total	**3,351**	**30.5**



3.0 LIMITATIONS OF CURRENT PLANNING PROCESS

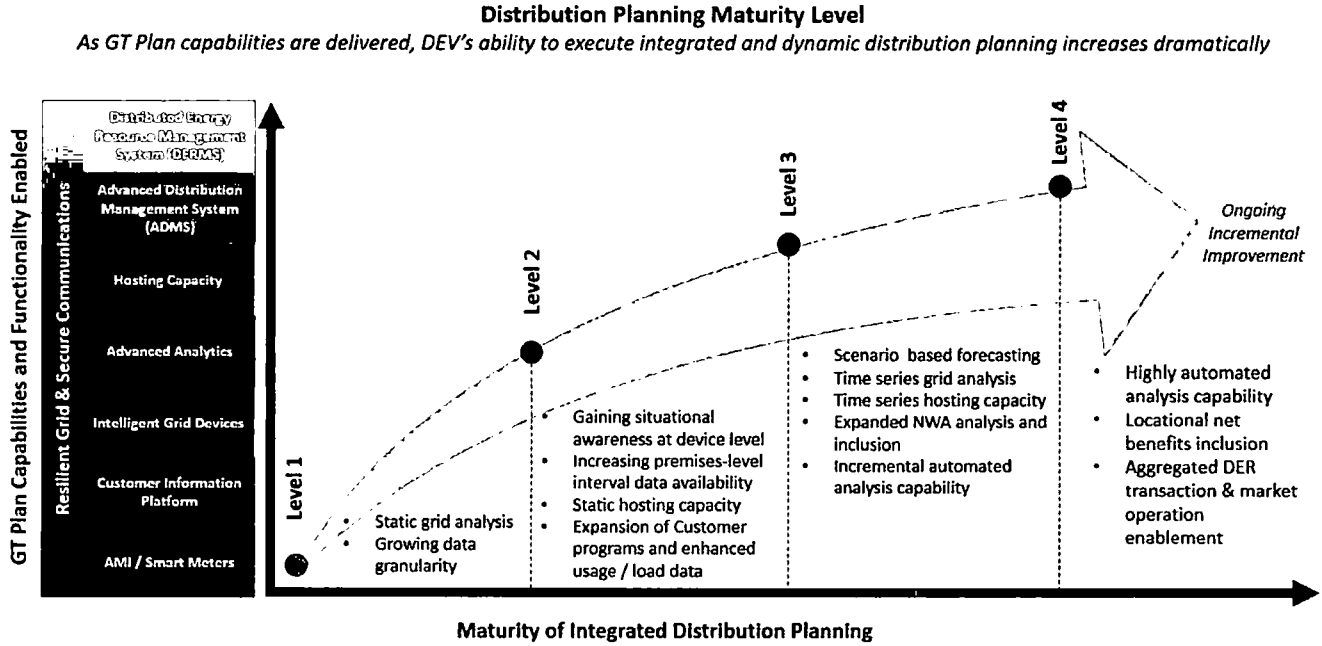
Current distribution planning methodologies and processes have been in place for decades and were designed to identify the most cost-effective means of maintaining a safe and reliable distribution grid. These practices have been effective in a world of centralized large-scale generation and one-way power flows. In that light, modeling and analyzing distribution grid limitations for discrete conditions (seasonal peak conditions) have worked effectively as a manual process. In the new paradigm of increasing DERs and other emerging end-use technologies creating a more dynamic distribution grid with bi-directional and constantly changing power flows, awareness of temporal and spatial growth and operating characteristics are necessary. Modeling the distribution grid under this necessity can no longer be done using traditional techniques. Future modeling and analysis requires the development of advanced and automated tools that are capable of using significantly more granular data and providing outputs on a much broader time scale of probabilistic distribution grid limitations. Limitations of grid visibility beyond the feeder head present uncertainty in determining non-peak characteristics of how the grid is functioning. Additionally, the ability to confidently leverage non-wires alternatives as a prudent alternative to traditional grid solutions requires a level of situational awareness, communications infrastructure, and control capabilities that do not currently exist on the Company's distribution grid.

