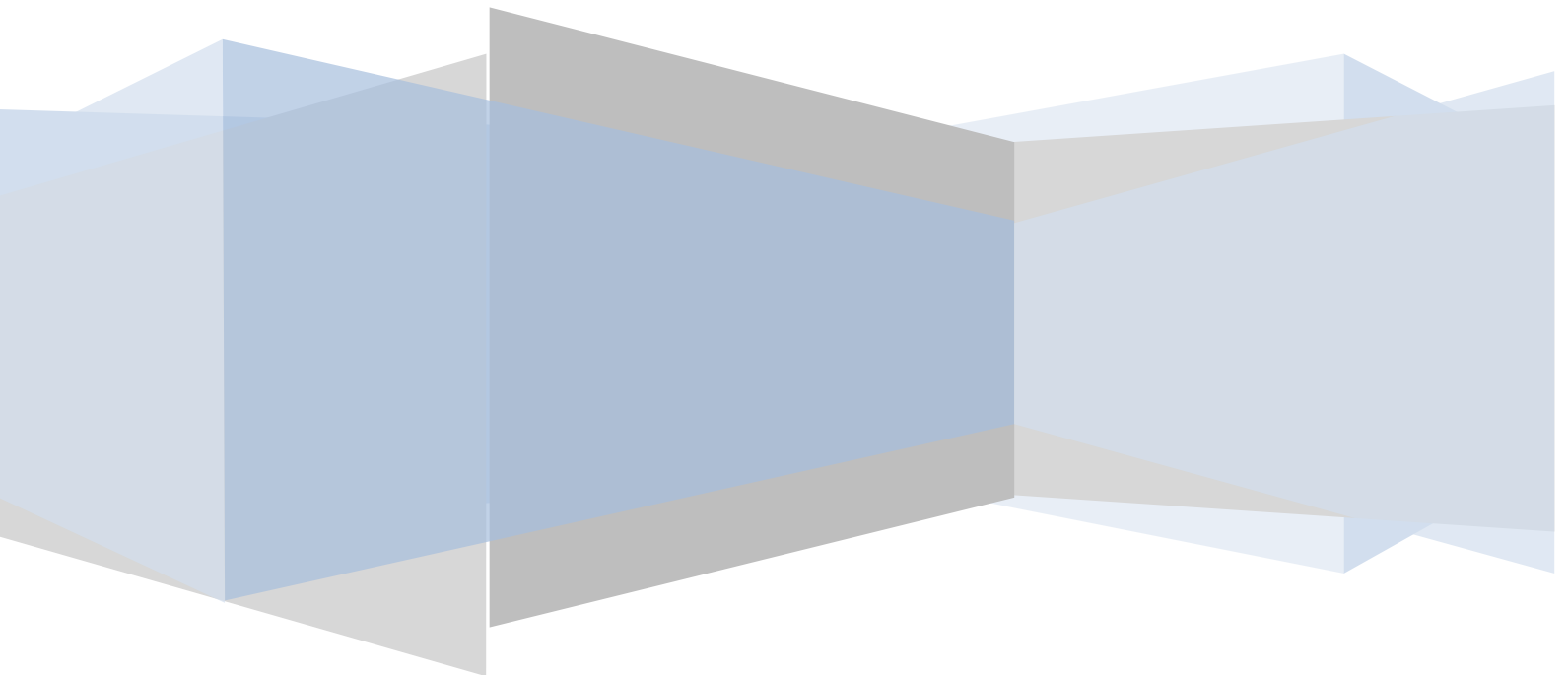


# **PJM and NCTPC Interface Study**

**American Electric Power (AEP)  
Progress Energy Carolinas (PEC)  
Duke Energy Carolinas (DEC)**

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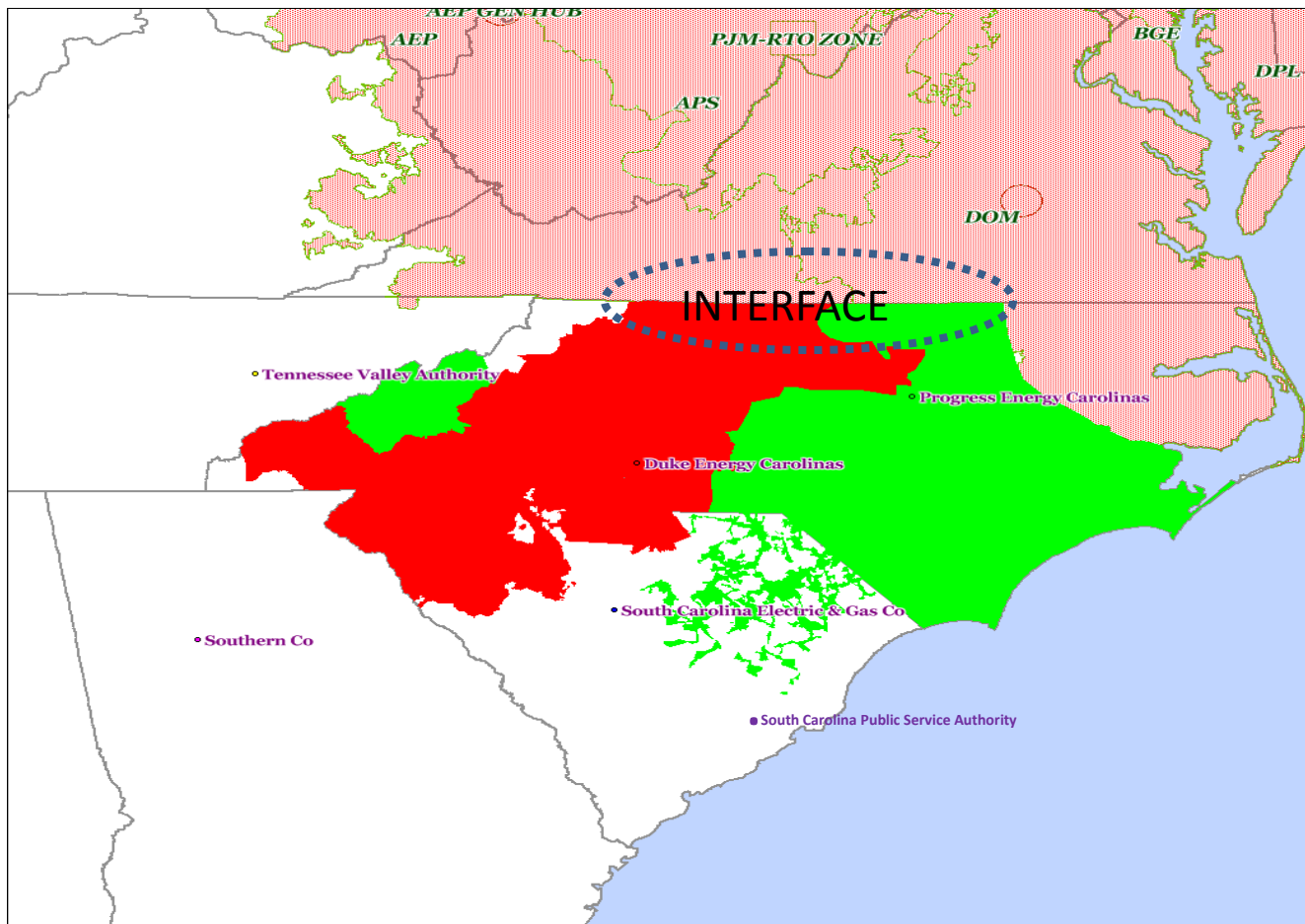
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## Executive Summary

The purpose of the this joint study is to assess the interface between PJM and North Carolina Transmission Planning Collaborative (NCTPC) to identify potential constraints in the Virginia and North Carolina transmission region. This includes the quantification of the magnitude and seriousness of the issues identified, and the determination of the appropriate course of corrective action to ensure reliability of service in accordance with NERC, PJM and NCTPC requirements. The study is a reliability analysis of the common interfaces between PJM Interconnection with Duke Energy Carolinas (DEC) and Progress Energy Carolinas (PEC).

The general area studied is shown in the map below:



The reliability studies used updated base cases from the MMWG 2021 summer peak and 2016 winter peak; the updated cases are non-stressed cases without additional power transfers. AC and DC analyses were conducted to stress the transmission system by simulating outages on facilities in PJM, PEC, DEC and the surrounding utility systems while monitoring PJM, PEC, DEC, and TVA facilities to determine the impact of affected facilities with potential criteria violations.

The study results indicate that the reliability issues observed in this study of PJM, DEC, and PEC are local area issues which have already been identified.

## **1. Study Scope**

### **1.1. Study Objective**

The joint study is an assessment of the interface between PJM and NCTPC to identify potential constraints in the Virginia and North Carolina transmission region, quantify the magnitude and seriousness of the issues, and determine the appropriate course of action for their remedy.

### **1.2. Methodology**

Studies were conducted using the Siemens PTI suite of products, including PSS/E and PSS/MUST. These studies included AC contingency analysis, and FCITC transfer sensitivity analysis.

### **1.3. Study Criteria**

Reliability Criteria are based on:

- NERC Reliability Standards
- Applicable regional planning criteria, such as the PJM Planning Criteria
- Appropriate individual transmission owner criteria, such as the AEP Planning Criteria and the NCTPC Members' Planning Criteria

A comprehensive list of applicable reliability planning criteria as detailed in Appendix B.

