Virginia State Corporation Commission
eFiling CASE Document Cover Sheet

Case Number (if already assigned)	PUR-2021-00041
Case Name (if known)	Application of Shockoe Solar, LLC, For a permit to construct and operate an energy storage facility
Document Type	APLA
Document Description Summary	Part 1 - Application and Appendix 1
Total Number of Pages	78
Submission ID	21138
eFiling Date Stamp	2/26/2021 3:04:21PM

WILLIAMS MULLEN

Robert F. Riley
Direct Dial: 202.293.8121
rriley@williamsmullen.com

February 26, 2021

VIA HAND-DELIVERY AND ELECTRONIC FILING

Mr. Bernard J. Logan, Clerk
c/o Document Control Center
State Corporation Commission
Tyler Building, First Floor
1300 East Main Street
Richmond, Virginia 23219

RE: **Application of Shockoe Solar, LLC, For a permit to construct and operate an energy storage facility, Case No. PUR-2021-00041**

Dear Mr. Logan:

Please find enclosed for filing with the State Corporation Commission ("Commission") the *Application of Shockoe Solar, LLC, For a permit to construct and operate an energy storage facility.*

This filing includes:

1. An original and fifteen (15) hardcopies of the EXTRAORDINARILY SENSITIVE Supplement, appropriately marked and submitted under seal. The EXTRAORDINARILY SENSITIVE Supplement is being provided to the Office of General Counsel and the Staff of the Commission pursuant to 5 VAC 5-20-170 of the Commission's Rules of Practice and Procedure. Thank you for filing this document in the appropriate manner.

2. An original and fifteen (15) hardcopies of a Motion for Protective Order and proposed Hearing Examiner's Protective Ruling.

3. A public application, including exhibits and appendices, filed electronically through the Commission's website.

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

Very truly yours,

/s/ Robert F. Riley

Robert F. Riley
Counsel for Shockoe Solar, LLC

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

APPLICATION OF

SHOCKOE SOLAR, LLC

For a permit to construct and operate an energy storage facility

Case No. PUR-2021-00041

Pauline Ung, Esq.
Vice President, Legal
and Asset Management
174 Power Global
200 Spectrum Center Drive
Suite 1020
Irvine, CA 92618
(917) 297-8671
pauline.ung@174powerglobal.com

Robert F. Riley
Bradley J. Nowak
Williams Mullen
1666 K Street, NW
Suite 1200
Washington DC 20006
(202) 833-9200
rriley@williamsmullen.com
bnowak@williamsmullen.com
Counsel for Shockoe Solar, LLC

Robert D. Perrow
Williams Mullen
200 South 10th Street, Suite 1600
Richmond, Virginia 23219
(804) 420-6446
bperrow@williamsmullen.com
Counsel for Shockoe Solar, LLC

Filed: February 26, 2021

TABLE OF CONTENTS

I. **Application**

II. **Appendices**

Appendix 1 Information required by 20 VAC 5-335-80 C

Attachment 5 a. Table of Solar Projects

Attachment 6 b. Topographical Map of BESS site

Attachment 14 a. Feasibility Report

Appendix 2 "DEQ Supplement" prepared by Stantec Consulting Services, Inc.

Attachment 1 Project Location Map

Attachment 2.F.1 Threatened and Endangered Species Searches

Attachment 2.F.2 DCR Natural Heritage Project Review

Attachment 2.H.1 Shockoe Solar Facility Phase I Archaeological Survey

III. **EXTRAORDINARILY SENSITIVE Supplement**

Application Insert Section I. C

Attachment 4 b. Financial Overview of Hanwha Group and Hanwha Energy

Attachment 4 c. List of projects that have been financed by 174 Power Global

COMMONWEALTH OF VIRGINIA
BEFORE THE
STATE CORPORATION COMMISSION

APPLICATION OF	)	
	)	
SHOCKOE SOLAR, LLC	)	**CASE NO. PUR-2021-00041**
	)	
For a permit to construct and operate an energy storage facility	)	

APPLICATION

Shockoe Solar, LLC ("Shockoe Solar"), by counsel, hereby submits this application to the State Corporation Commission ("Commission") pursuant to Rule 80 A of the Commission's Rules of Practice and Procedure, 5 VAC 5-20-80 A, and 20 VAC 5-335-80 C, *Permitting of non-utility energy storage facilities*, for a permit ("Permit") to construct, own and operate an approximately 20 megawatt ("MW") battery energy storage system ("BESS") to be located in Pittsylvania County, Virginia ("Application").[1] Shockoe Solar was formed for the purpose of developing, constructing, owning, and operating an approximately 60 MW alternating current ("AC") photovoltaic solar electric generating project ("Solar Facility") and the associated BESS that is the subject of this Application (collectively, "Project"). As the BESS will be an integral component of the Solar Facility, this Application at times provides information about the renewable energy Project as a whole. In this Application, however, Shockoe Solar is requesting a Permit from the Commission for the BESS only.

Shockoe Solar requests that the Commission approve the BESS, grant a Permit and grant such other authority, approval, waivers, or relief as may be appropriate under the law and the

[1] For purposes of this Application, the BESS is an energy storage facility, an energy storage system, and an energy storage resource as such terms are defined in 20 VAC 5-335-20, and includes all equipment, other than a transmission or distribution line, needed to interconnect the energy storage resource to the utility's electric system. Such additional equipment includes all switchgear, transformers, inverters, switches, cables, wires, conductors, bus work, protection devices and systems, communication and control devices and systems, fire protection systems, environmental protection systems, and other related equipment.

Commission's rules and regulations for Shockoe Solar to construct, own, and operate the BESS. In support of its Application, Shockoe Solar respectfully states the following:

I. The Applicant Has the Technical and Financial Fitness to Construct, Operate and Maintain the BESS

A. Ownership of Shockoe Solar

Shockoe Solar, a Delaware limited liability company, is a wholly owned indirect subsidiary of Hanwha Energy USA Holding Corporation d/b/a 174 Power Global LLC ("174 Power Global") which is a wholly owned indirect subsidiary within the Hanwha Group ("Hanwha Group"). 174 Power Global and the Hanwha Energy Corporation ("Hanwha Energy") will provide the financial backing and technical expertise for the Shockoe Solar Project. Hanwha Energy is the parent company of 174 Power Global. The Hanwha Group is a Fortune Global 500 company deeply invested in the solar business and uniquely motivated to fully execute on project opportunities. An overview of Shockoe Solar's ownership is attached as Appendix 1, Attachment 4 a. None of Shockoe Solar's direct or indirect owners is an affiliate of an incumbent electric utility as that term is defined in § 56-576 of the Code of Virginia ("Code").

B. Experience in Developing Renewable Energy Projects

174 Power Global and its affiliates have extensive experience in the development, construction, and operation of photovoltaic solar energy generating facilities and battery energy storage systems throughout the United States. A table showing the other projects developed and managed by the affiliates of Shockoe Solar is attached as Appendix 1, Attachment 5 a.

C. Financial Resources of Shockoe Solar

174 Power Global and Hanwha Energy will provide the financial backing and technical expertise for the Shockoe Solar Project. See **EXTRAORDINARILY SENSITIVE** Supplement

for (i) Application Insert Section I. C; (ii) Attachment 4 b (an ownership overview); and (iii) Attachment 4 c (a list of projects that have been financed by 174 Power Global).

D. FERC's Regulation of Shockoe Solar

Shockoe Solar intends to file a notice with the Federal Energy Regulatory Commission ("FERC") to certify that it is an exempt wholesale generator ("EWG") as that term is defined in the Public Utility Holding Company Act of 2005[2] and Section 366.7 of the FERC regulations.[3] Shockoe Solar anticipates that FERC will authorize it to sell energy, capacity, and ancillary services at market-based rates. Because Shockoe Solar will sell electricity for resale, it will be subject to FERC's jurisdiction. Therefore, Shockoe Solar's rates and services will be regulated by FERC, and not by the Commission.

As noted above, none of Shockoe Solar's direct or indirect owners is affiliated with an incumbent electric utility as defined in § 56-576 of the Code. The Project will not serve any Virginia electric retail customers, and the costs of the Project will not be included in the base rates of any utility regulated by the Commission. Therefore, Shockoe Solar will not be subject to any provisions of the Code that regulate the rates and service of public utilities that supply retail electric service.

E. Permit by Rule for the Solar Facility

This Application seeks a Permit from the Commission for the BESS only. Shockoe Solar will file a permit by rule ("PBR") application for the Solar Facility portion of the Project with the Virginia Department of Environmental Quality ("DEQ") pursuant to Code § 10.1-1197.5 *et seq.*

[2] 42 U.S.C. §§ 16451-16463.
[3] 18 C.F.R. § 366.7.

II. Description of the Project and the Proposed BESS

A. Description of the Project

Shockoe Solar intends to construct, own, and operate the (i) Solar Facility on approximately 800 contiguous acres, and (ii) the BESS on approximately 1.33 acres, within the Solar Facility's project site. The BESS will allow the Solar Facility to provide energy to the grid during periods when the photovoltaic solar panels cannot produce electricity, thereby contributing to the efficiency of the Project and allowing for more consistent energy inputs into the electrical grid.

B. Description of the Proposed BESS

The BESS is an energy storage facility, an energy storage system, and an energy storage resource as defined in 20 VAC 5-335-20 and includes all equipment, other than a transmission or distribution line, needed to interconnect the energy storage resource to the utility's electric system. Such additional equipment includes, as applicable, all switchgear, transformers, inverters, switches, cables, wires, conductors, bus work, protection devices and systems, communication and control devices and systems, fire protection systems, environmental protection systems, and other related equipment and facilities.[4]

Shockoe Solar anticipates that the proposed nickel manganese cobalt ("NMC")-based Lithium-Ion solution batteries will be AC-coupled and used primarily for energy shifting to create a dispatchable solar energy power plant. The design, however, will allow utilization of the batteries in any fashion that best supports the objective to supply reliable power to customers. The proposed BESS will have a two- to four-hour duration and will be AC-coupled to the Solar Facility. The battery generally comprises four components: (i) cell, (ii) module, (iii) rack, and (iv) container. One battery rack consists of battery modules and each module is made of multiple

[4] 20 VAC 5-335-20.

individual battery cells. Each rack will have a BPU (Battery Protection Unit) to protect the system. Multiple racks are combined into a container to increase the overall power of the system and fed into a power conversion unit. This complete system is controlled by an Energy Management System ("EMS") that coordinates and aggregates the functions of each subsystem. A more detailed description of the BESS is set forth in Appendix 1.

C. Construction Standards and Environmental Permits.

The BESS will be constructed pursuant to all applicable codes and standards as detailed in Appendix 1 in the response to question 7e. Shockoe Solar is presently consulting with numerous regulatory agencies and will obtain all necessary environmental permits for the BESS in coordination with the DEQ and other agencies such that the BESS will reasonably minimize adverse impacts on the environment. Shockoe Solar retained Stantec Consulting Services, Inc. ("Stantec") to conduct an assessment of the BESS site to facilitate the DEQ's and other relevant agencies' review and analysis of the proposed installation and operation of the BESS. The DEQ Supplement is attached as Appendix 2. Based on Stantec's assessment, the BESS, among other things, (i) will not emit any harmful air pollutants or greenhouse gases ("GHGs"), (ii) does not require any air permits, (iii) will not emit pollutants during operations, (iv) does not need emissions offsets or allowances, and (v) does not require a water source for installation or operation. In addition, no wetlands or waters of the United States are located within the BESS site. The status of applications and other communications with these agencies, as of the filing of the Application, is indicated in the DEQ Supplement.

D. Project Site.

The BESS site consists of approximately 1.33 acres in Pittsylvania County, Virginia, of which 0.71 acres is row crop agricultural fields and 0.62 acres is forest that will be converted for

construction of the BESS. A topographical map depiction of the proposed BESS site is attached as Appendix 1, Attachment 6 b. Shockoe Solar holds an option to lease the site from a private entity. Shockoe Solar will exercise the option and lease the land prior to the commencement of construction activities. As such, Shockoe Solar maintains operating control over all real estate required for the BESS.

E. Scenic Assets and Historic Assets. Stantec has conducted a Phase IA Cultural Resources Survey for the proposed BESS site. Based on Stantec's assessment, all shovel tests conducted within the BESS footprint and the immediate surrounding areas were negative for cultural resources and therefore no archaeological resources were identified within the BESS site area. An overview of the archaeological and architectural resources in the vicinity of the BESS is set forth in the DEQ Supplement. See Appendix 2.

F. Pittsylvania County Approval. On September 8, 2020, the Pittsylvania County Board of Zoning Appeals approved a special use permit, with conditions (Final Order S-20-012), approving Shockoe Solar's Solar Facility which includes the BESS.

III. The Proposed BESS Meets the Applicable Regulatory Standards to Obtain a Permit

Shockoe Solar seeks an order granting Shockoe Solar a Permit to construct, own and operate the BESS pursuant to 20 VAC 5-335-80[5] and for such other authority, approval, waivers, or relief as may be appropriate under the law and the Commission rules and regulations.

A. Regulatory Standards for Approval of Permit

Pursuant to 20 VAC 5-335-80 B, in order to approve an energy storage facility, the Commission must find it (i) will have no material adverse effect upon the reliability of electric

[5] *See 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. 201230015, Order Adopting Regulations (Dec. 18, 2020).

service provided by any regulated public utility; (ii) does not adversely impact any goal established by the Virginia Environmental Justice Act (Code § 2.2-234 *et seq.*); and (iii) is not otherwise contrary to the public interest.

B. The Proposed BESS Meets the Applicable Regulatory Standards

The BESS satisfies each criteria the Commission designated in 20 VAC 5-335-80 B. Shockoe Solar's Application supports a finding that the BESS: (i) will have no material adverse effect upon the reliability of electric service provided by any regulated public utility; (ii) does not adversely impact any goal established by the Virginia Environmental Justice Act; and (iii) is not otherwise contrary to the public interest.

1. The BESS Will Have No Material Adverse Effect Upon the Reliability of Electric Service Provided by Any Regulated Public Utility.

The BESS will not have a material adverse effect upon the reliability of electric service provided by any regulated public utility in Virginia. Rather, the BESS should assure greater reliability of electric service in the local region.[6] Shockoe Solar's integration of the BESS into the Solar Facility will allow the Project to smooth the flow of generation output into the grid resulting in increased energy reliability and will enable firm dispatch of renewable energy to provide load following. Further, it will increase the power delivered through the same electrical interconnection infrastructure, thus reducing the need for additional transmission or distribution lines to serve the area.

Shockoe Solar is progressing through the PJM Interconnection, L.L.C. ("PJM") interconnection process. The BESS will utilize the same interconnection facilities that will be

[6] *See, e.g., Application of Chickahominy Power, LLC, For certification of an electric generating facility in Charles City County pursuant to § 56-580 D of the Code of Virginia*, Case No. PUR-2017-00033, 2018 S.C.C. Ann. Rept. 209, Final Order at 9 (May 8, 2018); *Application of C4GT, LLC, For certification of an electric generating facility in Charles City County pursuant to § 56-580 D of the Code of Virginia*, Case No. PUE-2016-00104, 2017 S.C.C. Ann. Rept. 378, Final Order at 9 (May 3, 2017); *Application of Doswell Limited Partnership, For approval and certification of a 340 MW electric generating facility in Hanover County y pursuant to §§ 56-46.1 and 56-580 D of the Code of Virginia*, Case No. PUE-2015-00127, 2016 S.C.C. Ann. Rept. 319, Final Order at 11 (June 1, 2016).

constructed for the Solar Facility to interconnect to the Mecklenburg Electric Cooperative system in accordance with an interconnection agreement between Shockoe Solar and Mecklenburg Electric Cooperative. Therefore, the BESS itself will not require any incremental physical interconnection facilities (see section 5, page 5 of the Feasibility Report referenced below). Shockoe Solar will fund the BESS's share of transmission system network upgrades based on the results of the PJM studies for Queue number AF2-403. In July 2020, for AF2-403, PJM completed the Generation Interconnection Feasibility Study Report ("Feasibility Report" or "Report") for the BESS, which is attached as Appendix 1, Attachment 14 a. As a condition of its ability to transmit power through the Mecklenburg Electric Cooperative system to and across the broader PJM system, Shockoe Solar will be obligated to pay for its *allocated portion* of required upgrades to the system in accordance with the finalized Interconnection Services Agreement ("ISA") with PJM, or an equivalent agreement with PJM, as an affected system. Completion of the Feasibility Report is the first step in determining what, if any, network upgrades will be required for the project. Although the Report indicates a cost of approximately $53 million for network upgrades, these costs are the total costs from which the BESS will receive an allocation. In the case of AF2-403, while the BESS will receive a cost allocation, it likely will not require any new system upgrades because it will utilize network upgrades already planned or installed. The BESS will pay its share of the cost of these planned or installed network upgrades, based on the capacity it requires. A more detailed overview of the anticipated interconnection is detailed in Appendix 1, in the response to question 14 a and 14 b.

As previously noted, Shockoe Solar anticipates that FERC will authorize it to sell energy, capacity, and ancillary services at market-based rates. The BESS will not make direct retail sales of electricity or provide retail electric service to end users in the Commonwealth. The BESS will

contribute to the diversity of competitive storage resources available in the Commonwealth.