The historical process of determining distribution system need only during forecasted seasonal peak conditions, with grid visibility limited primarily to the feeder head, is approaching obsolescence. Under the current distribution capacity planning process, anticipated growth in DERs and emerging technology are not able to be addressed. Further, the current process does not assess multiple potential scenarios of adoption rates of DER and emerging technologies. Changing distribution grid load flows along with temporal and spatial growth patterns and operating characteristics at times other than peak hours are, and will continue, to change the dynamics (*i.e.*, the load shape) of the distribution grid moving forward. Limitations of grid visibility beyond the feeder head present uncertainty in determining non-peak characteristics of how the grid is functioning.

4.0 FUTURE INTEGRATED DISTRIBUTION PLANNING PROCESS

The Company plans to implement an integrated distribution planning ("IDP") process that will evolve the current planning processes to adapt to the increasing proliferation of customer-owned DERs and other changes relevant to the modern grid. True IDP will require changes to people's skills, the technologies and tools they use, and processes for performing planning activities. The sections below describe the enhancements the Company plans to make within each of these categories. Figure 4.0 provides a chart showing the evolution of integrated distribution planning over time as enabling technologies are deployed.

Figure 4.0: IDP Evolution



4.1 People

As an initial step towards integrated distribution planning, the Company is centralizing the modeling and analysis activities for capacity planning, reliability planning, and DER interconnection as an integrated functional organization. The Company will continue to evaluate its organizational structure as integrated distribution planning matures in support of the

enhancements described below.

4.2 Technologies

IDP is highly dependent on having highly granular and spatial visibility of existing grid conditions. The Company has a plan to transform its distribution grid (the "Grid Transformation Plan" or "GT Plan") to adapt to the fundamental changes to the energy industry described above and to meet its customers' needs and expectations. Many of these proposed investments are foundational to IDP, including investments in advanced metering infrastructure ("AMI"); a self-healing grid, including intelligent grid device and an advanced distribution management system ("ADMS") with system capabilities for distributed energy resources management ("DERMS"); and Advanced Analytics. Advanced Analytics can suitably model the behavior of the entire distribution network including the renewable resources. These applications can analyze weather patterns along with past generation profiles and forecast the generation that will be available from the DER. Advanced Analytics will highlight opportunities for non-wires alternatives to be evaluated. Also vital are secure communications between the field devices and the back office systems. The Company's executive summary of the Grid Transformation Plan (the "Plan Document") provides additional information on these proposed investments.

4.3 Processes and Tools

IDP requires advanced distribution modeling and analysis capabilities that consider a range of possible futures where varying levels of DER and emerging technologies are adopted on the distribution system. The distribution grid needs to be analyzed at a wide range of load conditions, rather than at just peak load periods. The ability to successfully perform time series modeling analysis ("TSA") of the distribution grid is heavily reliant on a highly granular visibility of existing load and DER characteristics. Finally, given the uncertainty associated with the size and location of DER growth, probabilistic or stochastic analytical techniques will be required to evaluate the robustness of the distribution grid from the feeder head to the feeder edge.

The Company plans to implement the following process-related enhancements to its distribution planning process to move toward IDP. These enhancements are illustrated in Figure 4.3 and discussed in more detail below.

Figure 4.3: Enhanced Distribution Planning Process

	Inputs	Modeling & Analysis	Alternatives Evaluation	Final Plan
Integrated Distribution Planning	• Feeder load forecast scenarios (time series) • DER & emerging tech growth forecast scenarios • Additional planning inputs: (hosting capacity, AMI & IGD load and voltage data, all DER output data, feeder characteristics (EAM data), performance metrics, etc. • Engineering model build and framework for scenario based analysis • Network assessment (Static and Time Series Analysis) • Reliability assessment • Planning criteria	• Reliance on engineering models based on a high level of data granularity • Automated generation of time series analysis and holistic solutions • Inclusion of Non-Wire Alternatives (Storage, Advanced Inverter Functionality, DSM, etc.) • Inclusion of locational value of resources	• Traditional Grid Solutions • DER & DSM Opportunities • Grid Transformation Projects • Optimization of alternatives over time	10 Year Distribution Forecast and Investment Roadmap Transmission and Generation System Planning Impacts

4.3.a Process Enhancement 1 – Comprehensive Feeder Level Forecasting

Long-term (*i.e.*, minimum 10 year) demand growth forecasts will be refined for each individual distribution feeder and include not only the amount but also the type of future DER capacity. Utility-scale, commercial, and residential net metering-scale sites will be forecasted annually. Unlike conventional demand forecasting methods, however, these forecasts will be more granular in that they will be developed down to the customer site whenever possible and will cover all hours in a year rather than just peak demand hours. The Company initially plans to develop these forecasts utilizing data obtained from its customers currently served with AMI meters and/or intelligent grid device data, where available. Until full deployment of AMI has been achieved, the Company will develop hourly demand assumptions for its monthly-metered customers using relationships obtained from historic AMI hourly load shapes and monthly customer billing records. Comprehensive feeder level forecasts will allow the Company to simulate power flow scenarios within a planning period. This ability is critically important as the Company expects more active management of grid stability to be necessary during low demand conditions that are coupled with high DER output.