## **2. Assumptions and Base Case Development**

### **2.1. Assumptions**

- Study considered a 10-year study timeframe, consistent with PJM RTEP reliability analysis
- Study utilized 2021 MMWG summer case
- Study utilized 2016 MMWG winter case

See Appendix A for additional study assumptions.

## 2.2. Base Case Development

Base cases for the reliability analysis are from the MMWG 2021 summer peak and 2016 winter peak cases. The cases were updated to reflect the PJM 2010 RTEP approved projects and the NCTPC 2010 approved projects and are non-stressed cases that exclude additional power transfers.

## 3. Reliability Analysis

### 3.1. AC Contingency Analysis

#### 3.1.1. Summary of Modeling Methods and Analysis

The purpose of the AC contingency analysis is to stress the transmission system by simulating outages on facilities in the study area and the surrounding utility systems. Monitoring of PJM, PEC, DEC, and TVA facilities to determine the impact of affected facilities with potential criteria violations of current and voltage area identified in attachment B. This analysis was performed using PTI's Power System Simulator for Engineering (PSS/E).

#### 3.1.2. Monitor and Contingency Files

The monitor file contains the bulk electric system facilities at or above 100 kV in PJM, DEC and PEC as well as areas surrounding the common interfaces. Contingency files for PJM, DEC and PEC considered the following:

- I) Cat. B<sub>s</sub>
- II) Cat. C1, C2, and C5 for all facilities 100 kV and above
- III) Critical Cat. C3 for EHV facilities 230 kV and above

Contingency files for PJM consisted of AEP and Dominion Virginia Power contingencies from the East Central Area Reliability Coordination (ECAR) contingency database. Contingency files for SCPSA, SCEG, SOCO and TVA considered single contingencies. Critical category C3 contingencies were tested as N-2 for each region. Contingency files for SCPSA, SCEG, SOCO and TVA considered single contingencies.

#### 3.1.3. Results

The 2021 summer case reveals future loading issues in the PEC Area during N-2 contingency operation. The Roxboro SE to Person 230 kV line loads to 102% of the normal rating during the outage of Roxboro SE to Person 230 kV line Ckt 1-2. The 2016 winter case has the same issue in the PEC area during N-2 contingency operation. The Roxboro SE to Person 230 kV line loads to 101% of the normal rating during the outage of Roxboro SE to Person 230 kV line Ckt 1-2. Ancillary equipment upgrades can eliminate the loading issues associated with the Roxboro SE to Person

230 kV line. PEC will continue to monitor this facility to determine the appropriate corrective actions.

The 2021 summer case reveals loading issues in the DEC area during Category C contingency operation. The Parkwood 500/230 kV transformer # 6 loads to 136% of the normal rating during the outages of Pleasant Garden 500/230 kV transformer # 5 and Parkwood 500/230 kV transformer #5. The Oconee to Jocassee 500 kV line loads to 126% of the normal rating during the outages of McGuire to Cliffside 500 kV line, and Jocassee 500/230 kV transformer. The Buck 230/100 kV transformer loads to 137% of the normal rating during the outage of Beckerdite 230 kV bus. The 2016 winter case reveals loading issues in the DEC Area during Category C contingency operation. The Oconee to North Greenville 230 kV Line loads to 143% of the normal rating during the outage of Central 230 kV bus junction breaker. For facilities that overload under Category C condition, DEC does not normally initiate corrective action plans. DEC will continue to monitor facilities that overload under Category C conditions and evaluate corrective actions depending on the impact on system operation. The table below is a summary of the Category C results for years 2021S and 2016W.

Table 1. Category C Summary for years 2021S and 2016W

Case	Area	Branch Over 100% Rate A	Rate A MVA	Loading %	Outaged Branch That Caused Overload
2021S	DEC	Parkwood 500/230 kV Transformer # 6	796.7	136	Pleasant Garden 500/230 kV Transformer # 5, Parkwood 500/230 kV Transformer #5
2021S	DEC	Oconee to Jocassee 500 kV Line	2132	126	McGuire to Cliffside 500 kV line, Jocassee 500/230 kV Transformer
2021S	DEC	Buck 230/100 kV Transformer	509	137	Beckerdite 230 kV Bus
2021S	PEC	Roxboro SE to Person 230 kV Line	797	102	Roxboro SE to Person 230 kV Line Ckt 1-2
2016W	DEC	Oconee to North Greenville 230 kV Line	478	143	Central 230 kV bus junction breaker
2016W	PEC	Roxboro SE to Person 230 kV Line	797	101	Roxboro SE to Person 230 kV Line Ckt 1-2

## 3.2. FCITC Analysis

### 3.2.1. Summary of Modeling Methods and Analysis

First Contingency Incremental Transfer Capability (FCITC) runs were performed to identify operating limits of various simulated transfers. The runs were designed to stress the transmission system beyond planning and operating criteria to identify any potential transmission constraints. The method of transfer used scaled generation up

and load down in the export system and scaled generation down and load up the same net amount in the import system. A maximum transfer limit of 4,000 MW was mutually agreed upon by the parties involved and used in the study. This analysis was performed using PTI/MUST. The Outage Transfer Distribution Factors (OTDFs), which is the percent of a transfer that will flow on a branch after the contingency occurs, was considered in the analysis of the results.

### 3.2.2 Monitor, Subsystem and Contingency Files

The monitor file monitors bulk electric system elements, 100 kV and above in PJM, DEC and PEC as well as areas surrounding the common interfaces. The contingency file contained single contingencies for the principal and surrounding study areas. The subsystem file was used to define the import and export systems between PJM and areas surrounding the common interfaces. The areas surrounding the interface considered were Tennessee Valley Authority “TVA”, Southern Company “SOCO”, South Carolina Electric and Gas “SCEG”, and South Carolina Public Service Authority “SCPSA”. Depending on the direction of transfer between PJM and surrounding areas, subsystems would be either import or export systems.

### 3.2.3 Results

Using PSS/MUST, FCITC analysis was completed for each of the eight selected transfers. The team performed a joint review of the results to validate the limiting constraints. See Appendices C and D for a complete list of results for 2021 summer and 2016 winter cases.

#### TVA to PJM 4000 MW Transfer (2016 Winter)

The first limiting constraint [2350 MW] for the TVA to PJM is the Boone to Greenville Tap2 161 kV line (TVA) for the outage of Volunteer to Phipps Bend 500 kV line (TVA) with an OTDF of 2.7%. TVA has acknowledged the constraint but does not have corrective action planned for this facility. The next limiting facility [3500 MW] is Bull Run to Volunteer 500 kV line (TVA) for outage of the Watts Bar to Volunteer 500 kV line (TVA) with an OTDF of 16.7%.

#### SOCO to PJM 4000 MW Transfer (2016 Winter)

The first limiting constraint [2400 MW] for the SOCO to PJM is the Boone to Greenville Tap2 161 kV line (TVA) for the outage of Volunteer to Phipps Bend 500 kV line (TVA) with an OTDF of 2.7%. TVA has acknowledged the constraint but does not have corrective action planned for this facility. The next limiting facility [3350 MW] is Sweet Gum to Pineville 161 kV line (TVA) for outage of the Volunteer to Phipps Bend 500 kV line (TVA) with an OTDF of 3.0%. The third limiting facility [3550 MW] is Bull

Run to Volunteer 500 kV line (TVA) for outage of the Watts Bar to Volunteer 500 kV line (TVA) with an OTDF of 16.4%.

#### SCEG to PJM 4000 MW Transfer (2016 Winter)

The first limiting constraint [2100 MW] for the SCEG to PJM is the Lexington to Columbia 115 kV line (SCPSA) under base case with a PTDF of 2.3%. Assuming that SCPSA has corrective action plan for this facility then the next limiting constraint [2150 MW] is the Lyles 1 (SCEG) to Lexington 115 kV line (SCPSA) under base case with a PTDF of 2.3%. The first limiting facility with an OTDF greater than 3% is at 2850 MW, VC Summer (SCEG) to Newport (DEC) 230 kV line for loss of the McGuire to Cliffside 500 kV line (DEC).

#### SCPSA to PJM 4000 MW Transfer (2016 Winter)

The first limiting constraint [1750 MW] for the SCPSA to PJM is the Anthony Shoals 230/115 kV transformer (SOCO) for the outage of Oconee to South Hall 500 kV line (DEC/SOCO) with an OTDF of 2.2%. Assuming that SOCO has corrective action plan for this facility then the next limiting constraint [2550 MW] is the Tuckasegee to Webster 161 kV line (DEC) for the outage of Oconee to South Hall 500 kV line (DEC/SOCO) with an OTDF of 2.8%. DEC has no corrective actions planned at this time; however, the facility will continue to be monitored to determine if there are ancillary upgrades that could be performed in order to increase the rating.

#### PJM to TVA 4000 MW Transfer (2016 Winter)

The first limiting constraint [2600 MW] for the PJM to TVA is the Tuckasegee to Webster 161 kV line (DEC) for the outage of Oconee to South Hall 500 kV line (DEC/SOCO) with an OTDF of 2.7%. DEC has no corrective actions planned at this time; however, the facility will continue to be monitored as to determine if there are ancillary upgrades that could be performed in order to increase the rating. An ancillary upgrade would alleviate the Tuckasegee to Webster 161 kV limit [raise to 6700 MW], and no hard limit for this transfer would be identified.

