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	For approval of its 2021 RPS Plan under § 56-585.5 of the Code of Virginia and related requests
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**PUBLIC VERSION** 

December 30, 2021

## **By Electronic Filing**

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

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AMERICAN

BOUNDLESS ENERGY

Re: Petition of Appalachian Power Company For approval of its 2021 RPS Plan under § 56-585.5 of the Code of Virginia and related requests Case No. PUR-2021-00206

Dear Mr. Logan:

Please find attached for filing the Petition of Appalachian Power Company for approval of its 2021 RPS Plan under § 56-585.5 D 4, and related requests, including for approval of rate adjustment clauses under § 56-585.1 to recover a revenue requirement of \$32,069,614 for the rate year of August 2022 through July 2023, and for prudence determinations pursuant to § 56-585.1:4 of the Code of Virginia. Please note that the Company is requesting in the Petition a waiver of the Commission's Rate Case Rules that would permit it to file one hard copy of certain extraordinarily sensitive and/or voluminous materials, as well as electronic copies of these documents on three compact disks, which are being filed simultaneously by hand with the Commission under separate cover. The Company has also made this information available to Staff.

The Company is also simultaneously filing a Motion for Protective Ruling and Additional Protective Treatment for Extraordinarily Sensitive Information.

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Enclosures cc: William H. Chambliss, Esq. C. Meade Browder, Jr., Esq.

## COMMONWEALTH OF VIRGINIA STATE CORPORATION COMMISSION

## **PETITION OF**

## **APPALACHIAN POWER COMPANY**

Case No. PUR-2021-00206

For approval of its 2021 RPS Plan under § 56-585.5 of the Code of Virginia and related requests

## PETITION OF APPALACHIAN POWER COMPANY FOR APPROVAL OF ANNUAL RPS DEVELOPMENT PLAN

**PUBLIC VERSION** 

VOLUME 1 PETITION AND TESTIMONY FILED: DECEMBER 30, 2021

## COMMONWEALTH OF VIRGINIA

## STATE CORPORATION COMMISSION

#### **PETITION OF**

## APPALACHIAN POWER COMPANY

Case No. PUR-2021-00206

For approval of its 2021 RPS Plan under § 56-585.5 of the Code of Virginia and related requests

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## SCHEDULE 46 A-E FILING REQUIREMENT INFORMATION

## COMMONWEALTH OF VIRGINIA STATE CORPORATION COMMISSION

## PETITION OF

## APPALACHIAN POWER COMPANY

Case No. PUR-2021-00206

For approval of its 2021 RPS Plan under § 56-585.5 of the Code of Virginia and related requests

## PETITION

#### December 30, 2021

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Counsel for Appalachian Power Company

## COMMONWEALTH OF VIRGINIA STATE CORPORATION COMMISSION

## PETITION OF

## APPALACHIAN POWER COMPANY

Case No. PUR-2021-00206

For approval of its 2021 RPS Plan under § 56-585.5 of the Code of Virginia and related requests

## PETITION AND REQUESTS FOR WAIVER OF APPALACHIAN POWER COMPANY

Appalachian Power Company ("Appalachian" or the "Company") files with the State

Corporation Commission of Virginia (the "Commission") this Petition in which it requests the

following:

- Approval of its annual plan for the development of new solar, wind, and energy storage resources pursuant to Va. Code § 56-585.5 D 4 in order to comply with the mandatory Renewable Portfolio Standard ("RPS") Program established by the Virginia Clean Economy Act ("VCEA") (the "2021 RPS Plan");
- Approval of a revenue requirement of \$32,069,614 for the rate year of August 2022 through July 2023, approximately 21 percent (\$6,628,807), of which are new costs that have not been previously approved for recovery;
- Approval of cost recovery mechanisms to recover this and future revenue requirements related to compliance with the RPS Program;
- Determination that the purchase of one solar facility and the power purchase agreements ("PPAs") with three other solar facilities, all located in Virginia, are prudent;
- Approval of the future cost recovery related to the acquisition of two other renewable facilities, which are not located in Virginia and will not be online during the rate year;
- Approval of the treatment of the renewable energy certificates ("RECs") generated by the run of river generation component of the Smith Mountain Lake Facility; and
- Grant of waivers of certain the Commission's Rules Governing Utility Rate Applications and Annual Informational Filings of Investor-Owned Electric Utilities (the "Rate Case Rules").

## I. BACKGROUND AND APPLICABLE STATUTES

Appalachian, a Phase I Utility under Chapter 23 of Title 56 of the Code of Virginia, is a Virginia public service corporation serving approximately 540,000 customers in Virginia with offices at Three James Center, 1051 East Cary Street, Suite 1100, Richmond, Virginia 23219. The names and addresses of the Company's legal counsel are listed at the foot of this Petition.

#### A. <u>The VCEA</u>

The VCEA, enacted in 2020, imposed a mandate on Appalachian to "petition the Commission for necessary approvals to construct, acquire, or enter into agreements to purchase the energy, capacity, and environmental attributes of 600 megawatts of generating capacity using energy derived from sunlight or onshore wind."<sup>1</sup> Initially, by December 31, 2023, Appalachian is required to petition the Commission "for necessary approvals to construct, acquire, or enter into agreements to purchase the energy, capacity, and environmental attributes of at least 200 megawatts of generating capacity located in the Commonwealth using energy derived from sunlight or onshore wind"<sup>2</sup> (the "VCEA Mandate").

The VCEA also establishes the RPS requirements that will result in Appalachian providing 100 percent clean energy to its customers by 2050.<sup>3</sup> In addition, the VCEA requires the Company to submit an annual plan outlining how it plans to meet the renewable energy generation and energy storage development targets of the VCEA.<sup>4</sup> The VCEA also allows Appalachian to recover costs associated with complying with meeting the RPS requirements through its fuel factor or through RACs established pursuant to Va. Code § 56-585.1, Subsection

- <sup>2</sup> Va. Code § 56-585.5 D 1 a.
- <sup>3</sup> Va. Code § 56-585.5 C.

<sup>&</sup>lt;sup>1</sup> Va. Code § 56-585.5 D 1.

<sup>&</sup>lt;sup>4</sup> Va. Code § 56-585.5 D 4.

A 5 or Subsection A 6. The VCEA requires Appalachian to petition the Commission for approvals to construct or acquire new, utility-owned energy storage resources, with the goal of installing at least 10 percent of such energy storage projects behind the meter.<sup>5</sup>

On July 10, 2020, the Commission issued an order establishing the first RPS proceeding for Appalachian, requiring Appalachian to file its first annual plan on November 2, 2020.<sup>6</sup> On April 30, 2021, the Commission issued its Final Order on the plan, which concluded that the plan was "reasonable and prudent," and set forth a number of requirements for subsequent filings.<sup>7</sup>

#### B. <u>Rate Adjustment Clauses</u>

Subsection A 5 states that Appalachian can recover through a RAC the "projected and actual costs of compliance with" the VCEA's RPS requirements that are not recoverable through Subsection A 6. Under that Subsection, the Commission "shall approve" a request for cost recovery for such costs if the Commission does not otherwise find that such costs were "unreasonably or imprudently incurred."

Subsection A 6 provides that a utility can petition the Commission for approval of a RAC to recover the costs of one or more generation facilities, including the accrual of allowance for funds used during construction ("AFUDC").

C. <u>Prudency Reviews</u>

Virginia Code § 56-585.1:4 H permits Appalachian to seek a prudency determination from the Commission

<sup>&</sup>lt;sup>5</sup> Va. Code § 56-585.5 D, E.

<sup>&</sup>lt;sup>6</sup> Order Establishing 2020 RPS Proceedings, Commonwealth of Virginia, ex rel. State Corporation Commission, Ex Parte: Establishing 2020 RPS Proceeding for Appalachian Power Company, Case No. PUR-2020-00135, Doc. Con. Cen. No. 200710235 (July 10, 2020).

<sup>&</sup>lt;sup>7</sup> Final Order, Commonwealth of Virginia, ex rel. State Corporation Commission, Ex Parte: Establishing 2020 RPS Proceeding for Appalachian Power Company, Case No. PUR-2020-00135, Doc. Con. Cen. No. 220440238 (April 30, 2021) ("Order on 2020 Filing").

with respect to the construction or purchase by the utility of one or more solar or wind generation facilities located in the Commonwealth or ... the purchase by the utility of energy, capacity, and environmental attributes from solar or wind facilities owned by persons other than the utility.

## D. <u>The GTSA</u>

In 2018, the General Assembly enacted the Grid Transformation and Security Act

("GTSA"),<sup>8</sup> which contained, among many provisions, Enactment Clause 21 (the "GTSA Solar

Mandate"):

That on or before July 1, 2028, subject to the approval of the [Commission], [Appalachian] shall construct or acquire a generation facility or facilities utilizing energy derived from sunlight with an aggregate capacity of not less than 200 megawatts located in the Commonwealth, which utility-owned generation facility or facilities is in the public interest as is set forth in this act.

## E. <u>West Virginia</u>

Appalachian is a Phase I Utility that serves customers in more than one jurisdiction, as it

also serves customers in West Virginia. The GTSA Solar Mandate states:

If a Phase I Utility serves in more than one jurisdiction, and a jurisdiction other than the Commonwealth denies the Phase I Utility recovery of the costs of the generation facility or facilities utilizing energy from sunlight allocated to that jurisdiction, the Phase I Utility can recover all of the costs of the generation facility or facilities utilizing energy from sunlight from its Virginia jurisdictional customers, and all attributes of the generation facility or facilities utilizing energy from sunlight, including energy and capacity shall be assigned to Virginia.

## Similarly, the VCEA states:

If a Phase I or Phase II Utility serves customers in more than one jurisdiction, such utility shall recover all of the costs of compliance with the RPS Program requirements from its Virginia customers through the applicable cost recovery mechanism, and all associated energy, capacity, and environmental attributes shall be assigned to Virginia to the extent that such costs are requested but not recovered from any system customers outside the Commonwealth.<sup>9</sup>

<sup>&</sup>lt;sup>8</sup> 2018 Va. Acts ch. 296 (SB 966).

<sup>&</sup>lt;sup>9</sup> Va. Code § 56-585.5 F.

Accordingly, Appalachian will seek approval in a petition filed in early January 2022 from the Public Service Commission of West Virginia ("WVPSC") to recover the West Virginia jurisdictional costs of the VCEA resources from its West Virginia customers. If the WVPSC denies such recovery, the costs and benefits of the facilities that would have been assigned to the West Virginia jurisdiction will instead be assigned to Company's Virginia customers, by operation of the Code.<sup>10</sup>

The Code of West Virginia has a similar provision:

If an electric utility serves customers in more than one jurisdiction, and a jurisdiction other than this state denies the electric utility recovery of the costs incurred pursuant to a renewable electric facilities program approved by the commission and allocated to that jurisdiction, the electric utility shall recover all of the costs of the renewable electric facilities program from its West Virginia jurisdictional customers if the commission finds that the expenditures and the associated rate requirements are just and reasonable, and all attributes of the renewable electric facilities program, including energy, capacity, and renewable energy credits shall be assigned to this state.<sup>11</sup>

Thus, if the Commission denies cost recovery for the Bedington facility, detailed below,

Virginia's portion of the costs and benefits associated with Bedington will be allocated to the

Company's West Virginia customers, if approved by the WVPSC.

## **II.** WITNESSES

The following witnesses offer testimony in support of this Petition and the 2021 RPS

Plan:

## William K. Castle, Director of Regulatory Services-VA/TN for Appalachian. Mr. Castle

describes the Company's proposed methodology for determining capacity, energy, and REC

costs associated with legacy wind PPAs and prospective renewable generators necessary to meet

<sup>&</sup>lt;sup>10</sup> The impact of this assignment of costs to the Company's Virginia customers on the requested revenue requirement, which is minor, is discussed below.

<sup>&</sup>lt;sup>11</sup> W.V. Code §24-2-10 (i)(6).

the standards in the VCEA, and describes the Company's various requests for approval related to renewable and energy storage projects, and the impact of those requests on the Company's operations in multiple jurisdictions. Mr. Castle discusses the Company's progress towards the requirements in Subsections C, D, and E of 56-585.5, and explains how Appalachian will comply with other statutory requirements. He also sponsors the PPAs between the Company and two Qualifying Facilities ("QFs") located in Virginia. Finally, he sponsors the results and conclusions of the Environmental Justice and economic development screening performed for the proposed projects.

*Amy E. Jeffries, Director of Regulated Infrastructure Development for AEPSC*. Ms. Jeffries provides an overview of Appalachian's Request for Proposals ("RFPs") that resulted in the projects presented in this Petition, and discusses the RFP evaluation process and the due diligence to complete the selection of the renewable energy resources. Ms. Jeffries provides an overview of the renewable energy resources that the Company will seek to purchase, own, and operate though Purchase and Sales Agreements ("PSAs"), including the terms and conditions of the PSAs, the total installed capital costs, projected ongoing operating and capital costs, and developer experience. Finally, Ms. Jeffries provides an overview of four solar PPAs that resulted from Appalachian's RFP processes through which Appalachian will purchase energy, capacity, and RECs (the "Renewable Energy Products").

*Carlos J. Casablanca, Managing Director of Distribution Planning and Analysis for AEPSC.* Mr. Casablanca discusses a potential non-wires alternative, energy storage solution that the Company is studying to address distribution-related issues on its Glade-Whitetop circuit. He explains why the installation of the project is anticipated to be the best option when compared to other solutions considered.

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*Aaron C. Thomas, Regulatory Accounting Case Manager, AEPSC.* Mr. Thomas addresses the accounting for actual costs, investment and revenues associated with the proposed rate adjustment clause framework presented by Company witness Sebastian, and discusses the Company's basis for deferring unrecovered costs related to the proposed rate adjustment clause framework. Mr. Thomas also supports the actual costs incurred by the Company in accordance with Schedule 46 filing requirements, and addresses the anticipated general ledger accounts to be used in the accounting for actual costs in accordance with reporting requirements outlined by the Order on 2020 Filing.

Michael M. Spaeth, Regulatory Consultant Principal, Regulated Pricing and Analysis, AEPSC. Mr. Spaeth discusses the methodology that the Company proposes to recover the costs of existing and proposed renewable facilities. He describes the economic analysis for the projects in this Petition that demonstrates in part why they are prudent utility investments for the Company and its Virginia customers. Finally, Mr. Spaeth calculates the revenue requirement for the Rate Year of August 2022 through July 2023.

#### Jennifer B. Sebastian, Regulatory Analysis and Case Manager VA/TN, Appalachian.

Ms. Sebastian discusses the rate adjustment clause framework proposed by the Company in order to comply with Va. Code § 56-585.5, and sponsors the proposed RPS-RAC tariff sheets that have been developed to recover the non-bypassable costs through those RACs.

Ismael Martinez, Jr., Resource Planning Manager, AEPSC. Mr. Martinez sponsors the 2021 RPS Plan.

#### III. THE 2021 RPS PLAN AND PROGRESS TOWARDS RPS REQUIREMENTS

Subsection D 4 of Section 56-585.5 requires Appalachian to submit an annual plan outlining how it plans to meet the renewable energy generation and energy storage development targets of the VCEA. Appalachian's 2021 RPS Plan is attached to the Petition as Attachment 1 and represents the Company's current path towards meeting the RPS requirements. The Plan includes a geographically varied portfolio of storage, solar and wind resources, both Companyand third-party owned, as well as market REC purchases. The Plan details six portfolios that illustrate the potential costs of compliance with the VCEA under various future resource assumptions. Portfolio 2 is the basis of the Plan, and assumes that the Company's Amos and Mountaineer coal-fired units will operate through 2040 and that fossil-fueled resources will not be used to replace them at that time. Portfolio 5 is a modified Portfolio 2 that was prepared under the assumption that 1,000 MW of additional wind resources above the minimum VCEA requirements is available and can be added based on favorable economics in time to capture production tax credits before they expire in 2026. As Portfolio 5 represents a lower cost option for customers, if the resources are available, the Company plans to issue RFPs in early 2022 to pursue the Portfolio 5 components. The RPS Plan includes the information and analyses required by the Commission's *Order Establishing 2020 RPS Proceedings* and the *Order on 2020 Filing*.<sup>12</sup>

The first RPS requirement for Appalachian is, for the year 2021, to procure and retire RECs from RPS eligible resources for six percent of the total electric energy sold in the year 2020.<sup>13</sup> Although the year 2021 is not yet over, the Company will meet this requirement, which will be demonstrated in the 2022 RPS filing, as Mr. Castle explains.

## IV. OVERVIEW OF THE PROJECTS AND ASSOCIATED REQUESTS

The specific projects addressed in this Petition are listed below, and summarized in the chart attached to this petition as Attachment 2. As shown in APCo Exhibit No. \_\_ (MMS)

<sup>&</sup>lt;sup>12</sup> Appendix E to the Plan identifies where the Company addresses each requirement.

<sup>&</sup>lt;sup>13</sup> Va. Code § 56-585.5 C.

Extraordinarily Sensitive Schedule I – Resource Recovery Percentage, Mr. Spaeth's analysis demonstrates that, on a net present value basis, the utility cost of service benefits and statutorily mandated benefits of each of the new projects (presented in Sections A, B, and C below) are greater than the costs of purchasing and operating the projects over the various useful lives, with the exception of Bedington. When the societal cost of carbon is added into the analysis, Bedington also has a positive analysis.

The Company's estimated owner's cost for the four facilities in Sections A and B is approximately \$60 million, as detailed further in APCo EXTRAORDINARILY SENSITIVE Exhibit No. \_\_ (AEJ) Schedule 15. This cost includes the direct cost for project management, environmental, engineering and construction, personnel and expenses, legal and regulatory costs, telecommunication, IT support and equipment, overheads, AFUDC, and contingency costs.

Subsection D requires the Company to petition the Commission for 130 MW of Company-owned RPS eligible resources in the Commonwealth by year-end 2023. As Mr. Castle testifies, by petitioning for approval of Amherst (5 MW) and Firefly (150 MW), the Company has met that requirement. Subsection C also requires the Company to petition for the approval to enter into 70 MW of PPAs with RPS eligible resources located in Virginia by the end of 2023. As the PPAs with Virginia solar facilities total 144 MW addressed in this Petition, the Company has met that requirement as well.

#### A. Virginia-Domiciled Solar Facilities to be Owned by Appalachian

*Amherst Facility*. Amherst is a 4.875 MW solar facility (fixed-tilt) to be located in Amherst County, and interconnecting to Appalachian's distribution system, which is being developed by SolAmerica. The Company has separately asked the Commission for a prudency determination related to that acquisition, which is pending in Case No. PUR-2021-00066. As Amherst will likely be in service during the Rate Year, the Company has included a request in this Petition to recover the costs associated with its acquisition and operation (if ultimately approved by the Commission) through the RACs proposed in this Petition.

*Firefly Facility.* Firefly is a 150 MW solar facility (single axis tracking) to be located in Pittsylvania County that is being developed by Recurrent. As part of this Petition, the Company seeks a prudency determination from the Commission regarding this acquisition, as set out below. If the Commission determines that the acquisition is prudent, Appalachian will return to the Commission for approval of the acquisition of Firefly pursuant to the Utility Facilities Act<sup>14</sup> before the transaction is completed. As Firefly will not be online until July 2024, Appalachian is not seeking approval to recover any associated costs in this Petition.

## B. Non-Virginia Domiciled Solar Facilities to be Owned by Appalachian

*Bedington Facility.* Bedington is a 50 MW solar facility (single axis tracking) to be located in Berkeley County, West Virginia. With the approval of the WVPSC, Appalachian will acquire Bedington from the developer, a subsidiary of DE Shaw Renewable Investments. As Bedington is not expected to be online until October 2023, in this Petition Appalachian seeks only the approval of future cost recovery through the proposed RACs.

*Top Hat Facility.* Appalachian has entered into an agreement with an affiliate of Invenergy to purchase Top Hat, a 204 MW wind project located in Logan County, Illinois. As Top Hat is not expected to be online until December 2024, in this Petition Appalachian seeks only the approval of future cost recovery through the proposed RACs.

Both Top Hat and Bedington qualify as "RPS eligible sources," pursuant to Subsection C, as they are both "physically located within the PJM region."

<sup>&</sup>lt;sup>14</sup> Va. Code § 56-265.1 et seq.

#### C. Power Purchase Agreements with Virginia Domiciled Solar Facilities

*Depot Solar PPA.* Depot Solar is a 15 MW solar facility (fixed tilt) located in Campbell County that will interconnect to Appalachian's distribution system. Appalachian first executed a PPA for the facility's output in 2017, after conducting an RFP that year for renewable resources. The facility encountered several challenges, as Mr. Castle discusses, which ultimately led to the execution of an amended and restated PPA with the developer, Hep-Petra, for a term of 35 years. Under the terms of the amended PPA, Appalachian will purchase the Renewable Energy Products for the first 20 years of the term. From years 21-35, Appalachian will purchase only the RECs. The first five MW are expected to be online by February 2022, with the remaining MW expected online by the end of the first quarter 2022. When Appalachian first executed the PPA in 2017, there was no option to seek a prudency determination from the Commission prior to execution. Given that the price of the output is notably competitive, as discussed by Mr. Castle, the Company has continued to work with the developer and pursue the PPA as a reasonable and prudent addition to its energy portfolio, one that will greatly benefit its customers. In this Petition, the Company requests approval to recover the costs associated with the Depot Solar PPA through the proposed RACs.

*Dogwood PPA*. Dogwood is an 18.9 MW solar facility (single axis tracking) located in Bedford County that will interconnect to Appalachian's distribution system. Appalachian and the developer, Madison Energy Investments, entered into a thirty year PPA under which Appalachian will purchase the Renewable Energy Products from the facility. As Dogwood will not begin service until December 2024, the Company does not seek approval of any associated costs in this Petition, but requests that the Commission make a prudency determination, as set out below.

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*Leatherwood PPA*. Leatherwood is a 20 MW solar Qualifying Facility (single axis tracking) located in Henry County. Appalachian and the developer, a subsidiary of Energix Renewables, entered into a 15 year PPA pursuant to Appalachian's Cogen and Small Power Production rate schedule ("Schedule Cogen/SPP") under which Appalachian will purchase the Renewable Energy Products from the facility. Leatherwood began service in August 2021. Appalachian seeks approval in this Petition to recover the associated costs through the RACs proposed in this Petition.

*Horsepen PPA*. Horsepen is a 20 MW solar facility (single axis tracking) located in Louisa County. Appalachian and the developer, Clenera, entered into a 30 year PPA under which Appalachian will purchase the Renewable Energy Products from the facility. As Horsepen will not begin service until December 2024, the Company does not seek approval of any associated costs in this Petition, but requests that the Commission make a prudency determination, as set out below.