For example, during the month of April, a residential customer's electricity demand at any hour is typically low (less than 5 kW). If that same customer has a solar PV system rated at 10 kW installed at their premise, it is quite likely that for many hours during April, the supply from that customer's premise will exceed their demand and that excess power will flow onto the distribution grid. This situation could cause a localized increase in distribution voltage levels that exceed rated standards. This voltage violation could result in damage to the Company's equipment or damage to appliances of other customers that are on the same feeder. As DERs continue to grow on the Company's system, phenomena such as this can spread to all areas of the distribution feeders and even onto the transmission grid. This undesirable phenomenon is not related to overall system DER penetration but rather is specific to locational concentrations of DER penetration. The magnitude of the challenge grows as this scenario occurs at grid locations with limited host capacity available.

4.3.b Process Enhancement 2 – Hosting Capacity Analysis

The Company will also study the DER hosting capacity on every distribution feeder in order to determine the strength of the distribution system during varying degrees of DER penetration and solar irradiance levels for every hour of the day. This analysis when overlaid with the Company's DER forecast can determine the year when a specific feeder becomes at risk for exceeding feeder design specifications (both thermal and voltage parameters), and will enable the use of active power management of DER as an alternative to traditional grid upgrades. The forecasts described above will be updated annually and will form the base or expected cases for subsequent distribution analysis and planning activities. Until such time as a proper stochastic algorithm can be developed, the Company will also prepare annually, high and low DER growth forecasts for each feeder to support the scenario analysis described below. This transition requires highly manual analysis until such time as automated analytical systems are developed and validated.

If the GT Plan investments are approved by the Commission, the Company plans to publish initial hosting capacity maps for both utility-scale and net metering DER by the end of 2020. As additional grid technologies and smart meters are deployed and grid operation capabilities increase, the hosting capacity maps will become more dynamic and support opportunities to reduce interconnection costs when DER output can be informed and adjusted to avoid grid

limitations through a DERMS.

4.3.c Process Enhancement 3 – Multi-Hour Capacity Planning Analysis

Consistent with conventional distribution capacity planning analysis, each feeder will be assessed under seasonal peak demand periods using the forecast for demand and DER growth described above. Also, like current state, the analysis will evaluate the distribution grid for violations with respect to loading and voltage. Beyond current state, the distribution grid will also be examined at conditions other than peak demand periods. At a minimum, the Company will evaluate the distribution grid under peak demand and minimum demand conditions for each month of the planning period. The frequency and the study time window of these studies will increase as advanced modeling techniques are refined. As discussed further below, the Company is investigating, with industry peers and research entities, the development of the necessary engineering tools and systems that can perform this analysis on a time series (*i.e.*, 8760) basis so that, when appropriate, each hour of the planning period can be examined in an automated fashion. This will ensure the Company examines all load and generation conditions associated with the base forecast for demand and DER growth. These new tools and systems will result in a more thorough analysis of each feeder under various load and generation conditions that is more representative of two-way power flows caused by DERs. Notably, specific GT Plan investments in intelligent grid devices and smart meters that gather this highly granular data are necessary to support robust analyses with greatly reduced uncertainty.

4.3.d Process Enhancement 4 – DER Scenario Analysis

The key uncertainties associated with future DER growth is with respect to rate of growth and location. As such, the enhanced distribution planning analysis will also include scenario analysis that utilizes the high and low DER growth forecasts identified above. Again, the Company will analyze each feeder for violations with respect to loading and voltage under monthly peak and low demand conditions using both the high and low DER growth rate forecasts.