2. The BESS Does Not Adversely Impact Any Goal Established by the Virginia Environmental Justice Act (§ 2.2-234 *et seq.* of the Code of Virginia)

The BESS does not adversely impact any goal established by the Virginia Environmental Justice Act ("Act"). Pursuant to the Act, it is the policy of the Commonwealth to promote environmental justice and ensure that it is carried out throughout the Commonwealth, with a focus on environmental justice communities and fenceline communities.[7] The Act defines environmental justice communities as "any low-income community or community of color." The Act defines "low-income community" as any census block group in which 30 percent or more of the population is composed of people with low income." Further, the Act defines "low income" as "having an annual household income equal to or less than the greater of (i) an amount equal to 80 percent of the median income of the area in which the household is located, as reported by the Department of Housing and Urban Development, and (ii) 200 percent of the Federal Poverty Level."

Shockoe Solar retained Stantec to review the BESS vis-à-vis the Act. The Census block in which the BESS is located would not be considered a low-income community because less than 30% of the population is composed of people with low income.[8] However, an adjacent Census block would qualify and, therefore, low-income communities are considered present.[9] The Act defines a "community of color" as a "geographically distinct area where the population of color, expressed as a percentage of the total population of such area, is higher than the population of color in the Commonwealth expressed as a percentage of the total population of

[7] *See* Code § 2.2-235.

[8] *See* the U.S. Environmental Protection Agency (EPA) EJ Screen Summary Report for Census Tract 208, accessed on February 17, 2021, available at https://ejscreen.epa.gov/mapper/.

[9] *See* the U.S. Environmental Protection Agency (EPA) EJ Screen Summary Report for Census Tract 208, accessed on February 17, 2021, available at https://ejscreen.epa.gov/mapper/.

the Commonwealth. However, if a community of color is composed primarily of one of the groups listed in the definition of "population of color," the percentage population of such group in the Commonwealth shall be used instead of the percentage population of color in the Commonwealth."

Using the definitions provided in the Act, the Census block in which the BESS will be located would be considered a community of color because according to the 2014-2018 ACS data, the percentage population group primarily comprising the population of color is more than the percentage of that population within the Commonwealth. [10] An adjacent Census block also includes a community of color.

The Act defines a fenceline community as "an area that contains all or part of a low-income community or community of color and that presents an increased health risk to its residents due to its proximity to a major source of pollution." The BESS is not a major source of pollution and no major sources of pollution are present within one mile of the BESS. As such, fenceline communities are not considered to be present within the vicinity of the BESS.

Shockoe Solar believes that the BESS will promote economic justice by contributing to the community through the creation of jobs and providing tax revenue to Pittsylvania County which can be used to serve the needs of the County and its residents. As described in the response to question 12 in Appendix 1, the BESS is part of the larger Project that will produce economic benefits for the area.

Shockoe Solar also took steps to inform the community about the Project and solicited feedback. A public information meeting was not held due to COVID-19; however, informational letters were sent out to landowners within approximately a half-mile radius of the Project limits.

[10] *See* the U.S. Census Bureau quick facts for Virginia, accessed on February 12, 2021, available at https://www.census.gov/quickfacts/VA.

In addition, Shockoe Solar held several meetings with the County Board of Supervisors, Planning Commission, and County Board of Zoning Appeals where Shockoe Solar presented information concerning the Project and addressed questions concerning the effect of the Project on the community.

The BESS will have minimal impact to the environment, as more fully described in the DEQ Supplement, included as Appendix 2 to this Application and as detailed in Appendix 1, in the response to question 12. The BESS will be located on approximately 1.33 acres, the majority of which is cleared land. The BESS will not emit harmful air pollutants or GHGs and will reduce the need for traditional energy generating facilities, such as coal, natural gas, and oil power plants. The BESS will allow the Solar Facility to provide energy to the grid during periods when the photovoltaic panels cannot produce, thereby further decreasing the need for traditional fossil fuel sources of energy and the associated impacts of air pollutants, GHG emissions, and other discharges. Furthermore, by serving as a "reservoir" of locally stored electricity, the BESS will contribute to a "non-wires" solution to transmission constraint and thereby generally relieve the need for transmission grid expansion. No wetlands or other waters will be impacted by construction of the BESS. Erosion and sediment control measures and post-construction stormwater facilities will protect downstream waters from stormwater runoff. There will be no storage of hazardous materials at the BESS; therefore, it will not be a source of land pollution. There will be no odors produced by the BESS. There will be minimal noise produced by standard HVAC systems used to cool the BESS. This noise will not be audible beyond the limits of the Solar Facility. The BESS will be screened from adjoining public roads and residences by existing vegetation and supplemental plantings in areas where existing tree growth and topography along the Project Boundary do not effectively reduce visibility of the BESS.

For the foregoing reasons, the BESS does not adversely impact any goal established by the Act.

3. Construction and Operation of the BESS Is Not Contrary to the Public Interest

The construction and operation of the BESS is not contrary to the public interest. Rather, as a part of the Project, the BESS will promote the public interest by providing economic benefits to Pittsylvania County. Moreover, the BESS Project will have no material adverse effect on the reliability of electric service provided by any regulated public utility. As noted above, as a condition of Shockoe Solar's delivery of power across Mecklenburg Electric Cooperative and broader PJM system, Shockoe Solar will be responsible for funding the cost of upgrades to the system that is will utilize (in accordance with agreements that are anticipated to be finalized among Shockoe Solar, PJM, and Mecklenburg Electric Cooperative) and that PJM concludes are necessary to ensure reliable operation of the transmission system as specifically identified and set forth in the ISA.[11] Shockoe Solar will comply with all necessary federal, state, and local environmental permits as required to construct and operate the BESS.[12]

As described herein, the BESS (i) will have no material adverse effect upon reliability of electric service provided by any regulated public utility, (ii) will contribute to the diversity of competitive energy storage resources in the Commonwealth, (iii) will not affect the reliability of electric service provided by any regulated public utility in Virginia, (iv) will provide local economic benefits, and (v) will comply with all necessary federal, state, and local environmental

[11] *See Application of Skipjack Solar Center, LLC, et al., For certificates of public convenience and necessity for solar generating facilities up to 320 MW in Charles City County, Virginia,* Case No. PUR-2019-00073, Order Granting Certificates at 15-16 (Mar. 5, 2020) ("Skipjack Solar Order") (the Commission determined that the solar project was not "contrary to the public interest" as contemplated by Code § 56-580 D, because, among other things, the record established that construction and operation of the proposed project would have no material adverse effect on reliability if the applicant funds and completes the upgrades PJM finds necessary for the Project); *see also,* Pleinmont Solar Order at 18, (the Commission determined that the solar project was not "contrary to the public interest" as contemplated by § 56-580 D of the Code).

[12] Pleinmont Solar Order at 18 and 19.

permits. Moreover, the business risk associated with constructing, owning, and operating the BESS, which will not provide retail electric service in the Commonwealth and will not be included in the rate base of any incumbent electric utility, rests solely with Shockoe Solar.[13] The BESS is not contrary to the public interest. See Appendix 1, section 17 for further details.

IV. General

A. Request for Waiver from Filing Requirements

1. Filing Requirements.

This Application is supported by the information contained in Appendix 1 in response to 20 VAC 5-335-80 C. The Commission shall consider requests for waivers of any provisions of Chapter 302 of the Virginia Administrative Code on a case-by-case basis and may grant waivers upon such terms and conditions as the Commission deems appropriate in the public interest.[14] Shockoe Solar respectfully requests waiver, pursuant to 20 VAC 5-335-130, of the applicability of any filing requirement that may apply to this proceeding, to the extent that Shockoe Solar has not provided such information in its Application.

As Shockoe Solar will not be subject to any provisions of the Code that regulate the rates and service of public utilities that supply retail electric service, Shockoe Solar requests waiver of certain information required in 20 VAC 5-335 C. As noted above, the BESS will not serve any Virginia electric supply customers and the costs of the BESS will not be included in the base rates of any utility regulated by the Commission. Further, Shockoe Solar intends to file a notice with FERC to certify that it is an EWG. As such, Shockoe Solar anticipates that FERC will authorize it to sell energy, capacity, and ancillary services at market-based rates. Because

[13] *Id. See also* Skipjack Solar Order at 15-16.

[14] *See, e.g., Application of James River Cogeneration Company, For a Certificate to Operate as an Electric Generating Facility Pursuant to Virginia Code § 56-580 D*, Case No. PUE-2007-00092, Final Order at 6, (Jan. 9, 2008) (the Commission granted waivers pursuant to 20 VAC 5-302-10 *et seq.* of any filing requirement that may have applied to the extent that the applicant had not provided such information in its application).

Shockoe Solar will sell electricity for resale, it will be subject to FERC's jurisdiction. Therefore, Shockoe Solar's rates and services will be regulated by FERC, and not by the Commission. In addition, none of Shockoe Solar's direct or indirect owners is affiliated with an incumbent electric utility as defined in § 56-576 of the Code. The Project will not serve any Virginia electric retail customers, and the costs of the Project will not be included in the base rates of any utility regulated by the Commission.

Specifically, Shockoe Solar respectfully requests a waiver of the requirement to provide certain information required by 20 VAC 5-335-80 C as set forth below:

7. Specific information about the proposed facility, including:
   c. Estimated costs, and schedule for construction, testing and commercialization.

   - Shockoe Solar respectfully requests waiver of the requirement to provide estimated cost information. However, Shockoe Solar has provided a schedule for construction, testing and commercialization.

8. A general discussion of the selection process for the energy storage technology, including a description of any competitive procurement processes used.

   - Shockoe Solar respectfully requests a waiver of the requirement to provide a description of any competitive procurement process that may have been used in the past or may be used in the future regarding the selection process for the energy storage technology. However, Shockoe Solar has provided the selection process for the energy storage technology.

C. Extraordinarily Sensitive Information

The **EXTRAORDINARILY SENSITIVE** Supplement to this Application is being filed under seal with the Clerk of the Commission pursuant to Rule 170 of the Commission's Rules of Practice and Procedure, 20 VAC 5-20-170, and Rule 120 of the Commission's Regulations Governing the Deployment of Energy Storage, 20 VAC 5-335-120, along with a separate Motion for Protective Order and Additional Protective Treatment.

D. Communications

All service and correspondence concerning this Application should be addressed to the following:

Pauline Ung, Esq.
Vice President, Legal
174 Power Global
200 Spectrum Center Drive
Suite 1020
Irvine, CA 92618
Tel: (917) 297-8671
pauline.ung@174powerglobal.com

Robert F. Riley
Bradley J. Nowak
Williams Mullen
1666 K Street NW
Suite 1200
Washington DC 20006
Tel: (202) 833-9200
rriley@williamsmullen.com
bnowak@williamsmullen.com
Counsel for Shockoe Solar, LLC

Robert D. Perrow
Williams Mullen
200 South 10th Street, Suite 1600
Richmond, Virginia 23219
(804) 420-6446
bperrow@williamsmullen.com
Counsel for Shockoe Solar, LLC

V. Relief Requested

WHEREFORE, as described in the Application, Shockoe Solar respectfully requests that the Commission issue an order granting Shockoe Solar (i) a Permit to construct, own and operate the BESS pursuant to 20 VAC 5-335-80 C and (ii) such other authority, approval, waivers, or relief as may be appropriate under the law and the Commission rules and regulations.

Dated at Richmond, Virginia, this 26th day of February 2021.

Respectfully submitted,

SHOCKOE SOLAR, LLC

By: /s/Robert F. Riley
Title: Counsel for Applicant

Robert D. Perrow
Williams Mullen
200 South 10th Street, 16th Floor
Richmond, Virginia 23218
Tel: (804) 420-6446
Email: bperrow@williamsmullen.com

Robert F. Riley
Bradley J. Nowak
Williams Mullen
1666 K Street N.W., Suite 1200
Washington, DC 20006
Tel: (202) 833-9200
Email: rriley@williamsmullen.com
Email: bnowak@williamsmullen.com

CERTIFICATE OF SERVICE

I hereby certify that on this 26th day of February, 2021, a copy of the Application of Shockoe Solar, LLC for a permit to construct, own and operate an energy storage facility was delivered by hand or mailed, first-class, postage prepaid, to the following:

William H. Chambliss, Esq.
State Corporation Commission
Tyler Building, 10th Floor
1300 E. Main Street
Richmond, Virginia 23219

C. Meade Browder, Jr., Esq.
Division of Consumer Counsel
Office of Attorney General
202 N. 9th Street, 8th Floor
Richmond, Virginia 23219-3424

/s/ Robert F. Riley

Robert F. Riley
Williams Mullen
1666 K Street NW, Suite 1200
Washington DC 20006
Tel: (202) 833-9200
rriley@williamsmullen.com
Counsel for Shockoe Solar, LLC

APPENDIX 1

TO THE APPLICATION OF SHOCKOE SOLAR, LLC

For a permit to construct and operate an energy storage facility

Case No. PUR-2021-00041

Containing information in response to
20 VAC 5-335-80, *Permitting of non-utility energy storage facilities*[1]

Filed: February 26, 2021

[1] Shockoe Solar, LLC is providing responses for the purposes of supporting its Application. To the extent the information requested is not currently available or is not applicable, Shockoe Solar, LLC has so noted herein.

20 VAC 5-335-80 C. Other than a Phase I or Phase II Utility, each person applying for a permit to construct and operate an energy storage facility with an energy storage power rating of one megawatt or greater shall file an application with the clerk of the commission. Applications shall include the following information:

1. **Legal name of the applicant as well as any trade name.**

   The legal name of the applicant is Shockoe Solar, LLC ("Shockoe Solar"). Shockoe Solar does not have a trade name.

2. **A description of the applicant's authorized business structure, identifying the state authorizing such structure and the associated date (e.g., if incorporated, the state and date of incorporation: if a limited liability company, the state issuing the certificate of organization and the date of issuance).**

   Shockoe Solar is a limited liability company organized under the laws of the state of Delaware. Shockoe Solar was formed on March 19, 2019. Shockoe Solar is registered to transact business in the Commonwealth of Virginia.

3. **Name and business addresses of all principal corporate officers and directors, partners, and LLC members, as appropriate.**

   The sole member of Shockoe Solar is Hanwha Energy USA Holding Corporation d/b/a 174 Power Global LLC ("174 Power Global"). 174 Power Global is the sole Manager of Shockoe Solar (there are no officers appointed). The business address for 174 Power Global is 300 Spectrum Center Drive, Suite 1020, Irvine, CA 92618.

4. **Financial information for the applicant, or principal participant in the project. If the applicant or principal participant is a private entity, financial information should include an analysis of the entity's financial condition and audited financial statements for the two most recent fiscal years, if available. If the applicant or principal participant is a public company, financial information should include a copy or a link to where a copy can be found on the internet of the entity's most recent stockholder report and most recent Securities and Exchange Commission Form 10-K. If such information is unavailable, provide evidence that applicant has the financial resources, or access to capital, necessary to complete the proposed project.**

Shockoe Solar was formed for the purpose of developing, constructing, owning, and operating an approximately 60 megawatt ("MW") alternating current ("AC") photovoltaic solar electric generating project ("Solar Facility") and the associated battery energy storage system ("BESS") in Pittsylvania County, Virginia. For purposes of this Application, the term "Project" includes the BESS and the Solar Facility. Shockoe Solar is a private company that does not yet have audited financial statements; as such, stockholder reports and Securities and Exchange Commission Form 10-K are not available.

Shockoe Solar is a wholly owned indirect subsidiary of 174 Power Global, which is a wholly owned indirect subsidiary within the Hanwha Group ("Hanwha Group"). 174 Power Global and Hanwha Energy Corporation ("Hanwha Energy") will provide the financial backing and technical expertise for the Shockoe Solar Project. Hanwha Energy is the parent company of 174 Power Global. The Hanwha Group is a Fortune Global 500 company deeply invested in the solar business and uniquely qualified to fully execute on project opportunities.

See **EXTRAORDINARILY SENSITIVE** Supplement for (i) Application Insert Section I. C; (ii) Attachment 4 b (an ownership overview); and (iii) Attachment 4 c (a list of projects that have been financed by 174 Power Global).

5. A discussion of the applicant's qualifications, including:

a. A summary of other projects developed and managed by the applicant. Include location, status, and operational history.

Shockoe Solar is a special-purpose entity organized solely to develop, construct, own, and operate the Project including the BESS and has not developed or managed other projects. A table showing the other projects developed and managed by Shockoe Solar's affiliates is attached as Appendix 1, Attachment 5 a.

b. A description of any affiliation with an incumbent electric utility as defined in § 56-576 of the Code of Virginia.

Shockoe Solar is not affiliated with an incumbent electric utility as defined in § 56-576 of the Code of Virginia ("Code").

c. A disclosure of any affiliate relationship with any other permit holder.

Shockoe Solar is not affiliated with any entity that holds a permit to build a battery energy storage facility in Virginia.

6. Specific information about the site for the proposed facility, including:

a. A written description of the location including identification of the city or county in which the facility will be constructed. Such description should be suitable for newspaper publication and sufficiently identify any affected areas.