#### PJM to SOCO 4000 MW Transfer (2016 Winter)

No constraints found under this transfer level.

PJM to SCEG 4000 MW Transfer (2016 Winter)

The first limiting constraint [1700 MW] for the PJM to SCEG is the Vogtle (SOCO) to Savannah River Services 230 kV line (SCEG) for the outage of Vogtle to McIntosh 500 kV line (SOCO) with an OTDF of 13.9%. Assuming that SCEG/SOCO have corrective action plans for these facilities then the next limiting constraint [2350 MW] is the Wateree 115/100 kV transformer (PEC) for the outage of Richmond (PEC) to Newport (DEC) 500 kV line with an OTDF of 3.4%. PEC and DEC have previously coordinated an Operating Guide to open the Wateree transformer as needed to alleviate loading issues thus eliminating this limit. The next limiting constraint [2550] is the Wateree 115/100 kV transformer (PEC) for the outage of Oconee to South Hall 500 kV (DEC/SOCO) with an OTDF of 3.4%. The PEC/DEC coordinated Wateree Operating Guide would also apply here thus eliminating this limit. The next limiting constraint [2700] is the Savannah River Services to Canadys 230 kV (SCEG) for the outage of the Vogtle to McIntosh 500 kV (SOCO) with an OTDF of 2.9%.

PJM to SCPSA 4000 MW Transfer (2016 Winter)

The first limiting constraint [1200 MW] for the PJM to SCPSA is the Savannah River Services to Canadys 230 kV line (SCEG) for the outage of Vogtle to McIntosh 500 kV line (SOCO) with an OTDF of 6.5%.

TVA to PJM 4000 MW Transfer (2021 Summer)

The first limiting constraint [450 MW] for the TVA to PJM is the Widows Creek to Sequoyah 500 kV line (TVA) for the outage of Maury to Browns Ferry 500 kV line (TVA) with an OTDF of 10.6%. TVA has acknowledged the constraint but does not have corrective action planned for this facility.

SOCO to PJM 4000 MW Transfer (2021 Summer)

The first limiting constraint [600 MW] for the SOCO to PJM is the Widows Creek to Sequoyah 500 kV line (TVA) for the outage of Maury to Browns Ferry 500 kV line (TVA) with an OTDF of 7.5%. TVA has acknowledged the constraint but does not have corrective action planned for this facility.

SCEG to PJM 4000 MW Transfer (2021 Summer)

The first limiting constraint [1200 MW] for the SCEG to PJM is the Woodleaf to Pleasant Garden 500 kV line (DEC) for the outage of McGuire to Antioch 500 kV line (DEC) with an OTDF of 7.3%. DEC has no corrective actions planned at this time;

however, the facility will continue to be monitored as there are ancillary upgrades that could be performed in order to increase the rating. An ancillary upgrade would alleviate the Woodleaf to Pleasant Garden 500 kV limit [raise to 5500 MW], and the next limiting constraint [1650 MW] with an OTDF of 14.5% is the Newport (DEC) to VC Summer Sub 1 (SCEG) 230 kV line for the outage of McGuire to Cliffside 500 kV line (DEC).

#### SCPSA to PJM 4000 MW Transfer (2021 Summer)

The first limiting constraint [1000 MW] for the SCPSA to PJM is the Woodleaf to Pleasant Garden 500 kV line (DEC) for the outage of McGuire to Antioch 500 kV line (DEC) with an OTDF of 8.7%. DEC has no corrective actions planned at this time; however, the facility will continue to be monitored as there are ancillary upgrades that could be performed in order to increase the rating. An ancillary upgrade would alleviate the Woodleaf to Pleasant Garden 500 kV limit [raise to 4600 MW], and the next limiting constraint [2400 MW] is the Clover 500/230 kV transformer (DVP) for the outage of Wake to Carson 500 kV line (PEC/DVP) with an OTDF of 6.8%. PJM/DVP has a 2010 RTEP approved upgrade to add a second 500/230 kV transformer at the facility to alleviate the Clover 500/230 kV limit [raise to 3750 MW], and the next limiting constraint [2500 MW] is the Tuckasegee to Webster 161 kV line (DEC) for the outage of Oconee (DEC) to Middle Fork (SOCO) 500 kV line with an OTDF of 2.7%. DEC has no corrective actions planned at this time; however, the facility will continue to be monitored to determine if there are ancillary upgrades that could be performed in order to increase the rating. An ancillary upgrade would alleviate the Tuckasegee to Webster 161 kV limit, and the next limiting constraint [2500 MW] is the Fayetteville E. to Erwin 230 kV line (PEC) for the outage of the Wake to Cumberland 500 kV line (PEC) with an OTDF of 4.2%. PEC has no corrective actions planned at this time. However, the facility will continue to be monitored to determine if there are ancillary upgrades that could be performed in order to increase the rating and alleviate the Fayetteville E. to Erwin 230 kV limit.

#### PJM to TVA 4000 MW Transfer (2021 Summer)

The first limiting constraint [2000 MW] for the PJM to TVA is the Spring Creek to Wolf Hills 138 kV line (AEP) for the outage of Bradford 765/500 kV transformer (AEP) with an OTDF of 2.6%. AEP acknowledges that generation dispatch at Wolf Hills 2 will eliminate the constraint. The next limiting constraint [2550 MW] is the Tuckasegee to Webster 161 kV line (DEC) for the outage of Oconee (DEC) to Middle Fork (SOCO) 500 kV line with an OTDF of 2.6%. DEC has no corrective actions planned at this time; however, the facility will continue to be monitored to determine if there are ancillary upgrades that could be performed in order to increase the rating. An

ancillary upgrade would alleviate the Tuckasegee to Webster 161 kV limit [raise to 6800 MW], and no hard limit for this transfer would be identified.

PJM to SOCO 4000 MW Transfer (2021 Summer)

No constraints found under this transfer level.

PJM to SCEG 4000 MW Transfer (2021 Summer)

The first limiting constraint [1750 MW] for the PJM to SCEG is the Vogtle (SOCO) to Savannah River Services 230 kV line (SCEG) for the outage of Vogtle to McIntosh 500 kV line (SOCO) with an OTDF of 15.0%.

PJM to SCPSA 4000 MW Transfer (2021 Summer)

The first limiting constraint [1700 MW] for the PJM to SCPSA is the Savannah River Services to Canadys 230 kV line (SCEG) for the outage of Vogtle to McIntosh 500 kV line (SOCO) with an OTDF of 6.8%.

#### **4. Summary and Conclusions**

The joint study between AEP, DEC and PEC evaluated the interface between PJM and North Carolina Transmission Planning Collaborative (NCTPC) to identify potential constraints in the Virginia and North Carolina transmission regions. The study analyzed two cases for reliability and FCITC analysis. Results indicate that the interregional power system of the study area has demonstrated good performance for the cases studied. In addition, the results indicate several FCITC limits with OTDF values less than 3 % that is usually indicative of a local reliability issues. The FCITC assessed transfer levels of 4000 MW for 2016 winter and 2021 summer cases; the potential limits to transfer that were identified in the area studied can be alleviated through ancillary upgrades and Operating Guides rather than additional or upgraded transmission facilities. Further, the results indicate other FCITC limits in other areas outside the scope of this study in TVA, SOCO, SCEG, and SCPSA.

DEC and PEC performed an N-1 analysis on the 2016 winter and 2021 summer cases based on their internal planning practices. The results of the analysis showed several DEC and PEC facilities that overload under contingency conditions; however, they did not identify any previously unidentified issues. DEC and PEC will continue to monitor the previously identified facilities and evaluate corrective action. The Category C analysis identified a few facilities that would overload under the studied Category C

conditions; however, DEC and PEC do not normally initiate plans for Category C conditions studied. The study does not propose any corrective actions.

For the PJM system, the results of the study analysis have shown several overloaded facilities under N-1 or Category C conditions; these overloaded facilities are known and local issues. PJM issues cited in this report will be used to inform PJM transmission reviews. The study does not propose any corrective actions.

Based on the results of this joint study, the team decided that the stability analysis and additional development of stressed cases will not be necessary as part of the scope of this study.