*Sun Ridge Solar PPA*. Sun Ridge Solar is a 50 MW solar facility (single axis tracking) located in Rockingham County. Appalachian and the developer, NextEra Energy Resources, entered into a 30 year PPA under which Appalachian will purchase the Renewable Energy Products from the facility. As Sun Ridge Solar will not begin service until December 2024, the Company does not seek approval of any associated costs in this Petition, but requests that the Commission make a prudency determination, as set out below.

*Wytheville PPA*. Wytheville is a 20 MW solar Qualifying Facility (single axis tracking) located in Wythe County. Appalachian and the developer, a subsidiary of Energix Renewables entered into a 15 year PPA pursuant to Schedule Cogen/SPP under which Appalachian will purchase the Renewable Energy Products from the facility. Wytheville is estimated to begin

service in February 2022. Appalachian seeks approval in this Petition to recover the associated costs through the RACs proposed in this Petition.

#### D. Legacy Voluntary RPS Compliance Resources

*Bluff Point Wind Farm PPA.* In 2016, Appalachian executed a PPA (20 year term) with Bluff Point Wind Farm LLC for the Renewable Energy Products from its 120 MW (nameplate capacity) Indiana wind farm. The Commission approved the Company's inclusion of the Bluff Point PPA as part of the Company's Voluntary RPS Compliance Portfolio in 2017.<sup>15</sup>

*Camp Grove Wind Farm PPA*. In 2007, Appalachian executed a PPA (20 year term) with Camp Grove Wind Farm LLC for the Renewable Energy Products from its 75 MW (nameplate capacity) Illinois wind farm. The Commission approved the Company's inclusion of the Camp Grove Wind Farm PPA as part of the Company's Voluntary RPS Compliance Portfolio in its initial order approving Appalachian's participation in the voluntary RPS program.<sup>16</sup>

*Fowler Ridge Wind Farm PPA*. In 2007, Appalachian executed a PPA (20 year term) with Fowler Ridge Wind Farm, LLC for the Renewable Energy Products from its 100 MW (nameplate capacity) Indiana wind farm. The Commission approved the Company's inclusion of the Fowler Ridge Wind Farm PPA as part of the Company's Voluntary RPS Compliance

<sup>&</sup>lt;sup>15</sup> Final Order, Petition of Appalachian Power Company For approval of a rate adjustment clause, RPS-RAC, to recover the incremental costs of participation in the Virginia renewable energy portfolio standard program pursuant to §§ 56-585.1 A 5 d and 56-585.2 E, Case No. PUE-2016-00042, 2017 S.C.C. Ann. Rep. 333 (Feb. 1, 2017) ("2017 RPS Order").

<sup>&</sup>lt;sup>16</sup> Final Order, Application of Appalachian Power Company For approval to Participate in the Virginia Renewable Energy Portfolio Standard Program, Case No. PUE-2008-00003, 2008 S.C.C. Ann. Rep. 466 (Aug. 11, 2008) ("2008 RPS Order").

Portfolio in its initial order approving Appalachian's participation in the voluntary RPS program.<sup>17</sup>

The Company is asking the Commission's permission to recover the RECs and capacity associated with these three wind PPAs (collectively, the "Legacy Wind PPAs") through the RACs proposed in this Petition and the energy through the fuel factor, as explained below and in the testimony of Ms. Sebastian and Mr. Spaeth.

*Smith Mountain Lake Facility*. Smith Mountain Lake Facility is a 636 MW pumped storage resource located in Penhook, Virginia that operates both in pumped storage and run of the river mode. The Company is asking the Commission's permission to continue to use the RECs associated with the run of the river generation for compliance with the RPS requirements, as it did to meet the voluntary RPS goals.

## V. REQUEST FOR APPROVAL OF COST RECOVERY MECHANISM AND REVENUE REQUIREMENT

### A. <u>Revenue Requirement</u>

The Rate Year revenue requirement, as supported by Company witness Spaeth and set out in Table 1 of his testimony, for which Appalachian requests approval to recover through the mechanisms detailed below, is \$32,069,614. Of that amount, \$6,628,807 accounts for (1) new resources that are online or that will go online during the Rate Year, and (2) REC purchases:

- Amherst: \$275,269
- Depot: \$468,046
- Leatherwood: \$971,619
- Wytheville: \$800,308
- REC purchases: \$4,113,639

The remainder of the revenue requirement is comprised of the capacity and REC components of the Legacy Wind PPAs (\$25,440,731). The energy component of the Legacy Wind PPAs will be recovered through the fuel factor. As Mr. Spaeth explains, the incremental costs associated with the Legacy Wind PPAs were previously recovered through the RAC associated with the voluntary RPS program, and the non-incremental costs have been recovered through fuel.

To support this Petition, Mr. Spaeth prepared alternative revenue requirements for each project: one assuming West Virginia approves recovery of the costs associated the projects and one assuming West Virginia does not. If the WVPSC does not approve the recovery of costs associated with Amherst from Appalachian's West Virginia customers, for example, the Virginia retail jurisdictional revenue requirement will increase by approximately \$238,000, as Mr. Spaeth testifies.<sup>18</sup> As Mr. Castle notes, the corresponding reduction in the need to purchase market RECs and energy will make the difference approximately \$135,000 to customers, when all recovery mechanisms are considered. Given the filing that the Company will shortly make for the approval of the new projects from the WVPSC, Appalachian's 2022 RPS filing should have clarity about the inter-jurisdiction allocation of the new projects.

## B. <u>Rate Impact</u>

Of the \$32,069,614 rate year revenue requirement requested in this Petition, approximately 79% has previously been approved for recovery in rates and is being consolidated into the rate proposal in this proceeding. As set out in Ms. Sebastian's testimony, the bill impact

<sup>&</sup>lt;sup>18</sup> For purposes of this Petition, the Company assumed that all of the RECs produced by two QFs, Leatherwood and Wytheville and market purchases of RECs would be assigned to the Virginia jurisdiction. Appalachian will include a request for approval of the West Virginia jurisdictional costs related to these RECs from its West Virginia customers in the January 2022 filing.

associated with the RPS RACs for a residential customer who uses 1,000 kWh a month would increase by \$2.37 (1.9%) compared to rates in effect on December 1, 2021.

## C. <u>Proposed Cost Recovery Mechanisms</u>

The cost recovery requirements of the VCEA are quite complex, and are made even more so, given Appalachian's obligations to charge customers who switch to alternative energy suppliers differently with regard to capacity costs, depending on the date their contract with the supplier was effective.<sup>19</sup> The Company designed the proposed cost recovery mechanisms to allow the Company to assign costs to customers consistent with the various statutory requirements. The Company is mindful of feedback from Staff and other parties in prior proceedings, and designed the proposed cost recovery mechanisms to allow the Company to bill each category of customers the appropriate charges with as much clarity and simplicity as possible.

As detailed in the testimony of Ms. Sebastian, and as applied by Mr. Spaeth, Appalachian proposes to recover the costs associated with VCEA-related facilities by quantifying the value streams of each facility, including, as applicable: energy, capacity, shifting or avoiding certain RTO costs, reactive power revenues, and RECs. To accomplish this, Ms. Sebastian reviewed the characteristics of each project and determined how the Virginia jurisdictional retail costs associated with each project could be reasonably broken down and assigned to three proposed rate adjustment clauses:

• A.5 RPS RAC to recover the non-energy, non-ancillary services, non-capacity costs for all owned facilities, PPAs, and REC purchases. (In this Petition: Amherst; the Depot, Leatherwood, and Wytheville PPAs; and the Legacy Wind PPAs)

<sup>&</sup>lt;sup>19</sup> See Va. Code § 56-577A.6.

- A.5 RPS-PCAP RAC to recover the costs of the capacity purchased through PPAs (In this Petition: the Depot, Leatherwood, and Wytheville PPAs; and the Legacy Wind PPAs)
- A.6 RPS RAC to recover the costs of capacity and energy from facilities owned by the Company. (In this Petition: Amherst)

The Company proposes that the identification and quantification of the cost component categories for each project occur only once, when the Commission approves the initial revenue requirement for each project, and the proportion of each category to the total costs of the project remain consistent thereafter for the life of the asset or the duration of the PPA. This proposed structure also allows the Company to determine, as required by Code, the "cost net of benefits" to charge each customer type, as Ms. Sebastian explains. The development of the cost recovery framework is described in greater detail by Ms. Sebastian.

#### VI. PROJECT SPECIFIC REQUESTS

#### A. <u>Requests for Prudency Determination</u>

Section 56-585.1:4 H of the Code permits the Company to seek a prudency determination from the Commission regarding, among other things, the purchase of a solar generation facility located in the Commonwealth and PPA agreements with solar generation facilities. Accordingly, the Company asks that the Commission determine that the purchase of Firefly and the execution of PPAs for the Renewable Energy Products from Dogwood, Horsepen, and Sun Ridge are prudent, based on the following considerations, which are discussed more fully in the testimonies of Company witnesses Castle, Spaeth, and Jeffries.

First, as Ms. Jeffries details, Appalachian selected Firefly and the three PPAs after a competitive and robust bidding process, significant due diligence, and extensive contract negotiations. Importantly, these projects will help the Company comply at a reasonable cost with the VCEA Mandate, the RPS requirements (by producing approximately 250,000 RECs annually on a Virginia retail basis), and, in the case of Firefly, the GTSA Solar Mandate. Mr. Spaeth's net

present value analysis demonstrates that the cost of the Facility is competitive with market costs and that the benefits of Appalachian owning the Facility over its 35-year useful life are greater than the costs of purchasing similar products in the market. Moreover, the reasonableness and prudence of the PPAs is evidenced by their competitive costs.

Firefly and the PPAs will, for instance, help Appalachian avoid costs it would otherwise incur as a PJM participant, especially by helping the Company to avoid purchasing energy from the PJM energy markets, which can be volatile. Moreover, Dogwood, as a distribution resource, will reduce the Company's load during the PJM five coincident peak hours, thus providing a capacity obligation benefit by allowing the Company to avoid an incremental purchase of capacity in the future. Dogwood will also reduce the amount of load based ancillary service charges and PJM load serving entity Open Access Transmission Tariff charges billed to the Company by PJM.

Each project will produce carbon-free energy, thus advancing the Commonwealth Energy Policy by

- increasing Virginia's reliance on sources of energy that, compared to traditional energy resources, are less polluting of the Commonwealth's air and waters, and
- developing the carbon-free energy resources required to fully decarbonize the electric power supply of the Commonwealth.<sup>20</sup>

Each of the projects will also provide direct and indirect economic benefits to the communities in which they will be located by adding jobs during and after construction and contributing to the tax base that will provide additional revenues for the localities for decades.

Appalachian performed an analysis of Firefly's economic impact on the Commonwealth, which Mr. Castle sponsors. The analysis concluded that the construction will support over 2,300

<sup>&</sup>lt;sup>20</sup> Va. Code §§ 67-101, 67-102.

direct and indirect jobs, and Firefly's ongoing operations will support over 80 direct and indirect jobs. The project will add nearly \$800 million to the state domestic product over its 35-year expected life.

In addition, the Company's review verified that none of the projects disproportionately affects any environmental justice communities, as defined in Section 2.2-234 of the Code.

Finally, the purchase of Firefly is, by statute, in the public interest. Section 56-585.1:4 A states that prior to January 1, 2024, Appalachian's purchase of a solar generation facility located in the Commonwealth of at least one MW and less than 5,000 MW "is in the public interest, and the Commission shall so find if required to make a finding regarding whether such construction or purchase is in the public interest." Similarly, Section 56-585.1:1.G states that Appalachian's purchase of solar facilities located in the Commonwealth "is in the public interest, and in determining whether to approve such facility, the Commission shall liberally construe the provisions of this section."

#### B. <u>Top Hat and Bedington</u>

Top Hat and Bedington will not be in commercial operation during the Rate Year: commercial operation at these facilities is currently anticipated to begin in fourth quarter 2024 and fourth quarter 2023, respectively. Accordingly, Appalachian is not requesting the recovery of specific costs in this Petition. Moreover, as neither facility is located in Virginia, Appalachian cannot request that the Commission make a prudency determination pursuant to Section 56-585.1:4 H. But the Commission's determination in this proceeding that these projects will be reasonable and prudent additions to the Company's portfolio of assets used to comply with the RPS requirements is fundamentally necessary to the projects' advancement. Both projects were selected after a competitive and robust bidding process, significant due diligence, and an extensive contract negotiations process, as discussed by Ms. Jeffries. If approved in this Petition, the Company will be able to take advantage of the federal tax credits for the benefit of its customers, which is one of the factors that supports the competitive pricing associated with these resources.

Thus, the Company requests that the Commission authorize the Company to implement "zero rates" for Top Hat and Bedington, to be kept in place until they enter commercial operation and the Company can close on the transactions.

#### C. <u>Request Regarding Treatment of the SML Run of River RECs</u>

Appalachian requests that the Commission allow it to count the RECs related to the SML Facility's run-of-river generation towards compliance with the requirements of Subsection C. In pumped storage mode, the SML Facility pumps water from the lower elevation Leesville Lake up to Smith Mountain Lake. When that water flows back through the SML Facility's turbines and into Leesville Lake, the power generated is not considered renewable under the Virginia Code. In contrast, a natural flow of water from Smith Mountain Lake to Leesville Lake arises from the rivers that feed Smith Mountain Lake and is considered "run of river." In the PJM-GATS system, all of the production of SML Facility, whether pumped or "run of river," has a REC associated with it that does not distinguish between the two types of generation.

Since the 2008 RPS Order, the Company has included the low-cost RECs associated with the run of the river generation of the SML Facility as part of its Voluntary RPS Compliance Portfolio.<sup>21</sup> To determine the amount of run of river RECs, the Company performs a "freewater" calculation that removes the pumped amount from the total production.

<sup>&</sup>lt;sup>21</sup> In 2011, for example, the Company retired 48,104 RECs associated with the run of river output from the SML Facility. Appalachian Power Company Annual Report to the Commission – November 2012.

The Company requests that the Commission explicitly approve this free water portion of Smith Mountain run of river generation, and the associated RECs, for the Company's continued use and annual retirement towards the RPS requirements.

#### VII. ENVIRONMENTAL JUSTICE

In compliance with the Virginia Environmental Justice Act,<sup>22</sup> the Company screened each of the proposed projects for any environmental justice concerns, as Mr. Castle testifies, and determined that each met the objectives of the Act and none disproportionately impacted environmental justice communities, as defined in Va. Code § 2.2-234. In addition, the Company reviewed the report provided by the developer of Firefly. Mr. Castle sponsors the Company's analyses and the Firefly report. In addition, Firefly is going through a lengthy local permitting and outreach process to receive and address concerns about the environmental impact of the facility's construction, and continues to hold community open houses.

## VIII. COMPLIANCE WITH VCEA REQUIREMENTS REGARDING ENERGY STORAGE

The VCEA requires Appalachian to petition the Commission for approvals to construct or acquire new, utility-owned energy storage resources, with the goal of installing at least 10 percent of such energy storage projects behind the meter.<sup>23</sup> As Mr. Castle explains, the Company included requests for energy storage paired with renewable resources in the RFP issued earlier this year, but did not receive a cost-competitive offer. The Company is in the process of identifying sites for storage resources, including one described by Company witness Casablanca, and will include more specifics in the RFP to be issued in early 2022. Mr. Castle also describes the behind the meter energy storage option already available to customers via the

<sup>&</sup>lt;sup>22</sup> Va. Code § 2.2-234 et seq.

<sup>&</sup>lt;sup>23</sup> Subsections D, E.

Company's Rider DRS, pursuant to which customers can satisfy or supplement their demand reductions using energy storage.

#### IX. COMPLIANCE WITH RATE CASE RULES AND REQUEST FOR WAIVERS

First, Rate Case Rule 60 requires that applications requiring an overall cost of capital include Schedules 3, 4, 5, and 8. Filing Schedules 3 through 5 and 8, sponsored by Mr. Spaeth, provide this information. The required components of Schedule 46, established by the Rate Case Rules, are sponsored by Company witnesses and are attached to and/or incorporated into their testimonies, as set out in the Index of Schedule 46 Requirements, which is attached to this Petition as Attachment 3.

Second, Rate Case Rule 20VAC5-204-40 states that for a prudency determination that does not request approval of an associated rate adjustment clause, such as the one for Firefly, "shall include Schedule 46 as identified and described in 20VAC5-204-90, which shall be submitted with the utility's direct testimony." Rule 20VAC5-204-90 does not contain requirements that are directly applicable to one request in this Petition: the request for a prudency determination, pursuant to Section 56-585.1:4, for a utility's acquisition of Firefly, a solar generation facility that will be constructed by another entity. Accordingly, the Company has provided documents that it determined comply with the Rule's requirements.

Third, the Company provided the Commission notice of its intent to file this Petition, pursuant to Rule 10 A, on August 30, 2021.

Fourth, the Company requests, pursuant to Rule 20VAC5-204-10.E, that the Commission grant a limited waiver, for good cause shown, of the requirement to file the voluminous documents required by Schedule 46 that related to the Legacy Wind PPAs. The Company provided these documents to Commission Staff and other parties in 2008 and 2016, and the Commission approved the PPAs in the 2008 RPS Order and the 2017 RPS Order as reasonable and prudent resources to help the Company meet the voluntary RPS goals. Since those approvals, the Commission has approved the recovery of the associated costs. Given that the Commission, Staff, and others have already reviewed the underlying documents, and given their voluminous and extraordinarily sensitive nature, the Company respectfully requests that the Commission waive the obligation to file them.

Finally, the Company requests, pursuant to Rule 20VAC5-204-10.E, that the Commission grant a limited waiver, for good cause shown, of the requirement to file the documents that comprise Schedule 46 in hard copy. Due to the size of some of these documents, as well as the current remote conditions under which many of the parties are working, it would be unduly burdensome and impractical to produce them in hard copy. Further, much of the supporting documentation is extraordinarily sensitive, and as such would not be posted to the Commission's online docket for public review. In lieu of a physical production, consistent with the Commission's *Order for Notice and Comment* in Case No. PUR-2021-00066<sup>24</sup> and *Order Granting Limited Reconsideration* in Case No. PUR-2021-00146,<sup>25</sup> the Company requests a limited waiver of this Rule to permit it to file one hard copy of these extraordinarily sensitive documents. In addition, the Company has made available electronic copies of these documents to the Division of Utility Accounting & Finance and the Division of Public Utility Regulation,

<sup>&</sup>lt;sup>24</sup> Order for Notice and Comment at 12, Petition of Appalachian Power Company For a prudency review, pursuant to § 56-585.1:4 H of the Code of Virginia, with respect to the purchase of the Amherst Solar Facility, Case No. PUR-2021-00066, Doc. Con. Cen. No. 211210222 (Dec. 7, 2021).

<sup>&</sup>lt;sup>25</sup> Order Granting Limited Reconsideration, Petition of Virginia Electric and Power Company for Approval of the RPS Development Plan, approval and certification of the proposed CE-2 Solar Projects pursuant to §§ 56-580 D and 56-46.1 of the Code of Virginia, revision of rate adjustment clause, designated Rider CE, under § 56-585.1 A 6 of the Code of Virginia, and a prudence determination to enter into power purchase agreements pursuant to § 56-585.1:4 of the Code of Virginia, Case No. PUR-2021-00146, Doc. Con. Cen. No. 210830286 (Aug. 26, 2021).

and will make them available for review by any respondents in an iManage folder established for

this proceeding.

WHEREFORE, Appalachian Power Company respectfully requests that the Commission:

- 1) Approve its 2021 RPS Plan;
- 2) Approve the revenue requirement of \$32,069,614 to be recovered in the Rate Year;
- 3) Approve the cost recovery mechanisms to recover this and future revenue requirements related to compliance with the RPS Program;
- 4) Determine that the purchase of Firefly and the execution of PPAs for the Renewable Energy Products from Dogwood, Horsepen, and Sun Ridge are prudent;
- 5) Approve Future cost recovery related to the acquisition of Top Hat and Bedington;
- 6) Approve the treatment of the RECs generated by the run of river generation component of the Smith Mountain Lake Facility;
- 7) Grant of waivers of certain the Rate Case Rules; and
- 8) Grant such other and further relief as it deems just and proper.

Respectfully submitted,

APPALACHIAN\_POWER COMPANY By:

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## **Counsel for Appalachian Power Company**

Dated: December 30, 2021

221230253

## **CERTIFICATE OF SERVICE**

I hereby certify that on this 30<sup>th</sup> day of December 2021 a true copy of the foregoing

Petition of Appalachian Power Company was delivered by hand or electronic submission to the

following:

Extraordinarily Sensitive Version: William H. Chambliss, Esq. Office of General Counsel State Corporation Commission 1300 East Main Street Richmond, Virginia 23219 william.chambliss@scc.virginia.gov

Public Version: C. Meade Browder, Jr., Esq. Senior Assistant Attorney General Division of Consumer Counsel Office of Attorney General *mbrowder@oag.state.va.us* 

### Attachment 1



## **RENEWABLE PORTFOLIO STANDARD PLAN**

## CASE NO. PUR-2021-00206

## December 30, 2021







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#### 1.0 Virginia Clean Economy Act Compliance Plan Overview

Consistent with the requirements of Virginia Code Section 56.585.5.D.4, Appalachian Power Company (Appalachian, APCo, or the Company) submits the second of its annual plans to meet the requirements in the Virginia Clean Economy Act (VCEA).

This year's report includes six separate VCEA compliant plans for informational purposes. Descriptions of the six Portfolios are provided in Table 1. Four of the plans, Portfolios 1-4, assume only the minimum level of renewable resources needed to meet the annual VCEA energy targets are added. These plans were prepared under varying scenarios in which the Company's two coal plants were retired in either 2028 or 2040, and replaced with either a combination of renewable and gas fired resources or 100% renewable resources. The fifth plan (Portfolio 5) was prepared under the assumption that 1,000 MW of additional wind above the minimum VCEA requirements is available and can be added based on favorable economics in time to capture production tax credits before they expire in 2026. The sixth plan (Portfolio 6) is a sensitivity case prepared as a result of a requirement in the Commission's order on the Company's 2020 VCEA filing,<sup>1</sup> in which future wind resources are assumed to have a capacity factor that is consistent with the Company's current wind PPA resources.

Portfolios							
1	2	3	4	5	6		
RGGI Only CO2 2040 AM & MNTR Ret. Gas Options Available	RGGI to \$15 CO2 2040 AM & MNTR Ret. No Gas Option Available	RGGI Only CO2 2028 AM & MNTR Ret. Gas Options Available	RGGI to \$15 CO2 2028 AM & MNTR Ret. No Gas Option Available	RGGI to \$15 CO2 2040 AM & MNTR Ret. No Gas Option Available Higher Wind Limits	RGGI to \$15 CO2 2040 AM & MNTR Ret. No Gas Option Available Current Wind Project Cap Factors		

**TABLE 1: PORTFOLIO DESCRIPTIONS** 

For the purposes of this report, the Company's base case assumption is that the coal plants will operate through 2040 and fossil fueled resources will not be used to replace them at that time. Portfolio 2 presents that scenario and will be referred to in this report as the VCEA Plan or the Plan. Nevertheless, APCo intends to issue Request for Proposals (RFPs) in the near

<sup>&</sup>lt;sup>1</sup> Final Order at 5, Commonwealth of Virginia, ex rel. State Corporation Commission Ex Parte: Establishing 2020 RPS Proceeding for Appalachian Power Company, Case No. PUR-2020-00135, Doc. Con. Cen. No. 210440238 (April 30, 2021) ("Order on 2020 Filing").