The BESS will be located on approximately 1.33 acres in Pittsylvania County within the Shockoe Solar Project site. The BESS facility will be located at 8961 Halifax Road, in Pittsylvania County - Tax map #2465-07-2142. The site is located at 36.814694, Latitude, -79.259779 Longitude.

The site is located along Halifax Road (State Route 57), approximately 1,095 feet from its intersection with Java Road (State Route 640). The site is located approximately 0.2 miles from the existing Shockoe DP substation owned by Mecklenburg Electric Cooperative.

b. A description of the site, and a topographic map depiction of the proposed site.

The BESS site consists of approximately 1.33 acres, of which 0.71 acres is row crop agricultural fields and 0.62 acres is forest that will be converted for construction of the BESS. Access to the site is provided by Java Road (State Route 640) which runs along the northern portion of the Solar Facility portion of the site. A topographical map depiction of the proposed BESS site is attached as Appendix 1, Attachment 6 b. The information provided on Attachment 1, 6 b is based on conceptual designs and is subject to change after consultation with Mecklenburg Electric Cooperative and final engineering design (locations are approximate and subject to change).

c. The status of site acquisition (e.g., purchase option, ownership).

Shockoe Solar holds an option to lease the site from a private entity. Shockoe Solar will exercise the option and lease the land prior to the commencement of construction activities.

d. A description of any applicable local zoning or land use approvals required and the status of such approvals.

On September 8, 2020, the Pittsylvania County Board of Zoning Appeals approved special use permit, with conditions (Final Order S-20-012), approving Shockoe Solar's Solar Facility which includes the BESS.

7. Specific information about the proposed facility, including:

a. **Description of all major systems, including energy storage technology type and battery storage chemistry type, if applicable, intended uses, intended facility useful life, facility configuration, and expected suppliers of major components.**

The BESS is an energy storage facility, an energy storage system, and an energy storage resource as such terms are defined in 20 VAC 5-335-20, and includes any equipment, other than a transmission or distribution line, needed to interconnect the energy storage resource to the utility's electric system. Such additional equipment includes, as applicable, all switchgear, transformers, inverters, switches, cables, wires, conductors, bus work, protection devices and systems, communication and control devices and systems, fire protection systems, and environmental protection systems and other related equipment.

Battery Storage Technical System Description
Battery storage can provide several services and functions which are useful to grid operators and load serving entities. Shockoe Solar anticipates that the proposed batteries will be AC-coupled and used primarily for energy shifting to create a dispatchable solar energy power plant, however the design will allow utilization of the batteries in any fashion that best supports the mission to supply reliable power to customers. The BESS will provide flexibility to system dispatchers to meet customer demand by giving the operators better control of the plant. The proposed BESS will have a two- to four-hour duration and will be AC-coupled to the Solar Facility.

The BESS generally comprises four components: (i) cell, (ii) module, (iii) rack, and (iv) container. One battery rack consists of battery modules and each module is made of multiple individual battery cells. Each rack will have a Battery Protection Unit (BPU) to protect the system. Multiple racks are combined into a container to increase the overall power of the system and fed into a power conversion unit. This complete system is controlled by an Energy Management System ("EMS") that coordinates and aggregates the functions of each subsystem.

Battery Specification
The battery modules are anticipated to be provided by Samsung (or equivalent), one of the largest suppliers of battery modules in the world. Samsung SDI is one of the market leaders in stationary energy storage systems. The Samsung Li-Ion energy storage system relies on advanced lithium nickel manganese cobalt oxide ("NMC") chemistry to provide a combination of high energy density, long life, low cost, and industry leading safety and reliability.

Power Conversion System ("PCS") Specification
The proposed PCS is manufactured by Power Electronics (or equivalent) and provides up to a maximum 98.8% round-trip efficiency. The PCS capacity has been designed with enough spare capacity so that the control system can be configured in a way that makes it easier to maintain the battery State of Charge.

The PCS can provide reactive power in addition to the active power which is produced by conversion of incoming battery power. The resulting apparent power which is defined by the PCS's nameplate rating is calculated using reactive power and active power. The PCS has the capability to support the grid by remaining online or by reactive power feed-in during a temporary change of the grid voltage beyond preset low voltage ("LV") and high voltage ("HV") thresholds. The PCS will also ride through abnormal frequency events with the capability of reducing the output power at high frequency scenarios.

Plant Control and Battery Technical Description
The BESS and Solar Facility power plant controllers can be directly connected to a Generator Management System via the supervisory control and data acquisition (SCADA) system and the EMS. The SCADA system will communicate via a slave dataset to facilitate any third-party requirements for monitoring, dispatch, and control.

Battery Degradation and Cycling Capabilities

The battery degradation is highly dependent on the number of cycles that the system experiences. A charge cycle is a complete charge and discharge on a rechargeable battery. A cycle is also defined as the cumulation of partial discharges and charges where the state of the charge of battery oscillates between the ranges of 100% and 0%. The total cycles per a given time period can be calculated by summing the real power discharged by the battery during that time period and dividing it by the capacity of the batteries. The discharges will be measured by the Battery Management System ("BMS"). Battery cycles can also be validated using a net generation output meter ("NGOM") which will measure both charging energy and discharging energy/power separately. All discharged energy can be summed then grossed up for losses to calculate the total output of the energy storage system. The number of cycles can be calculated taking the total output of the energy storage system and dividing it by the summed usable capacity of all connected battery modules integrated in the system.

When the system is allowed to cycle the batteries as much as 365 times per year, the battery capacity degradation is expected to be roughly 2% per year. Increased cycling, but at a shallower depth, will also preserve battery capacity. The Project's ability to cycle on and off, along with other operating limitations, will be configured in and controlled by the BESS EMS, which will function based upon the BESS's state of charge. Cycling limits of the battery system will be dictated by the battery manufacturer's warranty terms. The total life of the battery is expected to be twenty years.

b. Energy storage power rating, energy capacity, and storage duration.

The BESS capacity will be approximately 20 MW, with a duration of 2 to 4 hours (40 to 80 megawatt-hours).

c. Estimated costs, and schedule for construction, testing and commercialization.

Shockoe Solar respectfully requests waiver of the requirement to provide such estimated cost information. Shockoe Solar notes that the Commission does not require an applicant to provide cost information regarding the certification of electric generating facilities (i) with rated capacities of 50 MW or less, or (ii) renewable energy electric generating facilities with rated capacities equal to 100 MW or less.[2] As Shockoe Solar is not a regulated utility, the business risk associated with the BESS will be borne solely by Shockoe Solar, with no impact on the rates paid by Virginia ratepayers. Thus, the business risk associated with the cost of constructing, owning, and operating the BESS, which will not be included in the rate base of any incumbent electric utility and rests solely with Shockoe Solar.[3]

---

[2] *See* 20 VAC 5-302-25.

[3] *See Application of Skipjack Solar Center, LLC, et al., For certificates of public convenience and necessity for solar generating facilities up to 320 MW in Charles City County, Virginia,* Case No. PUR-2019-00073, Order Granting Certificates at 15-16 (Mar. 5, 2020); *Application of Pleinmont Solar, LLC et al.,* Case No. PUR-2017-00162, Order Granting Certificates (Aug. 8, 2018) ("Pleinmont Solar Order") at 18 and 19; *Application of C4GT, LLC, For certification of an electric generating facility in Charles City County pursuant to § 56-580 D of the Code of Virginia,* Case No. PUE-2016-00104, 2017 S.C.C. Ann. Rept. 378, Final Order at 11 (May 3, 2017) ("C4GT Order"); *see also Application of CPV Warren, LLC, For a certificate of public convenience and necessity for electric generation facilities in Warren County, Virginia,* Case No. PUE-2002-00075, Final Order at 17 (Mar. 13,

Construction of the BESS is anticipated to begin in the fourth quarter of 2022. Testing of the BESS is anticipated to begin during the first quarter of 2023, followed by commissioning and commercial operation in the second quarter of 2023. The foregoing draft schedule is based on current information and is subject to the Commission's approval of this Application.

d. Site layouts that provide for integration of energy storage systems with adequate spacing and property setback requirements incorporated.

Appendix 1, Attachment 6 b provides a conceptual site layout of the BESS.

e. Codes and standards to which the proposed facility will be constructed.

Underwriter Laboratories (UL)

- 1642 Standard for Lithium Batteries
- 1973 Standard for Batteries for Use in Stationary, Vehicle, and Light Electric Rail Applications
- 9540 Standard for Energy Storage Systems and Equipment
- 9540A Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
- 1741 Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
- 508C Standard for Power Conversion Equipment

National Fire Protection Association (NFPA)

- 855 Standard for the Installation of Stationary Energy Storage Systems
  - 10 - Standard for Portable Fire Extinguishers (2013)
  - 12 - Standard on Carbon Dioxide Extinguishing Systems (2011)
  - 13 - Standard for the Installation of Sprinkler Systems (2013)
- 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances (2013)
- 70 National Electrical Code (2014)
- 72 Fire Alarm and Signaling Code (2013)
- 80 Standard for Fire Doors and Other Opening Protectives (2013)
- 2001 Standard on Clean Agent Fire Extinguishing Systems (2015)

International Fire Code (IFC)

- Section 1206 Electrical Energy storage Systems

2003) ("CPV Warren Order").

International Electrotechnical Commission (IEC)

- IEC 62933-1 Electrical energy storage (EES) systems - Part 1: Vocabulary
- 62933-2-1 ESS Unit parameters and testing methods - General specification
- 62933-3-1 ESS, Planning and performance assessment of electrical energy storage systems
- 62933-5-1 Safety considerations for grid integrated ESS systems
- Fire Suppression to local codes
- Notifications/Alarms to local codes

f. Where applicable, the manner and location of the facility's interconnection to the transmission or distribution grid.

Shockoe Solar is progressing through the PJM Interconnection, L.L.C. ("PJM") interconnection process. Shockoe Solar has two pending PJM queue positions for the Project: AF2-403 (relating to the BESS) and AE2-187 (relating to the Solar Facility). See the response provided to question 14 (a) and (b) for additional and related information.

8. A general discussion of the selection process for the energy storage technology, including a description of any competitive procurement processes used.

174 Power Global continuously evaluates the utility scale storage market to keep abreast of the latest developments from dozens of vendors. This includes competitively bid and confidential RFPs for several projects and evaluating vendors with industry-wide confidential vendor RFIs. 174 Power Global has evaluated several storage technologies including multiple variants of Lithium-Ion, LFP, hydrogen, and flow batteries. For the BESS project, 174 Power Global has selected a nickel manganese cobalt (NMC)-based Lithium-Ion solution housed in outdoor containers. This technology was chosen because it is (i) the most mature (since 2016, over 1GW of NMC has been installed in the US alone); (ii) the most well understood (over 50% of grid scale batteries currently use NMC); and (iii) the most cost-effective solution available for the Shockoe Solar Project site. The NMC modules are placed in several containers near the substation. The containers are modular, feature fire suppression systems, sealed environments, HVAC, advanced battery/energy management systems and require no internal access. This results in a very stable, safe, and reliable energy storage system designed to work seamlessly with the solar resource.

Shockoe Solar respectfully requests a waiver of the requirement to provide a description of any competitive procurement process that may have been used in the past or may be used in the future regarding the selection process for energy storage technology.

9. A general discussion of economic development impacts of the project.

The Project will have a significant positive impact on the local economy and promote economic development. The BESS contributes to the efficiency of the Project thereby

allowing the economic benefits of the entire Project to be realized.

The Project is expected to provide substantial local and regional benefits from renewable energy electric generation and storage construction jobs and millions of dollars in private infrastructure investment in Virginia. The Project represents an initial capital investment of approximately $100 million. This is a significant private investment and economic development project in Pittsylvania County. The Project construction will create approximately 180 full-time equivalent jobs during construction and approximately four full-time equivalent local jobs during the 35-year operations phase of the Project. The Project will provide significant property tax revenue – approximately $100,000 in the first year of operations and an average of approximately $50,000 per year over the 35-year life of the Project. Additionally, participating landowners will receive an annual lease payment. As noted above, the BESS contributes to the efficiency of the Project thereby allowing the economic benefits of the entire Project to be realized.

As such, jobs created during construction and operation of the Project will provide significant payroll benefits and have important indirect economic benefits both locally and regionally.[4] In addition, other economic benefits will include the purchase of local supplies and services throughout Pittsylvania County and the surrounding area.

Moreover, while the Project, including the BESS, will contribute in a positive manner to the local economy, it will not cause any significant population growth and therefore will have very little impact on local services and infrastructure. In addition, none of the capital costs of the BESS will be borne by electric ratepayers of the Commonwealth.[5]

10. A list of other local, state or federal government agencies whose requirements must be met in connection with the construction or operation of the project and a statement of the status.

---

[4] *See, e.g., Application of Skipjack Solar Center, LLC, et al., For certificates of public convenience and necessity for solar generating facilities up to 320 MW in Charles City County, Virginia,* Case No. PUR-2019-00073, Order Granting Certificates at 14 (Mar. 5, 2020) ("Skipjack Solar Order") (finding that the solar project will likely generate direct and indirect economic benefits to the County as a result of employment and spending from construction and operation of the Project and the County will likely benefit from an increase in the local tax base); *Application of Foxhound Solar LLC, For approval and certification of certain electrical facilities associated with a small renewable energy project,* Case No. PUR-2019-00107, Final Order (Oct. 17, 2019) (construction of collection facilities will likely generate slight direct and indirect economic benefits to the County and the Commonwealth as a result of employment and spending from construction of said facilities and operation of the Project) ("Foxhound Order"); Pleinmont Solar Order (finding that the project will likely generate direct and indirect economic benefits to the County and the Commonwealth as a result of employment and spending from construction and operation of the project and the County will likely benefit from an increase in the local tax base); *Application of Doswell Limited Partnership, For approval and certification of electric transmission facilities: Remington-Gordonsville 230 kV Double Circuit Transmission Line,* Case No. PUE-2015-00127, Final Order (June 1, 2016) (finding that the Doswell Facility is likely to produce economic benefits in terms of jobs, taxes, and revenues. The"[p]roject will provide economic benefits to Hanover County and the Commonwealth" and is "is likely to create or support a number of jobs in the area and also may result in indirect benefits to the local community as a result of an increase in employment and incomes in the area.") ("Doswell Order").

[5] With regard to the Commonwealth, the Commission's finding of economic benefits takes into consideration the fact that a project will be owned by a non-utility and that the capital costs of the project would be borne by private investors, not by a utility's customers. *See, e.g.,* Pleinmont Solar Order at 16, footnote 77.

Permit/approval	Activity	Agency/ Entity	Status
General Virginia Pollution Discharge Elimination System ("VPDES") VAR10	Water quality and quantity impacts associated with project construction	Virginia Department of Environmental Quality	To be submitted
Land Use Permit	Work within VDOT right-of-way	Virginia Department of Transportation	To be submitted
Sediment and Erosion Control Plan Approval	Stormwater Pollution Prevention Plan for managing associated stormwater runoff	Pittsylvania County	To be submitted
Land Disturbance Permit	Land disturbance permits for residential and commercial construction and for general land clearing projects	Pittsylvania County Office of Environmental Management	To be submitted
Building Permit	Constructing, moving, altering, or demolishing a building or structure	Pittsylvania County Building Inspections Office	To be submitted
Special Use Permit	Utility-scale solar facility use in the A-1 Zoning Districts	Pittsylvania County Department of Community Development	Approved September 2020
Market-based rate authority and exempt wholesale generator status	Market-based rate authority and exempt wholesale generator status	Federal Energy Regulatory Commission	To be submitted

11. An analysis of the environmental impact of the project. This analysis shall include the impacts on the environment and natural resources, analysis of alternatives considered, unavoidable adverse impacts, mitigation measures proposed to minimize unavoidable impacts, and any irreversible environmental changes. The information required by this subdivision shall be submitted to the Department of Environmental Quality, simultaneously with its filing with the commission, for coordination and review by state agencies responsible for environmental and natural resource protection. [To the extent any of the following information is not applicable to a particular project or technology, the applicant shall indicate it is not applicable.] The information shall identify:

Shockoe Solar's responses to Section 11(a) – (n) are set forth in the "DEQ Supplement" prepared by Stantec Consulting Services, Inc., ("Stantec") which is attached to the Application as Appendix 2.

a. Required air permits, expected restrictions, expected emissions, rates of emissions, and any needed emissions offsets or allowances.

b. Required permits for water withdrawals, expected restrictions, the amount of water estimated to be used, the source of such water, identification of a backup source of water, if any, and identification of any facilities that need to be constructed to provide such water.

c. Required permits for water discharge and potential impacts on regional water flows.

d. Required permits related to the wetlands and an identification of any tidal and nontidal wetlands located near the proposed site and how such wetlands will be impacted by applicant's proposed facility.

e. Impact of solid and hazardous wastes on local water resources.

f. Impact on natural heritage resources, and on threatened and endangered species.

g. Erosion and sediment control measures.

h. Archaeological, historic, scenic, cultural, or architectural resources in the area.

i. Chesapeake Bay Preservation Areas designated by the locality.

j. Wildlife resources.

k. Agricultural and forest resources and federal, local, state or private parks and recreation areas.

l. Use of pesticides and herbicides.

m. Geology and mineral resources, caves, and sinkholes.

n. Transportation infrastructure.