## Appendix A

### Additional Assumptions:

- Unless indicated otherwise power flow models for load and topology is based on the MMWG 2016W and 2021S base case
- PJM topology is the MMWG 2016W and 2021S base case updated with RTEP upgrades approved as part of the 2010 RTEP plan
- DEC and PEC topology is based on NCTPC 2010-2020 Collaborative Transmission Plan
- Existing and planned generation expected to be in service for study years will be modeled
- PJM generation will be based on market dispatch
  - Generation units within AEP, DEC and PEC will be dispatched to reflect realistic operation
  - PROMOD run data is outside of the scope of this joint study
- Study area includes
  - PJM
  - NCTPC
  - TVA
- Monitored all 100 kV facilities and above PJM, NCTPC, and TVA
- Study is based on pre-merger data for DEC and PEC.
- The PATH project was removed from the cases developed

## Appendix B

### Reliability Planning Criteria

NERC Contingency Category	Transmission Facilities										
	EHV				Bulk			Sub			100 Kv
		AEP	PROGRESS	DUKE	AEP	PROGRESS	DUKE	AEP	PROGRESS	DUKE	DUKE
A - No contingencies	Voltage Thermal	1.05 - 0.95 Rate A	1.08 - 1.00 Rate A	1.10 - 1.00 Rate A	1.05 - 0.95 Rate A	1.05 - 0.90 Rate A	1.05 - 0.95 Rate A	1.05 - 0.95 Rate A	1.05 - 0.90 Rate A	1.09 - 0.94 Rate A	.95 - 1.07 Rate A
B1 - Single Gen. B2 - Single line B3 - Single TX Capacitor (Duke)	① Voltage	1.05 - 0.92	1.08 - 1.00	1.10 - 1.00	1.05 - 0.92	1.05 - 0.90	1.05 - 0.95	1.05 - 0.92	1.05 - 0.90	1.09 - 0.94	.95 - 1.07
	Thermal	Rate A	Rate A	② Rate B Rate C	Rate B	Rate A	② Rate B Rate C	Rate B	Rate A	② Rate B Rate C	② Rate B Rate C
C1 - Bus C2 - BKR Failure C5 - Dble. CKT. TWR.	① Voltage	1.05 - 0.92	1.08 - 1.00	1.10 - 1.00	1.05 - 0.92	1.05 - 0.90	1.05 - 0.95	Not planned	1.05 - 0.90	1.09 - 0.94	.95 - 1.07
	Thermal	Rate B	Rate A	③ Rate C 125% of Rate A	Rate B	Rate A	③ Rate C 125% of Rate A	Not planned	Rate A	③ Rate C 125% of Rate A	③ Rate C 125% of Rate A
C3 - Two cat. B contingencies (cat. B contingent followed by another cat. B contingency)	① Voltage	1.05 - 0.92	1.08 - 1.00	1.10 - 1.00	1.05 - 0.92	1.05 - 0.90	1.05 - 0.95	Not planned	1.05 - 0.90	1.09 - 0.94	.95 - 1.07
	Thermal	Rate B	Rate A	Rate C	Rate B	Rate A	Rate C	Not planned	Rate A	Rate C	Rate C
D7 - Loss of TLs on the same ROW D8 - Loss of Substation D10 - loss of all gen. at a station	① Voltage	N/A		1.10 - 1.00	N/A		1.05 - 0.95	Not planned		1.09 - 0.94	.95 - 1.07
	Thermal	N/A		125% of Rate A	N/A		125% of Rate A	Not planned		125% of Rate A	125% of Rate A

① Maximum voltage drop for facilities in AEP and Duke is 8%, and 5% for EHV and Bulk facilities in Progress

② Rate B for single line or single transformer 500/230 kV

③ 125% of rate A for C1 and C2 contingencies

## Appendix C

### FCITC Results for 2021 Summer Case

TRANSFER	BASE CASE (see notes)	NITC FCITC (MW)	Total Import (MW)	N O T E	LIMITING FACILITY <sup>a</sup> Common Name	SYSTEM	RATING (MVA)	OUTAGED FACILITY <sup>a</sup> Common Name	SYSTEM	PTDF (%)	LODF (%)	TDF (%)
TVA_EXP to PJM_MP	Base	450	450	2	Widows Creek - Sequoyah 500 kV	TVA	1732	MAURY - BROWNS FERRY 500 kV (TVA)	TVA	9.4	29.2	10.6
		1700	1700		Widows Creek - Sequoyah 500 kV	TVA	1732	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	9.4	20.6	9.4
		1800	1800	2	Woodleaf - Pleasant Garden 500 kV	DUKE	1904	McGuire - Antioch 500 kV (DUKE)	DUKE	3.6	22.7	4.9
		1850	1850		Woodleaf - Pleasant Garden 500 kV	DUKE	1904	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	3.6	18.8	4.4
		1950	1950		Loretto B - Wilton Center 345 kV (CE)	CE	1280	Dresden R - Pontiac Mid-Point R 345 kV (CE)	CE	2.3	56.1	3.5
		2250	2250		Pontiac Mid-Point - Loretto B 345 kV (CE)	CE	1234	Dresden R - Pontiac Mid-Point R 345 kV (CE)	CE	2.3	56.1	3.6
		2450	2450		Jack Mountain 2 - Juniata 500 kV (PJM)	PJM	2598	Juniata - Jack Mountain 1 500 kV (PJM)	PJM	4.9	77.4	8.6
		3650	3650		Pontiac Mid-Point - Dresden R 345 kV (CE)	CE	1341	Loretto B - Wilton Cr B 345 kV (CE)	CE	2.2	56.9	3.5
		3650	3650		Brokaw (AMIL) - Pontiac Mid-Point 345 kV (CE)	AMIL	1441	Blue Mound B - Pontiac Mid-Point B 345 kV (CE)	CE	2.7	62.3	3.9
		3700	3700		Colver 500/230 kV Transformer (DVP)	DVP	927	Wake - Dummy Gen 500 kV (CPLE)	CPLE	2.5	22.1	4.5
		3900	3900		Lafayette - Summershade 161 kV	TVA	228	Volunteer - Phipps Bend 500 kV (TVA)	TVA	3.2	2.6	3.6
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
SOCO_EXP to PJM_MP	Base	600	600	2	Widows Creek - Sequoyah 500 kV	TVA	1732	MAURY - BROWNS FERRY 500 kV (TVA)	TVA	5.6	29.2	7.5
		1200	1200	2	Woodleaf - Pleasant Garden 500 kV	DUKE	1904	McGuire - Antioch 500 kV (DUKE)	DUKE	4.7	22.7	7.3
		1400	1400		Woodleaf - Pleasant Garden 500 kV	DUKE	1904	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	4.7	18.8	5.7
		2000	2000		Volunteer - John Sevier 161 kV	TVA	182	Volunteer - Phipps Bend 500 kV (TVA)	TVA	1.1	9.8	2.6
		2550	2550		Loretto B - Wilton Center 345 kV (CE)	CE	1280	Dresden R - Pontiac Mid-Point R 345 kV (CE)	CE	1.6	56.1	2.7
		2600	2600		Jack Mountain 2 - Juniata 500 kV (PJM)	PJM	2598	Juniata - Jack Mountain 1 500 kV (PJM)	PJM	4.6	77.4	8.1
		2900	2900		Widows Creek - Sequoyah 500 kV	TVA	1732	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	5.6	20.6	5.6
		2950	2950		Colver 500/230 kV Transformer (DVP)	DVP	927	Wake - Dummy Gen 500 kV (CPLE)	CPLE	3.1	22.1	5.6