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#### Attachment 1

term based on Portfolio 5, and seek approval of those resources based on the results of APCo's economic analyses. The Company's 2021 VCEA Plan includes a geographically varied portfolio of storage, solar and wind resources, both Company and third party owned, as well as market REC purchases. In the filing associated with this Plan, the Company is seeking a prudency determination of the acquisition of one 150 MW solar facility and the agreements to purchase the output of three solar facilities via power purchase agreements (PPAs) totaling approximately 89 MW; approval to recover the costs of 50 MW of owned West Virginia solar and 204 MW of Illinois wind resources. In addition, APCo is seeking cost recovery for RECs associated with 40 MW of Virginia solar contracted through its Cogen/SPP rate schedule; 15 MW of contracted solar located in Virginia; 5 MW owned solar in Virginia; as well as market REC purchases necessary for annual compliance.

The Company developed these VCEA compliant plans in a way that is similar to how Integrated Resource Plans are developed, using the same general methods, commodity price forecasts, optimization software, load forecasts, and resource cost assumptions. The amount and timing of the resource additions were determined with Plexos<sup>®</sup> optimization software, adjusted as needed to include resource additions that were necessary to meet certain annual requirements associated with energy efficiency targets and Virginia-domiciled renewable and storage.

In addition to determining the type and timing of resource additions, this report provides an estimate for the rate impacts associated with compliance, consistent with the Commission's requirement in the Order on the 2020 Filing.

## 1.1 VCEA Expected Resource Additions

APCo issued a series of RFPs for renewable resources and RECs in 2021 to meet the VCEA requirements and is seeking approval in both Virginia and West Virginia for several projects that resulted from that process. It is assumed for purposes of this Plan that both Virginia and West Virginia commissions will approve those investments and that each retail jurisdiction will receive its allocated share of costs and attributes. All other identified renewable resource additions are assumed to accrue exclusively to Virginia retail customers.

In the short term, APCo expects to acquire or contract for 498 MW of resources. These specific resources, which are the subject of the petition filed simultaneously with this report, are shown in Table 2.

Facility	Nameplate Capacity MW	Owned / PPA	State	Resource Type	Operation
Firefly	150.0	Owned	Virginia	Solar	July 2024-June 2059
Amherst*	4.9	Owned	Virginia	Solar	Jan 2023 - Dec 2057
Horsepen	20.0	РРА	Virginia	Solar	Jan 2025 - Dec 2054
Dogwood*	18.9	PPA	Virginia	Solar	Jan 2025 - Dec 2054
Sun Ridge	50.0	PPA	Virginia	Solar	Jan 2025 - Dec 2054
Virginia Domiciled	243.8				
Top Hat	204.0	Owned	Illinois	Wind	Jan 2025 - Dec 2054
Bedington	50.0	Owned	West Virginia	Solar	Oct 2023 - Sep 2058
TOTAL	498				

TABLE 2 APCO PLANNED NEAR-TERM RESOURCE ADDITIONS

\*Distribution Resource

In addition, the Company expects the Depot (15 MW) and Wytheville (20 MW) solar facilities to be operational in late 2021-early 2022. The Leatherwood (20 MW) solar facility was placed in-service in September 2021. All of the renewable attributes of the Leatherwood and Wytheville facilities, which are PURPA projects, are being attributed to Virginia. Finally, the Company is proposing to add approximately 8 MW of energy storage for the purposes of improving reliability along its Glade Station – White Top circuit.

The RFP issued for RECs in May 2021 resulted in one bid. The Company elected not to pursue this bid based on its economic analysis, and will continue to issue RFPs for RECs from time to time to evaluate the cost effectiveness and level of availability of REC contracts as a compliance option.

As shown in Table 3 below, the Company will satisfy the 2023 interim wind and solar requirements of Section 56-585.5 D.1 by petitioning the Commission for approval to acquire approximately 155 MW of owned Virginia-domiciled solar facilities (Firefly and Amherst), and approximately 144 MW of contracted, third-party owned, Virginia-domiciled solar facilities (Wytheville, Leatherwood, Depot, Horsepen, Sun Ridge, and Dogwood). Progress towards the Virginia-domiciled resources that will be used for compliance with the 2023 petition requirement are listed in Table 3.

56-585.5.D Requirement	PPA	Owned	Total
YE 2023	70	130	200
YE 2027	140	260	400
YE 2030	210	390	600
2021 Plan	144	155	299

TABLE 3: APCO PROGRESS TOWARDS 56-585.5 D. WIND/SOLAR REQUIREMENTS

The VCEA section 56-585.5 E also contains interim storage resource requirements. See Table 4 for the Company's Progress towards these requirements. The Company expects to solicit bids for qualifying storage resources in a future RFP in 2022.

TABLE 4: APCO PROGRESS TOWARDS	556-585.5	E. STORAGE	REQUIREM	ENTS
EC EQE E E Doquiromont	004	Owned	Tatal	

56-585.5.E Requirement	PPA	Owned	Total
YE 2025	9	16	25
YE 2030	53	98	150
YE 2035	140	260	400
2021 Plan	0	0	0

## 1.2 Virginia Clean Economy Act Near-Term Compliance

The Company met the RPS requirements of Section 56-585.5 C for 2021 largely with its current supply of renewable resources. In Table 5, the Company has prepared a projection of its expected position in terms of VCEA qualifying energy production versus each year's energy targets through 2025. Given the assumed production of the existing and planned energy resources, the Company projects a deficit in each year. It is anticipated this deficit will be addressed through the tactical purchase of REC's, when market conditions are favorable.

TABLE 5: APCO	NEAR TERM	VCEA Enerc	BY COMPLIAN	CE	
Projected REC p	production and	forecast requ	irments (MW	<u>h)</u>	
	<u>2021</u>	<u>2022</u>	<u>2023</u>	<u>2024</u>	<u>2025</u>
Current Resources					
Hydro - owned	478,739	478,739	478,739	478,739	478,739
Hydro (PPA)	70,366	70,366	70,366	70,366	70,366
Bluff Point Wind (PPA)	189,720	189,720	189,720	189,720	189,720
Camp Grove Wind (PPA)	99,893	99,893	99,893	99,893	99,893
Fowler Ridge (PPA)	114,235	114,235	114,235	114,235	114,235
Leatherwood (PPA)	13,039	45,153	44,927	44,703	44,479
Sub-total Current Resources	965,993	998,107	997,881	997,656	997,433
Projected Resources					
Wytheville (PPA)	0	42,968	42,753	42,539	42,327
Depot (PPA)	0	13,285	15,475	15,398	15,321
Amherst - owned	0	314	5,290	5,264	5,237
Horsepen (PPA)					21,765
Dogwood (PPA)					16,446
Sun Ridge (PPA)					58,200
Top Hat - owned					381,979
Firefly - owned				111,428	167,142
Bedington - owned			10,962	52,225	51,964
Subtotal - Projected Resources	0	56,567	74,481	226,854	760,381
Total - Current and Projected	965,993	1,054,674	1,072,361	1,224,510	1,757,814
less APCo Renewable Riders	(80,342)	(80,342)	(80,342)	(80,342)	(80,342)
Production Available for Compliance	885,651	974,332	992,019	1,144,168	1,677,472
Virginia Retail Load (forecast)(MWh)	15,040,556	15,017,019	15,002,519	14,989,673	14,998,772
RPS % Requirement	6%	7%	8%	10%	14%_
RPS REC Requirement	902,433	1,051,191	1,200,202	1,498,967	2,099,828
REC Deficit	(16,783)	(76,859)	(208,182)	(354,799)	(422,356)
Cumulative REC Surplus/(Deficit)		(93,642)	(301,824)	(656,623)	(1,078,979)
Embedded Jurisdictional Split	0.501				
, New Asset Split	0.501				
	2021	2022	2023	2024	2025
Requirement	902,433	1,051,191	1,200,202	1,498,967	2,099,828

871,923

965,993

953,166

1,054,674

959,959

1,072,361

1,002,627

1,224,510

WV Approves

**Only Virgina Approves** 

Attachment 1

1,657,979 1,757,814

## 1.3 APCo's Coal Units

The Company is required to make certain environmental investments in its two coal plants (2,930 MW Amos, St. Albans, WV; 1,336 MW Mountaineer, New Haven, WV) in order for them to operate past 2028. In Case No. PUR-2020-00258, the Virginia SCC did not approve cost recovery for the Virginia jurisdictional share of the investment necessary to comply with the Effluent Limitation Guidelines (ELG) rule. As a result, the Company modeled two sets of scenarios: one with the two plants retiring at the end of 2028 and one with the plants retiring in 2040. During the performance of the analyses in this report, the Public Service Commission of West Virginia (WVPSC) ordered (Case No. 20-1040-E-CN) APCo to proceed with the investments necessary to keep the plants operational past 2028 and held that West Virginia customers will, if necessary, pay for the entire investment. There are unresolved issues associated with the sharing of capacity and energy benefits of these plants between the states if the Virginia SCC ultimately denies cost recovery of the ELG investment and the coal plants remain operational past 2028. For the purposes of discussion of the VCEA Plan (Portfolio 2) in this report, it is assumed that Virginia will continue to have the benefit of the two coal plants through 2040.

#### 1.4 Environmental Justice

Appalachian is committed to the tenets of the Commonwealth's Policy on Environmental Justice and considers it in all prospective transactions for renewable resources. Identification and remediation of potential concerns are made during the RFP process, as discussed in the petition. Because Environmental Justice is specific to the communities immediately surrounding resources, meaningful screening can only be accomplished once potential sites have been identified. The Plexos® selected resource additions identified in this Plan are generic in nature and are not site specific and thus cannot be evaluated for potential Environmental Justice issues.

#### 1.5 Reliability Impacts

Through Plexos®, the Company models reliability at a system level by ensuring that sufficient resources are available to meet customer load based on the hourly profile of both load and resources. Because the Company is a member of PJM, Plexos® has the option to fill energy deficits in any specific hour with market purchases. At this time, the Company expects that supply of energy from PJM will be available through at least 2030 when needed with pricing

based upon scarcity. The Company will continue to evaluate and identify potential reliability concerns and mitigation as renewable penetration increases in APCo's service territory, Virginia, and PJM.

## 2.0VCEA Summary

In 2020, the General Assembly passed the VCEA, which was signed into law by Governor Northam. The VCEA is a transformative law that seeks to end carbon dioxide emissions from the electric utility industry in Virginia.<sup>2</sup>

## 2.1 VCEA Requirements

There are four primary requirements of the VCEA related to resource acquisition:

1. Annual RPS requirement. For APCo, this requirement is reproduced in Table 6 and begins at 6% in 2021 and escalates to 100% by 2050.

Year	APCo RPS	Year	APCo RPS
	Requirement (%)		Requirement (%)
2021	6	2036	53
2022	7	2037	53
2023	8	2038	57
2024	10	2039	61
2025	14	2040	65
2026	17	2041	68
2027	20	2042	71
2028	24	2043	74
2029	27	2044	77
2030	30	2045	80
2031	33	2046	84
2032	36	2047	88
2033	39	2048	92
2034	42	2049	96
2035	45	2050 and thereafter	100%

TABLE 6: APCO VCEA RPS REQUIREMENTS BY YEAR

Development of Virginia domiciled solar and wind resources. APCo is required to
petition the Commission for 600 MW solar or wind resources by December 31, 2030,
with interim targets beginning December 31, 2023; 35% of those resources are required
to be contracted via PPA. The Company is using nameplate capacity to determine
compliance with these requirements.

<sup>&</sup>lt;sup>2</sup> Appalachian is a "Phase I" utility as defined in Section 56.585.1. A.1. of the Code of Virginia. As such, this report will refer to the requirements in the VCEA that only apply to Appalachian.

3. Development of Energy Storage resources. By December 31, 2035, the VCEA requires APCo to have petitioned the Commission for necessary approvals to construct or acquire 400 MW of energy storage capacity, or more with Commission approval. These resources must meet the same 35% PPA requirement that applies to the Virginia domiciled solar and wind resources. Further, 10% of the battery installations are required to be behind the meter (BTM) installations.

The Commission opened Case No. PUR-2020-00120 to establish rules and regulations for the required addition of storage and subsequently issued regulations to determine the appropriate timing of storage additions on December 18, 2020. The Company is working to identify the preferred location and size of storage resources, and will issue an RFP in 2022 for storage resources. See Table 7 for those interim storage addition minimums<sup>3</sup>.

TABLE 7. VCEA REQUIRED STORAGE ADDITIONS					
Date	New Storage	Cumulative			
	Additions (MW)	Storage Additions			
		(MW)			
12-31-2025	25	25			
12-31-2030	125	150			
12-31-2035	250	400			

TABLE 7: VCEA REQUIRED STORAGE ADDITIONS

4. Energy Efficiency requirement. APCo must implement energy efficiency measures that achieve energy savings equivalent to at least 2% of the Company's 2019 retail sales by 2025. The VCEA also specifies that the Commission shall establish new EE requirements for the period of 2026 to 2028, and for every three year period thereafter. Due to the uncertain nature of any future proceeding regarding the efficacy or cost-effectiveness of additional EE, the amount of EE requirements set by the Commission was assumed to remain constant beyond 2025, with any additional EE in future years only being selected for economic purposes.

<sup>&</sup>lt;sup>3</sup> Order for Notice and Comment, Commonwealth of Virginia, ex rel., State Corporation Commission Ex Parte: In the matter of establishing rules and regulations pursuant to §56-585.5 E 5 of the Code of Virginia related to the deployment of energy storage, Case No. PUR-2020-00120, Doc. Con. Cen. No. 200910238 (Sept. 11, 2020).

## 2.1.1 Commission Filing Requirements

In the Attachment to its July 10, 2020 Order Establishing 2020 RPS Proceedings, the Commission set forth certain filing requirements. In addition, in the Order on the 2020 Filing, the Commission imposed certain requirements for this 2021 VCEA filing. The requirements of each of these orders, along with a description of where they are addressed in this report, are contained in Appendix E.

## 3.0 APCo Company Summary and Assumptions Overview

## 3.1 Overview of APCo

APCo's customers are retail and sales-for-resale (wholesale) customers located in the states of Virginia, West Virginia and Tennessee (see Figure 1). Currently, APCo serves nearly 1 million customers, with nearly 540,000 of those customers being in Virginia. The peak load requirement of APCo's total retail and wholesale customers is seasonal in nature, with distinctive peaks occurring in the summer and winter seasons. APCo's all-time highest recorded peak demand was 8,708 MW, which occurred in February 2015, and the highest recorded summer peak was 6,755 MW, which occurred in August 2007. The most recent (summer 2021 and winter 2020/21) actual APCo summer and winter peak demands were 5,348 MW and 5,975 MW, occurring on August 24, 2021 and February 8, 2021, respectively.



#### FIGURE 1: APCO'S SERVICE TERRITORY

## 3.2 APCo's existing resources

APCo serves its customers through owned generation resources and PPAs for renewable resources. See Table 8 and Table 9 for a summary of these owned and contracted resources, respectively.

Plant	Capacity [MW <sup>1</sup> ]	No. of Units	Location	Fuel	First Unit Commissioned	Retirement Date
John E. Amos	2930	3	Winfield, WV	Coal	1971	2040*
Mountaineer	1305	1	New Haven, WV	Coal	1980	2040
Ceredo	450	6	Ceredo, WV	Natural Gas	2001	2041
Clinch River	455	2	Carbo, VA	Natural Gas	1958	2025
Dresden	570	3	Dresden, OH	Natural Gas	2012	2047
Buck	1.5	3	Ivanhoe, VA	Hydro	1912	2024
Byllesby	4.2	4	Byllesby, VA	Hydro	1912	2024
Claytor	75.5	4	Radford, VA	Hydro	1939	2041
Leesville	50	2	Leesville, VA	Hydro	1964	2040
London	6.5	3	Montgomery, WV	Hydro	1935	2044
Marmet	5.8	3	Marmet, WV	Hydro	1935	2044
Niagara	2.4	2	Roanoke, VA	Hydro	1906	2024
Smith Mountain	585	5	Penhook, VA	Hydro	1965	2040
Winfield	10	3	Winfield, WV	Hydro	1938	2044
TOTAL	1310.9	32				

#### TABLE 8. APCO OWNED GENERATION RESOLECES

<sup>1</sup> Nameplate rating. For capacity planning purposes, PJM UCAP ratings are used.

\*Retirement date for planning purposes. May differ from retirement dates for depreciation purposes

Facility	Nameplate Capacity MW	State	Resource Type	Contract Expiration
Ohio Valley Electric Corporation	332	Ohio	Coal	2040
Summers ville I and II	80	West Virginia	Hydro	2027
Bluff Point	120	Indiana	Wind	2037
Camp Grove	75	Illinois	Wind	2028
Beech Ridge	101	West Virginia	Wind	2030
Fowler Ridge III	99	Indiana	Wind	2029
Grand Ridge II and III	101	Illinois	Wind	2029
Depot Solar	15	Virginia	Solar	2041
Wytheville*	20	Virginia	Solar	2036
Leatherwood*	20	Virginia	Solar	2036
TOTAL	963			

\*Behind the Meter Resources

## 3.3 Key Modeling Assumptions

Key assumptions included in the VCEA Plan

1. Appalachian Power operates in both Virginia and West Virginia and is subject to regulation in both states, with resource acquisition determinations made by regulators

in both states and resource costs allocated between the jurisdictions. The Company assumes, for the purposes of this Plan, that all of the specific resources in Table 4 will be approved by both Virginia and West Virginia. Subsequent renewable resources will accrue entirely to Virginia retail customers. There is not currently a renewable portfolio standard in place in West Virginia.

- 2. The Company's base case assumption is that Amos and Mountaineer coal-fired plants will run through 2040 consistent with the WVPSC's order in Case No. 20-1040-E-CN. After 2040, the Company has assumed, in the VCEA Plan, that capacity shortfalls will be met with a combination of renewable generators and energy storage. In other cases where the Company modeled fossil additions for informational purposes, it is understood that those resources would necessarily be located outside of Virginia.
- 3. The Company will sell the REC bank that it accumulated through the end of the Voluntary RPS in 2020 during 2021 for the benefit of customers that were subject to the voluntary RPS. As a consequence, the Company's starting REC position for the VCEA is zero.
- 4. RECs were made available to the Plexos® model as a resource option that could be selected if they were a less costly VCEA compliance option than other renewable resources, based on an assumed REC price curve. Projected RECs in excess of any one year's VCEA energy requirement were assumed to be sold the following year in order to reduce overall compliance costs.
- 5. Any capacity additions resulting in excess capacity above the Company's minimum PJM UCAP capacity requirement were modeled to be sold to either the PJM capacity market or to a third party under a bilateral purchased power agreement beginning in 2026, at the Company's fundamental PJM capacity price forecast.
- 6. The Company's existing renewable resources are contributing to the VCEA renewable energy goals. Existing renewable resources are allocated based on the ratio of APCo Virginia retail load (including Public Authority and Commonwealth customers) to total company load, which is estimated to be 50.1%. Existing contracts are modeled as ending on their expiration date and are not expected to be renewed.

## 3.4 APCo Load Forecast

The APCo load forecast was developed by the American Electric Power Service Corporation (AEPSC) Economic Forecasting organization and completed in June 2021.<sup>4</sup> The load forecast is the culmination of a series of underlying forecasts that build upon each other. The economic forecast provided by Moody's Analytics is used to develop the customer forecast,

<sup>&</sup>lt;sup>4</sup> The load forecasts (as well as the historical loads) integral to this Plan reflect the traditional concept of internal load, i.e., the load that is directly connected to the utility's transmission and distribution system and that is provided with bundled generation and transmission service by the utility. Such load serves as the starting point for the load forecasts used for generation planning. Internal load is a subset of *connected load*, which also includes directly connected load for which the utility serves only as a transmission provider. Connected load serves as the starting point for the load forecasts used for transmission planning.

which is then used to develop the sales forecast, which is ultimately used to develop the peak load and internal energy requirements forecast.

Over the next 15-year period (2022-2036),<sup>5</sup> APCo's service territory is expected to see population to decline at 0.3% per year and non-farm employment growth 0.3% per year, and APCo is projected to see its customer count decline by 0.1% over this period. Over the same forecast period, APCo's retail sales are projected to decline at 0.2% per year, with growth expected from the industrial class (+0.2% per year) while the residential class is projected to decline at a compounded annual growth rate (CAGR) of 0.4% per year. Finally, APCo's internal energy is expected to decline by 0.4% per year and peak demand is expected to decline by 0.6% per year through 2036. For this forecast, it has been assumed that APCo's current wholesale customers will not renew their contracts beyond the current contract expiration dates, resulting in removal of their load from the forecast.

Figure 2 shows both the total load forecast for APCo and the Virginia retail sales applicable to the VCEA. The Company understands "retail" as defined in the Code to include the Public Authority and Commonwealth customers in Virginia, for the purposes of determining VCEA RPS requirements. These forecasted retail sales along with the annual VCEA energy targets provided a key input into the development of the proposed VCEA Plan.



#### FIGURE 2: APCO ENERGY REQUIREMENTS

## 3.5 The Fundamentals Forecast

The Fundamentals Forecast is a long-term, weather-normalized commodity market forecast principally based upon the assumptions contained in the Energy Information Administration's Annual Energy Outlook (AEO). It is provided to AEPSC and all AEP operating companies for purposes such as resource planning, capital improvement analyses, fixed asset impairment accounting, and others. These projections cover the electricity market within the Eastern Interconnect, the Electric Reliability Council of Texas, and the Western Electricity Coordinating Council. The Fundamentals Forecast includes, among other factors: 1) hourly, monthly and annual regional power prices (in both nominal and real dollars); 2) prices for various qualities of coals; 3) monthly and annual locational natural gas prices, including the benchmark Henry Hub; 4) nuclear fuel prices; 5) SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> burden values; 6) locational implied heat rates; 7) electric generation capacity values; 8) renewable energy subsidies; and 9) inflation factors; 10) VCEA compliance for Virginia utilities among others.

Table 10 below describes the Fundamentals Forecast components, which are sourced directly from the EIA AEO, from third party energy consultancies, or were sourced internally. As the EIA AEO does not provide the granularity for most regulatory applications, the Aurora energy market simulation model was utilized to create a reasonable proxy for the EIA AEO while providing the level of detail necessary for downstream consumption.