12. An analysis of the social impact of the project, including a general discussion of why the facility will not have a disproportionate adverse impact on "historically economically disadvantaged communities" as defined in § 56-576 of the Code of Virginia.

Shockoe Solar retained Stantec to assist in reviewing this question. A "historically economically disadvantaged community" is defined in Code § 56-576 as "(i) a community in which a majority of the population are people of color or (ii) a low-income geographic area."

Code § 56-576 defines a "community in which a majority of the population are people of color" as "a U.S. Census tract where more than 50 percent of the population comprises individuals who identify as belonging to one or more of the following groups: Black, African American, Asian, Pacific Islander, Native American, other non-white race, mixed race, Hispanic, Latino, or linguistically isolated." The U.S. Census tract for the BESS site indicates a population consisting of 38% people of color according to the 2014-2018 American Community Survey ("ACS") data. [6] Therefore, the majority of the population in the vicinity of the BESS site are not people of color.

Code § 56-576 defines "low income-geographic area" as "any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income, or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service." According to the Virginia Housing Development Authority, 80% of the median income of Pittsylvania County was $33,850.00 in 2020.[7] The BESS site lies within Census Block Group 2, Census Tract 107 of Pittsylvania County. The 2019 five-year estimate for the median income for this Census block is $46,250.[8] The BESS location is not within a qualified opportunity zone.[9] As such, the BESS location is not in a low-income geographic area.

As more fully described in the DEQ Supplement, included as Appendix 2 to this Application, the BESS will have minimal impact to the environment. The BESS will be located on approximately 1.33 acres of cleared lands currently zoned agricultural. The facility will not emit harmful air pollutants or greenhouse gases ("GHG") and will reduce the need for traditional energy generating facilities, such as coal, natural gas, and oil power plants. Furthermore, the BESS will allow the Solar Facility to provide energy to the grid during periods when the photovoltaic panels cannot produce, thereby further decreasing the need for traditional fossil fuel sources of energy and the associated impacts of air pollutants, GHG emissions, and other discharges. No wetlands or other waters will be impacted by construction of the BESS. Erosion and sediment control measures and post-construction stormwater facilities will protect downstream waters from stormwater runoff. There will be no storage of hazardous materials at the BESS site; therefore, it will not be a source of land pollution. There will be no odors produced by the BESS. There will be minimal noise produced by standard HVAC systems used to cool the BESS. This noise will not be audible beyond the limits of the Solar Facility. The BESS will be screened from adjoining public

[6] *See* the U.S. Environmental Protection Agency (EPA) EJ Screen Summary Report for Census Tract 208 accessed on February 17, 2021, available at https://ejscreen.epa.gov/mapper/. EJSCREEN is an environmental justice mapping and screening tool provided by the EPA, which provides demographic and environmental information.

[7] Virginia Development Housing Authority, accessed on February 18, 2021, available at https://www.vhda.com/BusinessPartners/PropertyOwnersManagers/Income-Rent-Limits/Pages/HUDMedianIncome.aspx.

[8] 2019 American Community Survey 5-year Estimates, accessed on February 18, 2021, available at https://data.guampdn.com/american-community-survey/pittsylvania-county-virginia/median-household-income/total/num/05000US51143/,

[9] Virginia Department of Housing and Community Development, accessed on February 18, 2021, available at https://dhcd.virginia.gov/opportunity-zones-oz.

roads and residences by existing vegetation and supplemental plantings in areas where existing tree growth and topography along the Project Boundary do not effectively reduce visibility of the BESS. As such, disproportionate adverse impacts to neighboring properties or historically disadvantaged communities, as defined in Code § 56-576 of the Code, are not expected.

The construction of the BESS will bring additional income and jobs into Pittsylvania County and tax revenue payable to Pittsylvania County. This additional revenue can be used at the discretion of the County to help address the needs of the County and its residents. The BESS contributes to the efficiency of the Solar Facility thereby contributing to the economic benefits of the entire Project. These economic benefits can be used to help the historically disadvantaged communities in the area. Based on all of the foregoing, the BESS will not have a disproportionately adverse impact on historically economically disadvantaged communities.

13. A general discussion of how the project will promote environmental justice in environmental justice communities and fenceline communities consistent with the Virginia Environmental Justice Act (§ 2.2-234 et seq. of the Code of Virginia).

The Virginia Environmental Justice Act (Code § 2.2-234 *et seq.*, the "Act") defines environmental justice communities as "any low-income community or community of color." The Act defines "low-income community" as any census block group in which 30 percent or more of the population is composed of people with low income." Further, the Act defines "low income" as "having an annual household income equal to or less than the greater of (i) an amount equal to 80 percent of the median income of the area in which the household is located, as reported by the Department of Housing and Urban Development, and (ii) 200 percent of the Federal Poverty Level."

Shockoe Solar retained Stantec to review the BESS vis-à-vis the Act. The Census block in which the BESS is located would not be considered a low-income community because less than 30% of the population is composed of people with low income.[10] However, an adjacent Census block would qualify and, therefore, low-income communities are considered present.[11]

The Act defines a "community of color" as a "geographically distinct area where the population of color, expressed as a percentage of the total population of such area, is higher than the population of color in the Commonwealth expressed as a percentage of the total population of the Commonwealth. However, if a community of color is composed primarily of one of the groups listed in the definition of "population of color," the percentage population of such group in the Commonwealth shall be used instead of the percentage population of color in the Commonwealth."

---

[10] *See* the U.S. Environmental Protection Agency (EPA) EJ Screen Summary Report for Census Tract 208, accessed on February 17, 2021, available at https://ejscreen.epa.gov/mapper/.

[11] *See* the U.S. Environmental Protection Agency (EPA) EJ Screen Summary Report for Census Tract 208, accessed on February 17, 2021, available on https://ejscreen.epa.gov/mapper/.

Using the definitions provided in the Act, the Census block in which the BESS will be located would be considered a community of color because according to the 2014-2018 ACS data, the percentage population group primarily comprising the population of color is more than the percentage of that population within the Commonwealth. [12] An adjacent Census block is also composed of a community of color.

The Act defines a fenceline community as "an area that contains all or part of a low-income community or community of color and that presents an increased health risk to its residents due to its proximity to a major source of pollution." The BESS is not a major source of pollution and no major sources of pollution are present within one mile of the BESS. As such, fenceline communities are not considered to be present within the vicinity of the BESS.

Shockoe Solar believes that the BESS will promote economic justice by contributing to the community through the creation of jobs and providing tax revenue to Pittsylvania County which can be used to serve the needs of the County and its residents. As described in the response to question 12 above, the BESS is part of the larger Project that will produce economic benefits for the area.

Shockoe Solar also took steps to inform the community about the Project and solicited feedback. A public information meeting was not held due to COVID-19; however, informational letters were sent out to landowners within approximately a half-mile radius of the Project limits. In addition, Shockoe Solar held several meetings with the County Board of Supervisors, Planning Commission, and County Board of Zoning Appeals where Shockoe Solar presented information concerning the Project and addressed questions concerning the effect of the Project on the community.

The BESS will have minimal impact to the environment, as more fully described in the DEQ Supplement, included as Appendix 2 to this Application and the response to question 12 above. The BESS will be located on approximately 1.33 acres of cleared lands currently zoned agricultural. The BESS will not emit harmful air pollutants or GHGs and will reduce the need for traditional energy generating facilities, such as coal, natural gas, and oil power plants. Furthermore, the BESS will allow the Solar Facility to provide energy to the grid during periods when the photovoltaic panels cannot produce, thereby further decreasing the need for traditional fossil fuel sources of energy and the associated impacts of air pollutants, GHG emissions, and other discharges. No wetlands or other waters will be impacted by construction of the BESS. Erosion and sediment control measures and post-construction stormwater facilities will protect downstream waters from stormwater runoff. There will be no storage of hazardous materials at the BESS; therefore, it will not be a source of land pollution. There will be no odors produced by the BESS. There will be minimal noise produced by standard HVAC systems used to cool the BESS. This noise will not be audible beyond the limits of the Solar Facility. The BESS will be screened from adjoining public roads and residences by existing vegetation and supplemental plantings in areas where existing tree growth and topography along the Project boundary do not effectively reduce visibility of the BESS.

[12] *See* the U.S. Census Bureau quick facts for Virginia, accessed on February 12, 2021, available at https://www.census.gov/quickfacts/VA.

For the foregoing reasons, not only will there be no adverse environmental impacts on environmental justice communities, but the environmental and economic benefits of the BESS will help to promote environmental justice in environmental justice communities and fence line communities, near the Project location. Therefore, the BESS will promote environmental justice in environmental justice communities and fence line communities consistent with the Act.

14. A general discussion of reliability impacts including:

a. A description of interconnection requirements and needed interconnection facilities. Any such facilities shall be depicted on a topographic map.

Shockoe Solar's Project is progressing through the PJM interconnection process. Shockoe Solar has two pending PJM queue positions for the Project that relate to the network upgrade requirements for the Project to enable transmission across the PJM transmission grid: (i) AF2-403 relates to the BESS portion of the Project, and (ii) AE2-187 relates to the Solar Facility portion of the Project. A third interconnection request, in process with Mecklenburg Electric Cooperative, relates to the specific attachment facilities required to interconnect the Project. All three requests are described below.

In early 2020, 174 Power Global Properties, LLC (an affiliate of Shockoe Solar) submitted to PJM an interconnection request for 20 MW x 4 hr. (i.e., 80 MWhs) of AC-coupled batteries. PJM assigned queue No. AF2-403. In July 2020, PJM completed the Generation Interconnection Feasibility Study Report ("Feasibility Report" or "Report") for the BESS project, which is attached as Appendix 1, Attachment 14 a. The BESS interconnection was requested as an uprate to AE2-187 (relating to the Solar Facility) which taps the Shockoe DP - Chatham 69 kV line (owned by Mecklenburg Electric Cooperative).[13] Under the BESS interconnection request, the BESS would utilize the interconnection facilities being developed under the Solar Facility (i.e., AE2-187), and therefore, no additional interconnection facilities will be required to accommodate the BESS (see section 5, page 5 of the Feasibility Report). As such, the total physical interconnection cost for the BESS is zero dollars (see section 5, page 5 of the Feasibility Report).

The AF2-403 queue application requests approval to charge the BESS from the Solar Facility – or from the grid – or a combination of both. Dispatch to the grid of power stored by the BESS, and generated by the Solar Facility, will not require any additional interconnection facilities (as noted above) or network upgrades (NUs). However, as a condition of being able to charge the BESS with power from the grid, Shockoe Solar will be obligated to pay its allocated portion of the total of NU costs presented in the report. This total is projected to be approximately $53.3 million (see section 5, page 5 of the Feasibility Report for AF2-403). This number is based on prior queued projects, of which some are historically likely to

[13] As outlined below, during the site visit for the AE2-187 Facilities Study (relating to the Solar Facility), it was discovered that the Shockoe DP – Chatham 69 kV line is owned by Mecklenburg Electric Cooperative and not by Dominion, as was indicated in the AE2-187 Feasibility Report, Impact Study Report, and the AF2-403 Feasibility Report.

withdraw. Revised NU requirements, reflecting subsequent withdrawals, their cost, and an allocation of those costs to Shockoe Solar will be presented in the PJM System Impact System Study Report for AF2-403 expected to be released shortly. Shockoe Solar anticipates that the System Impact Study Report, and the subsequent Facility Study Report may present substantially reduced total NUs and that Shockoe Solar's share of those costs will be at a level that will enable grid charging and subsequent discharge to be economically feasible.

These NUs and their cost allocation to Shockoe Solar will be contracted in the Interconnection Services Agreement ("ISA").[14] Provided that the allocated costs of NUs to enable grid charging and later dispatch are economically feasible, Shockoe Solar anticipates proceeding with the grid charging option. However, if the allocated cost of NUs to enable grid charging and later dispatch are not deemed economically feasible, Shockoe Solar anticipates withdrawing the grid charging request and proceeding with only onsite charging from the Solar Facility.

The location and conceptual design of the interconnection facilities is depicted on Appendix 1, Attachment 6 b (which includes a topographic map). See the answer provided to question 14 (b) for related information.

The AE2-187 queue position (which relates to the Solar Facility portion of the Project) requests interconnection rights for 60 MWs of solar generation. PJM has produced the Feasibility Report and the Impact Study Report for the AE2-187 queue position and the related Facilities Study is underway. However, during the site visit for the AE2-187 Facilities Study, it was discovered that the Shockoe DP – Chatham 69 kV line is owned by Mecklenburg Electric Cooperative, and not by Dominion, as was indicated in the AE2-187 Feasibility Report, Impact Study Report, and the AF2-403 Feasibility Report. Therefore, Shockoe Solar has recently submitted an interconnection request to Mecklenburg Electric Cooperative which will specify the requirements for the interconnection facilities (which are likely to be consistent with those from the PJM Feasibility and System Impact Studies). The network upgrades will be determined by the PJM Facilities Study for AE2-187, which is currently underway and expected late this year.

b. A description of the potential impact of the proposed facility on the interconnected system. Discussion should identify and summarize any system impact studies or proposed studies.

See the response to question 14 (a) for additional details. As noted, Shockoe Solar is progressing through the PJM interconnection process. Shockoe Solar has two pending PJM queue positions for the Project: AF2-403 (BESS portion of the Project) and AE2-187 (Solar Facility portion of the Project).

[14] Section 217.3 of PJM's Open Access Transmission Tariff ("PJM OATT") requires that "[e]ach New Service Customer shall be obligated to pay for 100 percent of the costs of the minimum amount of Local Upgrades and Network Upgrades necessary to accommodate its New Service Request...." Shockoe Solar is required to comply with this provision of the PJM tariff as anticipated to be required by the ISA. *See* Section 7.0 of the Interconnection Services Agreements, Attachment O to the PJM OATT. *See* Pleinmont Solar Order at 15.

AE2-187 (Solar Facility portion of the Project) – 174 Power Global Properties, LLC (an affiliate of Shockoe Solar) filed an application with PJM that proposed a solar/storage generating facility located in Pittsylvania County, Virginia. The Solar Facilities will have a total capability of 60 MW with 36 MW of this output recognized by PJM as capacity. The BESS proposed in AE2-187 was proposed as DC-coupled and has not been considered by PJM in the study results for AE2-187.

In July of 2019, PJM issued the Generation Interconnection Feasibility Study Report for AE2-187 and in February 2020 (revised May 2020), PJM completed the Generation Interconnection Impact Study Report for the Solar Facility. PJM is currently processing the Generation Interconnection Facilities Report. As noted above, the solar facility described in AE2-187 will interconnect to the Mecklenburg Electric Cooperative-owned Shockoe DP to Chatham 69 kV line, with upgrades to the PJM system being studied under the AE2-187 Facilities Study now in process.

AF2-403 (BESS) – Shockoe Solar filed an interconnection application with PJM that proposed an uprate in capacity injection rights ("CIRs") to a planned Solar Facility associated with AE2-187, but that does not change the Maximum Facility Output ("MFO"). In other words, it is still a 60 MW interconnection position, but with battery storage added to shape the power output. This new application was designated as PJM Queue no. AF2-403. In July 2020, PJM completed the AF2-403 Feasibility Report. See Appendix 1, Attachment 14 a. The BESS will interconnect at the low side of the Solar Facility Project generator step-up transformer and will utilize the same attachment facilities and access the same point of interconnection as the Solar Facility; no incremental interconnection facilities will be required for the BESS. Shockoe Solar will be responsible for funding a share of NUs that enable the BESS to charge from the grid. Although the Feasibility Report for the BESS indicates a cost of approximately $53 million for network upgrades (see Section 5 on page 5), these costs are for all of the AF2-XXX interconnection requests, including AF2-403. The AF2-403 costs will be just a portion of the $53.3 million, and the study suggests that AF2-403 likely will not require any new system upgrades because it will utilize network upgrades already planned or installed. Section 11.1 on page 9 of the Report indicates that one portion of the transmission grid, identified as No. 97589302, is less than 100% loaded pre-project but greater than 100% loaded post-project under the N-1 contingency scenario. This suggests, on a preliminary basis, that the BESS will trigger an upgrade. However, this upgrade is already included in the upgrades identified as Index 1 in Section 11.5 on page 11 of the Report. Index 1 also include No. 97589300 which is already overloaded under the pre-project scenario (as indicated in Section 11.3 on page 9). Therefore, the upgrades in Index No. 1, which include upgrade No. 97589302 at an estimated cost of $2.1 million, will proceed with or without the AF2-403 project advancing, such that the Feasibility Study does not indicate that any new network upgrades are triggered by the BESS. PJM is currently processing the Generation Interconnection Impact Study Report for the BESS and Shockoe Solar anticipates that PJM will issue such Report in the 1st quarter of 2021. The Generation Interconnection Impact Study Report will provide both an update to the NUs that the BESS will utilize and the BESS share of the costs for those upgrades. The final determination will be made in the Facilities Study Report and will be incorporated into a final interconnection agreement.

c. A description of anticipated services that may be provided to any transmission service provider or local distribution company, including associated costs and benefits.