4.3.e Process Enhancement 5 – Non-Wires Alternatives Analysis

In addition to traditional distribution grid solution approaches such as re-conductoring or equipment upgrades, the Company will also assess non-wires alternatives to address violations that may surface in the distribution grid analysis process. New mitigation options such as utilizing customer-owned advanced inverter capabilities, battery energy storage systems, micro-grids, or demand response will be evaluated along with traditional solutions to assure that the optimal solutions for the Company and customers are prudently implemented.

5.0 PROOF OF CONCEPT ANALYSIS AND RESULTS

The ultimate objective of the Company's IDP process is to develop a prudent distribution investments roadmap based on load growth, reliability needs, DER growth, new technology adoptions, and other changes on the distribution system over the planning horizon. To that end, the Company engaged DNV GL Digital Solutions ("DNV GL") to develop a proof of concept. The DNV GL analysis focused on the process enhancements described above, namely multi-hour capacity planning analysis, DER scenario analysis, and non-wires alternatives analysis.

DNV GL developed an analytical process using Synergi Electric software, which provides tools

that are capable of automating the grid analysis. DNV GL then tested the software using three demonstration feeders identified by the Company. The analytical process involved running a multi-year time series analysis ("TSA"), identifying times where technical violations may occur due to load growth or due to DER operation, designing appropriate mitigations and evaluating the hosting capacity of the system for different capacities of DER.

The Company intends to continue to work with DNV GL as the Company implements the process enhancements described above. Notably, the DNV GL process integrates the Company's current capacity planning and DER interconnection processes, but does not incorporate the current reliability planning processes. As recognized industry-wide, incorporating the reliability planning component is the area of analysis having the greatest complexity . The Company will continue to work toward complete integration of its distribution planning process.

DNV GL produced a report providing its analyses and results. The report is Attachment 1 to this white paper.

6.0 CAPABILITIES ENABLED BY INTEGRATED DISTRIBUTION PLANNING

The evolution of IDP over time will enable capabilities and benefits for the Company and customers not available today. For instance, with people, technologies, and processes described above, locational net benefits could be identified and published, an expanding portfolio of non-wires alternatives can be developed and utilized, and lower DER integration costs can result. With proper policy and regulatory support, IDP also enables aggregated DER transactions.

7.0 GENERATION, TRANSMISSION, AND DISTRIBUTION INTEGRATION ASSESSMENT

Currently, power system analysis is performed separately for generation, transmission and distribution systems. With higher overall system penetration levels of DERs expected, the one-way flow of the Company's distribution system is being significantly altered and will impact the generation, transmission, and distribution systems. Therefore, the Company (along with the electric utility industry) needs to continue its development of new methods and tools to properly integrate the overall power system. For example, as DERs continue to grow within the Company's service territory and emerging technologies take hold, customer load shapes will change. This change in load shape will not only impact the distribution grid but also the transmission and generation systems as well. Power flows along the transmission system will change (and could even reverse) and traditional generators will be dispatched in a manner that may be quite different than has been done in the past in order to accommodate these new customer demands. Thus, it is important that the Company understand how customer energy use is changing and how those changes are impacting the entire electric network, from distribution, to transmission and generation.

Importantly, the shift to integrated distribution planning is a process that will take time, as illustrated in Figure 4.0. The Virginia Code now requires that the Company's total-system integrated resource plans evaluate long-term electric distribution grid planning. Va. Code § 56-599 B 10. The Company thus intends to continue to report on its progress toward IDP in future integrated resource plans. The Company plans to include IDP as part of the stakeholder processes used for the Company's GT Plans and integrated resource plans.

CERTIFICATE OF SERVICE

I hereby certify that on this 1st day of May 2020, a true and accurate copy of the foregoing filed in Case No. PUR-2020-00035 was delivered by hand, email, or mail first class postage pre-paid, or was provided by electronic service, to the following:

Ashley B. Macko, Esq.
K. Beth Clowers, Esq.
Office of the General Counsel
State Corporation Commission
Tyler Building, 1300 E. Main St., 10th Floor
Richmond, Virginia 23219

C. Meade Browder, Jr., Esq.
C. Mitch Burton, Jr., Esq.
Office of the Attorney General
Division of Consumer Counsel
202 N 9th Street, 8th Floor
Richmond, VA 23219

William C. Cleveland, Esq.
Gregory D. Buppert, Esq.
Nathaniel Benforado, Esq.
Hannah Coman, Esq.
Southern Environmental Law Center
201 W Main Street, Suite 14
Charlottesville, VA 22902-5065

/s/ Vishwa B. Link