<b>TABLE 10: FUNDAMENTALS FC</b>	DRECAST COMPONENTS
----------------------------------	--------------------

Forecast Components	EIA	Other	Source
Economy; inflation/GDP deflators	1		EIA Reference case
Generating Reserve Margins		✓	RTO Requirements
Electric Load		✓	AEP Load Forecasting
Electric Load shapes		✓	AEP Fundamentals
Solar/Wind production shapes by area		✓	NREL
Coal; Delivered price to EIA regions	1	1	EIA Reference case FOB prices + AEP Fundamentals
Natural gas price; Henry Hub	1		EIA Reference case
Natural gas price; Locational values	~	~	EIA Reference case - Henry Hub + AEP Fundamentals
Natural gas supply; Lower 48 production	✓		EIA Reference case
Natural gas demand (Incl. losses)	1		EIA Reference case
Natural gas; net pipeline/LNG exports	~		EIA Reference case
Oil price, WTi	1		EIA Reference case
Fuel Oil price; locational values	1	1	EIA Reference case - WTI + AEP Fundamentals
Uranium prices		✓	AEP Fundamentals
Other Fuel( Blofuel, etc)	~		EIA Reference case
New gen unit options and capital costs	✓		EIA Reference case
Existing gen units	~		EIA Reference case
Announced new gen units	1		EIA Reference case
Aged-out retirements of existing gen units	1		EIA Reference case
Gen unit maintenance schedule		✓	AEP Fundamentals
Gen unit outages		✓	AEP Fundamentals
Unit-level emission rates; $CO_2$ , $SO_2$ , $NO_4$		1	US EPA CEMS data
Application of a CO <sub>2</sub> burden		1	AEP Environmental
REC		1	AEP Regulatory Forecast
PTC	1		EIA Reference case
ITC	1		EIA Reference case
State-mandated Renewable Portfolio Standards		1	AEP Environmental
Reporting parameters; Peak/Off-Peak/NERC Holidays		~	PJM/SPP/other RTO and/or internal guidelines
Transmission/links between Zones		1	AEP Fundamentals

The Fundamentals Forecasts incorporates requirements of the Virginia Clean Energy Act

and the Regional Greenhouse Gas Initiative (RGGI) for both APCo and Dominion:

- Including Virginia in the RGGI, applying RGGI CO<sub>2</sub> prices through 2027 before switching to an assumption of a higher \$15/metric ton national standard in 2028
- Applying the Virginia RPS program to Phase I and Phase II utilities within the state
- Retiring all fossil units named in the VCEA law by stated retirement dates
- Retiring all remaining Phase I fossil units by 2050 and Phase II fossil units by 2045
- Including the resource additions required for Dominion under the VCEA based upon the Company's understanding of those requirements

The Aurora model iteratively generates zonal, but not company-specific, long-term capacity expansion plans, annual energy dispatch, fuel burns and emission totals from inputs including fuel, load, emissions, and capital costs, among others. Ultimately, Aurora creates a weather-normalized, long-term forecast of the market in which a utility would be operating. AEPSC also has ample energy market research information available for its reference, which includes third-party consultants, industry groups, governmental agencies, trade press, investment community, AEP-internal expertise, various stakeholders, and others. The Aurora model is widely used by utilities for integrated resource and transmission planning, power cost analysis

and detailed generator evaluation. The database includes approximately 25,000 electric generating facilities in the contiguous United States, Canada, and Baja Mexico. These generating facilities include wind, solar, biomass, nuclear, coal, natural gas, and oil. A licensed online data provider, ABB Velocity Suite, provides up-to-date information on markets, entities and transactions along with the operating characteristics of each generating facility, which are subsequently exported to the Aurora model.

The annual results from each scenario developed are shown in Appendix A and include on-peak and off-peak energy prices, natural gas prices, coal prices, CO<sub>2</sub> prices and capacity prices.

## 3.6 Determining Compliant VCEA Plans

For the purposes of modeling compliance with the VCEA, APCo used a process nearly identical to its typical IRP process, which used the Plexos® model to address the gap between resource needs and current resources, while also including minimums related to the requirements established under the VCEA for energy from renewable resources, energy savings from energy efficiency resources and capacity from energy storage resources.

Given the cost and performance parameters around sets of potentially available proxy resources-both supply and demand side-and a scenario of economic conditions that include long-term fuel prices, capacity costs, energy costs, emission-based pricing proxies including CO<sub>2</sub>, as well as projections of energy usage and peak demand, Plexos® will return the optimal suite of proxy resources (portfolio) that meet the resource need. Portfolios created under similar pricing scenarios may be ranked on the basis of cost, or the net present value of the resulting stream of revenue requirements. The least cost option is considered the optimum portfolio for that unique input parameter scenario.

# FIGURE 3: RESOURCE PLANNING DIAGRAM



# 4.0 Supply- and Demand-side Resource Options

Supply-side resource options including natural gas base/intermediate and peaking generating technologies and intermittent renewable resources including large-scale solar, wind and battery storage were selectively made available in different scenarios to develop compliant plans.<sup>6</sup> To reduce the computational problem size within Plexos<sup>®</sup>, the number of alternatives explicitly modeled was reduced through an economic screening process that analyzed various supply options and developed a quantitative comparison levelized over technologies life cycle. It is important to note that alternative technologies with comparable cost and performance characteristics, subject to limitations included in Section 56-585.5, can ultimately be substituted, should technological or market-based profile changes warrant.

Table 11 includes a summary of the technologies made available to the model, depending upon scenario, and their associated performance parameters. These generation technologies were intended to represent reasonable proxies for each capacity type (base-load, intermediate, peaking). Subsequent substitution of specific technologies could occur in any later plan, based on emerging economic or non-economic factors not yet identified.

Other generation resource technologies were not made available to Plexos<sup>®</sup> due to their respective costs, and to improve modeling process time. Technologies such as natural gas resources with carbon capture and storage, hydrogen-capable combustion turbines, long duration storage, and small modular nuclear reactors were evaluated and found not to be competitive on cost when compared to the resource types shown in Table 11 which were made available to Plexos<sup>®</sup>, APCo will continue to monitor developments in these and other technologies and including cost, availability, and the availability of federal tax credits, which could make these resources more attractive options in the future.

<sup>&</sup>lt;sup>6</sup> The Company referred to the EIA ANNUAL ENERGY OUTLOOK 2020 report (<u>https://www.cia.gov/outlooks/aeo/pdf/aeo2020.pdf</u>) and the associated EIA Capital Cost and Performance Characteristic Estimate for Utility Scale Electric Power Generating Technologies (https://www.eia.gov/analysis/studies/powerplants/capitalcost/pdf/capital\_cost\_AEO2020.pdf) to inform the analysis process.

### TABLE 11: GENERATION TECHNOLOGY OPTIONS (2021\$)

#### AEP System New Generation Technologies Key Supply-Side Resource Option Assumptions (a)(b)(d)

				Installed	Capacity	
	Cap	ability (MV	/) (e)	Cost (d,f)	Factor	LCOE (g)
Туре	Std. ISO	Summer	Winter	- (\$/kW)	(%)	(\$/MWh)
Base Load						
COMB TURBINE H CLASS, 1100-MW COMBINED CYCLE (c)	1,030	1,010	1,070	1,100	75	55.5
COMB TURBINE H CLASS, COMBINED-CYCLE SINGLE SHAFT, 430 MW (c)	420	410	440	1,200	75	58.9
Peaking						
COMB TURBINE F CLASS, 240-MW SIMPLE CYCLE (c)	230	230	250	800	25	95.0
COMB TURBINES AERODERIVATIVE, 100-MW SIMPLE CYCLE (c)	110	100	110	1,300	25	128.4
INTERNAL COMBUSTION ENGINES, 20 MW (c)	20	20	20	2,100	25	173.9
Intermittent						
BATTERY ENERGY STORAGE SYSTEM, 50 MW / 200 MWH (c)	50	50	50	1,472	25	156.7
SOLAR PHOTOVOLTAIC WITH BATTERY ENERGY STORAGE SYSTEM, 150 MWx200 MWh (h)	150	150	150	2,041	20	101.7
ONSHORE WIND, LARGE PLANT FOOTPRINT, 200 MW (i)	200	200	200	1,505	35	40.3
SOLAR PHOTOVOLTAIC, 150 MWAC (h)	150	150	150	1,469	24	57.1

(a) Costs and performance data informed by EIA report <u>Capital Cost and Performance Characteristic Estimates for Utility Scale Electric Power</u> <u>Generating Technologies (Feb 2020)</u>

(b) Installed cost, capability and heat rate numbers have been rounded

(c) All costs in 2021 dollars, except as noted. Costs adjustments made based on EIA report Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2020 - Region 11 (PIMW)

(d) \$/kW costs are based on summer capability

Notes:

(e) All Capabilities adjusted by the Performance Adjustment Factors defined in the reference report (a)

(f) Total Plant Investment Cost w/AFUDC (AEP rate of 6.41%, site rating \$/kW)

(g) Levelized cost of energy based on capacity factors shown in table

(h) Dollars are in 2023 informed by ApCo RFP

(i) Dollars are in 2023 informed by Bloomberg New Energy Finance's (BNEF) 2H 2020 U.S. Renewable Energy Market Outlook

For this analysis, the Company adopted "learning curve" forecasts published by the National Renewable Energy Laboratory (NREL) in its 2021 Annual Technology Baseline (ATB)<sup>7</sup> for capital costs for all resource types and for wind and solar O&M costs. The notion behind learning curve forecasts is that over time real costs will come down due to economies of scale, technology improvements, manufacturing improvements, and other factors. NREL forecasts that overnight installed capital costs will decline over time for all of these resource options. These effects of the cost reduction rates as a percentage of 2019 price are illustrated in Figure 4 and applied to the technology installed cost forecasts used in the Plexos<sup>®</sup> modeling. For a table of the overnight installed cost per technology in 2019 real dollar terms with the NREL learning rates, please see Appendix E: Overnight Installed Cost of Technologies in 2019 Real Dollars (\$/kW) The Company then applied a forecasted inflation rate to these real dollar

amounts to convert them to the nominal dollars over the 30 year forecast period, for the purposes of determining the actual future installation costs for each resource type.



#### 4.1 Power Purchase Agreement (PPA) Options

Consistent with the requirements in Section 56-585.5.D.4, the Plan reflects, in the aggregate and over its duration, a 35% PPA – 65% ownership split for the Virginia jurisdictional share of new Solar and Wind resources. The modeling attempted to maintain approximately this ownership to PPA ratio over a period of years, not in each individual year. In practice, the amount of PPA versus owned wind and solar added in any one year will be the result of competitive solicitations subject to regulatory approval.

PPA resource costs were informed from the results of the RFPs APCo issued in 2021. The PPA bids in response to those RFPs were on average 8% less expensive than owned asset bids. This difference was used as an initial proxy for this analysis to determine the levelized PPA costs relative to levelized owned costs for solar, wind and hybrid solar resources and are not reflective of long-term pricing differences including tax credit effects. This does not necessarily reflect the results of future RFPs and does not include other factors both explicit and implicit regarding ownership benefits. Actual owned and PPA resource costs will be identified in future solicitations for specific resources and may depend on multiple factors including federal tax policy.

## 4.2 Baseload & Peaking Resource Options

For Baseload resources, the Company modeled two natural gas combined cycle configurations shown in Table 11, the multi-shaft 1,100 MW resource and the single shaft, 430 MW resource. For Peaking resource options, the Company modeled the three resources including a 240 MW combustion turbine (CT), a 105 MW aero-derivative engine (AD) and a 20 MW Reciprocating Internal Combustion Engine (RICE).

## 4.3 Intermittent and Renewable Resource Options

Various intermittent and renewable generating technologies were available for selection by the model, with constraints for each year equivalent to the requirements of the VCEA for Scenarios 1-4. Development of these resources continue to grow as advancements in both solar photovoltaics and wind turbine manufacturing have reduced both installed and ongoing costs.

Renewable energy resources, because of their intermittent nature, typically provide more energy value than capacity value, and PJM continues to refine its guidance on the Effective Load Carrying Capability (ELCC) for intermittent resources. In general, under the current PJM draft guidance, as intermittent resources continue to increase in relation to the total of all PJM resources, the planning capacity credit of new renewable resources added to the system will decline. The Company referred to PJM's July 2021 ELCC Report<sup>8</sup> to inform the plan for intermittent resource contributions to the Company's capacity obligations. A summary chart of the ELCC levels assumed in this plan is shown in Figure 5. PJM's July 2021 ELCC Report did not produce projections beyond 2031. For the Company's analysis, the 2031 ELCC values were held constant until the end of the planning horizon.

<sup>&</sup>lt;sup>8</sup> https://www.pjm.com/-/media/planning/res-adeq/elcc/elcc-report-for-july-2021-results.ashx



## 4.3.1 Solar

Large-scale solar resources were available starting in 2025. The Company relied on information from the RFP of owned assets for APCo to model prospective owned solar costs for assets to be placed in service in early 2025. Tier 1 build cost was based upon the top bid in the RFP and Tier 2 based upon the average of bids excluding winning bid. Figure 6 illustrates the forecasted Utility Tier 1, Tier 2, and PPA Solar levelized cost of energy (LCOE) through time. The costs included in these estimates include all costs that would be expected, including a return on rate base, depreciation, land leases, operations and maintenance expense, property taxes, insurance, asset retirement costs, and normalization of the solar investment tax credit (ITC). The property tax and land lease assumptions are tailored to this analysis based on the Company's experience with tax rates in its service territory, and from evaluating specific resources located in both Virginia and in other PJM states.

#### FIGURE 6: SOLAR RESOURCE LCOE



## 4.3.2 Large-Scale Wind

For Portfolios 1-5, the Company assumed a 35% capacity factor for the new wind resource. Additionally, the Company prepared Portfolio 6 in which the wind capacity factors were assumed to be equivalent to historical 30.4% capacity factor of APCo's existing wind resources. The build cost was based on Bloomberg New Energy Finance's (BNEF) 2H 2020 U.S. Renewable Energy Market Outlook. Figure 7 illustrates the forecasted Utility and PPA Wind LCOEs. The increase from 2025 to 2026 in this figure is due to the expiration of the currently available wind Federal production tax credits. Increases after 2026 are inflation driven.



#### 4.3.3 Energy Storage

The stand-alone Energy Storage resource modeled in this plan is a Lithium-ion storage technology and has a nameplate rating of 50 MW/200 MWh, with a round trip efficiency of Page **26** of **68** 

82.3%. The modeling of Energy Storage utilized the values shown in Table 12, with the nameplate rating adjusted from 50 MW to 25 MW to align with the storage levels in the Commission's order regarding the interim requirements. A Storage PPA option was not modeled as separate resource from an owned storage resource, under the assumption that the cost of the solar resource included in the model represents a blend of owned and PPA. Both PPA and owned storage resources will be considered in future RFPs.

#### 4.3.4 Hybrid Solar / Storage

Hybrid Solar systems include a Solar PV plant with a 4 hour closed loop battery storage system associated with it. For this analysis, a 150 MW<sub>ac</sub> solar plant was modeled, coupled with a 50 MW (200 MWh) Li-Ion Battery Energy Storage system.

#### 4.3.5 Renewable Energy Certificates (RECs)

The Company included RECs as a RPS energy compliance option in the Plexos® modeling, allowing the model to choose whether to build physical resources or purchase RECs based on economics. In this analysis a 150 MW block of utility solar with an assumed ~350 GWh set the size for a single REC addition in the model. The first year when RECs could be added was assumed to be 2025. A third party forecast provided by S&P Global<sup>9</sup>, as shown in Figure 8, was used for the base REC price forecast in all portfolios. The number of RECs selected by the model in each portfolio is presented in Appendix B. Higher and lower priced REC sensitivity cases were also prepared.

A lower priced REC sensitivity case was also prepared, based on an assumption that RECs would be available of 50% of the cost of the base REC forecast curve. That price curve is also shown in Figure 8. The results of that sensitivity analysis are presented in Section 5.

<sup>&</sup>lt;sup>9</sup> S&P Global, SPGlobalMI\_RECForecast\_2021Q2\_06302031, available by subscription.

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## 4.3.6 Annual and Cumulative Resource Limits

For each portfolio, annual and cumulative intermittent and renewable resource limits were determined based on simultaneous consideration of multiple regulatory requirements. All six portfolios are VCEA-compliant. Different limits were necessarily applied to each portfolio based on the unique assumptions of each portfolio, such as the assumed retirement date of Amos and Mountaineer, as well as whether gas-fired options were available. Table 12 contains a summary of the limits for the wind, solar, storage, and REC options included in the modeling for each portfolio.

New Resource Assumptions											
Resource Type	First Year Available	Life	Portfolio 1,2,6	Portfolio 3 & 4	Portfolio 5	Individual Technology Total	Cumulative Technology Total				
Solar PPA		35 years	150 MW/yr	300 MW/yr	150 MW/yr	900 MW					
Solar Utility T1	1/1/2025	35 years	300 MW/yr	600 MW/yr	300 MW/yr	2,100 MW	3,150 MW				
Solar Utility T2	1/1/2025	35 years	150 MW/yr	300 MW/yr	150 MW/yr						
Solar Hybrid		35 years	15	0 MW Block 450 M	W/yr	1,050 MW					
Wind PPA Limits	1/1/2026	30 years	100 MW/yr	300 MW/yr	100 MW/yr	350 MW Total	950 M/M				
Wind Owned Limits	1/1/2026	30 years	200 MW/yr	600 MW/yr	00 MW/yr -		55614177				
Wind Owned Limits	1/1/2026	30 years		2026 1, 2028 2, 2030 3, 2032 4, 2032 4,		5,000 MW Total	5,350 MW				
Renewable Energy Certificates	1/1/2025	5 years		20 Blocks/yr		~7,000 GWh	~7,000 GWh				
Stand Alone Storage	1/1/2025	10 years	2,500	MW/yr		12,500 MW	12,500 MW				
NG 240 MW Combustion Turbine	1/1/2026	30 years	P1 unlimited P2 N/A	P3 unlimited P4 N/A	P3 unlimited N/A P4 N/A		Unlimited				
NG 1,100 MW Combined Cycle	1/1/2026	30 years	P1 unlimited P2 N/A	P3 unlimited P4 N/A	N/A	Unlimited	Unlimited				

#### **TABLE 12: NEW RESOURCE LIMITATIONS**

The primary regulatory constraints considered in setting the annual and cumulative resource limits were 1) PJM minimum capacity requirements; 2) VCEA annual Virginiajurisdictional renewable energy targets; 3) VCEA 35% wind and solar PPA requirements; and 4) near term (prior to 2030) VCEA wind, solar, and storage new resource requirements. All of these constraints must be applied simultaneously. Compliance with the minimum obligations under any one of these requirements, such as the VCEA annual energy targets, could and did lead to substantial over-compliance with other requirements, such as PJM's minimum capacity requirement, in some portfolios. In addition, to the extent possible, the Company spread out resource additions gradually over time, rather than all at once, to help mitigate near-term rate increases that can result from adding required resources. This can result in the addition of resources earlier than the year in which one of these regulatory obligations requires them. Finally, there are practical limits regarding the absolute levels of cost-effective renewable capacity that are available in Virginia and more broadly across PJM.

The timing of the assumed retirement of Amos and Mountaineer also impacted the resource limitations. This resulted in higher annual wind and solar limits in Portfolios 3 and 4 than in Portfolios 1 and 2 in order to allow more resources to be constructed during the period prior to Amos and Mountaineer retiring in 2028. This constraint also resulted in a high annual limit for storage resources in all portfolios in order to allow enough storage to be selected for its capacity to replace a substantial share of the capacity that would be lost when Amos and

Mountaineer retire. This also drives a high cumulative lifetime storage limit, if storage is selected again at the end of its 10-year useful life, if the model deemed it to be the most economic option available.

Lastly, the near-term availability of Virginia domiciled wind and solar resources was considered. Based on the numbers of bids received of each resource type in the two RFP's issued in 2021, solar resources are expected to be more widely available than wind, and the quantity of wind MW available in Virginia could be quite limited. As a result, higher limits were allowed for solar than wind.

By choosing these limits for the various scenarios, the Company is not expressing an opinion regarding whether these levels of resources are in fact available, or whether adding that level of a given resource is desired. The assumption that 2,500 MW of storage could be added to a Company the size of APCo in any one year, or even cumulatively prior to 2030, is particularly aggressive. These limits are simply an attempt to give the model enough available capacity and energy options to meet the necessary PJM and VCEA requirements in all years of the analysis from a portfolio of all of the available resource types under each scenario.

#### 4.4 Demand-Side Resource Options

#### 4.4.1 Energy Efficiency

The Company included both Residential and Commercial/Industrial energy efficiency bundles as demand-side resource options to consider. Table 13 shows the Residential Bundles cost and potential by year, and Table 14 shows the Commercial/Industrial Bundles included in the model.

Bundle	Installed Cost (\$/kWh)	Yearly Potential Savings (MWh) 2022-2026	Yearly Potential Savings (MWh) 2027-2031	Yearly Potential Savings (MWh) 2032-2036	Yearly Potential Savings (MWh) 2037-2041	Bundle Life					
Thermal Shell - AP	\$0.21	6,621	2,794	3,120	2,824	10					
Thermal Shell - HAP	\$0.31	20,514	54	0	0	10					
Heating/Cooling - AP	\$0.68	49,323	7,365	0	0	18					
Heating/Cooling - HAP	\$0.96	7,576	0	0	0	18					
Water Heating - AP	\$0.24	34,877	11,711	13,000	6,265	14					
Water Heating - HAP	\$0.35	82,827	10,498	10,391	0	14					
Appliances - AP	\$0.22	33,242	3,018	3,133	2,460	13					
Appliances - HAP	\$0.31	7,449	0	0	0	13					
Lighting - AP	\$0.08	1,669	0	0	0	31					
Lighting - HAP	\$0.13	1,103	0	0	0	30					
Behavioral Programs	\$0.04	23,137	0	0	0	2					

TABLE 13: RESIDENTIAL EE BUNDLES

Bundle	Installed Cost (\$/kWh)	Yearly Potential Savings (MWh) 2022-2026	Yearly Potential Savings (MWh) 2027-2031	Yearly Potential Savings (MWh) 2032-2036	Yearly Potential Savings (MWh) 2037-2041	Bundle Life
Heat Pump - AP	\$9.00	2,985	0	0	0	15
Heat Pump - HAP	\$13.49	199	0	0	0	15
HVAC Equipment - AP	\$0.16	2,718	0	0	0	15
HVAC Equipment - HAP	\$0.24	1,624	0	0	0	15
Indoor Screw-In Lighting - AP	\$0.01	2,345	0	0	0	6
Indoor Screw-In Lighting - HAP	\$0.02	995	0	0	0	6
Indoor HID/Fluor. Lighting - AP	\$0.11	15,646	1,409	0	0	14
Indoor HID/Fluor. Lighting - HAP	\$0.16	1,738	0	0	0	14
Outdoor Lighting - AP	\$0.38	3,946	567	0	0	15
Outdoor Lighting - HAP	\$0.57	4,384	0	0	0	15

#### TABLE 14: COMMERCIAL EE BUNDLES

## 4.4.2 Demand Response

The Company included one Demand Response resource option to be considered, which is based on a Residential Bring-Your-Own-Thermostat program. Table 15 shows the characteristics of this resource.