The BESS is intended to provide renewable power shaping and dispatch capabilities to its customers. Ancillary benefits such as reactive power can be provided as well. Through these products, the BESS can contribute to the "non-wires" solution to transmission constraints to reduce the need for transmission system upgrades and enhance utilization of existing infrastructure.

d. A discussion of existing and expected generation reserves in the region and the impact of the proposed facility on such reserves.

The Project is being developed as a result of anticipated procurement needs of PJM member utilities, local electric cooperatives and commercial and industrial clients, with a specific requirement of renewable energy and/or battery storage, with delivery in the Virginia markets.

15. A discussion of safety measures the applicant will implement, including fire and explosion protection, detection and mitigation measures, and an emergency response plan, as well as a discussion of whether such measures are compliant with all applicable codes and standards.

Shockoe Solar will develop a site-specific emergency response plan as part of the BESS detailed design and such plan will be compliant with all applicable codes and standards. There are three main categories of lithium ion battery failures: Electrical, Mechanical, and Thermal. One may also consider a fourth category of "human error," which could be the source of the above three categories. Each of these failures is briefly addressed below along with the mitigation techniques used in other 174 Power Global BESS projects.

Failure Category	Failure	Mitigation
Electrical Failure	Overcharge or undercharge based on catastrophic inverter failure.	There are multiple fuses and disconnect switches inside the battery containers that will protect the battery from fault current coming from the power conversion system ("PCS"). In the event of a catastrophic failure these devices will isolate the battery container from the inverter.
Mechanical Failure	Physical damage onsite due to heavy impact during maintenance (internal short circuit)	Hiring of qualified and reputable operations and maintenance ("O&M") company. Testing to be done after any O&M activity.

	Physical damage due to impact during transport (internal short circuit)	Both 174 Power Global, and representatives from the BESS provider and system integrator will inspect and supervise the installation of the batteries. Battery installation to be performed by qualified personnel only.
	Manufacturing defect (internal short circuit) that affects multiple cells	The 174 Power Global team will run rigorous commissioning and testing experiments to verify that the batteries are operating as intended.
Thermal Failure	Overheating (due to power outage)	Backup generators on site will supply power to the BESS HVAC systems during station blackout, or the system will be thermally designed per the original equipment manufacturer ("OEM") specifications to withstand a blackout.
	Overheating (due to HVAC failure)	There are multiple AC units inside each battery container. Up to one may fail before battery temperature exceeds operational range. In the event of a total failure the batteries will trip offline and internal heat generation will virtually cease.
	Overheating from short circuit and/or electrical/mechanical failures above	BMS (battery management system) installed to monitor and shut down batteries before a fire. An active fire suppression system installed in each container for worst case scenario. Each module has a fusible busbar and each cell has an internal fuse designed to mitigate cascading failures and stop/slow the spread of heat and flame to its neighbors.
Human Error	Human error during commissioning, installation, repair, or operating activities	Attention to safety, multiple testing and commissioning procedures to test system functionality and safety. Installation, testing, operation and maintenance of the BESS systems to be performed by trained and qualified personnel. Safety briefings discussing the sensitive nature of Li-ion battery technology to be held prior to all activities and operational evolutions.

Service to be performed	Frequency
Inspect and test all switches, fuses, and disconnects.	Annually
Inspect HVAC filters, vents, oil, and refrigerant charge	Annually
Verify mechanical integrity of enclosures/buildings	Annually
Inspect fire detection & suppression system for defects such as over-discharged batteries or loss of charge in suppression tanks	Annually
Inspect and diagnose status of emergency and safety sub-systems and backup power	Annually
Check torque marks and re-tightening appropriate wiring connections to design specification torque force per manufacturer's guidelines.	Annually
Perform thermal imaging and address connections and hot spots.	Annually
Perform BESS preventive maintenance per manufacturer's Owner Manual.	Annually per system requirements
Perform BESS PCS preventive maintenance per manufacturer's Owner Manual.	Annually per system requirements
Inspect BMS data for early warning signs.	Annually

In addition to the mitigation standards above, the BESS will also have automated 24/7 monitoring and the ability to automatically isolate battery strings through the energy management system (EMS) and BMS operation. The EMS and BMS are integrated with the plant SCADA system and will be programmed for safety and reliability. It will also feature all applicable safety standards and UL Ratings. The batteries will be placed in containers (as opposed to in a building or other less fire safe structure). The containers will be placed far enough away from any other structures or flammable materials. Each of these containers is equipped with its own fire suppression system.

16. A discussion of the projected useful life of the energy storage facility, including known or projected performance degradation, roundtrip efficiency, and the proposed plan for and cost of decommissioning at the end of the facility's useful life.

Shockoe Solar anticipates that the BESS will have a useful life of approximately 20 years, which can be extended to approximately 35 years with battery replacement. The round-trip efficiency of the BESS is anticipated to be approximately 85%. During this time the batteries will be routinely augmented to ensure that there is minimal degradation to the capacity and performance.

Battery Degradation and Cycling Capabilities

Battery degradation is highly dependent on the number of cycles that the system experiences. A charge cycle is a complete charge and discharge on a rechargeable battery. A cycle is also defined as the cumulation of partial discharges and charges where the state of the charge of the battery oscillates between the ranges of 100% and 0%. The total cycles per a given time period can be calculated by summing the real power discharged by the battery during that time period and dividing it by the capacity of the batteries. The discharges will be measured by the BMS. Battery cycles can also be validated using a net generation output meter ("NGOM") which will measure both charging energy and discharging energy/power separately. All discharged energy can be summed then grossed up for losses to calculate the total output of the energy storage system. The number of cycles can be calculated taking the total output of the energy storage system and dividing it by the summed usable capacity of all connected battery modules integrated in the system.

When the system is allowed to cycle the batteries as much as 365 times per year, the battery capacity degradation is expected to be roughly 2% per year. Increased cycling, but at a shallower depth will also preserve battery capacity. Photovoltaic ("PV") projects are limited by the available energy provided by the PV modules. The BESS's ability to cycle on and off, along with other operating limitations, will be configured in and controlled by the BESS EMS, which will function based upon the BESS's state of charge. Cycling limits of the battery system will be dictated by the battery manufacturer's warranty terms.

Decommissioning

Shockoe Solar is committed to providing a decommissioning process that is safe, sustainable, and environmentally friendly manner. The process includes:

i. Decommissioning the BESS software, discharging all batteries, and shutting down all of the management systems.
ii. Removing the battery modules from the containers.
iii. Delivering the battery modules back to the OEM (or to a third-party recycler). The OEM has programs in place to receive the batteries, break them down, and salvage all usable material.
iv. After the battery modules have been removed from the containers, the containers can be recycled/salvaged. The containers are made of steel and have value for reuse/recycling. After all the racks and steel have been salvaged, a negligible residual amount of material is anticipated.
v. The final step is to take care of any required civil work to decommission the foundations.

17. A discussion of whether the proposed facility is not contrary to the public interest. The discussion shall include an analysis of any reasonably known impacts the proposed facility may have upon reliability of service to and rates paid by customers of any regulated public utility providing electric service in the Commonwealth.

The BESS is not contrary to the public interest:

- The Project, including the BESS, will promote the public interest by providing substantial local and regional benefits from renewable energy electric generation and storage construction jobs and millions of dollars in private infrastructure investment in Virginia. The Project represents an initial capital investment of approximately $100 million. This is a significant private investment and economic development project in Pittsylvania County. The Project construction will create approximately 180 full-time equivalent jobs during construction, which will utilize local labor as much as possible. During operations, approximately four full-time equivalent local jobs during the 35-year operations phase of the Project. The Project will provide significant property tax revenue, approximately $100,000 in the first year of operations and an average of approximately $50,000 per year over the 35-year life of the Project. As noted above, the BESS contributes to the efficiency of the Project thereby allowing the economic benefits of the entire Project to be realized.[15]
- Jobs created during construction and operation of the Project, including the BESS, will provide significant payroll benefits and have important indirect economic benefits both locally and regionally. In addition, other economic benefits will include the purchase of local supplies and services throughout Pittsylvania County and the surrounding area.
- Construction of the BESS will generate direct and indirect economic benefits to Pittsylvania County and the Commonwealth as a result of employment and spending from construction of the BESS and operation of the Project.[16]
- While the Project, including the BESS, will contribute in a positive manner to the local economy, it will not cause any significant population growth and therefore will have very little adverse impact on local services and infrastructure. In addition, none of the capital costs of the BESS will be borne by electric ratepayers of the Commonwealth.
- The Project, including the BESS, will have a significant positive impact on the local economy and promote economic development. The Project is expected to provide substantial local and regional benefits from a new energy storage resource, renewable energy electric generation, construction jobs and millions of dollars in private infrastructure investment in Virginia.
- The Pittsylvania County Board of Zoning Appeals has approved a special use permit for the Project, including the BESS. The special use permit imposes numerous conditions including,

---

[15] *See, e.g.*, Skipjack Order at 14 (finding that the solar project will likely generate direct and indirect economic benefits to the County as a result of employment and spending from construction and operation of the project and the County will likely benefit from an increase in the local tax base); Foxhound Order (Oct. 17, 2019) (construction of collection facilities will likely generate slight direct and indirect economic benefits to the County and the Commonwealth as a result of employment and spending from construction of said facilities and operation of the Project); Pleinmont Solar Order at 16 (finding that the project will likely generate direct and indirect economic benefits to the County and the Commonwealth as a result of employment and spending from construction and operation of the project and the County will likely benefit from an increase in the local tax base); Doswell Order at 12 (finding that the Doswell "[p]roject will provide economic benefits to Hanover County and the Commonwealth" and is "is likely to create or support a number of jobs in the area and also may result in indirect benefits to the local community as a result of an increase in employment and incomes in the area.")

[16] *See, e.g.*, Foxhound Order (construction of collection facilities will likely generate slight direct and indirect economic benefits to the County and the Commonwealth as a result of employment and spending from construction of said facilities and operation of the Project).

among other things: site development plan, setbacks, landscaping, construction management and mitigation, erosion and sediment control, fire and rescue training.

- The construction and operation of the BESS will promote the public interest by, among other things, contributing to the viability of the Project thereby providing economic benefits to Pittsylvania County, the surrounding area, and the Commonwealth by providing a source of new clean energy storage in Virginia.
- The integration of batteries in a solar project allows a project to smooth the flow of generation output into the grid resulting in increased energy reliability as well as to increase the power delivered through the same electrical interconnection infrastructure, thus reducing the need for additional transmission and or distribution lines to serve the area.
- The BESS is intended to provide renewable power shaping and dispatch capabilities to its customers. Ancillary benefits such as reactive power can be provided as well. Through these products, the BESS can contribute to the "non-wires" solution to transmission constraints to reduce the need for transmission system upgrades and enhance utilization of existing infrastructure.
- None of the capital costs of the BESS will be borne by electric ratepayers in the Commonwealth. With regard to the Commonwealth, the Commission's finding of economic benefits takes into consideration the fact that a project will be owned by a non-utility and that the capital costs of the project will be borne by private investors, not by a utility's customers.[17]
- While substantial benefits accrue to the Commonwealth of Virginia, Pittsylvania County, and the surrounding area, the business risk associated with constructing, owning, and operating the BESS, which will not provide retail electric service in the Commonwealth and will not be included in the rate base of any incumbent electric utility, rests solely with Shockoe Solar.[18]
- The BESS will have no material adverse effect on the reliability of electric service provided by any regulated public utility. The Feasibility Report for the BESS confirms that the BESS will not require any additional physical interconnection facilities and indicates that the BESS will utilize network upgrades already planned or installed. Shockoe Solar will fund the BESS's share of the cost of these network upgrades.
- The BESS will provide extensive benefits to Pittsylvania County and the surrounding region including reliable on-demand storage with no emissions (see DEQ Supplement, Appendix 2).
- The BESS promotes the Commonwealth's recently enacted energy storage goals. During its 2020 Session, the Virginia General Assembly enacted the Virginia Clean Economy Act ("VCEA") which requires Appalachian Power Company ("APCo") and Virginia Electric and Power Company ("Dominion") to construct or acquire 400 MW and 2,700 MW of energy storage resources, respectively, by 2035.[19] At least 35% of such storage requirements must be procured from third parties. Moreover, pursuant to Code § 56-585.5 E, Dominion and APCo must petition the Commission for approvals to construct or acquire energy storage resources. Shockoe Solar's BESS facility will be available to participate in those solicitations and contribute to the Energy Storage Targets.

---

[17] *See, e.g.*, Pleinmont Solar Order at 16, fn77.

[18] *See, e.g.*, Skipjack Order at 15-16: C4GT Order at 11; *see also* CPV Warren Order at 17 (finding that the facility is not otherwise contrary to the public interest in that "rates for the regulated public utility will not be impacted").

[19] *See* Senate Bill 851, 2020 Va. Acts ch. 1194, and identical House Bill 1526, 2020 Va. Acts ch. 1193 (effective July 1, 2020), as codified in Code § 56-585.5 E ("Energy Storage Targets").

- Code § 56-585.1 A 6 declares energy storage resources to be in the public interest: "Additionally, energy storage facilities with an aggregate capacity of 2,700 megawatts are in the public interest."
- The BESS will assist meeting the rising demand for storage resources using environmentally responsible lithium ion battery resources.
- As an in-state resource, Shockoe Solar's BESS facilities, will improve reliability and its economic benefits will be retained in the Commonwealth of Virginia.
- The BESS facilities, will be designed, constructed and operated in a way to minimize any adverse environmental impact as more fully described in the DEQ Supplement attached as Appendix 2 to the Application. Among other things:
    - The BESS will not emit any harmful air pollutants or greenhouse gases during operations.
    - By providing stored energy generated from the photovoltaic solar facility, the BESS will help Virginia reduce the need for traditional energy generating facilities, such as coal, natural gas, and oil power plants and further reduce harmful emissions and air pollutants.
    - The BESS does not require any water source for its installation or operation
    - No stream features occur on the BESS site.
    - No wetland or waters of the U.S. have been identified within the BESS site.
    - No discharge of cooling waters is associated with the installation or operation of the BESS.
- The BESS will allow for a more efficient and secure electricity grid that is more resistant to disruptions.

Appendix 1

Attachment 5 a.

Appendix 1, Attachment 5a. Project Experience List

Listing of projects that have been developed, built, operated, and/or owned by Hanwha Energy and its affiliates around the world.

Projects Developed, Built, Operated, and/or Owned by Hanwha Energy Network

Project Name	Project Location	MW Capacity (AC)	Type of Tech.	Mounting/ ESS size	Project Status	Project Operator	Project Owner
MMPA	MN	7	Solar PV	Ground	In Service/Sold	HEUH	HGC
SD Sun I	SD	20	Solar PV	Ground	Sold	Project developer: Hanwha Energy USA Holdings corp. (dba 174 Power Global)	
SD Sun II&III	SD	32	Solar PV	Ground	Sold		
Sweetwater	WY	100	Solar PV	Ground	In Service/Sold		
Midway	Texas	180	Solar PV	Ground	In Service/Sold		
Techren I	Nevada	100	Solar PV	Ground	In Service/Sold		
Techren II	Nevada	200	Solar PV	Ground	In Service/Sold		
Techren III	Nevada	25	Solar PV	Ground	Sold		
Techren IV	Nevada	25	Solar PV	Ground	Sold		
Techren V	Nevada	50	Solar PV	Ground	Sold		
Laguna Solar	Mexico	101	Solar PV	Ground	In Service	HEUH	HEUH
Imeson	Florida	6	PV+ESS	2MW/4MWh	In Service	HEUH	HEUH
Oberon 1A	Texas	150	Solar PV	Ground	In Service	HEUH	HEUH
Oberon 1B	Texas	30	Solar PV	Ground	In Service	HEUH	HEUH
Ho'Ohana	Hawaii	52	PV+ESS	52MW/208MWh	PPA Awarded	HEUH	HEUH
Guam 2nd	Guam	60	PV+ESS	32MW/67MWh	PPA Awarded	HEUH	HEUH
Gerdau	TX	80	Solar PV	Ground	PPA Awarded	HEUH	HEUH
Boulder Solar III	NV	128	PV+ESS	58MW/230MWh	PPA Awarded	HEUH	HEUH
Skysol	OR	55	PV	Ground	PPA Awarded	HEUH	HEUH
Rayos Del Sol	TX	179	PV	Ground	PPA Awarded	HEUH	HEUH
Astoria	NY	100	ESS only	100MW/400MWh	PPA Awarded	HEUH	HEUH
Kupeahu	HI	60	PV	60MW/240MWh	PPA Awarded	HEUH	HEUH
Black Hollow Sun	CO	150	PV	Ground	PPA Awarded	HEUH	HEUH
Silver Peak	NV	60	ESS only	60MW/240MWh	PPA Awarded	HEUH	HEUH