TRANSFER	BASE CASE (see notes)	NITC FGTTC (MW)	Total Import (MW)	N O T E	LIMITING FACILITY* Common Name	SYSTEM	RATING (MVA)	OUTAGED FACILITY* Common Name	SYSTEM	PTDF (%)	LODF (%)	TDF (%)
SCEG_EXP to PJM_MP	Base	2950	2950		Pontiac Mid-Point - Loretto B 345 kV (CE)	CE	1234	Dresden R - Pontiac Mid-Point R 345 kV (CE)	CE	1.7	56.1	2.7
		3450	3450		Villa Rica 500/230 Transformer (SOCO)	SOCO	1647	Union City - Villa Rica 500 kV (SOCO)	SOCO	1.5	42.5	2.7
		3600	3600		Fayetteville E. - Erwin 230 kV (CPL)	CPL	478	Wake - Cumberland 500 kV (CPL)	CPL	1.8	13.4	3.0
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
		1200	1200	2	Woodleaf - Pleasant Garden 500 kV	DUKE	1904	McGuire - Antloch 500 kV (DUKE)	DUKE	3.7	22.7	7.3
		1650	1650	2	VC Summer Sub 1 (SCEG) - Newport 230 kV (DUKE)	SCEG	456	McGuire - Clifside Tap500 kV (DUKE)	DUKE	14.3	3.9	14.5
		1700	1700		Lyles 1 (SCEG) - Lexington 115 kV (SC)	SCEG	133	Base Case	----	3.0	---	3.0
		1700	1700		VC Summer Sub 1 (SCEG) - Newport 230 kV (DUKE)	SCEG	456	Oconee - ASBTRT 500 kV (DUKE)	DUKE	14.3	5.6	14.5
		1900	1900		VC Summer Sub 1 (SCEG) - Newport 230 kV (DUKE)	SCEG	437	Base Case	----	14.3	---	14.3
		2150	2150		Columbia Erg Ctr - Edenwood 115 kV (SCEG)	SCEG	237	Base Case	----	11.0	---	11.0
		2150	2150		Woodleaf - Pleasant Garden 500 kV	DUKE	1904	Richmond (CPL) - Newport 500 kV (DUKE)	CPL- DUKE	3.7	18.8	3.8
		2200	2200		Fayetteville E. - Erwin 230 kV (CPL)	CPL	478	Wake - Cumberland 500 kV (CPL)	CPL	3.1	13.4	4.8
		2200	2200	2	Lyles 1 (SCEG) - Lexington 115 kV (SC)	SCEG	153	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.5	3.0
		2300	2300	2	Columbia Erg Ctr - Edenwood 115 kV (SCEG)	SCEG	255	Limestone 500/161 kV Transformer (TVA)	TVA	11.0	---	11.0
		2300	2300		Columbia Erg Ctr - Edenwood 115 kV (SCEG)	SCEG	255	Richmond (CPL) - Newport 500 kV (DUKE)	CPL- DUKE	11.0	---	11.0
		2300	2300		Lyles 1 (SCEG) - Lexington 115 kV (SC)	SCEG	153	Richmond (CPL) - Newport 500 kV (DUKE)	CPL- DUKE	3.0	0.2	3.0
		2350	2350		Colver 500/230 kV Transformer (DVP)	DVP	927	Wake - Dummy Gen 500 kV (CPL)	CPL	3.7	22.1	7.0
		2450	2450		Lexington - Columbia 115 kV (SC)	SC	131	Base Case	----	3.0	---	3.0
		2500	2500	2	Whiterock (SCEG) - BUSH RIVER TY 115 kV (DUKE)	SCEG	83	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	2.6	0.4	2.6
		2550	2550		Whiterock (SCEG) - BUSH RIVER TY 115 kV (DUKE)	SCEG	83	Middle Fork - Thompson 500 kV (SOCO)	SOCO	2.6	0.4	2.6
		2550	2550		FAIRFIELD PUMPED STORAGE 5-8-VC SUMMER 230 kV (SCEG)	SCEG	475	Base Case	----	18.4	---	18.4
		2600	2600	2	Robinson - Cheraw Tap 230 kV (CPL)	CPL	539	Richmond (CPL) - Newport 500 kV (DUKE)	CPL- DUKE	8.4	5.5	8.4
		2650	2650		Pomaria - Newberry 230 kV (SC)	SC	478	Base Case	----	12.0	---	12.0
		2650	2650	2	Cheraw - Rockingham 230 kV (CPL)	CPL	478	Richmond (CPL) - Newport 500 kV (DUKE)	CPL- DUKE	8.4	5.5	8.4
		2700	2700	2	Waterlee 1 (SCEG) - Sumter (CPL) 230 kV	SCEG	478	Richmond (CPL) - Newport 500 kV (DUKE)	CPL- DUKE	8.3	3.3	8.3
		2700	2700		Whiterock (SCEG) - BUSH RIVER TY 115 kV (DUKE)	SCEG	83	Base Case	----	2.6	---	2.6
		2750	2750	2	FAIRFIELD PUMPED STORAGE 5-8-VC SUMMER 230 kV (SCEG)	SCEG	510	Brunot Island to Arsenal 345 kV (DLCO)	DLCO	18.4	---	18.4
		2750	2750		FAIRFIELD PUMPED STORAGE 5-8-VC SUMMER 230 kV (SCEG)	SCEG	510	Lockport R to Kendall City E-Center 345 kV (CE)	CE	18.4	---	18.4
		2800	2800		Robinson - Cheraw Tap 230 kV (CPL)	CPL	539	McGuire - Clifside Tap500 kV (DUKE)	DUKE	8.4	2.7	8.5
		2850	2850		Jack Mountain 2 - Juniata 500 kV (PJM)	PJM	2598	Juniata - Jack Mountain 1 500 kV (PJM)	PJM	4.3	77.4	7.4
		2850	2850		Waterlee 1 (SCEG) - Sumter (CPL) 230 kV	SCEG	478	McGuire - Clifside Tap500 kV (DUKE)	DUKE	8.3	1.4	8.4
		2900	2900		Cheraw - Rockingham 230 kV (CPL)	CPL	478	McGuire - Clifside Tap500 kV (DUKE)	DUKE	8.4	2.7	8.5
		2900	2900	2	Lexington - Columbia 115 kV (SC)	SC	150	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.5	3.0
		3000	3000		Lexington - Columbia 115 kV (SC)	SC	150	Richmond (CPL) - Newport 500 kV (DUKE)	CPL- DUKE	3.0	0.2	3.0
		3000	3000	2	Pomaria - Newberry 230 kV (SC)	SC	550	Walton - Rockville 500 kV (SOCO)	SOCO	12.0	1.4	12.0
		3000	3000		VC Summer Sub 1 (SCEG) - Blythwood 230 kV (SC)	SCEG	478	Base Case	----	5.6	---	5.6
		3050	3050		Pomaria - Newberry 230 kV (SC)	SC	550	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	12.0	1.6	12.0
		3050	3050		Waterlee 1 (SCEG) - Sumter (CPL) 230 kV	SCEG	475	Base Case	----	8.3	---	8.3
		3400	3400	2	BUSH RIVER Y 115/100 kV Transformer (DUKE)	DUKE	104	Walton - Rockville 500 kV (SOCO)	SOCO	2.6	0.2	2.6
		3400	3400		BUSH RIVER Y 115/100 kV Transformer (DUKE)	DUKE	104	Thalmann - McCall Road 500 kV (SOCO)	SOCO	2.6	0.3	2.6
		3450	3450	2	Columbia Erg Ctr - Edenwood 230 kV (SCEG)	SCEG	510	Thalmann - McCall Road 500 kV (SOCO)	SOCO	15.5	0.4	15.5
		3450	3450		Columbia Erg Ctr - Edenwood 230 kV (SCEG)	SCEG	510	Walton - Rockville 500 kV (SOCO)	SOCO	15.5	0.2	15.5
		3600	3600	2	COLUMBIA ENERGY CTR - HOPKINS 230 kV (SCEG)	SCEG	510	Bonaire - Smerr 500 kV (SOCO)	SOCO	13.1	0.2	13.1
		3600	3600		COLUMBIA ENERGY CTR - HOPKINS 230 kV (SCEG)	SCEG	510	CORBETT to WEST COAST CC2 500 kV (FPL)	FPL	13.1	0.3	13.1
		3800	3800	2	Fairfield - VC Summer Sub 1 230 kV (SCEG)	SCEG	510	Madison - Limestone 500 kV (TVA)	TVA	9.5	---	9.5
		3800	3800		Fairfield - VC Summer Sub 1 230 kV (SCEG)	SCEG	510	Shawnee to Marshall 500 kV (TVA)	TVA	9.5	---	9.5
		3900	3900	2	Coit1 - Congaree VT 115 kV (SCEG)	SCEG	166	Walton - Rockville 500 kV (SOCO)	SOCO	4.2	0.2	4.2
		3950	3950		Coit1 - Congaree VT 115 kV (SCEG)	SCEG	166	Thalmann - McCall Road 500 kV (SOCO)	SOCO	4.2	0.2	4.2
		3950	3950	2	Saluda5 - Saluda1 115 kV (SCEG)	SCEG	139	Lagoon Creek 500/13.8 kV Transformer (TVA)	TVA	3.0	---	3.0
		3950	3950		Saluda5 - Saluda1 115 kV (SCEG)	SCEG	139	Big Shanty to Bowen 500 kV (SOCO)	SOCO	3.0	---	3.0