Sector	Participants	Demand Savings (kW)	Energy Savings (kWh)	Enrollment Cost	Annual Cost	Total First Year Cost	Service Life (Years)
Residential	2,500	3,375	70,000	\$165,000	\$950,500	\$1,115,500	7

TABLE 15: APCO DEMAND RESPONSE

## 4.4.3 Volt VAR Optimization

The Company included Volt VAR Optimization (VVO), which represents a form of voltage control that allows the grid to operate more efficiently as a resource option. VVO sensors and intelligent controllers monitor load flow characteristics and direct controls on capacitor and voltage regulating equipment in order to optimize power factor and voltage levels. Power factor is the ratio of real or active power (MW) to apparent power (MVA), and is a characteristic of electric power flow that is controlled to optimize power flow on an electric network. Power factor optimization also improves energy efficiency by reducing losses on the system. VVO enables Conservation Voltage Reduction (CVR) on a utility's system. CVR is a process by which the utility systematically reduces voltages in its distribution network, resulting in a proportional reduction of load on the network. Voltage optimization can allow a reduction of system voltage that still maintains minimum levels needed by customers, thereby allowing customers to use less energy without any changes in behavior or appliance efficiencies.

Although there are no "embedded" incremental VVO load reduction impacts implicit in the load forecast, VVO has been modeled as a unique EE resource. Table 16 below shows the resource characteristics of the VVO resources made available to the model in all portfolios.

Tranche	No. of Circuits	Capital Investment	Annual O&M	Demand Reduction (kW)	Energy Reduction (MWh)
1	36	\$12,600,000	\$378,000	11,172	45,996
2	36	\$12,600,000	\$378,000	9,639	39,684
3	36	\$12,600,000	\$378,000	8,799	36,227
4	36	\$12,600,000	\$378,000	8,298	34,163
5	36	\$12,600,000	\$378,000	7,826	32,222
6	36	\$12,600,000	\$378,000	7,458	30,705
7	36	\$12,600,000	\$378,000	7,126	29,340
8	36	\$12,600,000	\$378,000	6,884	28,343
9	- 36	\$12,600,000	\$378,000	6,629	27,292
10	36	\$12,600,000	\$378,000	6,435	26,493
11	36	\$12,600,000	\$378,000	6,186	25,470
12	36	\$12,600,000	\$378,000	5,909	24,329
13	36	\$12,600,000	\$378,000	5,849	24,081
14	36	\$12,600,000	\$378,000	5,473	22,532

TABLE 16: VVO RESOURCES

## 4.4.4 Distributed Generation

The Company included both the capacity and energy associated with Distributed Generation in all six portfolios. Figure 9 shows the cumulative nameplate DG MW forecasted to be installed. For capacity planning purposes, the Company referred to the PJM ELCC report discussed in Section 4.3, beginning at 38% of the nameplate value in 2023. The associated energy produced from this customer-owned DG was assumed to not be part of the Company's achievement of the VCEA RPS requirement.





# 5.0VCEA Compliance Plan Portfolios and Results

## 5.1 Modeled Portfolios

As previously stated, the Company modeled six VCEA compliant portfolios in order to evaluate compliance strategies under a wide range of assumptions. Modeling was performed under fundamental forecasts based on two different  $CO_2$  tax assumptions, as described in Section 3. Portfolios were also modeled to evaluate how resources needed for VCEA compliance would be impacted by the availability of the Amos and Mountaineer resources and natural gas resources. Table 17 summarizes the portfolio variations for each scenario.

	Portfolios									
	1	2		3	4		5	6		
Description	RGGI Only CO2 2040 AM & MNTR Ret. Gas Options Available	RGGI to \$15 CO2 2040 AM & MNTR Ret. No Gas Option Available		RGGI Only CO2 2028 AM & MNTR Ret. Gas Options Available	RGGI to \$15 CO2 2028 AM & MNTR Ret. No Gas Option Available		RGGI to \$15 CO2 2040 AM & MNTR Ret. No Gas Option Available Higher Wind Limits	RGGI to \$15 CO2 2040 AM & MNTR Ret. No Gas Option Available Actual Wind Cap Factors		
Coal retires 2040	•	•					•	•		
Coal retires 2028				•	•					
RGGI CO2 Commodity Forecast	•			•						
RGGI to \$15 Federal CO2 Commodity Forecast		•			•		•	•		
Include Gas resource options	•			•						
RFP REC prices	-	<u> </u>		-	-		-	-		
S&P REC prices	•	•		•	•		•	•		
PJM ELCC	•	•		•	•		•	•		
Dynamic ELCC		•		-	•		-	-		
NREL Wind Cap Factors	•	•		•	•		•	-		
Existing Wind Cap Factors	-	•		•	-		-	•		
Higher Wind Limits	-	-		-	•		•	-		

TABLE 17: PORTFOLIO ASSUMPTIONS MATRIX

## 5.2 REC Price Sensitivities

The Company performed a lower cost sensitivity on the REC price using Plexos®. The sensitivity analysis reflected a 50% lower price than the base REC forecast. That sensitivity price curve was presented in Figure 8. The VCEA Plan (Portfolio 2) assumptions were used with the exception of a lower REC price forecast. The 30-year Net Present Value of Revenue Requirements for the lower REC sensitivity build plan was projected to be lower by 0.44% than Portfolio 2. Lowering the cost of RECs by 50% resulted in only two changes to the VCEA Plan. The changes were that the model selected RECs in 2036 which allowed 300 MW of solar to be delayed from 2035 to 2037, and that 95 MW of solar hybrid facilities previously added in 2038 were delayed until 2041 and reduced to 69 MW. By the end of the forecast horizon, the total amount of renewables (solar and wind) selected to be built under the lower REC price sensitivity case was unchanged from the VCEA Plan.

In addition to a lower priced REC sensitivity case, the Company evaluated higher REC prices. Based on the fact that RECs were not economically selected by the model in any of the six portfolios results displayed in the REC purchase table in Appendix B until 2036 or later, the Company did not use Plexos® to perform a higher priced REC sensitivity. That result would indicate that if RECs were not selected based on economics compared to physical resources at the base REC price, they would also not be selected at any higher REC price.

#### 5.3 Portfolio Analysis and Economic Analysis Summary

Table 18 summarizes the net present value of the expected revenue requirement (NPVRR) for each compliant portfolio computed over 30 years. Total costs of each portfolio reflect a combination of fixed and variable costs and energy revenues from the Plexos<sup>®</sup> model, and certain other fixed costs and revenues, including capacity revenues and REC sales revenues calculated outside of Plexos<sup>®</sup>. The top half of the table displays each scenario's NPVRR broken down over four time periods which help to display the impacts of the assumed timing of the coal plant retirements. The 2028-2039 period is the period which will be most impacted by retirement of the coal plants in 2028 rather than their currently planned 2040 retirement dates.

The bottom half of the table under Column 3 displays the incremental cost of Portfolio 3 in which the coal plants retire in 2028 over Portfolio 1 in which the coal plants retire in 2040 assuming gas-fired resources are available to replace the plants. Column 4 in the bottom half of the table displays the incremental cost of Portfolio 4 in which the coal plants retire in 2028 over

Portfolio 2 in which the coal plants retire in 2040 assuming gas-fired resources are not available to replace the plants.

TABLE 18: NPV OF PORTFOLIO REVENUE REQUIREMENTS										
Column	1	2	3	4	5	6				
	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	Portfolio 6				
Customer Revenue Requirements	2040 AM+MNTR Ret. RGGI CO2 Gas Option	2040 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option	2028 AM+MNTR Ret. RGGI CO2 Gas Option	2028 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option	2040 AM+MNTR Ret, RGGI-515 CO2 No Gas Option High Wind Limits	2040 AM+MNTR Ret. RGGI-S1S CO2 No Gas Option Historical Wind CF				
Net Present Value \$M										
Utility NPV 2021-2027	\$4,837	\$4,839	\$4,823	\$5,018	\$4,894	\$4,850				
Utility NPV 2028-2039	\$7,047	\$8,132	\$8,615	\$10,643	\$8,041	\$8,218				
Utility NPV 2040-2051	\$5,242	\$6,078	\$4,869	\$5,878	\$5,980	\$6,435				
NPV of End Effects beyond 2051	\$4,494	\$5,662	\$4,556	\$5,706	\$5,276	\$5,762				
TOTAL Utility Cost, Net Present Value	\$21,620	\$24,710	\$22,863	\$27,245	\$24,191	\$25,266				

Incremental Cost/ (Savings) of Early Coal Retirement									
	Portfolio 3-Portfolio 1	Portfolio 4-Portfolio 2							
	2028-2040	2028-2040 2028-2040							
	RGGI CO2	RGGI-\$15 CO2							
Customer Revenue Requirements	Gas Option	No Gas Option							
Net Present Value \$M	Incremental C	ost/ (Savings)							
Utility NPV 2021-2027	(\$14)	\$179							
Utility NPV 2028-2039	\$1,568	\$2,511							
Utility NPV 2040-2051	(\$373)	(\$199)							
NPV of End Effects beyond 2051	\$62	\$45							
TOTAL Utility Cost, Net Present Value	\$1,242	\$2,535							

## 5.4 Economic Analysis Conclusions

High-level conclusions from Table 18 include:

- The Scenarios that retired Amos and Mountaineer in 2040 would be less costly for customers than the scenarios (Portfolio 3 and 4) that retired them in 2028;
- Allowing gas-fired resources to replace a portion of the capacity of Amos and Mountaineer when they retire, whenever that is, is likely to be less costly than replacing them with 100% renewable resources. This does not reflect that additional technologies, particularly non-emitting technologies such as small modular nuclear reactors, hydrogen, carbon capture, advanced battery concepts, and renewables, will be available in the future, particularly when considering a 2040 retirement date for these units; and
- Portfolio 5 with 1,000 MW more near term wind has a lower NPVRR than the
  minimally compliant Portfolio 2 VCEA Plan, which indicates that the Company
  should seek to acquire more wind while PTCs are available than the minimum
  required for VCEA compliance. In addition, Portfolio 6, which was a lower wind
  capacity factor sensitivity case, indicates that the results are not very sensitive to

wind capacity factor. The capacity factor in that scenario was assumed to be 30.4% instead of the base case assumed 35%. Comparing the NPVRR to Portfolio 2, which is the other comparable "2040 retirement, no gas" case, reveals that the results are only 2.2% more expensive when viewed over 30 years.

## 5.5 Capital Investment Requirements

The six portfolios resulted in a wide range of potential capital investment in resources necessary to maintain both the required amount of capacity and meet the VCEA renewable energy targets. Total expected capital investment for all resources is summarized in Table 19.

	Total 2025-2028 Capital Investment (\$ Millions)				
	Total All Total Owned Total Resources Resources Resou				
Portfolio 1 2040 Ret With Gas	\$628	\$317	\$311		
Portfolio 2 2040 Ret No Gas	\$628	\$317	\$311		
Portfolio 3 2028 Ret With Gas	\$4,230	\$3,918	\$311		
Portfolio 4 2028 Ret No Gas	\$5,746	\$4,619	\$1,127		
Portfolio 5 2040 Ret No Gas High Wind	\$2,039	\$171	\$1,868		
Portfolio 6 2040 Ret No Gas Hist Wind CF	\$700	\$389	\$311		

TABLE 19: PORTFOLIO NEW RESOURCE CAPITAL INVESTMENT REQUIREMENTS

	Total 30 year Capital Investment (\$ Million)				
	Total All Total Owned Total				
	Resources	Resources	Resources		
Portfolio 1 2040 Ret With Gas	\$10,137	\$8,057	\$2,080		
Portfolio 2 2040 Ret No Gas	\$12,841	\$10,771	\$2,071		
Portfolio 3 2028 Ret With Gas	\$9,946	\$7,652	\$2,294		
Portfolio 4 2028 Ret No Gas	\$16,712	\$13,945	\$2,767		
Portfolio 5 2040 Ret No Gas High Wind	\$16,157	\$10,367	\$5,790		
Portfolio 6 2040 Ret No Gas Hist Wind CF	\$13,178	\$10,654	\$2,524		

The analysis summarized in Table 19 shows that retiring Amos and Mountaineer in 2028 would result in \$4-6 billion of investment between the Company and PPA providers between 2025 and 2028 to replace those plants. This level of investment is unprecedented, and is quite large relative to the overall size of APCo in a relatively short time frame, leading to large rate

increases in a short period of time. The VCEA Plan (Portfolio 2) would delay the required capital investment in replacing Amos and Mountaineer, with very modest capital expense requirements in the 2025-2028 period for the resources required by the VCEA. Over the full 30-year period, the VCEA Plan would require the third highest amount of capital investment of the six portfolios. This is largely due to the high cost of storage which would be required in the event gas options are not available to replace the retiring coal plants in 2040.

The underlying construction costs of each resource type over the period on a real dollar cost per KW basis are presented in Appendix E. Based on projections by NREL that were adopted by the Company in this analysis and reflected in Appendix E, costs are expected to decline in real dollars terms over the near term on most resource types for several years before beginning to increase again towards the end of the 30-year period.

#### 5.6 VCEA Plan Resource Additions

Figure 10 and Figure 11 illustrate the timing of new renewable and storage resources included in the VCEA Plan to meet the requirements. Additions of new renewable and intermittent resources to the fleet begin in 2021 and continue periodically through the planning period. Storage resources, are added beginning in 2025 and include gradual increases until meeting the 400 MW VCEA RPS minimum. Further details of the resource additions by resource type for all portfolios are presented in Appendix B.

#### FIGURE 10: VCEA COMPLIANT WIND AND SOLAR ADDITIONS



#### FIGURE 11 VCEA COMPLIANT STORAGE ADDITIONS



Storage VCEA Stag Brinne

Table 20 lists the cumulative Energy Efficiency additions in the VCEA plan through 2025 to meet the VCEA requirements.

	Port	folios	Portfolio 2										
	Descr	iptions	2040 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option										
		VCEA EE			Surplus/								
		Trgt Svgs	RES	СОМ	(Deficit)								
	Tgt %	GWh	GWh	GWh	GWh								
2022	0.5%	72	48	24	(0)								
2023	1.0%	145	99	47	1								
2024	1.5%	217	144	73	(0)								
2025	2.0%	289	197	93	1								

#### TABLE 20: VCEA PLAN ENERGY EFFICIENCY ADDITIONS

## 5.7 VCEA Plan Compliance Plan Summary

The composition of APCo's generation fleet, including existing and new resources modeled in the VCEA Plan (Portfolio 2) to meet the RPS requirements is illustrated in terms of nameplate capacity MW in Figure 12. APCo's capacity position versus its PJM UCAP capacity obligation is shown in tabular format in Table 21. In response to requirement (5) in the Order on the 2020 Filing, the Company, a multi-jurisdictional utility, is meeting its PJM capacity obligations through the use of all resource types, including fossil resources, where appropriate.



#### FIGURE 12: APCO VCEA PLAN 2021-2050 CAPACITY

TABLE 21. VCEATEAN (FORTFOLIO 2) RESOURCE ADDITIONS AND CAPACITY FOSTION
--

0602	201	117	0	•	1,200	312	8	234	636	165	83	\$	SE	35	2,725	2,480	717	102	01	8	101	3,751	(IET,S)	8
6502	40S	117	0	0	1,200	312	8	234	114	107	윻	97	22	35	8	364	137	130	6	47	8	1,491	185	1,675
2038	507	117	0	0	1,200	312	06	234	111	ୟ	90 <del>7</del>	07	350	S.	8	364	37	æ	8	88	32	1,303	186	1,489
(602	202	117	0	0	006	<b>NEZ</b>	8	234	0	0	Ş	40	SE	35	09	364	•		1	ୟ	88	1,146	186	1,332
960Z	202	117	0	0	806	VEZ	<b>00</b> 6	234	0	0	ŝ	¢	9 <u>5</u>	35	<b>6</b>	364	0	•	9	36	83	1,129	207	1,337
2035	<i>1</i> 95	117	0	0	80	951	750	195	0	0	ĝ	<b>Q</b>	SE	35	ន្ម	197	0	0	4	9	ĥ	<b>169</b>	216	386 286
MOX	507	117	0	0	300	8/	80	321	0	0	8 <del>9</del>	0≯	350	35	951	137	0	0	S	0	11	646	216	098
EEOZ	507	211	0	0	300	81	450	117	0	0	8	017	052	35	150	137	0	0	6	0	76	505	214	518
2032	207	117	0	0	5	69	300	78	0	0	8	40	DSE	35	051	137	0	0	8	0	74	527	212	6EL
1502	40S	117	0	a	150	<b>6</b> 9	051	R	0	0	훻	07	9SE	35	251	137	0	0	9	0	2	488	802 208	<b>3</b> 8
2030	205	117	0	0	0	0	•	0	0	0	400	\$	350	35	22	ត	0	0	EI	0	67	សេ	207	495
6202	507	117	0	0	0	0	0	0	0	0	<b>8</b> 4	<b>1</b> 7	052	87	52	17	•	0	16	0	5	281	302	98†
2028	205	117	0	0	0	0	0	0	0	0	8	77	8	22	25	81	0	0	88	0	52	228	195	493
2027	201	132	0	0	0	0	٥	0	0	0	200	24	8	12	25	81	0	0	ц	0	46	303	<b>1</b> 94	498
2026	507	148	0	0	0	0	0	0	0	0	82	36	8	13	25	81	0	0	75	0	¢	319	204	523
202	605	163	0	0	0	٥	0	0	0	0	•	0	0	0	0	•	0	0	57	0	35	255	Ħ	376
2024	418	135	0	0	0	0	0	0	0	0	•	0	0	0	0	•	0	0	44	0	0	179	133	æ
ELOZ	65	35	0	0	0	0	0	0	0	0	•	0	0	0	0	0	0	0	8	0	0	8	198	262
2022	5	8	0	0	0	-	•	0	0	0	•	0	0	0	0	0	0	0	14	0	0	22	ଷ୍ୟ	312
Portfolio 2	Resources under Development (NmPlt)	Resources under Dovelopment (Firm)	New Nat. Gas-CC	New Nat. Gas-CT	New Utility Solar (NmPlt)	New Utility Solar (Firm)	New PPA Solar (NmPlt)	New PPA Solar (Firm)	New Paired Solar (NmPit)	pliant New Paired Solar (Firm)	\$15 New Wind (Nameplate)	New Wind (Firm)	New Wind PPA (NmPit)	New Wind PPA (Firm)	Storage Capacity (NmPit)	Storage Capacity (Firm)	Storage Paired (NmPlt)	Storage Paired (Firm)	New EE	New VVO	New DG	tions (Firm & Degraded)	eserves (NMV) without new additions	eserves (MW) with new additions
	vcea compl wRGGI Spi cO2													Total Addit	Capadity Re	Capacity Re								

The transition to more intermittent and renewable resources will impact the Company's anticipated energy output from its fleet. The Company will maintain appropriate capacity
reserves, however, energy delivered to APCo's non-Virginia customers is expected to be purchased from the market and from fossil resources as shown in Figure 13.



# FIGURE 13: VCEA PLAN SOURCES OF ENERGY – TOTAL COMPANY

### 5.8 Carbon Dioxide Reduction Requirements

The Company's six modeled portfolios reflect a forecasted reduction of CO<sub>2</sub> emissions. Figure 14 illustrates the 2022-2036 reduction of CO<sub>2</sub> from associated with the modeled portfolios. Portfolios 1 and 3 reflect a RGGI-only carbon view, and Portfolios 2, 4, 5 and 6 reflect a RGGI plus \$15/ton national carbon burden and show a quicker reduction of CO<sub>2</sub>.

APCo's Carbon Dioxide Emissions

#### FIGURE 14: CARBON DIOXIDE EMISSIONS - TOTAL COMPANY

# 6.0Rate Impacts

The Company prepared estimated rate impacts associated with the implementation of the VCEA under Portfolio 2. In order to estimate rate impacts, the Company assumed a consistent class allocation for the period 2022-2035, based on a 2020 test year. The class allocation methodology splits costs 85-15% between a 6-cp and an energy allocation methodology. The actual cost allocation methodology could vary from the Company's assumption in this proceeding.

# 6.1 VCEA Lifetime Revenue Requirement - Gross

The lifetime revenue requirement includes the costs of the renewables and storage, including financing costs. It is undiscounted, meaning that \$100 in 2050 is not distinguished from \$100 spent in 2021. This number is not particularly meaningful and can be misleading as it

does not include the value of the energy or capacity generated by these renewable, efficiency and storage resources. Table 22 shows the gross revenue requirement by year and by component.

.