210240048

Projects Developed, Built, Operated, and/or Owned by Hanwha Energy Network							
Project Name	**Project Location**	**MW Capacity (AC)**	**Type of Tech.**	**Mounting/ ESS size**	**Project Status**	**Project Operator**	**Project Owner**
Oberon II	TX	150	PV	Ground	PPA Negotiation	HEUH	HEUH
Oberon III	TX	50	PV	Ground	PPA Negotiation	HEUH	HEUH
Atlas	AZ	200	PV	Ground	PPA Negotiation	HEUH	HEUH
NY C&I	NY	30	Solar PV	91 projects	In Service	HEUH	HEUH
Kitsuki	Japan	24.5	Solar PV	Ground	In Service	HECJ	HECJ
Imabari	Japan	2.1	Solar PV	Ground	In Service	HECJ	HECJ
Accordia	Japan	7.1	Solar PV	Ground	In Service	HECJ	HECJ
Naka Nagamine	Japan	3.8	Solar PV	Ground	In Service	HECJ	HECJ
Hokota	Japan	0.8	Solar PV	Ground	In Service	HECJ	HECJ
Akiba	Japan	1.0	Solar PV	Ground	In Service	HECJ	HECJ
Awanishi	Japan	2.0	Solar PV	Ground	In Service	HECJ	HECJ
Higashi Nagamine	Japan	2.7	Solar PV	Ground	In Service	HECJ	HECJ
Nishi Nagamine	Japan	2.1	Solar PV	Ground	In Service	HECJ	HECJ
Kushiro Minami	Japan	2.8	Solar PV	Ground	In Service	HECJ	HECJ
Kushiro Kita	Japan	0.8	Solar PV	Ground	In Service	HECJ	HECJ
Kushiro Higashi	Japan	0.8	Solar PV	Ground	In Service	HECJ	HECJ
Monbetsu	Japan	6.0	Solar PV	Ground	In Service	HECJ	HECJ
Inashiki	Japan	0.6	Solar PV	Ground	In Service	HECJ	HECJ
Wakayama	Japan	17.6	Solar PV	Ground	In Service	HECJ	HECJ
Kogen1	Japan	31.5	Solar PV	Ground	In Service	HECJ	HECJ
Misasa	Japanv	12.5	Solar PV	Ground	In Service	HECJ	HECJ
Aira	Japan	10.8	Solar PV	Ground	In Service	HECJ	HECJ
Ichihara	Japan	2.8	Solar PV	Ground	In Service	HECJ	HECJ
Fujiyishida	Japan	1.8	Solar PV	Ground	In Service	HECJ	HECJ
Sunny Side Hills	Japan	25.4	Solar PV	Ground	In Service	HECJ	HECJ
Kogen2	Japan	29.9	Solar PV	Ground	In Service	HECJ	HECJ
Kikuchi	Japan	6.4	Solar PV	Ground	In Service	HECJ	HECJ
Izu kogen	Japan	45.0	Solar PV	Ground	Construction	HECJ	HECJ
Shobara	Japan	16.3	Solar PV	Ground	Construction	HECJ	HECJ
Pine hills	Japan	34.9	Solar PV	Ground	Construction	HECJ	HECJ
Mashiki	Japan	1.9	Solar PV	Ground	Construction	HECJ	HECJ
Makino	Japan	1.2	Solar PV	Ground	Construction	HECJ	HECJ
Yokaichi	Japan	3.5	Solar PV	Ground	PPA Negotiation	HECJ	HECJ

Projects Developed, Built, Operated, and/or Owned by Hanwha Energy Network

Project Name	Project Location	MW Capacity (AC)	Type of Tech.	Mounting/ ESS size	Project Status	Project Operator	Project Owner
CAMLAM	Vietnam	99.1	Solar PV	Ground	In Service	HECVN	HECVN
LSS 2nd	Malaysia	48	Solar PV	Ground	Construction	HECSG	HECSG
LSS 3rd	Malaysia	155	Solar PV	Ground	PPA Negotiation	HECSG	HECSG
Azure UP	India	59	Solar PV	Ground	In Service	HEC	HEC
Primo	Turkey	32	Solar PV	Ground	In Service	HEC	HEC
Margtel	Spain	50	Solar PV	Ground	Construction	HECE	HECE
ABO Wind	Spain	82	Solar PV	Ground	Construction	HECE	HECE
Ignis A	Spain	950	Solar PV	Ground	Construction	HECE	HECE
Ecotec	Italy	200	Solar PV	Ground	Construction	HEC	HEC
Caltagirone	Italy	12.5	Solar PV	Ground	Construction	HECE	HECE
Gravina	Italy	17.5	Solar PV	Ground	Construction	HECE	HECE
Ireland FR	Ireland	200	ESS only	200MW/120MWh	Construction	HECE	HECE
Barcaldine	Australia	25	Solar PV	Ground	In Service	HEC AU	N/A
Bannerton	Australia	110	Solar PV	Ground	Construction	HEC AU	N/A
Gregadoo	Australia	53.7	Solar PV	Ground	PPA Negotiation	HEC AU	N/A
Jindera	Australia	147.7	Solar PV	Ground	PPA Negotiation	HEC AU	N/A
Yeosu	South Korea	250	Cogeneration	250MW+1,450t/h	In Service	HEC	HEC
Gunsan	South Korea	222	Cogeneration	222MW+935t/h	In Service	HEC	HEC
Daesan	South Korea	50	Hydrogen Fuel Cell		In Service	HEC	HEC
Total		5,442.21					

Notes: HEC = Hanwha Energy Corporation, HEUH = Hanwha Energy USA Holdings Corporation(dba 174 Power Global), HECJ= Hanwha Energy Japan, HEC AU = Hanwha Energy Australia, HGC = Hanwha General Chemical, HAM= Hanwha Advanced Materials

Listing of some of the Energy Storage projects that have been developed, built, operated, and/or owned by Hanwha Energy and its affiliates around the world.

Energy Storage Projects Developed, Built, Operated, Owned by Hanwha Energy Network

Project Name	Project Location	Type of Technology	ESS size	Project Status	COD	Bidder's role
Imeson	Florida	PV+ESS	2MW/4MWh	In Service	Oct.2019	Development, O&M
Ho'Ohana	Hawaii	PV+ESS	52MW/208MWh	PPA Awarded	May.2023	Development, O&M
Guam 2nd	Guam	PV+ESS	32MW/67MWh	PPA Awarded	Jun. 2023	Development, O&M

Energy Storage Projects Developed, Built, Operated, Owned by Hanwha Energy Network

Project Name	Project Location	Type of Technology	ESS size	Project Status	COD	Bidder's role
Boulder Solar III	Nevada	PV+ESS	58MW/232MWh	PPA Awarded	Sep.2023	Development, O&M
Kupehau	Hawaii	PV+ESS	60MW/240MWh	PPA Awarded	May.2023	Development, O&M
Astoria	New York	ESS Only	100MW/400MWh	PPA Awarded	Dec.2022	Development, O&M
Silver Peak	Nevada	ESS Only	60MW/240MWh	PPA Awarded	Aug.2022	Development, O&M
Ireland FR	Ireland	ESS	200MW/120MWh	Construction	Mar.2021	Development, EPC, O&M
Saemangeu	South Korea	PV+ESS	6MW/18MWh	In Service	Jan.2016	EPC, O&M
Daehyun	South Korea	PV+ESS	1MW/3MWh	In Service	Jul.2018	EPC, O&M
Seogok	South Korea	PV+ESS	1MW/3MWh	In Service	Jul.2018	EPC, O&M
Hanwha Sejong Factory	South Korea	PV+ESS	2MW/8MWh	In Service	Mar.2018	EPC
Hanwha Eumseong Factory	South Korea	PV+ESS	2MW/8MWh	In Service	Mar.2018	EPC
Hanwha DaeSan Factory	South Korea	Peak Cut	4MW/22MWh	In Service	Jun.2018	Development, EPC, O&M
Hanwha Yeosoo Factory	South Korea	Peak Cut	1MW/2MWh	In Service	Mar.2018	EPC
KD Solar One Project	South Korea	PV+ESS	1MW/3MWh	In Service	Mar.2018	EPC, O&M
Highway Solar Project	South Korea	PV+ESS	4MW/13MWh	In Service	Mar.2018	EPC, O&M
Chungmyoun	South Korea	PV+ESS	2MW/8MWh	In Service	Jun.2019	EPC, O&M
ES Power	South Korea	PV+ESS	2MW/8MWh	In Service	Jun.2019	EPC, O&M
PoCheon Changso	South Korea	PV+ESS	4MW/12MWh	In Service	Jul.2019	EPC, O&M
HanGyo PV+ESS	South Korea	PV+ESS	3MW/8MWh	In Service	Jul.2019	EPC, O&M
HanMaeum Energy	South Korea	PV+ESS	5MW/19MWh	In Service	Jul.2019	EPC, O&M
YoungGok	South Korea	PV+ESS	4MW/12MWh	In Service	Mar.2019	O&M
KT-KDB Infra(PV+ESS)	South Korea	PV+ESS	15MW/40MWh	In Service	Apr.2019	O&M
SamChulLee ES DaeBudo	South Korea	PV+ESS	0.3MW/1MWh	In Service	Dec.2019	EPC
YoungGwang BongNam	South Korea	PV+ESS	15MW/47MWh	In Service	Dec.2019	EPC, O&M

Energy Storage Projects Developed, Built, Operated, Owned by Hanwha Energy Network

Project Name	Project Location	Type of Technology	ESS size	Project Status	COD	Bidder's role
Goesan Solar Campus	South Korea	PV+ESS	12.5MW/40MWh	In Service	Dec.2019	Development, EPC, O&M
YoungGwang Hashari	South Korea	PV+ESS	87MW/312MWh	In Service	May.2020	EPC, O&M
Total			737.8MW/2102MWh			

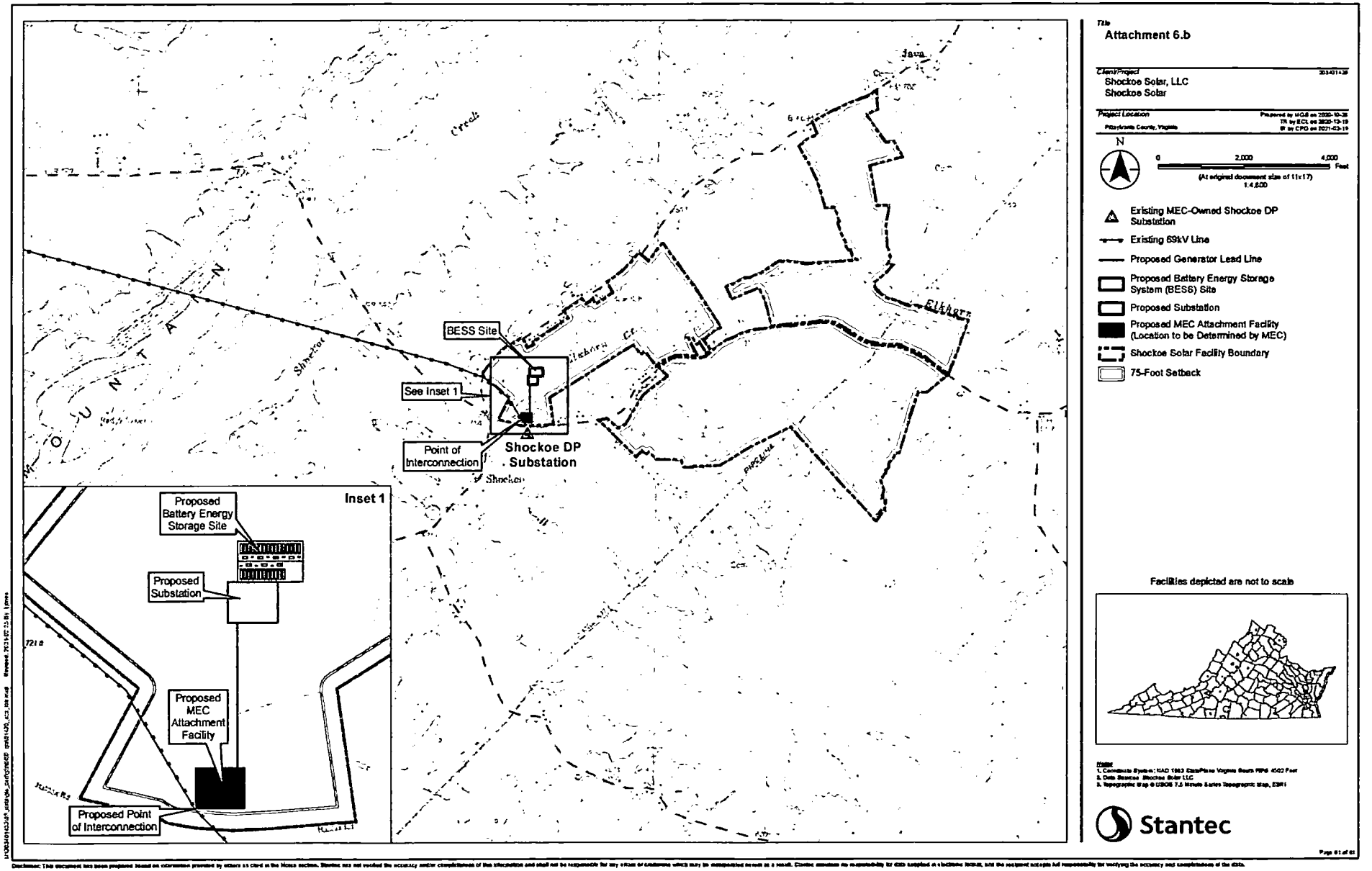
The table below provides a listing of the O&M projects Hanwha Energy and its affiliates around the world are managing.

O&M Projects Currently In Service

Region	Type	Contracted Capacity (MW)	# of Plants(contracted)
South Korea	PV, PV+ESS	PV 372.12MW, ESS 601.33MWh	52
South Korea	Co-Generation	472MW + 2,385t/h	2
Japan	PV	PV 244MW	18
Vietnam	PV	PV 99.1MW	1
US/Mexico	PV, ESS	PV 333.76MW, ESS 4MWh	55
Ireland	ESS	ESS 120MWh	1
Total	**PV, PV+ESS** **Co-Generation**	**PV 1048.92MW, ESS 725.33MWh** **472MW + 2,385t/h**	**127** **2**

Appendix 1

Attachment 6 b.



Appendix 1

Attachment 14 a.

Generation Interconnection

Feasibility Study Report

for

Queue Project AF2-403

SHOCKOE DP-CHATHAM 69 KV

8 MW Capacity / 0 MW Energy

July 2020

Table of Contents

1 Introduction 4
2 Preface 4
3 General 4
4 Point of Interconnection 5
5 Cost Summary 5
6 Transmission Owner Scope of Work 6
7 Schedule 6
8 Transmission Owner Analysis 7
8.1 Power Flow Analysis 7
9 Interconnection Customer Requirements 7
9.1 System Protection 7
9.2 Compliance Issues and Interconnection Customer Requirements 7
9.3 Power Factor Requirements 8
10 Revenue Metering and SCADA Requirements 8
10.1 PJM Requirements 8
10.2 Interconnected Transmission Owner Requirements 8
11 Summer Peak - Load Flow Analysis 8
11.1 Generation Deliverability 9
11.2 Multiple Facility Contingency 9
11.3 Contribution to Previously Identified Overloads 9
11.4 Potential Congestion due to Local Energy Deliverability 9
11.5 System Reinforcements - Summer Peak Load Flow - Primary POI 11
11.6 Flow Gate Details 12
11.6.1 Index 1 13
11.6.2 Index 2 14
11.6.3 Index 3 16
11.6.4 Index 4 18
11.6.5 Index 5 20
11.7 Queue Dependencies 21
11.8 Contingency Descriptions 22
12 Short Circuit Analysis 24

13 Affected Systems 24
13.1 TVA 24
13.2 Duke Energy Progress 24
Attachment 1: One Line Diagram 25

1 Introduction

This Feasibility Study has been prepared in accordance with the PJM Open Access Transmission Tariff, 36.2, as well as the Feasibility Study Agreement between the Interconnection Customer (IC), and PJM Interconnection, LLC (PJM), Transmission Provider (TP). The Interconnected Transmission Owner (ITO) is Dominion.

2 Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. Cost allocation rules for network upgrades can be found in PJM Manual 14A, Attachment B. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

3 General

The Interconnection Customer (IC) has proposed an uprate to a planned solar/storage generating facility located in Campbell, Virginia. This project is an increase to the Interconnection Customer's AE2-187 project, which will share the same point of interconnection. The AF2-403 queue position is a 0 MW uprate (8 MW Capacity uprate) to the previous project. The total installed facilities will have a capability of 60 MW with 44 MW of this output being recognized by PJM as Capacity. The proposed in-service date for this uprate project is December 15, 2022. This study does not imply a TO commitment to this in-service date.

Queue Number	AF2-403
Project Name	SHOCKOE DP-CHATHAM 69 KV
State	Virginia
County	Pittsylvania
Transmission Owner	Dominion
MFO	60
MWE	0
MWC	8
Fuel	Storage
Basecase Study Year	2023

Any new service customers who can feasibly be commercially operable prior to June 1st of the basecase study year are required to request interim deliverability analysis.

4 Point of Interconnection

AF2-403 will interconnect with the Dominion transmission system as an uprate to AE2-187 which taps the Shockoe DP - Chatham 69 kV line.

5 Cost Summary

The AF2-403 project will utilize the interconnection facilities being developed under the AE2-187 project.