TRANSFER	BASE CASE (see notes)	NITC FCITC (MW)	Total Import (MW)	N O T E	LIMITING FACILITY* Common Name	SYSTEM	RATING (MVA)	OUTAGED FACILITY* Common Name	SYSTEM	PTDF (%)	LODF (%)	TDF (%)
SCPSA_EXP to PJM_IMP	Base	4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
		1000	1000	2	Woodleaf - Pleasant Garden 500 kV	DUKE	1904	McGuire - Antloch 500 kV (DUKE)	DUKE	5.0	22.7	8.7
		1400	1400		Woodleaf - Pleasant Garden 500 kV	DUKE	1904	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	5.0	18.8	5.7
		2400	2400	2	Colver 500/230 kV Transformer (DVP)	DVP	927	Wake - Dummy Gen 500 kV (CPLE)	CPLE	3.6	22.1	6.8
		2500	2500	2	Tuckasegee - Webster 161 kV (DUKE)	DUKE	223	Oconee (Duke) - Middle Fork 500 kV (SOCO)	DUKE-SOCO	2.4	5.3	2.7
		2500	2500		Fayetteville E. - Erwin 230 kV (CPLE)	CPLE	478	Wake - Cumberland 500 kV (CPLE)	CPLE	2.6	13.4	4.2
		2700	2700		Tuckasegee - Webster 161 kV (DUKE)	DUKE	223	McGuire - Cliffs Tap 500 kV (DUKE)	DUKE	2.4	2.4	2.7
		2800	2800		Jack Mountain 2 - Juniata 500 kV (PJM)	PJM	2598	Juniata - Jack Mountain 1 500 kV (PJM)	PJM	4.3	77.4	7.5
		3550	3550		JS Rainey 2 (SC) - Anderson 230 kV (Duke)	SC	956	Base Case	----	23.8	---	23.8
		3550	3550		JS Rainey 1 (SC) - Anderson 230 kV (Duke)	SC	956	Base Case	----	23.8	---	23.8
		3750	3750		Colver 500/230 kV Transformer (DVP)	DVP	927	Elmont - Cunningham 500 kV (DVP)	DVP	3.6	6.5	3.6
		3750	3750		Bristers - OX 500 kV (DVP)	DVP	2598	Ladysmith - Possum Point 500 kV (DVP)	DVP	4.6	43.2	7.6
PJM_EXP to TVA_IMP	Base	4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
		2000	2000		Spring Creek - Wolf Hills 138 kV (AEP)	AEP	167	Broadbird 765/500 kV Transformer (AEP)	AEP	1.2	8.5	2.6
		2550	2550		Tuckasegee - Webster 161 kV (DUKE)	DUKE	223	Oconee (Duke) - Middle Fork 500 kV (SOCO)	DUKE-SOCO	2.0	5.3	2.6
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
PJM_EXP to SOCO_IMP	Base	4000	4000		Sequoyah - Concord 161 kV (TVA)	TVA	350	Sequoyah - Bradley 500 kV (TVA)	TVA	1.3	9.1	2.9
		4000	4000		Test Transfer Level -- No limits found below test transfer level					---	---	---
		1750	1750	2	Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	1020	Vogtle - McIntosh 500 kV (SOCO)	SOCO	13.8	15.3	15.0
		2450	2450		Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	950	Base Case	----	13.8	---	13.8
PJM_EXP to SCPSA_IMP	Base	2500	2500		Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	1020	Middle Fork - Thompson 500 kV (SOCO)	SOCO	13.8	8.0	13.3
		2550	2550		McIntosh (SOCO) - Purrysburg SW 230 kV (SC)	SOCO	956	Base Case	----	19.6	---	19.6
		2800	2800	2	McIntosh (SOCO) - Purrysburg SW 230 kV (SC)	SOCO	1100	Thalmann - McCall Road 500 kV (SOCO)	SOCO	19.6	11.1	18.8
		3000	3000		McIntosh (SOCO) - Purrysburg SW 230 kV (SC)	SOCO	1100	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	19.6	4.3	19.6
		3150	3150		Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	510	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.1	7.9	3.7
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
		1700	1700	2	Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	510	Vogtle - McIntosh 500 kV (SOCO)	SOCO	6.2	7.9	6.8
		1800	1800	2	Marion - Anor 115 kV (SC)	SC	100	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.4	3.1
		1850	1850		Marion - Anor 115 kV (SC)	SC	100	Oconee (Duke) - Middle Fork 500 kV (SOCO)	DUKE-SOCO	3.0	0.6	3.0
		1950	1950		MARION 230/115kV transformer (SC)	SC	100	Base Case	----	3.0	---	3.0
		2000	2000		Marion - Anor 115 kV (SC)	SC	100	Base Case	----	3.0	---	3.0
		2250	2250	2	Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	1020	Vogtle - McIntosh 500 kV (SOCO)	SOCO	10.5	15.3	11.7
		2450	2450	2	MARION 230/115kV transformer (SC)	SC	120	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.4	3.1
		2500	2500	2	MARION 230/115kV transformer (SC)	SC	120	Oconee (Duke) - Middle Fork 500 kV (SOCO)	DUKE-SOCO	3.0	0.6	3.0
		2500	2500	2	St George - Byrds Tap 115 kV (SC)	SC	120	Vogtle - McIntosh 500 kV (SOCO)	SOCO	2.5	0.3	2.5
		2550	2550	2	Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	475	Base Case	----	6.2	---	6.2
		2550	2550		St George - Byrds Tap 115 kV (SC)	SC	120	Middle Fork - Thompson 500 kV (SOCO)	SOCO	2.5	0.2	2.5
		2650	2650		St George - Harleyville SW 115 kV (SC)	SC	179	Base Case	----	3.6	---	3.6
		2650	2650		St George - Byrds Tap 115 kV (SC)	SC	120	Base Case	----	2.5	---	2.5
		2650	2650		Anor - 4 Mile 115 kV (SC)	SC	109	Base Case	----	3.0	---	3.0
		2650	2650	2	Byrds Tap - St George 115 kV (SC)	SC	120	Vogtle - McIntosh 500 kV (SOCO)	SOCO	2.5	0.3	2.5
		2700	2700		McIntosh (SOCO) - Purrysburg SW 230 kV (SC)	SOCO	956	Base Case	----	18.8	---	18.8
		2750	2750		Byrds Tap - St George 115 kV (SC)	SC	120	Middle Fork - Thompson 500 kV (SOCO)	SOCO	2.5	0.2	2.5
		2750	2750	2	Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	510	Middle Fork - Thompson 500 kV (SOCO)	SOCO	6.2	2.8	6.0
		2800	2800		Byrds Tap - St George 115 kV (SC)	SC	120	Base Case	----	2.5	---	2.5
		2900	2900	2	McIntosh (SOCO) - Purrysburg SW 230 kV (SC)	SOCO	1100	Thalmann - McCall Road 500 kV (SOCO)	SOCO	18.8	11.1	18.0
		3000	3000	2	Anor - 4 Mile 115 kV (SC)	SC	125	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.4	3.1
		3050	3050		Anor - 4 Mile 115 kV (SC)	SC	125	Oconee (Duke) - Middle Fork 500 kV (SOCO)	DUKE-SOCO	3.0	0.6	3.0
		3100	3100		DUNN - 34 MILE 115 kV (SC)	SC	109	Base Case	----	3.0	---	3.0
		3150	3150		McIntosh (SOCO) - Purrysburg SW 230 kV (SC)	SOCO	1100	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	18.8	4.3	18.8

TRANSFER	BASE CASE (see notes)	NITC FCITC (MW)	Total Import (MW)	N O T E	LIMITING FACILITY* Common Name	SYSTEM	RATING (MVA)	OUTAGED FACILITY* Common Name	SYSTEM	PTDF (%)	LODF (%)	TDF (%)
		3200	3200	2	St George - Harleyville SW 115 kV (SC)	SC	206	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	3.6	0.6	3.7
		3250	3250	2	Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	950	Base Case	----	10.5	---	10.5
		3300	3300		St George - Harleyville SW 115 kV (SC)	SC	206	McGuire - Cliffside Tap500 kV (DUKE)	DUKE	3.6	0.3	3.6
		3350	3350	2	Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	1020	Middle Fork - Thompson 500 kV (SOCO)	SOCO	10.5	8.0	10.0
		3450	3450	2	DUNN - 34 MILE 115 kV (SC)	SC	125	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.4	3.1
		3450	3450	2	Williams (SCEG) - Charity 230 kV (SC)	SCEG	797	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	15.7	2.7	15.8
		3500	3500		DUNN - 34 MILE 115 kV (SC)	SC	125	Oconee (Duke) - Middle Fork 500 kV (SOCO)	DUKE-SOCO	3.0	0.6	3.0
		3550	3550		Dunn - 3 Conway 115 kV (SC)	SC	109	Base Case	----	3.0	---	3.0
		3550	3550		Williams (SCEG) - Charity 230 kV (SC)	SCEG	797	McGuire - Cliffside Tap500 kV (DUKE)	DUKE	15.7	1.4	15.7
		3650	3650		Williams (SCEG) - Charity 230 kV (SC)	SCEG	797	Base Case	----	15.7	---	15.7
		3700	3700		Richmond - Laurel Hill 230 kV (CPLE)	CPLE	797	Richmond - Cumberland 500 kV (CPLE)	CPLE	9.3	11.9	8.7
		3850	3850	2	Dunn - 3 Conway 115 kV (SC)	SC	125	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.4	3.1
		3900	3900		Dunn - 3 Conway 115 kV (SC)	SC	125	Oconee (Duke) - Middle Fork 500 kV (SOCO)	DUKE-SOCO	3.0	0.6	3.0
		2250	2250	2	Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	1020	Vogtle - McIntosh 500 kV (SOCO)	SOCO	10.5	15.3	11.7
		2450	2450	2	MARION 230/115kV transformer (SC)	SC	120	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.4	3.1
		2500	2500		MARION 230/115kV transformer (SC)	SC	120	Oconee (Duke) - Middle Fork 500 kV (SOCO)	DUKE-SOCO	3.0	0.6	3.0
		2550	2550		Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	475	Base Case	----	6.2	---	6.2
		2750	2750		Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	510	Middle Fork - Thompson 500 kV (SOCO)	SOCO	6.2	2.8	6.0
		3250	3250		Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	950	Base Case	----	10.5	---	10.5
		3350	3350		Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	1020	Middle Fork - Thompson 500 kV (SOCO)	SOCO	10.5	8.0	10.0
		4000	4000	2	Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
(1) The transfer capabilities stated in this report are NOT the Available Transfer Capabilities (ATC) noted in FERC Orders 888 and 889. (2) This facility may overload at higher transfer levels for other single contingencies which are not shown in this table for brevity. (3) This transfer capability does not reflect the implementation of an established operating procedure to relieve this overload. (4) This transfer capability reflects the implementation of an established operating procedure to relieve a more limiting overload.												