[				371	583	216	756	£	963	484	585	633	443	324	350	374	459	598	819	991	497	665	947	013	590	5	693	50	086	063	561	480	
		Total \$00		7	ĘÌ	15,	36	ą	76,	35,	120,	120,	189,	260	287,	325,	346	385,	494	520,	561,	685	658,	645,	673,	717,	740,	784,	744	,067	829	872	
		rage FO&M			•	•			637	643	651	656	662	4,019	4,077	4,111	4,155	4,197	11,341	11,421	11,532	11,648	11,806	11,890	12,015	12,141	12,297	12,389	12,513	12,640	12,798	12,887	
	<b>.</b>	d FO&M Sto		,	•	•	-	11,637	11,834	24,056	24,517	24,840	37,847	38,442	39,135	52,824	53,600	67,962	69,105	006'69	85,062	86,251	102,346	103,579	105,071	121,834	123,925	141,006	142,964	161,068	163,736	165,508	
		0&M Wine							,	-	5,911	5,952	2,019	8,215	4,625	4,842	1,396	1,735	8,567	5,338	5,789	2,845	0,214	0,699	8,110	8,831	6,717	7,277	5,155	6,034	4,399	12,362	
		ry Is  Solar F							75	55	8/	33	33 1	33 1	33 2	33 2	33 3	33 3	33 3	33 4	33 4	3	3 6	33 6	3 6	33 6	33 7	3 7	33 8	33 8	33 9	33 10	
		ntercompar IEC Transfer		,	•	•	•		2,97	2,97	2'2	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	1,8(	
					9,045	10,221	12,002	14,666	16,446							-	-					-								<b>—</b>			
		e Generic wnership) EE				•	•		6,913	6,913	6,913	6,913	6,913	41,384	41,384	41,384	41,384	41,384	103,892	103,892	103,892	103,892	103,892	69,420	69,420	69,420	69,420	69,420	•	•		•	
	•	Storage (PPA+O	-					84	184	242	44	344	56	556	556	391	391	545	545	545	562	962	338	338	138	576	576	593	<b>193</b>	160	160	160	
	Wind	Ownership Seneric	į					13,7	13,7	36,8	36,5	36,8	60,5	509	509	848	84,5	109,2	109.	109,5	134,5	134,5	159,8	159,8	3,921	185,6	185,6	211,8	211,6	238,4	238,4	238,4	
		Solar PPA			•	•	4,861	4,869	4,882	4,872	11,081	11,058	23,446	36,077	42,505	42,302	42,260	42,284	61,684	68,238	68,085	74,399	81,058	100,094	107,110	107,412	107,185	106,834	113,522	113,209	127,775	147,341	
	lar	wnership 15 eneric (0		,		•		•	•	•	13,728	13,728	27,422	41,116	54,844	54,844	68,652	68,652	82,471	96,302	96,302	110,098	123,894	123,894	137,691	137,691	151,499	151,499	165,306	165,306	179,114	192,922	
	8	<u>ë 5</u> x		987	1,309	1,303	1,296	1,290	1,283	1,277	1,270	1,264	1,258	1,251	1,245	1,239	1,233	1,227	1,220	1,214	1,208	1,202	1,196	1,190	•	•	,	•	•	•	•	•	
			_	1,384 5	2,783 \$	2,798 \$	2,815 \$	2,833 \$	2,852 \$	2,873 \$	2,895 \$	2,918 \$	2,943 \$	2,969 \$	2,996 \$	3,026 \$	3,057 \$	3,090 \$	1,550 \$	-  \$	\$ •	<u>ہ</u>	•	- \$	\$ •	-  \$	; ;	•	-   \$	•	-  \$	-   \$	
		5 QF5			52	94	8	85	50	36	.42	38	23	60	.95	16.	78	64	50	37	24	10	40.	94	81	68	55	43	39	27	15	503	
		Solar Ownershit			4	8	~	~	8		ŝ	8	~	~	1	-	-	7	-	7	-		^	9	9	9	9	9	9	و ا	9	9	
		olar Iwnership 1		.	•		14,892	14,579	14,506	14,197	13,655	13,821	13,752	13,683	13,384	13,317	13,250	12,957	12,892	12,602	12,539	12,254	12,193	11,911	11,851	11,574	11,516	11,242	11,186	10,916	10,861	10,595	
		<u>v 0</u>	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	3E02	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	

TABLE 22: GROSS REVENUE REQUIREMENT

Revenue Requirement By Year - No Offsets (\$000)

#### Attachment 1

# 6.2 Rate Impacts

The Company has prepared the rate impacts of the VCEA relative to current rates. The increases are the result of multiple factors including the addition of resources required to meet the VCEA, assumptions about the start of a national carbon tax in 2028, the need to replace the Company's retiring coal and gas plants, and an assumption of general commodity price inflation. For illustrative purposes, the Company shows the estimated impact on a residential customer using 1,000 kWh, and SGS customer using 5,000 kWh, and a 1 MW customer with an 80% load factor in Table 23. Please note that the rate impacts show in table 23 are not solely the cost of VCEA RPS compliance. To show that impact the Company would need to model a non-RPS compliant plan and compare it to RPS compliant plans. The Company was instructed in the Commission's 2021 VCEA Order to no longer model non-RPS compliant plans. Appendix provides a schedule for the derivation of the identified cost impacts shown in Table 23.

				Estin	nated Mont	thly Rate In	npacts - Seli	ected Rate	Schedules						
	<b>1</b> 20	202	800	<u>2074</u>		<u> 300</u>	100	800	କ୍ଷା	<u> 080</u>					XSI XSI
Residential Customer ( 1000 kWh)	\$ 11/B \$	53.85	\$ 397.93 \$	\$ 80'9¥S	101.40 \$	882.51 \$	1,06A.34 \$	1,280.96 \$	1,485.08 \$	1,678.11 \$	1,853.74 \$	2,021.63	2,190.17 \$	\$ 01.106,5	2,545.56
Offsets	•	(136.51)	(280.49)	(426.87)	(280,82)	(152.81)	(332.86)	(1,116.13)	(1,313.58)	(1,504.77)	(1,677.81)	(1,841.55)	(2,004.91)	(2,172.98)	[2,348,49]
Net Impact	117.13	117.34	H7(I)	<b>31.011</b>	126.58	07.621	131.49	164.83	171.50	173.39	17.93	180.09	185.86	191.12	90761
% increase (cumulative)	ž	80	30	5%	*	11%	12%	41%	46%	48%	205	¥	59%	63%	<u></u>
SGS Customer [5,000 kWh]	\$ 496.13 \$	1046.34	\$ 1,626.12 \$	\$ 11.717 \$	2,871.51 \$	3,576.19 \$	4,307.93 \$	\$ 119.65 \$	6,001.03 \$	6,777.84 \$	1,494.62 \$	8,160.24 \$	8,840,89 \$	9,538.38 \$	10,268,61
Offsets	· ·	(16.93)	\$ (1,128.73) \$	(1,717.81) \$	(2,337.32) \$	(3,029.45) \$	(3,754.00) \$	(4,491.53) \$	(5,286.08) \$	(6,055.28) \$	(6,751.84) \$	(7,410.74) \$	(\$,068.15) \$	\$ (67,144,49)	6/ 05/6
Net Impact	\$ 496.13	\$ 497.01	\$ 497.40 \$	504.32 \$	534.20 \$	\$ 14.6.74 \$	5392 \$	688.11 \$	714.95 \$	722.56 \$	792.78 \$	\$ 15.94	тля \$	793.90 \$	817.82
K increase (cumulative)	25	26	Ľ	×.	<b>%</b>	10%	12%	39%	ХW	<b>\$</b> \$	% *	51%	265	809	
inc. i tatt ond jood footor	ά τη γοιτο C	INC ONC 20	170 E11 AC	and the feature	30E GOT 34 - C-1	D TO DA LO	EIE ON TE C	CIE 10 M C	5 OF 011 OT	טעב בכא עד קינ	111 100 AC C	000 DE 22 - Č 1	1 1 10C 100	171 TEN 01 C	
LLD, LIMW, OUR IUDE IACIUI	ה מויטוסי/וכל		ל מרדוכינוד ל		6 b7'Tao'ccc	4.24,000,51	¢ αι.#20(cuc	< HU.CHI,COD	(co,140.10 >	יל מרואגלרא	¢ 01:00:116	ו ל מימגלאנג	r č /r:roz/500'	. ¢ ₩	
Offsets	; · \$	\$ [68,889.11]	\$(141,548.54) \$	(215,421.91) \$(	23,111.39] \$(	379,908,94} \$[	470,771,48) \$(	263,261.47] \$	(62,901.79) \$(	(759,363.30) \${	946,715.06) \$	(1)\$ (3344.85) \$(1)	01,787,97} (12,187,110,	,06,603.68) \${	5 (M.17.01)
Net Impact	\$37,806.09	\$ 37,916.18	\$ 37,964.43 \$	38,83253 \$	42,579.86 \$	44,151.97 \$	45,053.28 \$	el,&1.57 \$	65,246.98 \$	66,201.66 \$	67,483.40 \$	69,580.38 \$	72,493.20 \$	75,147.26 \$	78,147.46
% increase (cumulative)	<b>%</b>	ж Ю	ж Ю	<b>%</b>	13%	17%	<b>%</b> 51	848	73%	75%	X62	84K	92%	39K	107%
1															
Total Net Annual Increases	0.0%	0.2%	0.1%	L7K	13%	73%	16%	29.2%	%S*	17%	16%	26%	35%	3.1%	3.4%

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# 7.0 RFP Process

The Company, by itself and through its support from AEPSC, has extensive RFP experience for the procurement of the resources required under the VCEA. AEPSC has previously performed RFPs in Virginia on behalf of APCo, and has also performed RFPs for AEP's other vertically-integrated utilities including KPCo, I&M, SWEPCO, PSO that have resulted in the procurement, or currently planned procurement, of thousands of megawatts of renewable resources. The Company has extensive experience analyzing purchase and sale agreements for both utility-owned and contracted renewables.

As reflected in Section 56.585.5, the Company is required to issue annual RFPs in order to meet the resource acquisition and RPS standards. The Company expects to procure materially all resources through this process, whether through acquisition or contracts for energy, capacity, and environmental attributes. The RFP process will be open to interested and qualified parties including, potentially, its own affiliates. The Company may also submit a "self-build" proposal.

In order to meet the 35% non-utility resource requirement, annual RFPs will allow for the procurement of both utility and non-utility owned resources. The Company does not expect to be able to meet the 35% PPA requirement included in Sections 56.585.5. D and 56.585.5. E with precision each year, as the most economic project sizes may not fit this metric in any given year. Nevertheless, it is the Company's intention to continue to adjust the RFP to target resources that will meet this requirement over time.

If the Company's competitive affiliates have the opportunity to participate in the RFP process, the Company will ensure that proper controls are in place to guarantee all bids are considered on an even basis. The Company and AEPSC have experience with monitoring bids from affiliates, and can ensure that all necessary protections to maintain an equitable and reasonable review process occur considering all bids on an equal basis.

Finally, the Company expects to issue its annual RFPs in the first quarter of each year.

## 8.0 Summary

The Company's 2021 VCEA plan includes a geographically varied portfolio of storage, solar and wind resources, both Company and third-party owned, as well as market REC purchases. In the petition accompanying this filing associated with this Plan, the Company is proposing a variety of resources to meet the mandates of the VCEA.

The Company has produced six portfolios for stakeholders' consideration that give an indication of the costs of compliance with the VCEA under various future resource assumptions.

Portfolio 2 is the Company's base plan, while Portfolio 5 is a modified Portfolio 2 that represents a lower cost option for customers, should the resources prove to be available. The Company's short-term Action Plan is as follows:

- o Issue RFPs early in 2022 in support of Portfolio 5.
- Seek competitive offers for energy storage in support of non-wires alternatives and the storage requirements in Subsection E.
- Utilize 100% of the Company's hydro resources for VCEA compliance beginning in 2025 through intra-Company transactions at market value.
- Monitor federal and state regulatory developments related to continued operation of the Amos and Mountaineer plants
- o Monitor developments in REC markets to evaluate RECs as a compliance option

# APPENDIX

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![](_page_82_Figure_1.jpeg)

![](_page_82_Figure_2.jpeg)

	+-11-1-0	-	-		- autor	- autor			0000	COL.	.ene	tent.		VCUL	3005	- Nore		acue	0500	1000
	Resources under Development NmP(t)	1 1	3 8	418	6905	506.9	506.9	506.9	6905	6.302	506.9	506.9	6.905	506.9	6.905	206.9	6.9	6.905	6.902	595
	New Nat. Gas-CC	•	•	0	•	0	•	•	•	0	•	•	-	•	0	•	•	0	-	1,390
	New Nat. Gas-CT	•	•	0	•	0	0	•	0	•	-	0	-	-	0	0	0	0	0	714
	New Utility Solar (NmPit)	•	•	0	0	0	•	0	0	0	150	50	300	80	300	600	06	1,200	1,200	1,200
	New Utility Solar (Firm)	•	0	0	0	•	٥	0	0	0	39	39	78	82	78	156	234	312	312	312
	New PPA Solar (NmPlt)	-	0	0	0	•	0	0	0	0	150	300	450	009	750	006	8	006	006	86
	New PPA Solar (Firm)	•	•	0	0	•	0	•	0	0	39	82	117	156	195	234	234	234	234	234
	New Paired Solar (NmPit)	•	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	219	699
	New Paired Solar (Firm)	0	•	0	•	•	0	•	0	0	0	0	0	0	0	0	0	•	57	174
VCEA Compila	New Wind (Nameplate)	•	0	0		8	80	8	8	8	<b>8</b>	<b>8</b>	8	<b>6</b> 4	<b>8</b>	400	8	<b>8</b>	400	<b>8</b>
CIC 10 01H/W	New Wind (Firm)	•	•	•	•	8	77	2	\$	\$	4	\$	ą	ទ្	ą	4	8	\$	\$	ą
200	New Wind PPA (NmPit)	•	0	0	0	91	8	200	250	350	350	350	350	350	350	350	350	350	350	350
	New Wind PPA (Firm)	•	0	0	0	B	12	n	28	35	35	35	35	35	35	35	35	35	35	35
	Storage Capadity (NmPlt)	•	•	0	0	ង	ង	2	R	ង	5	50	150	<b>1</b> 5	150	400	400	400	400	8
	Storage Capadity (Firm)	•	•	•	•	18	18	81	17	61	137	137	137	137	137	364	364	364	364	364
	Storage Paired (NmPlt)	0	0	0	0	0	0	•	0	0	0	0	0	0	0	- 0	0	0	3	223
	Storage Paired (Firm)	•	0	0	0	0	0	•	-	0	0	0	0	0	0	0	0	0	5	212
	New EE	14	ุฆ	4	25	71	3	8	ព	Ħ	8	6	4	2	1	0	1	1	2	2
	New VVO	0	0	•	0	0	0	0	0	0	0	0	0	0	0	0	10	8	62	41
	New DG	0	0	•	35	\$	46	52	\$	67	7	74	76	7	2	83	88	92	96	101
Total Addition:	s (Firm & Degraded)	8	¥	462	<b>599</b>	675	675	685	669	679	876	916	565	1,032	1,072	1,420   :	.513	1,605	1,745	4,126
Capacity Reser	rves (MW) without new additions	290	198	133	121	쳤	194	361	202	Ŕ	807	212	214	216	216	207	186	186	185	(187,6
Capacity Reser	rves (MW) with new additions	312	262	312	376	519	434	490	<b>4</b> 83	493	<b>3</b> 5	737	817	828	863	1 1 1	308	1,400	1,539	5

Table 25 Portfolio 2 Nameplate and Firm (UCAP) Resource Additions And Capacity Position

ş	7	2			8	~		R	ų	50	2		9	5	22	8	2	5		9	E	5	(IE	
ନ୍ <u>ଧ</u>	2	[ ]			172	31	8	57	3	IE	4	4	8	3	2.7	2,4	1 21	20	1	2	1	1 3,7	e	~
ŝ	507	117	0	0	1,200	312	8	ลี	411	101	<b>8</b>	<b>\$</b>	350	35	400	364	137	130	6	47	8	1,491	281	1.675
803	507	117	0	0	1,200	312	ğ	234	ITT	ิ ณ	<b>8</b>	4	350	35	400	364	37	35	8	8R	92	1,303	186	1.489
2037	503	117	0	0	<b>0</b> 6	234	8	734	0	0	윻	4	350	35	400	364	0	0	7	ଯ	88	1,146	81	1.332
2026	507	117	0	0	006	234	8	73W	0	0	8 <del>4</del>	ą	350	35	400	364	0	0	6	15	83	1,129	202	1.337
SEOK	507	117	0	0	809	156	750	뚼	0	0	윻	4	350	35	150	137	0	0	4	6	er.	769	216	586
2034	507	117	0	0	ន្ត	8	89	<b>1</b> 56	0	0	8	40	ŝ	35	051	137	0	0	5	0	π	644 6	216	980
2033	507	117	0	0	윩	8	450	117	•	0	400	40	350	35	150	137	0	0	6	0	76	8	214	819
2692	202	117	0	0	ន្ល	<u>۾</u>	Ř	78	0	0	<b>8</b>	4	ß	35	150	137	0	0	8	0	74	527	212	bEL
1802	207	117	0	0	ន្ម	66	51	ଳ ମ	0	0	<b>4</b> 00	40	350	35	150	137	0	0	10	0	и	488	208	909
80	202	117	0	0	0	0	0	•	0	0	0 <del>0</del>	<del>1</del>	350	35	25	티	0	0	13	•	67	162	204	565
6202	507	117	0	•	-	0	0	0	0	0	<b>6</b> 5	44	<u> </u>	28	25	17	0	0	16	0	55	281	502	486
870	202	117	0	0		0	0	0	0	0	00	ឌ	8	2	3	18	0	0	68	0	52	<b>2</b> 86	561	6
227	40	132	0	0		_	0	0	0	0	8	54	8	я П	22	18	0	0	71	0	45	103	8	8
256 2	07 1	48	0	-		_	_	_		_	8		8		5	8	0	0	5	0	Q	51	8	23
X 22	37 5	1		_	_	-	-	_	-		-	-	-	_	2		_			_	2 2	55 3	2	2
8	8	5   11	_	_	_	_	_	_				-	_				-		5	_	3	9 25	н е	3
а П	41	EI	•	-	°	•	-	-	-	-	-	-		•	0	0	0	0	4	0	0	17	3 13	11
202	ខ	35	0	0	•	•	0	•	•	•	•	•	•	•	0	0	0	0	52	0	0	23	391	26
202	ដ	8	0	0	0	•	0	0	0	•	0	0	•	0	0	0	0	0	14	0	0	22	82	312
Portalio 2	Resources under Development (NmPit)	Resources under Development (Firm)	New Nat. Gas-CC	New Nat. Gas-CT	New Utility Solar (NmPit)	New Utillty Solar (Firm)	New PPA Solar (NmPlt)	New PPA Solar (Firm)	New Paired Solar (NmPlt)	nt New Paired Solar (Firm)	New Wind (Nameplate)	New Wind (Firm)	New Wind PPA (NmPlt)	New Wind PPA (Firm)	Storage Capacity (NmPlt)	Storage Capadty (Firm)	Storage Paired (NmPlt)	Storage Paired (Firm)	New EE	New VVO	New DG	s (Firm & Degraded)	ves (MW) without new additions	ves (MW) with new additions
										VCEA Complia	w/RGGI \$15	<b>C</b> 02										Total Addition:	Capacity Reser	Canadhe Baser

TABLE 26 PORTFOLIO 3 NAMEPLATE AND FIRM (UCAP) RESOURCE ADDITIONS AND CAPACITY POSITION

	Perticito 3	202	202	2024	202	5026	2027	202	202	002	1602	2032	2033	2034	2035	900	037	2038	607	2040
	Resources under Development (NmPlt)	ม	8	418	203	202	203	65	202	<b>105</b>	201	201	50	507	207	202	205	201	201	6
	Resources under Development (Firm)	8	S	SEI	1631	148	733	117	117	117	117	117	117	117	117	117	117	117	117	117
	New Nat, Gas-CC	0	0	0	0	0	0	2,780	2,780	2,780	2,780	2,780	2,780	2,780	2,780 2	780	280	2,780	2,780	2,780
	New Nat Gas-CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	•	•
	New Utility Solar (NmPit)	0	0	0	0	0	0	0	0	0	3	25	ន្ល	300	450	- 82	80	950	080	1,050
	New Utility Solar (Rm)	0	0	0	0	0	0	0	0	0	8	ጽ	8	8	117	156	5	513	E	23
	New PPA Sciar (NmPit)	0	0	0	0	50	2	8	\$50	8	22	R	8	80	8	8	8	86	8	8
	New PPA Sotar (Firm)	0	0	0	0	39	8	117	162	196	ន្ម	132	Ā	Ř	234	NE2	đ	ħ	Ā	Ē
	New Paired Solar (NmPit)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	•	•
VCEA Complian	t New Palred Solar (Rrm)	0	•	0	0	0	0	0	0	0	0	o	0	0	0	0		•	-	•
w/RGGI	New Wind (Nameplate)	0	0	0	0	200	8	8	202	200	8	<b>8</b>	8	804	400	8	8	88	8	8
Federal CO2	New Wind (Hrm)	•	0	0	0	8	24	R	R	ន	ิล	Ş	ę	ę	9	\$	\$	8	8	8
	New Wind PPA (NmPit)	0	0	0	0	8	8	150	150	021	150	120	ន្ត	82	ន្ត	8	8	8	8	8
	New Wind PPA (Firm)	0	0	0	0	13	ñ	17	17	35	ม	3	ន	Я	22	23	8	8	8	8
_	Storage Cepedty (NmPlt)	0	0	0	0	22	22	8	300	8	425	425	9	425	425	6	5	8	8	8
	Storage Capadity (Firm)	0	0	0	0	81	18	210	207	228	387	387	387	387	387	614	514	364	3ČE	38
	Storage Paired (NmPit)	0	0	0	0	•	•	0	0	0	0	•	0	0	0	0	0	•	0	0
	Storage Paired (Rim)	0	0	0	•	•	0	0	0	0	0	0	0	0	0	0	0	•	•	0
	New EE	16	31	49	ĸ	901	ğ	8	\$	38	8	23	16	п	7	4	2	2	1	0
	New VVO	0	0	0	•	0	ñ	R	23	23	R	ន	R	2	33	23	23	ន	2	ព
	New DG	0	0	0	ž	40	\$	8	8	67	R	74	76	7	8	83	88	52	8	101
<b>Total Additions</b>	(Him & Degraded)	ព	8	184	£	417	<b>8</b>	3,436	3,431	3,474	3.677	3,692	3,731	3,7TL	9,808 4	115 4	82	1,974	1.61	3,982
Capadity Reserv	es (MW) without new additions	06Z	198	EET	121	204		(3,417)	(007/E)	(3,402)	(3,396)	(3, 369)	(3355)	(286)	3,380)	336) (;	,422)	3,423)	3,424)	(1EL)
Capadity Reserv	ies (MW) with new additions	EIE	797	317	ŝ	13	8	9	8	2	281	۶,	SHE	363	427	718	Ē	8	ß	ន
																				1