The AF2-403 project will be responsible for the following costs:

Description	Total Cost
Total Physical Interconnection Costs	$ 0
Total System Network Upgrade Costs	$ 53,272,000
Total Costs	**$ 53,272,000**

This cost excludes a Federal Income Tax Gross Up charges. This tax may or may not be charged based on whether this project meets the eligibility requirements of IRS Notice 88-129. If at a future date it is determined that the Federal Income Tax Gross charge is required, the Transmission Owner shall be reimbursed by the Interconnection Customer for such taxes.

Cost allocations for any System Upgrades will be provided in the System Impact Study Report.

6 Transmission Owner Scope of Work

Dominion assessed the impact of the proposed Queue Project AF2-403 was evaluated as an 8 MW Capacity (0.0 MW Energy) injection at the new AE2-187 69 kV substation in the Dominion Transmission System, for compliance with NERC Reliability Criteria on Dominion Transmission System. The system was assessed using the summer 2023 AF2 case provided to Dominion by PJM. When performing a generation analysis, Dominion's main analysis will be load flow study results under single contingency (both normal and stressed system conditions). Dominion Criteria considers a transmission facility overloaded if it exceeds 94% of its emergency rating under normal and stressed system conditions. A full listing of Dominion's Planning Criteria and interconnection requirements can be found in the Company's Facility Connection Requirements which are publicly available at: http://www.dominionenergy.com.

The results of these studies evaluate the system under a limited set of operating conditions and do not guarantee the full delivery of the capacity and associated energy of this proposed generation facility under all operating conditions. NERC Planning and Operating Reliability Criteria allow for the re-dispatch of generating units to resolve projected and actual deficiencies in real time and planning studies. Specifically, in Planning Studies, NERC Planning Event 3 and 6 Contingency Conditions (Loss of generator, transmission circuit, transformer, shunt device, or Single Pole of a DC line followed by the loss of a generator, transmission circuit, transformer, shunt device or single pole of a DC line) allow for re-dispatch of generating units to resolve potential reliability deficiencies. For Dominion Planning Criteria the re-dispatch of generating units for these contingency conditions is allowed as long as the projected loading does not exceed 100% of a facility Load Dump Rating.

Note that the ITO findings were made from a conceptual review of this project and the cost estimate data contained in this document should be considered high level estimates since it was produced without a detailed engineering review. The applicant will be responsible for the actual cost of construction. ITO herein reserves the right to return to any issues in this document and, upon appropriate justification, request additional monies to complete any reinforcements to the transmission systems.

7 Schedule

The schedule for the required Network Impact Reinforcements will be more clearly identified in future study phases. The estimate elapsed time to complete each of the required reinforcements is identified in the "System Reinforcements" section of the report.

8 Transmission Owner Analysis

8.1 Power Flow Analysis

PJM performed a power flow analysis of the transmission system using a 2023 summer peak load flow model and the results were verified by Dominion. Additionally, Dominion performed an analysis of its transmission system and no further deficiencies were identified.

9 Interconnection Customer Requirements

9.1 System Protection

The IC must design its Customer Facilities in accordance with all applicable standards, including the standards in Dominion's "Dominion Energy Electric Transmission Generator Interconnection Requirements" documented in Dominion's Facility Interconnection Requirements "Exhibit C" located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access. Preliminary Protection requirements will be provided as part of the Facilities Study. Detailed Protection Requirements will be provided once the project enters the construction phase.

9.2 Compliance Issues and Interconnection Customer Requirements

The proposed Customer Facilities must be designed in accordance with Dominion's "Dominion's Facility Interconnection Requirements" document located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access. In particular, the IC is responsible for the following:

1. The purchase and installation of a fully rated protection device (circuit breaker, circuit switcher, fuse) to protect the IC's GSU transformer(s).
2. The purchase and installation of the minimum required Dominion generation interconnection relaying and control facilities as described in the System Protection noted above. This includes over/under voltage protection, over/under frequency protection, and zero sequence voltage protection relays.
3. The purchase and installation of supervisory control and data acquisition ("SCADA") equipment to provide information in a compatible format to the Dominion Transmission System Control Center.
4. Compliance with the Dominion and PJM generator power factor and voltage control requirements.

The GSU(s) associated with the IC queue request shall meet the grounding requirements as noted in Dominion's "Dominion's Facility Interconnection Requirements" document located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access.

The IC will also be required to meet all PJM, SERC, and NERC reliability criteria and operating procedures for standards compliance. For example, the IC will need to properly locate and report the over and under voltage and over and under frequency system protection elements for its units as well as the submission of the generator model and protection data required to satisfy the PJM and SERC audits. Failure to comply with

these requirements may result in a disconnection of service if the violation is found to compromise the reliability of the Dominion system.

9.3 Power Factor Requirements

The IC shall design its non-synchronous Customer Facility with the ability to maintain a power factor of at least 0.95 leading (absorbing VARs) to 0.95 lagging (supplying VARs) measured at the high-side of the facility substation transformer(s) connected to the Dominion transmission system.

10 Revenue Metering and SCADA Requirements

10.1 PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 8 of Attachment O.

10.2 Interconnected Transmission Owner Requirements

See Section 3.4.6 "Metering and telecommunications" of Dominion's "Dominion's Facility Interconnection Requirements" document located at: https://www.dominionenergy.com/company/moving-energy/electric-transmission-access.

11 Summer Peak - Load Flow Analysis

The Queue Project AF2-403 was evaluated as a 0 MW (Capacity 8.0 MW) uprate to AE2-187 which is a tap on the Shockoe DP - Chatham 69 kV line in the Dominion area. Project AF2-403 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AF2-403 was studied with a commercial probability of 53%. Potential network impacts were as follows:

11.1 Generation Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
97589302	314730	2STONE MIL	69.0	DVP	314670	2ALTVSTA	69.0	DVP	1	DVP_P1-2: LN 35-A	single	101.52	98.32	106.2	DC	8.0

11.2 Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

None

11.3 Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
95975769	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	Base Case	single	167.0	129.06	130.69	DC	2.73
95975770	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	DVP_P1-2: LN 1016-B	single	240.0	118.29	119.71	DC	3.4
95975752	242741	05OTTER	138.0	AEP	242687	05JOHNMT	138.0	AEP	1	Base Case	single	167.0	133.91	135.54	DC	2.73
95975753	242741	05OTTER	138.0	AEP	242687	05JOHNMT	138.0	AEP	1	DVP_P1-2: LN 1016-B	single	245.0	119.14	120.53	DC	3.4
95542229	314667	4ALTVSTA	138.0	DVP	242741	05OTTER	138.0	AEP	1	Base Case	single	167.0	136.54	138.18	DC	2.73
95542230	314667	4ALTVSTA	138.0	DVP	242741	05OTTER	138.0	AEP	1	DVP_P1-2: LN 1016-A	single	245.0	115.86	117.25	DC	3.4
97589341	314670	2ALTVSTA	69.0	DVP	314667	4ALTVSTA	138.0	DVP	1	Base Case	single	128.78	102.74	108.95	DC	8.0
97589300	314730	2STONE MIL	69.0	DVP	314670	2ALTVSTA	69.0	DVP	1	Base Case	single	101.52	130.33	138.21	DC	8.0

11.4 Potential Congestion due to Local Energy Deliverability

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

ID	FROM BUS#	FROM BUS	kV	FROM BUS AREA	TO BUS#	TO BUS	kV	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
95975764	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	Base Case	operation	167.0	166.6	168.23	DC	2.73
95975765	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	DVP_P1-2: LN 1016-B	operation	240.0	166.42	167.84	DC	3.4
95542332	242701	05LEESVI	138.0	AEP	314667	4ALTVSTA	138.0	DVP	1	Base Case	operation	205.0	115.6	119.25	DC	7.49
95542333	242701	05LEESVI	138.0	AEP	314667	4ALTVSTA	138.0	DVP	1	242549 05BANST R 138 940080 AE1-250 TAP 138 1	operation	284.0	112.35	114.74	DC	6.78
95542334	242701	05LEESVI	138.0	AEP	314667	4ALTVSTA	138.0	DVP	1	AEP_P1-2_#5366-A	operation	284.0	112.35	114.74	DC	6.78
95975930	242734	05NEWLDN	138.0	AEP	242569	05BRUSHT	138.0	AEP	1	AEP_P1-2_#5481	operation	205.0	103.38	104.48	DC	2.26
95975747	242741	05OTTER	138.0	AEP	242687	05JOHNMT	138.0	AEP	1	Base Case	operation	167.0	171.45	173.08	DC	2.73
95975748	242741	05OTTER	138.0	AEP	242687	05JOHNMT	138.0	AEP	1	DVP_P1-2: LN 1016-B	operation	245.0	166.29	167.68	DC	3.4
95975935	247499	05SMITHMTN2	138.0	AEP	242701	05LEESVI	138.0	AEP	1	242549 05BANST R 138 940080 AE1-250 TAP 138 1	operation	284.0	97.63	100.01	DC	6.78
97589605	314666	3ALTVSTA	115.0	DVP	314667	4ALTVSTA	138.0	DVP	1	DVP_P1-3: 4ALTVSTA-TX#4	operation	126.524002075	100.28	104.35	DC	5.14
95542224	314667	4ALTVSTA	138.0	DVP	242741	05OTTER	138.0	AEP	1	Base Case	operation	167.0	174.08	175.72	DC	2.73
95542225	314667	4ALTVSTA	138.0	DVP	242741	05OTTER	138.0	AEP	1	DVP_P1-2: LN 1016-A	operation	245.0	162.11	163.49	DC	3.4
97589619	314667	4ALTVSTA	138.0	DVP	314666	3ALTVSTA	115.0	DVP	2	DVP_P1-3: 4ALTVSTA-TX#3	operation	130.472000122	102.28	103.95	DC	2.19
97589338	314670	2ALTVSTA	69.0	DVP	314667	4ALTVSTA	138.0	DVP	1	Base Case	operation	128.779998779	193.35	199.57	DC	8.0
97589297	314730	2STONE MIL	69.0	DVP	314670	2ALTVSTA	69.0	DVP	1	Base Case	operation	101.519996643	245.27	253.15	DC	8.0
97589630	314733	2GRNA DP	69.0	DVP	314731	2GRETNA	69.0	DVP	1	Base Case	operation	111.86000061	93.6	100.75	DC	8.0
97589373	314735	2ALTAVISTA DP	69.0	DVP	314730	2STONE MIL	69.0	DVP	1	Base Case	operation	85.5400009155	154.55	163.9	DC	8.0
97589509	314736	2SHKO DP	69.0	DVP	314685	2CHTM TP	69.0	DVP	1	Base Case	operation	54.5200004578	115.92	130.59	DC	8.0
97589553	314739	2MT A TP	69.0	DVP	314735	2ALTAVISTA DP	69.0	DVP	1	Base Case	operation	123.139999339	113.45	119.94	DC	8.0
95542348	314861	3SKIMMER	115.0	DVP	242886	05SKIMMR	69.0	AEP	1	DVP_P1-3: 3SKIMMER-ID#2	operation	53.0	119.19	119.65	DC	0.54
95542352	314861	3SKIMMER	115.0	DVP	242886	05SKIMMR	69.0	AEP	2	DVP_P1-3: 3SKIMMER-ID#1	operation	53.0	118.3	118.75	DC	0.53

11.5 System Reinforcements - Summer Peak Load Flow - Primary POI

ID	Idx	Facility	Upgrade Description	Cost
95542230,95542229	4	4ALTVSTA 138.0 kV - 05OTTER 138.0 kV Ckt 1	AEP AEPA0014a (228) : Rebuild / reconductor 0.9 miles of overhead conductor (ACSR ~ 397.5 ~ 30/7 ~ LARK) Project Type : FAC Cost : $1,350,000 Time Estimate : 24-36 Months AEPA0014b (229) : Replace 795 AAC station conductors at Altavista Project Type : FAC Cost : $100,000 Time Estimate : 12-18 Months DVP dom-001 (1091) : Relay Change Outs (Secondary) at Altavista Substation Project Type : FAC Cost : $120,000 Time Estimate : 6-12 Months	$1,570,000
95975753,95975752	3	05OTTER 138.0 kV - 05JOHNMT 138.0 kV Ckt 1	AEP AEPA0019a (241) :Replace JohnMt - Otter Line, ACSR ~ 397.5 ~ 30/7 ~ LARK Conductor Section 1, 7 Miles. $10.5M Project Type : FAC Cost : $10,500,000 Time Estimate : 24-36 Months AEPA0019b (242) : Replace 795 AAC station conductors at Otter Project Type : FAC Cost : $10,670,000 Time Estimate : 18-24 Months	$21,170,000
97589302,97589300	1	2STONE MIL 69.0 kV - 2ALTVSTA 69.0 kV Ckt 1	DVP dom-111 (1201) : Rebuild 1.64 miles of 69 kV Line 35 from Stone Mill to Altavista with 768 ACSS. Project Type : FAC Cost : $2,132,000 Time Estimate : 30-36 Months	$2,132,000

ID	Idx	Facility	Upgrade Description	Cost
95975769,95975770	2	05JOHNMT 138.0 kV - 05NEWLDN 138.0 kV Ckt 1	AEP AEPA0020a (244) : Current Station Rating: S/N: 167, S/E: 240 1) Rebuild/reconductor ACSR ~ 397.5 ~ 30/7 ~ LARK ~ Fe Clamps 9 d, Conductor Section 1, 14.43 miles Project Type : FAC Cost : $21,650,000 Time Estimate : 12-18 Months AEPA0020b (245) : Replace 1200 A Wavetrap at New London Project Type : FAC Cost : $50,000 Time Estimate : 24-36 Months AEPA0020c (246) : Replace 7 Sub cond 1590 AAC 61 Str. At New London Project Type : FAC Cost : $700,000 Time Estimate : 12-18 months Months	$22,400,000
97589341	5	2ALTVSTA 69.0 kV - 4ALTVSTA 138.0 kV Ckt 1	DVP dom-121 (1211) : Add additional 138/69 kV transformer at Altavista substation Project Type : CON Cost : $6,000,000 Time Estimate : 16-18 Months	$6,000,000
			TOTAL COST	$53,272,000

11.6 Flow Gate Details

The following indices contain additional information about each facility presented in the body of the report. For each index, a description of the flowgate and its contingency was included for convenience. The intent of the indices is to provide more details on which projects/generators have contributions to the flowgate in question. All New Service Queue Requests, through the end of the Queue under study, that are contributors to a flowgate will be listed in the indices. Please note that there may be contributors that are subsequently queued after the queue under study that are not listed in the indices. Although this information is not used "as is" for cost allocation purposes, it can be used to gage the impact of other projects/generators. It should be noted the project/generator MW contributions presented in the body of the report are Full MW Impact contributions which are also noted in the indices column named "Full MW Impact", whereas the loading percentages reported in the body of the report, take into consideration the PJM Generator Deliverability Test rules such as commercial probability of each project as well as the ramping impact of "Adder" contributions. The MW Impact found and used in the analysis is shown in the indices column named "Gendeliv MW Impact".