## Appendix D

### FCITC Results for 2016 Winter Case

TRANSFER	BASE CASE (see notes)	NITC FCITC (MW)	Total Import (MW)	N O T E	LIMITING FACILITY* Common Name	SYSTEM	RATING (MVA)	OUTAGED FACILITY* Common Name	SYSTEM	PTDF (%)	LODF (%)	TDF (%)
TVA_EXP to PJM_MP	Base	2350	2350		Boone to Greenville Tap 2 161 kV (TVA)	TVA	223	Volunteer - Phipps Bend 500 kV (TVA)	TVA	1.4	7.9	2.7
		3500	3500		Bull Run to Volunteer 500 kV (TVA)	TVA	2598	Watt B 1 to Volunteer 500 kV (TVA)	TVA	12.5	73.1	16.7
		3550	3550		Sweet Gum - Pineville KY 161 kV	TVA	259	Volunteer - Phipps Bend 500 kV (TVA)	TVA	1.7	7.2	2.9
		3800	3800		Norris - LaFollette TN 161 kV	TVA	335	Volunteer - Phipps Bend 500 kV (TVA)	TVA	1.7	7.2	2.9
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
SOCO_EXP to PJM_MP	Base	2400	2400		Boone to Greenville Tap 2 161 kV (TVA)	TVA	223	Volunteer - Phipps Bend 500 kV (TVA)	TVA	1.4	7.9	2.6
		3350	3350		Sweet Gum - Pineville KY 161 kV	TVA	259	Volunteer - Phipps Bend 500 kV (TVA)	TVA	1.9	7.2	3.0
		3550	3550		Bull Run to Volunteer 500 kV (TVA)	TVA	2598	Watt B 1 to Volunteer 500 kV (TVA)	TVA	11.3	73.1	16.4
		3600	3600		Norris - LaFollette TN 161 kV	TVA	335	Volunteer - Phipps Bend 500 kV (TVA)	TVA	1.9	7.2	3.0
		3800	3800		Volunteer - John Sevier 161 kV	TVA	281	Volunteer - Phipps Bend 500 kV (TVA)	TVA	1.1	9.8	2.7
SCEG_EXP to PJM_MP	Base	3900	3900		Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	1020	Vogtle - McIntosh 500 kV (SOCO)	SOCO	6.2	19.0	6.0
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
		2100	2100		Lexington - Columbia 115 kV (SC)	SC	131	Base Case	----	2.3	---	2.3
		2150	2150		Lyles 1 (SCEG) - Lexington 115 kV (SC)	SCEG	159	Base Case	----	2.3	---	2.3
		2750	2750	2	Lexington - Columbia 115 kV (SC)	SC	150	Vogtle - McIntosh 500 kV (SOCO)	SOCO	2.3	0.4	2.2
		2850	2850	2	Wateree 1 (SCEG) - Sumter (CPLE) 230 kV	SCEG	478	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	8.2	3.3	8.2
		2850	2850		Lexington - Columbia 115 kV (SC)	SC	150	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	2.3	0.3	2.3
		2850	2850	2	VC Summer Sub 1 (SCEG) - Newport 230 kV (Duke)	SCEG	456	McGuire - Cliffside Tap 500 kV (DUKE)	DUKE	13.9	3.4	14.0
		2900	2900		VC Summer Sub 1 (SCEG) - Newport 230 kV (Duke)	SCEG	456	Oconee - ASBTRT 500 kV (DUKE)	DUKE	13.9	4.9	14.0
		2950	2950		Wateree 1 (SCEG) - Sumter (CPLE) 230 kV	SCEG	478	McGuire - Cliffside Tap 500 kV (DUKE)	DUKE	8.2	1.3	8.2

TRANSFER	BASE CASE (see notes)	NITC FC/TC (MW)	Total Import (MW)	N O T E	LIMITING FACILITY* Common Name	SYSTEM	RATING (MVA)	OUTAGED FACILITY* Common Name	SYSTEM	PTDF (%)	LODF (%)	TDF (%)
SCPSA_EXP to PJM_IMP	Base	3000	3000		Columbia Erg Ctr - Edenwood 115 kV (SCEG)	SCEG	237	Base Case	----	7.8	---	7.8
		3050	3050	2	Lyles 1 (SCEG) - Lexington 115 kV (SC)	SCEG	183	Vogtle - McIntosh 500 kV (SOCO)	SOCO	2.3	0.4	2.2
		3150	3150		Lyles 1 (SCEG) - Lexington 115 kV (SC)	SCEG	183	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	2.3	0.3	2.3
		3150	3150		Waterree 1 (SCEG) - Sumter (CPLE) 230 kV	SCEG	478	Base Case	----	8.2	---	8.2
		3150	3150		VC Summer Sub 1 (SCEG) - Newport 230 kV (Duke)	SCEG	456	Base Case	----	13.9	---	13.9
		3250	3250	2	Columbia Erg Ctr - Edenwood 115 kV (SCEG)	SCEG	255	Beaver Valley Crescent 345 kV (DLCO)	DLCO	7.8	---	7.8
		3250	3250		Columbia Erg Ctr - Edenwood 115 kV (SCEG)	SCEG	255	Masca R to Lombard R 345 kV (CE)	CE	7.8	---	7.8
		3500	3500		Fairfield - VC Summer Sub 1 230 kV (SCEG)	SCEG	475	Base Case	----	13.4	---	13.4
		3550	3550	2	Whiterock (SCEG) - BUSH RIVER TY 115 kV (DUKE)	SCEG	92	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	2.4	0.4	2.4
		3600	3600		Whiterock (SCEG) - BUSH RIVER TY 115 kV (DUKE)	SCEG	92	Thalmann - McCall Road 500 kV (SOCO)	SOCO	2.4	0.5	2.4
		3600	3600		FAIRFIELD PUMPED STORAGE 5-8 - VC SUMMER 230 kV (SCEG)	SCEG	475	Base Case	----	13.0	---	13.0
		3750	3750		East Danville - Danville 138 kV	AEP	352	Jackson Ferry 765/500 kV Transformer (AEP)	AEP	3.2	11.3	5.7
		3750	3750		Whiterock (SCEG) - BUSH RIVER TY 115 kV (DUKE)	SCEG	92	Base Case	----	2.4	---	2.4
		3800	3800		SALUDA HYDRO1 - GEORGIA PACIFIC TAP 115 kV (SCEG)	SCEG	89	Base Case	----	2.1	---	2.1
		3800	3800	2	Fairfield - VC Summer Sub 1 230 kV (SCEG)	SCEG	510	Snowdown to Autaugaville 500 kV (SOCO)	SOCO	13.4	---	13.4
		3800	3800		Fairfield - VC Summer Sub 1 230 kV (SCEG)	SCEG	510	Marquis (AEP) to Killen 345 kV (DAY)	AEP-DAY	13.4	---	13.4
		3800	3800	2	SALUDA HYDRO1 - GEORGIA PACIFIC TAP 115 kV (SCEG)	SCEG	95	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	2.1	0.4	2.1
		3850	3850		SALUDA HYDRO1 - GEORGIA PACIFIC TAP 115 kV (SCEG)	SCEG	95	Thalmann - McCall Road 500 kV (SOCO)	SOCO	2.1	0.4	2.2
		3900	3900	2	BUSH RIVER TIE R (DUKE) - GEORGIA PACIFIC TAP 115 kV (SCEG)	DUKE_SCEG	92	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	2.1	0.4	2.1
		3900	3900	2	FAIRFIELD PUMPED STORAGE 5-8 - VC SUMMER 230 kV (SCEG)	SCEG	510	Libertyville B to Zion B 345 kV (CE)	CE	13.0	---	13.0
		3900	3900		FAIRFIELD PUMPED STORAGE 5-8 - VC SUMMER 230 kV (SCEG)	SCEG	510	Pleasant Valley 345/138 kV (CE)	CE	13.0	---	13.0
		3900	3900		BUSH RIVER TIE R (DUKE) - GEORGIA PACIFIC TAP 115 kV (SCEG)	DUKE_SCEG	92	Thalmann - McCall Road 500 kV (SOCO)	SOCO	2.1	0.4	2.2
		3950	3950		Tuckasegee - Webster 161 kV (DUKE)	DUKE	223	Jackson Ferry 765/500 kV Transformer (AEP)	AEP	1.8	3.5	2.6
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
		1750	1750	2	Anthony Shoals 230/115 kV Transformer (SOCO)	SOCO	162	Oconee to S. Hall 500 kV (SOCO)	SOCO	2.0	3.9	2.2
		2550	2550	2	Tuckasegee - Webster 161 kV (DUKE)	DUKE	223	Oconee to S. Hall 500 kV (SOCO)	SOCO	2.5	5.7	2.8
		2850	2850		Anthony Shoals 230/115 kV Transformer (SOCO)	SOCO	162	CORBETT to WEST COAST CC2 500 kV (FPL)	FPL	2.0	0.8	2.0
		2900	2900		Tuckasegee - Webster 161 kV (DUKE)	DUKE	223	McGuire - Cliffside Tap 500 kV (DUKE)	DUKE	2.5	2.5	2.7
		3000	3000	2	BELTON TIE to LEE Station 100 kV (DUKE) ckt 1	DUKE	104	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	2.1	0.5	2.1
		3000	3000	2	BELTON TIE to LEE Station 100 kV (DUKE) ckt 2	DUKE	104	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	2.1	0.5	2.1
		3150	3150		BELTON TIE to LEE Station 100 kV (DUKE) ckt 2	DUKE	104	Volunteer - Phipps Bend 500 kV (TVA)	TVA	2.1	0.2	2.1
		3150	3150		BELTON TIE to LEE Station 100 kV (DUKE) ckt 1	DUKE	104	Volunteer - Phipps Bend 500 kV (TVA)	TVA	2.1	0.2	2.1
		3150	3150		Anthony Shoals 230/115 kV Transformer (SOCO)	SOCO	162	Base Case	----	2.0	---	2.0
		3300	3300		BELTON TIE to LEE Station 100 kV (DUKE) ckt 1	DUKE	104	Base Case	----	2.1	---	2.1
		3300	3300		BELTON TIE to LEE Station 100 kV (DUKE) ckt 2	DUKE	104	Base Case	----	2.1	---	2.1
		3600	3600	2	Pegah to EMC Cradle 115 kV (CPLW)	CPLW	200	Jackson Ferry 765/500 kV Transformer (AEP)	AEP	2.0	2.9	2.6
		3750	3750		JS Rainey 1 (SC) - Anderson 230 kV (Duke)	SC	1157	Base Case	----	24.8	---	24.8
		3750	3750		JS Rainey 2 (SC) - Anderson 230 kV (Duke)	SC	1157	Base Case	----	24.8	---	24.8
		3800	3800	2	JS Rainey 1 (SC) - Anderson 230 kV (Duke)	SC	1195	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	24.8	1.8	24.8
		3800	3800	2	JS Rainey 2 (SC) - Anderson 230 kV (Duke)	SC	1195	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	24.8	1.8	24.8
		3850	3850		Pegah to EMC Cradle 115 kV (CPLW)	CPLW	200	Oconee to S. Hall 500 kV (SOCO)	SOCO	2.0	2.7	2.1
		3850	3850		JS Rainey 2 (SC) - Anderson 230 kV (Duke)	SC	1195	Thalmann - McCall Road 500 kV (SOCO)	SOCO	24.8	0.8	24.8
		3850	3850		JS Rainey 1 (SC) - Anderson 230 kV (Duke)	SC	1195	Thalmann - McCall Road 500 kV (SOCO)	SOCO	24.8	0.8	24.8
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
PJM_EXP to TVA_IMP	Base	2600	2600	2	Tuckasegee - Webster 161 kV (DUKE)	DUKE	223	Oconee to S. Hall 500 kV (SOCO)	SOCO	2.2	5.7	2.7
		3800	3800		Tuckasegee - Webster 161 kV (DUKE)	DUKE	223	Bradford 765/500 kV Transformer (AEP)	AEP	2.2	2.5	2.6
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---
		4000	4000		Test Transfer Level -- No limits found below test transfer level					---	---	---
PJM_EXP to SOCO_IMP	Base	5850	5850		Spring Creek - Wolf Hills 138 kV (AEP)	AEP	210	Bradford 765/500 kV Transformer (AEP)	AEP	1.0	8.5	2.2
		1700	1700	2	Vogtle - Savannah River Services 230 kV	SOUTHER N-SCEG	1020	Vogtle - McIntosh 500 kV (SOCO)	SOCO	12.5	19.0	13.9
PJM_EXP to SCEG_IMP	Base	2350	2350	2	Waterree 115/100 kV Transformer (CPLE)	CPLE	150	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	3.4	2.6	3.4
		2550	2550		Waterree 115/100 kV Transformer (CPLE)	CPLE	150	Oconee to S. Hall 500 kV (SOCO)	SOCO	3.4	1.9	3.4
		2700	2700		Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	510	Vogtle - McIntosh 500 kV (SOCO)	SOCO	2.1	10.2	2.9
		2950	2950		Waterree 115/100 kV Transformer (CPLE)	CPLE	150	Base Case	----	3.4	---	3.4
		3100	3100		Vogtle - Savannah River Services 230 kV	SOUTHER N-SCEG	950	Base Case	----	12.5	---	12.5
		3200	3200		Vogtle - Savannah River Services 230 kV	SOUTHER N-SCEG	1020	Bad Creek - Jocassee PH 500 kV (DUKE)	DUKE	12.5	3.8	12.5
		3350	3350	2	Newport (Duke) - VC Summer Sub 1 230 kV (SCEG)	DUKE	456	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	12.7	5.4	12.6
		3400	3400		Newport (Duke) - VC Summer Sub 1 230 kV (SCEG)	DUKE	456	Oconee to S. Hall 500 kV (SOCO)	SOCO	12.7	5.1	12.7
		3700	3700		Newport (Duke) - VC Summer Sub 1 230 kV (SCEG)	DUKE	456	Base Case	----	12.7	---	12.7
		3850	3850	2	Elgin T to Waterree 115 kV (CPLE)	CPLE	113	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	2.1	0.9	2.1
		3850	3850		Elgin T to Waterree 115 kV (CPLE)	CPLE	113	Oconee to S. Hall 500 kV (SOCO)	SOCO	2.1	1.0	2.1
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---