TABLE 27 PORTFOLIO 4 NAMEPLATE AND FIRM (UCAP) RESOURCE ADDITIONS AND CAPACITY POSITION

-	Portfall o 4	2002	5002	NOX.	202	3826	2020	200   XCC	0002   0	1202	2082	800	NO2	2005	2096	LEOK	2038	6602	<b>N</b>
	Resources under Development (NmPit)	ສ	65	418	507	507	507 5	07 SO7	507	\$07	507	507	507	68	507	507	507	202	S
	Resources under Development (Firm)	8	35	335	163	148	132 1	17 117	117	117	117	117	117	117	117	117	117	117	117
	New Nat, Gas-CC	0	0	0	0	0	0	0	0	•	0	0	0	0	0	0	0	0	0
	New Net, Gas-CT	0	0	0	0	0	0	0	•	•	0	0	٥	0	0	0	0	0	•
	New Utility Solar (NmPit)	0	0	0	8	8	600 61	009	8	8	8	8	8	1,050	1,350	1,350	1,650	1,950	1,95(
	New Utility Solar (Firm)	0	0	0	144	ž	252 25	216	186	2	32	ž	234	23	351	351	429	5	8
	New PPA Solar (NmPlt)	0	0	0	150	8	300 3(	300	8	ŝ	8	450	450	8	8	8	80	8	8
	New PPA Solar (Firm)	0	0	0	2	132	126 1.	17 108	66	82	28	117	117	156	234	234	234	234	294
	New Paired Solar (NmPit)	0	0	0	0	148	148 1.	148	148	148	148	148	148	148	148	148	148	148	148
VCEA Compliant	1 New Palred Solar (Firm)	0	0	0	0	8	8	8	46	6E	39	8	<b>6</b> E	39	39	8	30 J	39	39
w/MGGI \$15	New Wind (Nameplate)	0	•	•	•	82	200	8	200	8	80	80	80	20	200	200	200	28	8
8	New Wind (Firm)	0	0	0	0	36	24 2	2 2	20	8	20	8	20	20	20	8	8	20	ຊ
	New Wind PPA (NmPit)	0	0	0	0	100	100	001	8	8	8	8	<u>10</u>	8	ğ	8	8	8	8
	New Wind PPA (Firm)	•		0	0	E	12 1	1 11	9	10	10	9	10	đ	10	ä	10	9	9
	Storage Capacity (NmPlt)	0	0	0	0	25 1	2,6 2,075 3,5	77. 3,72	5 3,725	3,850	3,850	3,850	3,850	3,850	4,100	3,050	2,600	2,500	2,82
	Storage Capacity (Firm)	0	0	0	0	81	774 2,5	15,57	2,831	3,504	3,504	3,504	3,504	3,504	3,731	2,776	2,366	2,275	2,57:
	Storage Palred (NmPit)	0	0	0	0	6	49 4	69 6	49	49	49	8	49	49	49	63	49	49	49
	Storage Paired (Firm)	0	•	0	0	31	34 3	5 36	42	<b>4</b> 5	46	<b>6</b> 6	46	46	46	45	46	46	\$
	New EE	8	58	107	163	224	206 11	38 121	8	r	55	8	25	16	10	6	9	6	9
	New WO	0	10	8	8	*	50 5	7 63	63	3	53	38	ន	65	71	R	2	39	£
	New DG	0	0	0	æ	8	46 5	8	6	7	74	*	7	۴	8	88	8	8	101
<b>Total Additions</b>	(Firm & Degraded)	*	104	282	<b>8</b>	998	718 3.5	54 3,37	3 3,575	4,181	4,164	4,265	4,253	4,324	4,712	3,767	3,440	3,432	3,73
Cepacity Reserv	res (MW) without new additions	290	198	133	121	204	194 (3.	4171 (3,40	0) (3,402)	(33E/E)	(3,366)	(3,385)	(235,6)	(1982)	(986)	(3,422)	(654/6)	(3,424)	(J,7
Capacity Reserv	res (MM) with new additions	326	ğ	395	728	1,202 1	E16,	5	201	814	803	8	8	543	1,316	345	17	7	2
			ĺ																

TABLE 28 PORTFOLIO 5 NAMEPLATE AND FIRM (UCAP) RESOURCE ADDITIONS AND CAPACITY POSITION

2026 2027 2028 2029 2030 2031 2032 2033 2034 2035	201 201 507 507 507 507 507 507 507 507 507	148 132 117 117 117 117 117 117 117 117 117					0 0 0 0 0 0 0 150 300 450 600 750	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			1,200 1,200 1,200 1,200 1,200 1,200 1,200 1,200 1,200 1,200 1,200	156 144 132 132 120 120 120 120 120 120	100 100 100 100 100 100 100 100 100 100	13 12 11 11 10 10 10 10 10 10 10	25 25 25 25 25 150 150 150 150 150	18 18 18 17 19 137 137 137 137 137			75 71 68 16 13 10 7 5 3 1 1		40 46 52 59 67 72 74 76 77 79	449 423 397 352 346 504 543 581 619 659	704 704 712 714 715 716 716 716 716 716 716	
2025	507	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	0	35	255	121	
2024	418	135	a	0	0	•	•	•	•	•	•	•	•	•	0	•	0	•	44	•	•	179	E	
2023	65	35	0	•	•	•	•	•	0	0	•	0	0	-	0	0	0	•	52	•	-	25	198	
2022	t ۲	8	0	0	0	•	•	•	0	0	0	•	0	•	0	0	0	•	14	0	0	22	କ୍ଷି	
Portfolio 5	Resources under Development (NmPlt)	Resources under Development (Firm)	New Nat. Gas-CC	New Nat. Gas-CT	New Utility Solar (NmPlt)	New Utility Solar (Firm)	New PPA Solar (NmPlt)	New PPA Solar (Firm)	New Paired Solar (NmPit)	A Compliant New Palred Solar (Firm)	r/RGGI \$15 New Wind (Nameplate)	CO2 New Wind (Firm)	New Wind PPA (NmPit)	New Wind PPA (Firm)	Storage Capacity (NmPlt)	. Storage Capacity (Firm)	Storage Paired (NmPit)	Storage Paired (Firm)	New EE	New VVO	New DG	il Additions (Firm & Degraded)	acity Reserves (MW) without new additions	

TABLE 29 PORTFOLIO 6 NAMEPLATE AND FIRM (UCAP) RESOURCE ADDITIONS AND CAPACITY POSITION

	¢.	1	14	12	× <sub>ا</sub>	1~	<u>-</u> ۲	12	× ،	VCEA Compliant	w/RGGI \$15 A	20 C0	<b>-</b> ۲	<u>،</u> ج	1.0	1 00	٢v	10	<u>ا</u> ح	<u>-</u>	1~	Total Additions (Fi	Capacity Reserves	Capacity Reserves
Portfolio 6	Resources under Development (NmPlt)	Resources under Development (Firm)	Vew Nat Gas-CC	Vew Nat. Gas-CT	Vew Utility Solar (NmPlt)	Vew Utility Solar (Firm)	vew PPA Solar (NmPlt)	Vew PPA Solar (Firm)	Vew Paired Solar (NmPlt)	Vew Paired Solar (Firm)	Vew Wind (Nameplate)	Vew Wind (Hrm)	Vew Wind PPA (NmPlt)	Vew Wind PPA (Firm)	Storage Capacity (NmPlt)	Storage Capacity (Firm)	Storage Paired (NmPit)	Storage Paired (Firm)	New EE	New WO	New DG	irm & Degraded)	(MW) without new additions	(MW) with new additions
2022	15	8	0	•	•	0	•	0	0	0	•	0	0	0	•	0	0	•	14	•	•	22	05Z	312
5023	3	35	0	0	0	•	•	•	0	•	•	-	•	•	•	0	0	•	ୟ	•	•	2	198	267
2024	418	135	0	•	•	•	•	0	•	•	0	•	•	0	0	0	•	0	44	0	•	179	133	112
2025	507	163	0	0	0	0	0	0	0	0	•	•	•	0	•	0	•	0	57	0	ĸ	255	121	376
2026	507	148	٥	-	•	0	•	0	0	•	8	56	8	E	ង	18	0	0	£	•	4	319	<b>50</b> 4	503
2027	203	<b>1</b> 32	0	0	0	0	-	•	0	•	20	24	150	18	ĸ	8	0	0	4	0	46	60E	형	ŝ
2028	507	117	0	•	•	0		0	0	0	80	2	ន្ល	82	z	81	0	0	83	0	22	303	361	8
202	202	117	0	0	0	0	প্র	R	0	0	200	2	350	£	z	17	0	0	16	0	8	324	205	903
2030	507	117	0	•	051	47	ĝ	63	0	•	20	ន	350	SE	55	ង	0	0	EI	0	67	410	204	614
2031	507	117	0	0	80	78	ŝ	117	0	0	82	8	350	35	3	137	0	0	g	0	ч	585	208	Ę
2032	507	117	0	0	300	78	8	156	0	0	200	R	350	35	ន្ម	761	0	0	6	0	74	625	212	837
2033	507	117	0	0	8	78	750	195	0	•	200	8	350	35	150	137	0	0	7	0	76	664	214	878
Z034	507	117	0	0	<b>0</b> 9	156	8	234	0	0	8	8	350	35	150	137	0	0	6	0	11	781	216	6
2035	507	117	0	0	8	234	8	234	0	0	200	20	350	35	150	137 <sub>.</sub>	0	0	5	9	62	856	216	1 /83
2036	507	117	0	0	1,200	312	8	234	0	0	8	20	350	35	400	364	0	0	6	18	8	1, 192	207	1 200
2037	507	117	0	0	1,200	312	006	234	0		200	20	350	35	400	364	0	0	6	52	88	1,207	186	202 1
2038	507	117	0	0	1,200	312	906	234	141	37	200	20	350	35	400	364	47	45	10	38	55	1,303	186	1 400
2039	507	117	0	0	1,200	312	8	234	162	76	<b>6</b>	<del>4</del>	350	35	400	364	97	92	п	47	8	1,423	185	1 600
2040	507	117	0	•	1,200	312	8	234	441	115	<u> </u>	8	350	35	2,800	2,548	147	140	11	56	101	3,728	(157,21)	-

#### TABLE 29 CAPACITY RESERVE MARGINS

,		Capad	tity Reserve l	Margin		и I
1 1 .		<u>with</u>	<u>n</u> ew additio	ons %		• •
	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	Portfolio 6
		2040		2028		,
	2040 AM+MNTR	AM+MNTR Ret.	2028 AM+MNTR	AM+MNTR Ret.	2040 AM+MNTR Ret.	2040 AM+MNTR Ret.
1	Ret. RGGI CO2 Gas Option	RGGI-\$15 CO2 No Gas	Ret. RGGI CO2 Gas Option	RGGI-\$15 CO2 No Gas	No Gas Option High Wind Limits	No Gas Option Historical Wind CF
		Option		Option		
2022	14.3	14.3	14.4	14.6	14.3	14.3
2023	13.4	13.4	13.4	14.1	13.4	13.4
2024	14.3	14.3	14.4	15.8	14.3	14.3
2025	15.9	15.9	16.3	22.8	15.9	<b>15.9</b>
2026	19.0	19.1	21.0	32.6	21.7	19.1
2027	18.5	18.6	20.7	47.1	. 21.0	18.7
2028	18.5	18.5	9.0	8.7	20.5	18.6
2029	18.4	18.4	9.2	8.7	19.9	19.3
2030	18.6	18.6	10.1	12.7	19.8	21.1
2031	22.7	22.7	14.3	25.1	23.1	24.7
2032	23.6	23.6	14.8	24.9	23.9	25.6
2033	25.2	25.3	15.6	27.1	24.8	26.5
2034	26.1	26.1	16.5	26.9	25.6	28.9
2035	26.9	28.7	17.3	27.8	, 26.4	30.7
2036	33.7	35.8	23.2	35.3	31.9	37.0
2037	35.1	35.6	24.4	15.6	33.5	36.8
2038	37.0	38.8	19.8	8.9	35.6	38.8
2039	39.8	42.5	19.8	8.7	42.7	41.2
2040	8.7	9.0	13.7	8.6	8.7	8.6
2041	8.7	9.0	8.7	8.7	8.7	8.6
2042	8.7	9.1	8.7	8.9	8.7	8.6
2043	8.9	9.2	8.7	8.8	8.8	8.7
2044	9.0	9.3	8.8	8.8	8.8	8.8
2045	9.1	9.4	9.0	8.9	9.0	8.9
2046	9.2	9.5	9.9	9.0	9.1	9.0
2047	8.7	9.0	8.7	8.8	8.7	8.8
2048	8.8	9.1	8.9	8.7	8.7	8.9
2049	8.9	9.2	9.0	8.8	8.9	9.0
2050	9.0	8.8	9.1	8.9	9.0	8.7
2051	8.8	9.0	8.9	9.1	8.7	8.6

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#### TABLE 30 VCEA ENERGY TARGET POSITION

, ,	VCEA	VCEA		VCEA AI	nnual Energy (G\	Target Over/ Nh)	(Under)	
1	TGT	GWh	Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	Portfolio 6
		1	2040 AM+MNTR Ret. RGGI CO2 Gas Option	2040 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option	2028 AM+MNTR Ret. RGGI CO2 Gas Option	2028 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option	2040 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option High Wind Limits	2040 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option Historical Wind CF
2022	7%	1,051	210	210	210	210	210	210
2023	8%	1,200	112	112	112	112	112	112
2024	10%	1,499	557	557	557	557	557	557
2025	14%	2,100	181	181	181	1,115	181	181
2026	17%	2,546	1,017	1,017	1,328	3,194	4,083	1,017
2027	20%	2, <del>99</del> 9	489	489	800	2,666	3,555	642
2028	24%	3,601	135	135	604	2,006	2,895	289
2029	27%	4,055	336	336	350	1,440	2,329	341
2030	30%	4,505	61	61	78	858	1,747	380
2031	33%	4,956	174	174	192	349	1,549	494
2032	36%	5,406	61	61	381	(74)	1,437	381
2033	39%	5,861	254	254	417	429	1,319	263
2034	42%	6,314	139	139	455	3	1,203	770
2035	45%	6,772	18	640	334	193	1,083	960
2036	53%	7,985	(20)	251	334	115	225	260
2037	53%	7,994	170	170	328	34	1,072	529
2038	57%	8,608	215	448	364	79	1,424	599
2039	61%	9,219	101	504	490	127	2,414	252
2040	65%	9,829	472	403	267	(96)	7,086	607
2041	68%	10,301	667	42	105	162	6,957	179
2042	71%	10,761	203	279	32	48	6,494	69
2043	74%	11,227	116	(159)	(40)	(38)	6,056	(18)
2044	77%	11,694	29	104	(128)	(126)	5,618	(106)
2045	80%	12,171	282	8	126	128	5,171	148
2046	84%	12,798	44	120	23	(111)	4,583	(90)
2047	88%	13,427	312	(120)	26	0	3,993	21
2048	92%	14,053	76	(6)	141	114	3,406	135
2049	96%	14,695	174	92	(112)	(138)	2,803	(117)
2050	100%	15,325	283	(148)	(2)	(28)	2,212	(8)
2051	100%	15,349	280	199	(5)	(32)	2,209	(11)

		TAI	ble 31 Ann	UAL REC P	URCHASES		
			An	nual REC Pu	rchases (GW	/h)	
		Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5	Portfolio 6
	VCEA Energy Require ment GWh	2040 AM+MNTR Ret. RGGI CO2 Gas Option	2040 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option	2028 AM+MNTR Ret. RGGI CO2 Gas Option	2028 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option	2040 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option High Wind Limits	2040 AM+MNTR Ret. RGGI-\$15 CO2 No Gas Option Historical Wind CF
2022	1,051	0	0	0	0	0	0
2023	1,200	0	0	0	0	0	0
2024	1,499	0	0	0	0	0	0
2025	2,100	0	0	0	0	0	0
2026	2,546	0	0	0	0	0	0
2027	2,999	0	0	0	0	0	0
2028	3,601	0	0	0	0	0	0
2029	4,055	0	0	0	0	0	0
2030	4,505	0	0	0	0	0	0
2031	4,956	0	0	0	0	0	0,
2032	5,406	0	0	0	0	0	0
2033	5,861	0	0	0	0,	0	0
2034	6,314	0	0	0	0	0	0
2035	6,772	0	0	0	0	0	0
2036	7,985	351	0	703	0	0	0
2037	7,994	0	0	0	0	0	350
2038	8,608	0	0	0	0	0	701
2039	9,219	0	0	701	0	0	0
2040	9,829	0	0	1,054	351	0	0
2041	10,301	0	0	701	1,051	0	0
2042	10,761	0	701	1,051	1,402	0	350
2043	11,227	350	701	1,402	1,752	0	701
2044	11,694	703	1,405	1,757	2,108	0	1,054
2045	12,171	1,402	1,752	2,453	2,803	0	1,752
2046	12,798	1,752	2,453	2,803	3,154	0	2,102
2047	13,427	2,453	2,803	2,453	3,854	0	2,803
2048	14,053	2,811	3,514	3,162	4,568	0	3,514
2049	14,695	3,504	4,205	3,504	4,906	0	3,854
2050	15,325	4,205	4,555	4,205	5,606	0	4,555
2051	15,349	4,555	5,256	4,555	5,957	350	4,906

blio 6 ANTR Ret.	l Ret. 22 3n 1 CF	Surplus/	(Deficit)	GWh	(0)	1	(0)	1
Portfolio 6	AM+MNTR GGI-\$15 CC o Gas Optic orical Winc		COM	GWh	24	47	В	93
	2040 Rt Nist		ß	GWh	87	ક્ર	144	197
		urplus/	Deficit)	GWħ	(0)	1	(0)	1
ortfolio 5	MHMNTR R il-\$15 CO2 Bas Option Wind Limit	5	COM (I	GWh	24	47	13	33
Pc	2040 AI RGG No ( High		RES	GWh	48	66	144	197
		urplus/	Deficit)	GWh	61	130	784	472
ortfolio 4	M+MNTR F 51-\$15 CO2 5as Optior		WOO	GWh	26	51	76	102
9	2028 AI RGC No (		RES	GWh	107	223	424	639
	let	Surplus/	(Deficit)	GWh	2	5	ß	69
ortfolio 3	MHMNTR I (GGI CO2 as Option		COM	GWh	26	51	76	102
6	2028 A 6		RES	GWh	48	66	160	256
	ti .	Surplus/	(Deficit)	GWh	(0)	1	(0)	
Portfolio 2	AM+MNTR R GGI-\$15 CO2 o Gas Option		COM	GWh	24	47	В	8
	2040 R N		RES	GWh	84	8	144	197
	Ret.	Surplus/	(Deficit)	GWh	(0)	1	(0)	1
ortfolio 1	AM+MNTR (GGI CO2 as Option		COM	GWh	24	47	В	8
	20407		RES	GWh	48	86	144	197
Vios	tions	VCEAEE	Trgt Svgs	GWh	и	145	נת	580
Portfo	Descrip			1gt %	0.5%	1.0%	1.5%	2.0%
					202	2023	2024	202

TABLE 32 ENERGY EFFICIENCY RESOURCE ADDITIONS

# Annual Energy Efficiency added for VCEA Compliance

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TABLE 33 RENEWABLE PORTFOLIO 2021 VCEA ORDER COMPLIANCE

VA Allocation of Existing Renewables = 50.10% VA Allocated 100% of Existing Hydro in 2026 Assumes Summersville Hydro contract is extended for 15 years in 2027