11.6.1 Index 1

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
97589300	314730	2STONE MIL	DVP	314670	2ALTVSTA	DVP	1	Base Case	single	101.52	130.33	138.21	DC	8.0

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
925661	AC1-042 C	15.9600	80/20	15.9600
926641	AC1-145 C	19.0000	80/20	19.0000
939941	AE1-230 C	7.2000	80/20	7.2000
941801	AE2-185 C	36.0000	80/20	36.0000
941821	AE2-187 C	36.0000	80/20	36.0000
942671	AE2-283 C	39.6000	80/20	39.6000
945081	AF1-173	13.9500	80/20	13.9500
961121	AF2-403	8.0000	80/20	8.0000

11.6.2 Index 2

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
95975770	242687	05JOHNMT	138.0	AEP	242734	05NEWLDN	138.0	AEP	1	DVP_P1-2: LN 1016-B	single	240.0	118.29	119.71

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
925661	AC1-042 C	6.7868	80/20	6.7868
926641	AC1-145 C	8.0796	80/20	8.0796
939941	AE1-230 C	3.0617	80/20	3.0617
941801	AE2-185 C	15.3086	80/20	15.3086
941821	AE2-187 C	15.3086	80/20	15.3086
942671	AE2-283 C	16.8395	80/20	16.8395
945081	AF1-173	5.9321	80/20	5.9321
961121	AF2-403	3.4019	80/20	3.4019
315156	1HALLBR1	3.69	80/20	3.69
925991	AC1-075 C	15.636	80/20	15.636
926021	AC1-080 C	5.2256	80/20	5.2256
927261	AC1-222 C	9.3489	80/20	9.3489
934311	AD1-055 C	6.4912	80/20	6.4912
942751	AE2-291 C O1	24.9849	80/20	24.9849
942761	AE2-292 C O1	31.1086	80/20	31.1086
247284	05LEESVG	2.3575	80/20	2.3575
246843	05SMG1	1.5773	80/20	1.5773
246847	05SMG5	1.5773	80/20	1.5773
246844	05SMG2	4.1631	80/20	4.1631
246845	05SMG3	2.3629	80/20	2.3629
246846	05SMG4	4.1631	80/20	4.1631
919841	AA2-070	0.7651	80/20	0.7651
938451	AE1-064 C	8.4934	80/20	8.4934
926051	AC1-083 C O1	3.6689	80/20	3.6689
933941	AD1-017 C	0.7338	80/20	0.7338
940081	AE1-250 C	6.4206	80/20	6.4206
926521	AC1-123 C O1	3.2531	80/20	3.2531
939011	AE1-130 C	3.292	80/20	3.292
CPLE	CPLE	0.4048	Confirmed LTF	0.4048
CBM-S2	CBM-S2	2.312	Confirmed LTF	2.312
NY	NY	0.0415	Confirmed LTF	0.0415
TRIMBLE	TRIMBLE	0.0384	Confirmed LTF	0.0384
BLUEG	BLUEG	0.1163	Confirmed LTF	0.1163
TILTON	TILTON	0.0391	Confirmed LTF	0.0391
GIBSON	GIBSON	0.0317	Confirmed LTF	0.0317
EDWARDS	EDWARDS	0.0196	Confirmed LTF	0.0196
MADISON	MADISON	0.1048	Confirmed LTF	0.1048
TVA	TVA	0.07	Confirmed LTF	0.07
NEWTON	NEWTON	0.0494	Confirmed LTF	0.0494
CBM-S1	CBM-S1	0.2471	Confirmed LTF	0.2471
FARMERCITY	FARMERCITY	0.0013	Confirmed LTF	0.0013

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
PRAIRIE	PRAIRIE	0.0542	Confirmed LTF	0.0542
CBM-W2	CBM-W2	0.0819	Confirmed LTF	0.0819

11.6.3 Index 3

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
95975752	242741	05OTTER	AEP	242687	05JOHNMT	AEP	1	Base Case	single	167.0	133.91	135.54	DC	2.73

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246843	05SMG1	1.1678	80/20	1.1678
246844	05SMG2	3.0823	80/20	3.0823
246845	05SMG3	1.7494	80/20	1.7494
246846	05SMG4	3.0823	80/20	3.0823
246847	05SMG5	1.1678	80/20	1.1678
247284	05LEESVG	1.8553	80/20	1.8553
315156	1HALLBR1	2.7785	80/20	2.7785
315266	1PLYWOOD A	0.4352	80/20	0.4352
919841	AA2-070	0.5665	80/20	0.5665
925661	AC1-042 C	5.4443	80/20	5.4443
925991	AC1-075 C	6.7757	80/20	6.7757
926021	AC1-080 C	2.2644	80/20	2.2644
926051	AC1-083 C O1	2.7911	80/20	2.7911
926271	**AC1-105 C O1 (Suspended)**	**1.8710**	**80/20**	**1.8710**
926641	AC1-145 C	6.4813	80/20	6.4813
927261	AC1-222 C	1.9836	80/20	1.9836
933941	AD1-017 C	0.5582	80/20	0.5582
934311	AD1-055 C	1.3773	80/20	1.3773
938451	AE1-064 C	6.1559	80/20	6.1559
939941	AE1-230 C	2.4561	80/20	2.4561
940081	AE1-250 C	5.0616	80/20	5.0616
941801	AE2-185 C	12.2803	80/20	12.2803
941821	AE2-187 C	12.2803	80/20	12.2803
942671	AE2-283 C	13.5084	80/20	13.5084
942751	AE2-291 C O1	13.2076	80/20	13.2076
942761	AE2-292 C O1	16.4447	80/20	16.4447
943901	AF1-058 C	0.7358	80/20	0.7358
945081	AF1-173	4.7586	80/20	4.7586
960061	AF2-297 C O1	2.9434	80/20	2.9434
961121	AF2-403	2.7290	80/20	2.7290
NEWTON	NEWTON	0.2063	Confirmed LTF	0.2063
CPLE	CPLE	0.7998	Confirmed LTF	0.7998
FARMERCITY	FARMERCITY	0.0081	Confirmed LTF	0.0081
G-007A	G-007A	0.0096	Confirmed LTF	0.0096
VFT	VFT	0.0193	Confirmed LTF	0.0193
NY	NY	0.0144	Confirmed LTF	0.0144
PRAIRIE	PRAIRIE	0.3668	Confirmed LTF	0.3668
EDWARDS	EDWARDS	0.0721	Confirmed LTF	0.0721
CBM-S2	CBM-S2	4.2078	Confirmed LTF	4.2078
TILTON	TILTON	0.1392	Confirmed LTF	0.1392
MADISON	MADISON	0.2157	Confirmed LTF	0.2157

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
GIBSON	GIBSON	0.1179	Confirmed LTF	0.1179
BLUEG	BLUEG	0.4132	Confirmed LTF	0.4132
TRIMBLE	TRIMBLE	0.1347	Confirmed LTF	0.1347

11.6.4 Index 4

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
95542229	314667	4ALTVSTA	DVP	242741	05OTTER	AEP	1	Base Case	single	167.0	136.54	138.18	DC	2.73

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
246843	05SMG1	1.1678	80/20	1.1678
246844	05SMG2	3.0823	80/20	3.0823
246845	05SMG3	1.7494	80/20	1.7494
246846	05SMG4	3.0823	80/20	3.0823
246847	05SMG5	1.1678	80/20	1.1678
247284	05LEESVG	1.8553	80/20	1.8553
315156	1HALLBR1	2.7785	80/20	2.7785
315266	1PLYWOOD A	0.4352	80/20	0.4352
919841	AA2-070	0.5665	80/20	0.5665
925661	AC1-042 C	5.4443	80/20	5.4443
925991	AC1-075 C	6.7757	80/20	6.7757
926021	AC1-080 C	2.2644	80/20	2.2644
926051	AC1-083 C O1	2.7911	80/20	2.7911
926271	**AC1-105 C O1 (Suspended)**	**1.8710**	**80/20**	**1.8710**
926641	AC1-145 C	6.4813	80/20	6.4813
927261	AC1-222 C	1.9836	80/20	1.9836
933941	AD1-017 C	0.5582	80/20	0.5582
934311	AD1-055 C	1.3773	80/20	1.3773
938451	AE1-064 C	6.1559	80/20	6.1559
939941	AE1-230 C	2.4561	80/20	2.4561
940081	AE1-250 C	5.0616	80/20	5.0616
941801	AE2-185 C	12.2803	80/20	12.2803
941821	AE2-187 C	12.2803	80/20	12.2803
942671	AE2-283 C	13.5084	80/20	13.5084
942751	AE2-291 C O1	13.2076	80/20	13.2076
942761	AE2-292 C O1	16.4447	80/20	16.4447
943901	AF1-058 C	0.7358	80/20	0.7358
945081	AF1-173	4.7586	80/20	4.7586
960061	AF2-297 C O1	2.9434	80/20	2.9434
961121	AF2-403	2.7290	80/20	2.7290
NEWTON	NEWTON	0.2063	Confirmed LTF	0.2063
CPLE	CPLE	0.7998	Confirmed LTF	0.7998
FARMERCITY	FARMERCITY	0.0081	Confirmed LTF	0.0081
G-007A	G-007A	0.0096	Confirmed LTF	0.0096
VFT	VFT	0.0193	Confirmed LTF	0.0193
NY	NY	0.0144	Confirmed LTF	0.0144
PRAIRIE	PRAIRIE	0.3668	Confirmed LTF	0.3668
EDWARDS	EDWARDS	0.0721	Confirmed LTF	0.0721
CBM-S2	CBM-S2	4.2078	Confirmed LTF	4.2078
TILTON	TILTON	0.1392	Confirmed LTF	0.1392
MADISON	MADISON	0.2157	Confirmed LTF	0.2157

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
GIBSON	GIBSON	0.1179	Confirmed LTF	0.1179
BLUEG	BLUEG	0.4132	Confirmed LTF	0.4132
TRIMBLE	TRIMBLE	0.1347	Confirmed LTF	0.1347

11.6.5 Index 5

ID	FROM BUS#	FROM BUS	FROM BUS AREA	TO BUS#	TO BUS	TO BUS AREA	CKT ID	CONT NAME	Type	Rating MVA	PRE PROJECT LOADING %	POST PROJECT LOADING %	AC|DC	MW IMPACT
97589341	314670	2ALTVSTA	DVP	314667	4ALTVSTA	DVP	1	Base Case	single	128.78	102.74	108.95	DC	8.0

Bus #	Bus	Gendeliv MW Impact	Type	Full MW Impact
925661	AC1-042 C	15.9600	80/20	15.9600
926641	AC1-145 C	19.0000	80/20	19.0000
939941	AE1-230 C	7.2000	80/20	7.2000
941801	AE2-185 C	36.0000	80/20	36.0000
941821	AE2-187 C	36.0000	80/20	36.0000
942671	AE2-283 C	39.6000	80/20	39.6000
945081	AF1-173	13.9500	80/20	13.9500
961121	AF2-403	8.0000	80/20	8.0000

11.7 Queue Dependencies

The Queue Projects below are listed in one or more indices for the overloads identified in your report. These projects contribute to the loading of the overloaded facilities identified in your report. The percent overload of a facility and cost allocation you may have towards a particular reinforcement could vary depending on the action of these earlier projects. The status of each project at the time of the analysis is presented in the table. This list may change as earlier projects withdraw or modify their requests.

Queue Number	Project Name	Status
AA2-070	Smith Mountain 138kV	In Service
AC1-042	Altavista-Mt. Airy 69kV	Engineering and Procurement
AC1-075	Perth-Hickory Grove 115kV	Engineering and Procurement
AC1-080	Perth-Hickory Grove 115kV	Engineering and Procurement
AC1-083	Smith Mountain-Bearskin 138kV	Active
AC1-105	Halifax-Mt. Laurel 115kV	Suspended
AC1-145	Gretna DP 69 kV	Engineering and Procurement
AC1-222	Crystal Hill-Halifax 115kV	Engineering and Procurement
AD1-017	Smith Mountain-Bearskin 138 kV	Active
AD1-055	Crystal Hill-Halifax 115 kV	Engineering and Procurement
AE1-064	Rockcastle 138 kV	Active
AE1-230	Shockoe 69 kV	Active
AE1-250	Smith Mountain-E. Danville 138 kV	Active
AE2-185	Gladys DP-Stonemill Switching Station 69 kV	Active
AE2-187	Shockoe DP-Chatham 69 kV	Active
AE2-283	Gladys-Stone Mill 69 kV	Active
AE2-291	Grit DP-Perth 115 kV	Active
AE2-292	Grit DP-Perth 115 kV	Active
AF1-058	Welco 34.5 kV	Engineering and Procurement
AF1-173	Gretna DP-Shockoe DP 69 kV	Active
AF2-297	Sedge Hill 115 kV	Active
AF2-403	Shockoe DP-Chatham 69 kV	Active

11.8 Contingency Descriptions

Contingency Name	Contingency Definition
AEP_P1-2_#5366-A	CONTINGENCY 'AEP_P1-2_#5366-A' OPEN BRANCH FROM BUS 242549 TO BUS 940080 CKT 1 / 242549 05BANSTR 138 940080 AE1-250 TAP 138 1 OPEN BRANCH FROM BUS 242549 TO BUS 242632 CKT 1 / 242549 05BANSTR 138 242632 05EDAN 2 138 1 OPEN BRANCH FROM BUS 242549 TO BUS 314668 CKT Z1 / 242549 05BANSTR 138 314668 4BANISTR 138 Z1 END
DVP_P1-2: LN 35-A	CONTINGENCY 'DVP_P1-2: LN 35-A' OPEN BRANCH FROM BUS 314729 TO BUS 942670 CKT 1 /* 2GLADYS 69.000 - AE2-283 TAP 69.000 END
DVP_P1-3: 3SKIMMER-ID#1	CONTINGENCY 'DVP_P1-3: 3SKIMMER-ID#1' OPEN BRANCH FROM BUS 242886 TO BUS 314861 CKT 1 /* 05SKIMMR 69.000 - 3SKIMMER 115.00 END
DVP_P1-3: 3SKIMMER-ID#2	CONTINGENCY 'DVP_P1-3: 3SKIMMER-ID#2' OPEN BRANCH FROM BUS 242886 TO BUS 314861 CKT 2 /* 05SKIMMR 69.000 - 3SKIMMER 115.00 END
242549 05BANSTR 138 940080 AE1-250 TAP 138 1	CONTINGENCY '242549 05BANSTR 138 940080 AE1-250 TAP 138 1' OPEN BRANCH FROM BUS 242549 TO BUS 940080 CKT 1 END

Contingency Name	Contingency Definition
AEP_P4_#10317_05REUSEN 138_D	CONTINGENCY 'AEP_P4_#10317_05REUSEN 138_D' OPEN BRANCH FROM BUS 242561 TO BUS 242641 CKT 1 / 242561 05BOONSBORO 138 242641 05FOREST 138 1 OPEN BRANCH FROM BUS 242561 TO BUS 242765 CKT 1 / 242561 05BOONSBORO 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242591 TO BUS 242765 CKT 1 / 242591 05CENTRR 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242641 TO BUS 242734 CKT 1 / 242641 05FOREST 138 242734 05NEWLDN 138 1 OPEN BRANCH FROM BUS 242719 TO BUS 242765 CKT 1 / 242719 05MONEL 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242765 TO BUS 242882 CKT 4 / 242765 05REUSEN 138 242882 05REUSENS 69.0 4 OPEN BRANCH FROM BUS 242765 TO BUS 242889 CKT 1 / 242765 05REUSEN 138 242889 05REUSENS 34.5 1 REMOVE SWSHUNT FROM BUS 242765 / 242765 05REUSEN 138 OPEN BRANCH FROM BUS 242860 TO BUS 242882 CKT 1 / 242860 05ABERT 69.0 242882 05REUSENS 69.0 1 OPEN BRANCH FROM BUS 242876 TO BUS 242882 CKT 1 / 242876 05MONROE A 69.0 242882 05REUSENS 69.0 1 OPEN BRANCH FROM BUS 247360 TO BUS 242882 CKT 1 / 247360 05PEAKLANDSS69.0 242882 05REUSENS 69.0 1 REMOVE SWSHUNT FROM BUS 242882 / 242882 05REUSENS 69.0 OPEN BRANCH FROM BUS 247866 TO BUS 242889 CKT 1 / 247866 05GLAMORGNSS34.5 242889 05REUSENS 34.5 1 REMOVE UNIT 1 FROM BUS 242889 / 242889 05REUSENS 34.5 END
AEP_P1-2_#5481	CONTINGENCY 'AEP_P1-2_#5481' OPEN BRANCH FROM BUS 242561 TO BUS 242641 CKT 1 / 242561 05BOONSBORO 138 242641 05FOREST 138 1 OPEN BRANCH FROM BUS 242561 TO BUS 242765 CKT 1 / 242561 05BOONSBORO 138 242765 05REUSEN 138 1 OPEN BRANCH FROM BUS 242641 TO BUS 242734 CKT 1 / 242641 05FOREST 138 242734 05NEWLDN 138 1 END
Base Case	
DVP_P1-3: 4ALTVSTA-TX#4	CONTINGENCY 'DVP_P1-3: 4ALTVSTA-TX#4' OPEN BRANCH FROM BUS 314666 TO BUS 314667 CKT 2 /* 3ALTVSTA 115.00 - 4ALTVSTA 138.00 END
DVP_P4-2: 151T1016	CONTINGENCY 'DVP_P4-2: 151T1016' /* SEDGE HILL 115 KV OPEN BRANCH FROM BUS 313825 TO BUS 314696 CKT 1 /* 3PLYWOOD 115.00 - 3SEDGE HILL 115.00 OPEN BRANCH FROM BUS 927260 TO BUS 314696 CKT 1 /* AC1-222 TAP 115.00 - 3SEDGE HILL 115.00 END

Contingency Name	Contingency Definition
DVP_P1-2: LN 1016-A	CONTINGENCY 'DVP_P1-2: LN 1016-A' OPEN BRANCH FROM BUS 314688 TO BUS 927260 CKT 1 /* 3CRSTL HILL 115.00 - AC1-222 TAP 115.00 OPEN BRANCH FROM BUS 314688 TO BUS 314714 CKT 1 /* 3CRSTL HILL 115.00 - 3PERTH 115.00 OPEN BUS 314688 /* ISLAND: 3CRSTL HILL 115.00 END
DVP_P1-3: 4ALTVSTA-TX#3	CONTINGENCY 'DVP_P1-3: 4ALTVSTA-TX#3' OPEN BRANCH FROM BUS 314666 TO BUS 314667 CKT 1 /* 3ALTVSTA 115.00 - 4ALTVSTA 138.00 END
DVP_P1-2: LN 1016-B	CONTINGENCY 'DVP_P1-2: LN 1016-B' OPEN BRANCH FROM BUS 927260 TO BUS 314696 CKT 1 /* AC1-222 TAP 115.00 - 3SEDGE HILL 115.00 END

12 Short Circuit Analysis

Short circuit analysis will be provided in the System Impact Study report.

13 Affected Systems

13.1 TVA

TVA Impacts to be determined during later study phases (as applicable).

13.2 Duke Energy Progress

Duke Energy Progress Impacts to be determined during later study phases (as applicable).

Attachment 1: One Line Diagram