TRANSFER	BASE CASE (see notes)	NITC FCITC (MW)	Total Import (MW)	N O T E	LIMITING FACILITY* Common Name	SYSTEM	RATING (MVA)	OUTAGED FACILITY* Common Name	SYSTEM	PTDF (%)	LODF (%)	TDF (%)
PJM_EXP to SCPSA_IMP	Base	1200	1200	2	Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	510	Vogtle - McIntosh 500 kV (SOCO)	SOCO	5.8	10.2	6.5
		1500	1500	2	Marion - Anor 115 kV (SC)	SC	100	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.5	3.0
		1600	1600		Marion - Anor 115 kV (SC)	SC	100	Oconee to S. Hall 500 kV (SOCO)	SOCO	3.0	0.6	3.0
		1650	1650		MARION 230/115kV transformer (SC)	SC	100	Base Case	----	3.0	---	3.0
		1700	1700		Marion - Anor 115 kV (SC)	SC	100	Base Case	----	3.0	---	3.0
		2100	2100	2	Waterree 115/100 kV Transformer (CPLE)	CPLE	150	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	3.7	2.6	3.8
		2100	2100	2	MARION 230/115kV transformer (SC)	SC	120	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.5	3.0
		2200	2200		MARION 230/115kV transformer (SC)	SC	120	Oconee to S. Hall 500 kV (SOCO)	SOCO	3.0	0.6	3.0
		2300	2300		Vogtle - Savannah River Services 230 kV	SOUTHERN-SCEG	1020	Vogtle - McIntosh 500 kV (SOCO)	SOCO	8.9	19.0	10.2
		2350	2350		Waterree 115/100 kV Transformer (CPLE)	CPLE	150	Oconee to S. Hall 500 kV (SOCO)	SOCO	3.7	1.9	3.7
		2350	2350		Anor - 4 Mile 115 kV (SC)	SC	109	Base Case	----	3.0	---	3.0
		2650	2650	2	St George - Byrds Tap 115 kV (SC)	SC	120	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	3.2	0.5	3.2
		2700	2700		Waterree 115/100 kV Transformer (CPLE)	CPLE	150	Base Case	----	3.7	---	3.7
		2700	2700	2	Anor - 4 Mile 115 kV (SC)	SC	125	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.5	3.0
		2700	2700		St George - Byrds Tap 115 kV (SC)	SC	120	Bath County 500/20.5 kV (DVP)	DVP	3.2	0.3	3.2
		2750	2750		St George - Byrds Tap 115 kV (SC)	SC	120	Base Case	----	3.2	---	3.2
		2750	2750		Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	475	Base Case	----	5.8	---	5.8
		2800	2800		Anor - 4 Mile 115 kV (SC)	SC	125	Oconee to S. Hall 500 kV (SOCO)	SOCO	3.0	0.6	3.0
		2850	2850		DUNN - 34 MILE 115 kV (SC)	SC	109	Base Case	----	3.0	---	3.0
		3100	3100		Dunn - 3 Conway 115 kV (SC)	SC	109	Base Case	----	3.0	---	3.0
		3150	3150		Savannah River Services - CANADYS 230 kV (SCEG)	SCEG	510	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	5.8	1.5	5.9
		3150	3150	2	DUNN - 34 MILE 115 kV (SC)	SC	125	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.5	3.0
		3250	3250		DUNN - 34 MILE 115 kV (SC)	SC	125	Oconee to S. Hall 500 kV (SOCO)	SOCO	3.0	0.6	3.0
		3450	3450	2	Richmond - Laurel Hill 230 kV (CPLE)	CPLE	797	Richmond - Cumberland 500 kV (CPLE)	CPLE	8.9	11.8	8.2
		3450	3450	2	Dunn - 3 Conway 115 kV (SC)	SC	125	Vogtle - McIntosh 500 kV (SOCO)	SOCO	3.0	0.5	3.0
		3550	3550		Dunn - 3 Conway 115 kV (SC)	SC	125	Oconee to S. Hall 500 kV (SOCO)	SOCO	3.0	0.6	3.0
		3550	3550		Richmond - Laurel Hill 230 kV (CPLE)	CPLE	797	Cumberland 500/230 kV (CPLE)	CPLE	8.9	10.2	9.6
		3800	3800	2	Laurinburg City to Laurel Hill 230 kV (CPLE)	CPLE	797	Richmond - Cumberland 500 kV (CPLE)	CPLE	8.9	11.8	8.2
		3850	3850		Laurinburg City to Laurel Hill 230 kV (CPLE)	CPLE	797	Cumberland 500/230 kV (CPLE)	CPLE	8.9	10.2	9.6
		3900	3900		Elgin T to Waterree 115 kV (CPLE)	CPLE	113	Richmond (CPLE) - Newport 500 kV (DUKE)	CPLE-DUKE	2.1	0.9	2.1
		4000	4000		Test Transfer Level -- No additional unique limits found below test transfer level					---	---	---

(1) The transfer capabilities stated in this report are NOT the Available Transfer Capabilities (ATC) noted in FERC Orders 888 and 889.

(2) This facility may overload at higher transfer levels for other single contingencies which are not shown in this table for brevity.

(3) This transfer capability does not reflect the implementation of an established operating procedure to relieve this overload.

(4) This transfer capability reflects the implementation of an established operating procedure to relieve a more limiting overload.