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Virginia Clean         Virginia Clean         PIM         Solar         On-shore         Off-shore         falling water         waste b         biomass         REC         Solar & Mondilisy           Renewatike         Virginia         Coast         PIM         Solar         On-shore         Off-shore         falling water         waste b         biomass         REC         Solar & Mondilisy           2002         99,736         88,007         807,050         74,091         Mod         Mod         Mod         Rec         Solar & Mondilisy           2002         91,954         88,007         807,050         74,051         398,234         103,073         98,734         807,050         807,050         74,339         807,950         807,050         807,050         74,339         807,950         807,050         807,050         807,050         734,339         734,339         74,339         807,351         807,050         807,050         807,050         807,050         734,339         74,339         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,351         807,3		Order Romt 1	Order Romt Le.i	Order Rqmt 1.a.li	Order Rqmt 1.a.fli	Order Ramt 1.b.l	Order Rqmt 1.b.fi	Order Rqmt 1.b.iii	Order Romt 1.b.lv	Order Ramt 1.b.v	Order Rgmt 1.b.vl	Order Romk 1.b.vli		Order Romt 1.c		
Verr         Requirement         Bay Cont		Virginia Clean Energy Act Renewable Energy	Virginia	Coast	P.IM (A)(B)(C)	Solar	On-shore Wind	Off-Shore Wind	falling water	waste to energy	blomass	REC Purchases	VA Domidled Solar & Wind Nonutility	VA Domiciled Solar & Wind Utility Sources	VCEA Domiched Solar & Wind Nonutility Source	l 10
ZUZ3         992,734         8,60°         70,06         70,04         60,416         394,234         103,07         234,60°         77,251           ZUZ3         1,133,611         91,554         80,700         13,076         400,416         394,234         234,60°         87,60°           ZUZ3         1,45,226         1,30,915         80,700         113,076         400,416         394,234         234,60°         87,60°           ZUZ3         1,45,226         1,30,915         80,700         113,076         400,416         394,234         234,60°         87,60°           ZUZ3         1,902,081         784,799         74,399         74,399         74,399         74,399         74,399         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307         74,399         74,307	Year	Requirement											SOUTICES		bercent	
2023         1.133 (cit)         91,954         807,050         74,027         406,816         396,234         234,607         877,261           2026         1,992,061         765,150         807,050         817,050         807,050         113,075         406,816         396,234         77,261         877,261           2026         2,402,988         1,705,089         877,050         877,050         877,050         386,050         1,235,754         734,339         407,455         877,050           2026         2,402,988         1,705,089         877,050         877,050         386,050         1,235,754         734,339         241,405         877,255           2026         2,402,988         1,705,089         877,050         386,050         1,235,754         734,339         241,405         966,157           2029         4,243,775         7,734,775         734,339         7,343,599         7,44,399         1,147         964,137           2030         4,233,754         7,734,775         734,339         7,34,399         1,147         964,137           2031         4,677,775         734,399         7,34,399         7,34,399         1,147         964,135           2031         5,056,612         4,667,775		998,734	83,607	•	807,050	70,094	408,815	•	398,234	•	•	108,077	83,607	•	100%	1
2024         1.45,226         130,95         807,050         131,075         406,816         386,234         677,251         877,252           2025         1.982,091         766,160         807,050         337,960         406,816         386,234         677,251         877,353           2025         2,402,968         1,776,060         807,050         337,960         406,816         386,234         774,399         487           2027         2,875,422         1,776,060         807,050         386,050         1,223,754         734,399         244,005         386,881         182,355           2029         3,287,620         2,012,997         807,050         386,050         1,223,754         734,399         2,44,05         966,15           2030         4,233,752         3,773,477         784,399         7,34,399         2,44,05         966,15         46,107         734,399         1,554         244,05         966,15         466,172         2,43,399         1,554         244,05         244,399         1,554         244,105         1,554         244,105         1,554         244,105         1,554         244,105         1,554         244,105         1,554         244,105         1,554         243,106         1,554         24	502	1,133,611	91,954	•	807,050	74,027	408,815	•	398,234	•	•	234,607	87,675	425	<b>%35</b>	
ADDE         1982.001         765,160         607,050         387,960         406,611         384,234         384,234         388,881         182.           ADDE         2,402,988         1,705,069         807,050         387,119         1,239,754         734,399         407.         486.           ADD         2,803,422         1,776,069         807,050         384,119         1,239,754         734,399         407.         487.           ADD         2,803,422         1,776,070         807,050         384,119         1,239,754         734,399         241,005         786.           ADD         3,876,455         2,773,477         783,339         1,641,709         734,399         241,005         784,399         1,1977         945.           ADD         4,673,752         3,773,355         2,490,475         734,399         1,437,399         1,437         945.           ADD         4,673,752         3,774,355         2,490,475         734,399         1,431,299         1,437,399         1,437,399         1,437,399         1,437,399         1,437,399         1,437,399         1,437,399         1,434,399         1,441,102         1,554,139         1,554,139         1,554,139         1,554,139         1,554,139         1,554,139	2024	1,415,226	130,915	•	807,050	113,076	408,816	•	398,234	•	•	1192/119	152'18	4,23	<b>X</b> 55	
2026         2.400.968         1.705.069         607.050         385.005         1.225.754         734.399         744.399         487.5           2020         2.829.422         1.776.069         607.050         384.119         1.125.754         734.399         487.5           2020         2.829.422         1.776.061         887.050         384.119         1.125.754         734.399         487.5           2020         2.879.425         1.773.755         2.070.755         2.490.475         734.399         1.1077         946.1           2030         4.577.723         3.777.476         5.856.105         1.773.585         2.490.755         734.399         1.1077         946.1           2030         4.577.723         3.777.376         5.856.105         1.734.399         1.1271         946.1           2031         4.677.775         5.856.105         1.373.585         2.490.220         734.399         1.41.107         1.657.1           2031         5.555.244         4.677.775         5.86.105         1.373.485         2.490.220         734.399         1.41.107         1.857.1           2031         5.555.244         4.677.775         5.86.105         1.373.485         2.490.220         2.34.399         1.41.107	8	1,982,091	786,150	•	807,050	606'/BE	408,816	•	398,234	•	•	388,881	182,388	OF DET	Ř	
2027         2.829.422         1,778,051         807,050         336,119         1,329,754         734,399         467,29         467,179         467,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         764,179         945,176         764,179         764,139         945,179         945,179         11,977         945,176         764,179         764,139         764,139         945,107         11,571         945,176         764,139         764,339         2490,037         734,339         234,003         233,003         1,552,136         246,0230         734,339         734,339         246,023         236,003         1,552,146         764,103         1,552,146         764,103         1,552,146         764,103         1,552,146         764,103         1,552,156         2,460,033         2,460,033         2,493,030         774,339         2,461,023         2,433,09         2,441,02         1,552,156         2,441,02         1,552,126         2,433,09         2,441,02         1,552,166         764,103         1,552,126         2,443,09         1,552,126         2,441,02 </td <td>2026</td> <td>2,402,988</td> <td>1,705,069</td> <td>•</td> <td>807,050</td> <td>386,049</td> <td>1,329,754</td> <td></td> <td>734,309</td> <td>•</td> <td></td> <td>•</td> <td>488,455</td> <td>783,895</td> <td>3886</td> <td></td>	2026	2,402,988	1,705,069	•	807,050	386,049	1,329,754		734,309	•		•	488,455	783,895	3886	
2028         3,337,617         2,012,997         807,056         382,198         1,64,1709         734,399         244,405         734,399         244,405         796,1           2029         3,824,956         2,773,473         3,00,475         3,80,287         2,800,475         734,399         24,309         11,977         946,1           2029         4,248,749         3,076,463         382,390         3,00,355         2,490,220         734,399         1,157.1         946,1           2030         4,673,723         3,777,723         3,777,356         2,490,220         734,399         1,554.1         1,556.1           2031         4,673,772         3,777,733         3,777,336         2,490,220         734,399         1,41,123         1,556.1           2032         5,056,612         4,637,779         5,856,109         1,273,395.2         2,490,220         734,399         1,41,123         1,897.1           2033         5,552,244         4,677,779         5,865,109         1,273,395.2         2,490,220         734,399         1,41,123         1,897.1           2034         5,552,244         4,677,779         5,865,109         1,273,490         7,74,399         7,433.99         1,41,123         1,897.1           203		259/629/2	1,708,051	•	807,050	384,119	1,329,754	•	66E'YEL	•	•	•	487,548	783,045	3885	
2029         3,20,455         2,773,477         708,343         380,257         2,300,475         734,399         11,977         946,1           2039         4,248,749         3,077,82         3,070,355         2,490,220         734,399         1,523         2,49,013         1,523           2031         4,673,752         3,777,375         3,777,375         3,777,376         2,690,250         734,399         1,41,173         1,564           2031         4,673,752         3,777,375         3,777,376         2,690,250         734,399         44,102         1,566           2032         5,695,124         4,677,779         5,865,106         1,273,492         2,490,250         734,399         1,41,173         1,897,156           2033         5,555,244         4,677,779         5,865,106         1,273,492         7,43399         7,43399         1,437,123         1,897,123           2034         5,555,244         4,677,779         5,865,106         1,297,4309         7,74,399         7,43399         7,43399         7,43399         1,437,123         1,897,123           2034         5,555,244         4,667,779         5,865,106         1,297,4309         7,34,399         7,43399         7,14,173         1,897,123         1,294,1239	802	3,387,617	2,012,997	•	807,050	382,198	1,641,709	•	COE VEL	•	•	241,405	796,112	784,687	203	
2030         4,2,48,7/49         3,077,463         588,109         1,077,385         2,490,220         734,339         2,43,339         2,28,013         1,256,1           2031         4,673,752         3,777,365         5,89,109         1,007,385         2,490,220         734,339         2,43,039         1,556,1         1,566,1         4,4102         1,566,1         1,566,1         4,617,779         2,499,549         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,461,173         1,566,1         1,566,1         1,461,173         1,566,1         1,566,1         1,461,173         1,566,1 </td <td></td> <td>3,824,956</td> <td>2,773,472</td> <td>•</td> <td>708,343</td> <td>380,287</td> <td>2,300,475</td> <td>•</td> <td>665E HEL</td> <td>•</td> <td>•</td> <td>11,977</td> <td>946,216</td> <td>1,395,317</td> <td>202</td> <td></td>		3,824,956	2,773,472	•	708,343	380,287	2,300,475	•	665E HEL	•	•	11,977	946,216	1,395,317	202	
2021         4 (67.7.2)         3.70/375         5.85/105         1.00/385         2.690/200         7.34.399         44,102         1.566           2022         5.096/612         4 (63.712)         5.85,109         1.273.982         2.499,549         7.34.399         44,102         1.566           2023         5.955,244         4,677,279         5.85,109         1.273.982         2.499,549         7.34.399         44,102         1.887,           2023         5.555,244         4,677,279         5.86,109         1.977,449         2.490,220         7.34.399         1.41,123         1.887,           2034         5,552,244         4,567,279         5.86,109         1.977,449         2.490,220         7.34.399         7.34.399         2.194,           2034         5,953,234         4,567,279         2.490,220         7.34.399         7.34.399         7.34.399         2.971,           2034         5,953,234         5,953,234         5,953,234         5,953,234         5,953,234         5,953,234         5,953,234         5,953,234         5,953,234         2,993,234         2,994,334         2,994,334         2,994,334         2,994,134         2,994,334         2,994,334         2,994,334         2,994,334         2,994,134         2,994,334	2080	4,248,749	3,078,463	•	586,109	378,385	2,490,220	•	66E NEL	•		248,013	105,22,1	1,394,480	<b>K</b>	
2022 5,056,612 4,062,215 585,109 1,222,982 2,499,549 734,339 14(1/12 1,187) 2,094 5,572,54 4,647,279 585,109 1,947,480 2,490,220 734,339 734,339 2,55,244 4,647,279 585,109 1,947,480 2,490,220 734,339 734,339 734,339 2,597,320 2,594,572 2,597,50 734,339 7367,330 734,339 7367,330 734,339 7367,330 734,339 7367,330 734,339 7367,330 734,339 7367,330 734,339 7367,330 734,339 7367,330 734,339 7367,330 734,339 7367,330 734,330 734,330 7367,330 734,330 7367,330 734,339 7367,330 734,339 7367,330 734,330 7367,330 734,330 7367,300 7367,300		4,673,752	3,707,376		586,109	1,007,385	2,490,220	•	66E VEL	ſ.	•	44,102	1,566,858	1,709,093	9687 1	
2033 5,525,244 4,647,279 586,109 1,947,460 2,493,220 734,399 2,194, 2,19	22	5,096,612	4,083,215	•	596,109	1302,502	2,499,549	•	- 66E VEL		•	141,123	1,887,794	1,714,251	20	
2034         5,950,034         4,953,460         286,109         2,530,220         734,399         70,254         2,507           2035         6,320,261         5,950,008         5,950,008         3,320,559         2,490,220         734,399         2,492,200         2,822,651         2,		5,525,244	4,647,279		586,109	1,947,460	2,490,220	•	GOE VEL	•	•	•	2,194,480	2,021,883	8	
2025 6,322,251 5,902,008 586,009 3,202,559 2,490,220 734,359 2,492,4399 2,452,44399 2,452,452,452,452,452,452,452,452,452,45		5,950,984	4,958,406	•	586,109	2,258,673	2,490,220	•	66E NEL	,		10,254	2,507,308	2,020,440	202	
3000 3101 000 100 100 110 2100 3 400 040 3140 3140	2002	6,382,261	5,902,008		586,109	925,205,5	2,490,220		66E WEL	•		•	2,821,976	2,649,619	Ŕ	
	2002	7,524,069	6,866,143	•	586,109	4,157,250	2,499,549	•	POE AET	•	•	•	3,146,422	3,289,558	A9%	

Virginia Clean Economy Act Analysis Renewable Portfolio Compliance All Values in MWhs

#### Attachment 1

211225 015 <u>v</u>j

#### Appendix C: Incremental Rate Impacts

#### TABLE 34 RATE IMPACTS

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BATTERY ENERGY STORAGE SYSTEM, 50 MW / 200 MWH	\$1,450	\$1,379	\$1,296	\$1,214	\$1,131	51,049	\$967	\$932	\$897	\$862	\$828	\$793	\$783	£77\$	\$763	\$753	\$743	\$733	\$724	\$714	\$704	\$694	\$684	\$674	\$664	\$654	\$644	\$634	\$624	\$614	\$605	\$595	\$585
SOLAR PHOTOVOLTAIC, 150 MWAC, Tier 2	\$1,969	\$1,948	\$1,863	\$1,778	\$1,693	\$1,608	\$1,523	\$1,438	\$1,353	\$1,268	\$1,183	\$1,098	\$1,088	\$1,078	\$1,069	\$1,059	\$1,049	\$1,039	\$1,030	\$1,020	\$1,010	\$1,000	066\$	\$981	1/6\$	\$961	\$951	\$941	\$932	\$922	\$912	\$902	\$893
SOLAR PHOTOVOLTAIC, 150 MWAC, Tier 1	\$1,550	\$1,534	\$1,467	\$1,400	\$1,333	\$1,266	\$1,199	\$1,132	\$1,066	666\$	\$932	\$865	\$857	\$849	\$842	\$834	\$826	\$818	\$811	\$803	\$795	\$788	\$780	\$772	\$765	\$757	\$749	\$741	\$734	\$726	\$718	\$711	\$703
ONSHORE WIND, LARGE PLANT FOOTPRINT, 200 MW	\$1,484	\$1,449	\$1,414	\$1,379	\$1,366	\$1,352	\$1,338	\$1,319	\$1,299	\$1,283	\$1,267	\$1,252	\$1,252	\$1;252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1,252	\$1.252
INTERNAL COMBUSTION ENGINES, 20 MW	\$1,958	\$1,939	\$1,921	\$1,912	\$1,873	\$1,852	\$1,845	\$1,832	\$1,804	\$1,790	\$1,779	\$1,770	\$1,763	\$1,751	\$1,740	\$1,731	\$1,722	\$1,710	\$1,701	\$1,692	\$1,685	\$1,673	\$1,664	\$1,655	\$1,646	\$1,637	\$1,630	\$1,621	\$1,612	\$1,602	\$1,591	\$1,573	\$1.554
COMBUSTION TURBINES AERODERIVATIVE, 100-MW SIMPLE CYCLE	\$1,262	\$1,250	\$1,238	\$1,232	\$1,207	\$1,194	\$1,189	\$1,180	\$1,163	\$1,154	\$1,146	\$1,140	\$1,136	\$1,129	\$1,121	\$1,115	\$1,109	\$1,102	\$1,096	\$1,090	\$1,086	\$1,078	\$1,072	\$1,067	\$1,061	\$1,055	\$1,050	\$1,044	\$1,039	\$1,033	\$1,025	\$1,013	\$1.002
COMBUSTION TURBINE F CLASS, 240-MW SIMPLE CYCLE	\$763	\$756	\$749	\$745	\$730	\$722	\$719	\$714	\$703	\$698	\$693	\$690	\$687	\$683	\$678	\$674	\$671	\$666	\$663	\$659	\$657	\$652	\$649	\$645	\$641	\$638	\$635	\$632	\$628	\$624	\$620	\$613	\$606
COMBUSTION TURBINE H CLASS, COMBINED-CYCLE SINGLE SHAFT, 430 MW	\$1,131	\$1,126	\$1,120	\$1,118	\$1,105	\$1,100	\$1,100	\$1,096	\$1,086	\$1,082	\$1,077	\$1,072	\$1,069	\$1,064	\$1,057	\$1,053	\$1,049	\$1,043	\$1,038	\$1,035	\$1,030	\$1,025	\$1,020	\$1,016	\$1,012	\$1,007	\$1,004	\$1,000	966\$	066\$	\$985	\$973	\$962
COMBUSTION TURBINE H CLASS, 1100-MW COMBINED CYCLE	\$1,063	\$1,059	\$1,053	\$1,051	\$1,039	\$1,034	\$1,034	\$1,030	\$1,021	\$1,017	\$1,012	\$1,008	\$1,005	\$1,000	\$994	066\$	\$986	\$980	\$976	\$973	\$96\$	\$964	\$959	\$955	\$952	\$947	\$944	\$940	\$936	\$930	\$926	\$915	\$904
Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051

Appendix D: Overnight Installed Cost of Technologies in 2019 Real Dollars (\$/kW)

Requirement	Citation	Development Plan/Testimony Location	Company Witness
Submit an annual plan that (i) reflects, in the aggregate and over the duration, the Subsection D requirements for allocation between utility-owned facilities and PPAs, and (ii) includes a plan to meet energy storage development targets under Subsection E, including the goal of installing at least 10% behind the meter.	Va. Code§ 56- 585.5 D 4	2021 RPS Development Plan	Witness Martinez
Consider the promotion of new renewable generation and energy storage resources within the Commonwealth, and associated economic development.	Va. Code§ 56- 585.5 D 4	2021 RPS Development Plan	Witness Martinez
Consider the fuel savings projected to be achieved by the plan.	Va. Code§ 56- 585.5 D 4	2021 RPS Development - Table 23 and Appendix C	Witness Castle
Report on the plan to meet and progress toward the interim targets set forth in the storage regulations.	20 VAC 5-335-30	2021 RPS Development Plan-Table 3	Witness Martinez
Report annually on any competitive solicitations for energy storage	20 VAC 5-335-40		Witness Casablanca
Address behind-the meter incentives related to energy storage projects	20 VAC 5-335-50		Witness Casablanca
Address non-wires alternative programs related to energy storage.	20 VAC 5-335-60		Witness Casablanca
Address peak demand reduction programs related to energy storage.	20 VAC 5-335-70		Witness Casablanca

		Att	achment 1
Requirement	Citation	Development Plan/Testimony Location	Company Witness Sponsor
Analyze how the Company's plan and petition requests address and implement the RPS and carbon dioxide reduction requirements in Code§ 56-585.5, including but not necessarily limited to Code 56-585.5c.	PUR-2020-00135 Final Order at 4	Sec 5.8 Carbon Dioxide Reduction Requirements	⊌ لاب Witness Martinez
Include a least cost plan consistent with the requirements of the 2020 IRP Final Order that meets (i) applicable carbon regulations and (ii) the mandatory RPS Program.	PUR-2020-00135 Final Order at 5	2021 RPS Development Plan-Table 19	Witness Martinez
Include an evaluation of RECs from all sources (with both high and low-price sensitivities), including utility- owned, third-party PPAs and unbundled REC purchases.	PUR-2020-00135 Final Order at 5	2021 RPS Development Plan-Figure 8, Section 5.3	Witness Martinez
Provide modeling of the Company's actual wind capacity factor and Virginia-specific or PJM-specific solar capacity factor.	PUR-2020-00135 Final Order at 5	See Portfolio 6 of the 2021 RPS Development Plan	Witness Martinez
Provide distributed generation sensitivities for unbundled REC purchases through Requests for Proposals ("RFPs"), fixed price offers and over-the- counter purchases.	PUR-2020-00135 Final Order at 5	2021 RPS- Development Plan-Figure 8 and Section 5.3	Witness Castle
Modeling of reliability impacts	PUR-2020-00135 Final Order at 5	Section 1.5	Witness Martinez
Provide updated fundamentals forecasts and commodity pricing that reflects the VCEA requirements.	PUR-2020-00135 Final Order at 5	Sec 3.4 Fundamentals Forecast	Witness Martinez
Provide a detailed chart showing how APCo has complied to date with the VCEA's RPS requirements.	PUR-2020-00135 Final Order at 5	2021 RPS Development Plan- Section 1.3	Witness Castle
The Company's bill analysis should include the effects of retirements, the effects of tax credits, offsets related to outside model additions, and any changes to customer class allocation factors. <sup>1</sup>	PUR-2020-00135 Final Order at 6	2021 RPS Development Plan Table 18	Witness Castle
Ensure modeling inputs and assumptions are consistent between IRP and RPS Development Plan proceedings and explain the reason behind any deviation in the assumptions and modeling used.	PUR-2020-00135 Final Order at 9	2021 RPS Development Plan Section 2.6	Witness Martinez

<sup>&</sup>lt;sup>1</sup> This requirement initially included a requirement to file a bill analysis. The Company has filed a consolidated bill analysis consistent with the Order on the 2020 Filing which modified the bill analysis-related requirements.

		Att	achment 1
Requirement	Citation	Development Plan/Testimony Location	Company Witness Sponsor
Provide the complete results of RPS-related RFPs must be included in each of the Company's RPS filings. In addition to the specific requirements set forth in Code § 56-585.5 D 3, the Company's RFPs shall address environmental justice considerations by assessing the impacts of proposed projects on underserved communities. The Company's RPS filing should identify how the RFP assessed environmental justice considerations, including any non-price considerations that were included in the Company's RFP analysis.	PUR-2020-00135 Final Order at 8	Testimony	Witness Jeffries/Witness Castle
The Company will propose reporting metrics, and any needed protocols, associated with RPS Program certification in its 2021 RPS filing.	PUR-2020-00135 Final Order at 6	Testimony	Witness Castle
Provide information related to accelerated renewable energy buyers ("ARBs")	PUR-2020-00135 Final Order at 7	Testimony Exhibit	Witness Sebastian
Present the Company proposed cost allocation methodology, along with the results of alternative cost allocation methodologies.	PUR-2020-00135 Final Order at 9	Testimony	Witness Spaeth/Witness Sebastian
Report each RPS-associated cost or benefit by type, month, general ledger account, rate mechanism and whether such cost or revenue is bypassable or non- bypassable.	PUR-2020-00135 Final Order at 10		Witness Spaeth/Witness Thomas/Witness Sebastian
(1) For each year, 2021 through 2035, provide an estimate of the yearly RPS Program requirement expressed in MWh in accordance with the schedule provided in § 56-585.5 C.	PUR-2020-00135 Order Establishing Proceeding Attachment	2021 RPS Development Plan Appendix B	Witness Martinez
<ul> <li>(1) (a) For each year, 2021 through 2035, provide an estimate (MWhs or RECs) of the RPS Program requirement that is expected to be met from generation located: (i) in Virginia;(ii) off the coast of the Commonwealth; or (iii) otherwise located in PJM.</li> </ul>	PUR-2020-00135 Order Establishing Proceeding Attachment	2021 RPS Development Plan Appendix B	Witness Martinez
(1) (b) For each year, 2021 through 2035, provide an estimate (MWhs or RECs) of the RPS Program requirement that is expected to be met from the following sources: (i) solar; (ii) on- shore wind; (iii) off-shore wind; (iv) falling water; (v) waste-to- energy or landfill gas; (vi) biomass; or (vii) any other qualifying resource.	PUR-2020-00135 Order Establishing Proceeding Attachment	2021 RPS Development Plan Appendix B	Witness Martinez

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		Att	achment 1
Requirement	Citation	Development Plan/Testimony Location	Company Witness Sponsor
(1) (c) For each year, 2021 through 2035, provide an estimate, expressed in MWhs, of the RPS Program requirement that must be provided by non-utility sources.	PUR-2020-00135 Order Establishing Proceeding Attachment	2021 RPS Development Plan Appendix B	ی لا Witness Martinez
(2) Provide the lifetime revenue requirement for the proposed RPS Program by component, including supporting calculations on an annual basis.	PUR-2020-00135 Order Establishing Proceeding Attachment	2021 RPS Development Plan Appendix B	Witness Martinez
(3) State whether the utility in its RPS Filing will treat the term "capacity" referenced in§ 56-585.5 as nameplate capacity, or in some other way to be identified and described by the utility.	PUR-2020-00135 Order Establishing Proceeding Attachment	2021 RPS Development Plan Section 2.1	Witness Martinez
(4) Estimate the nameplate capacity of all renewable resources the utility will be required to procure to meet its capacity obligations in PJM, following the utility's full transition to renewable resources by 2045 (Phase II Utility), and 2050 (Phase I Utility), as required by § 56-585.5.	PUR-2020-00135 Order Establishing Proceeding Attachment	2021 RPS Development Plan Table 21	Witness Martinez
(5) Regarding the tranches described in § 56-585.5 D 1 a, b, and c for a Phase I utility, (i) describe how the utility will obtain the requisite 35% of energy, capacity and environmental attributes from non-utility sources as required by the statute, and (ii) state, in detail, whether affiliates of the utility may potentially provide any of that energy, capacity or environmental attributes.	PUR-2020-00135 Order Establishing Proceeding Attachment		Witness Castle

#### APPALACHIAN'S 2021 VCEA PETITION PROJECT DESCRIPTION AND PROPOSED REGULATORY TREATMENT

Project	Location	Туре	Size	Online Date	Ownership	Proposal in the Petition
Amherst	Virginia	Solar	4.875 MW	2022	Appalachian	Cost recovery in Rate Year
Bedington	West Virginia	Solar	50 MW	2023	Appalachian	Future cost recovery
Depot	Virginia	Solar	15 MW	2022	Depot Solar	Cost recovery in Rate Year
Dogwood	Virginia	Solar	18.9 MW	2024	Dogwood Solar	Prudency determination
Firefly	Virginia	Solar	150 MW	2023	Appalachian	Prudency determination
Horsepen	Virginia	Solar	20 MW	2024	Clenera	Prudency determination
Leatherwood	Virginia	Solar	20 MW	2021	Caden Energix	Cost recovery in Rate Year
Sun Ridge	Virginia	Solar	50 MW	2024	NextEra	Prudency determination
Top Hat	Illinois	Wind	204 MW	2024	Appalachian	Future cost recovery
Wytheville	Virginia	Solar	20 MW	2022	Caden Energix	Cost recovery in Rate Year
Bluff Point	Indiana	Wind	120 MW	2018	NextEra Energy Partners	Rate Mechanism Change
Camp Grove	Illinois	Wind	75 MW	2008	Orion Energy	Rate Mechanism Change
Fowler Ridge	Indiana	Wind	100 MW	2009	BP Energy	Rate Mechanism Change