CAROLINAS TRANSMISSION COORDINATION ARRANGEMENT (CTCA)

2018/19 WINTER PEAK
2022 SUMMER PEAK
RELIABILITY STUDY

FINAL

May 22, 2017

STUDY PARTICIPANTS

Prepared by: **CTCA Power Flow Studies Group (PFSG)**

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Reviewed by: **CTCA Planning Committee (PC)**

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PURPOSE OF STUDY

The purpose of this study is to assess the existing transmission expansion plans of Duke Energy Carolinas (“Duke”), Duke Energy Progress (“Progress”), South Carolina Electric and Gas (“SCE&G”), and South Carolina Public Service Authority (“SCPSA”) to ensure that the plans are simultaneously feasible. In addition, this study evaluated any potential joint alternatives identified by the Planning Committee (“PC”) representatives which might improve the simultaneous feasibility of the Participants’ transmission expansion plans through potentially more efficient or cost-effective joint plans. The Power Flow Studies Group (“PFSG”) performed the technical analysis outlined in this study scope under the guidance and direction of the PC.

OVERVIEW OF THE STUDY PROCESS

The scope of the proposed study process included the following steps:

1. **Study Assumptions**
    - Study assumptions selected
2. **Study Criteria**
    - Establish the criteria by which the study results will be measured
3. **Case Development**
    - Develop the models needed to perform the study
4. **Study Methodology**
    - Determine the methodologies that will be used to carry out the study
5. **Technical Analysis and Study Results**
    - Perform the technical analysis (thermal, voltage, and stability as needed) and produce the study results
6. **Assessment and Potential Issues Identification**
    - Evaluate the results to identify potential issues
    - Report potential issues to the PC
7. **Potential Alternative Development**
    - Evaluate potential joint alternatives as directed by the PC
8. **Report on the Study Results**
    - Combine the study scope and assessment results into a report

LIST OF RECENT AND CURRENT STUDIES

Study Year	Reliability Study	Description
2010	2014/21 Summer Peak	14S: Near-term 21S: Long-term (VC Summer 2-3)
2011	2015/18 Summer Peak	15S: Near-term 18S: Long-term (VC Summer 2)
2012	2016 Summer Peak/Shoulder	16S: VC Summer Transmission Only 16H: Low Gas Price Dispatch
2013	2019 Summer Peak	19S: Long-term (VC Summer 2-3)
2014	2018/21 Summer Peak	18S: Near-term (VC Summer 2) 21S: Long-term (VC Summer 2-3)
2015	2020/26 Summer Peak	20S: Near-term (VC Summer 2-3) 26S: Long-term (VC Summer 2-3)
2016	2018/19 Winter Peak 2022 Summer Peak	18W: Near-term (VC Summer 2) 22S: Long-term (VC Summer 2-3)

STUDY ASSUMPTIONS

- The years studied (study year) were 2018/19 Winter Peak for a near-term reliability analysis and 2022 Summer Peak for a long-term reliability analysis.
- Generation was dispatched for each Participant in the study cases to meet that Participant’s peak and shoulder load in accordance with the designated dispatch order. Participants also provided generation down scenarios for their resources, as requested (e.g., generation outage with description of how generation was replaced, such as by that Participant’s dispatch orders).
- PSS/E and/or MUST were used for the study.
- Load growth assumptions were in accordance with each Participant company’s practice.
- Generation, interchange, and other assumptions were coordinated between the Participant companies as needed. The 2016 series LTSG cases for 2018 Winter Peak and 2022 Summer Peak were used as the starting points for study cases and interchange development.

- The PFSG used the 2018/19 Winter Peak and 2022 Summer Peak cases to analyze the existing transmission expansion plans to determine if any reliability criteria violations were created. Based on this analysis, the PFSG provided feedback to the PC on the simultaneous feasibility of these plans for ensuring the reliability of service. The results of this analysis were included in the 2016 study report.

STUDY CRITERIA

The study criteria with which results were evaluated was established, promoting consistency in the planning criteria used across the systems of the Participants, while recognizing differences between individual systems. The study criteria included the following reliability elements:

- NERC Reliability Standards
- Individual company criteria (voltage, thermal, stability, short circuit and phase angle)

CASE DEVELOPMENT

- The latest LTSG models were used as a starting point for the study cases used by the PFSG in their analyses. Systems external to Duke, Progress, SCE&G, and SCPSA came directly from the LTSG model.
- The study cases included the detailed internal models for Duke, Progress, SCE&G, and SCPSA. Transmission and generation additions planned to be in-service for the given year (i.e. in-service by winter 2018/19 for 2018/19 Winter Peak case as well as in-service by summer 2022 for 2022 Summer Peak case) were included in the study cases. The detailed internal models were based on the latest publicly available data for each system, i.e., data that had been included in the annual FERC 715 filing.
- The Participants coordinated interchange which included all confirmed long term firm transmission reservations with roll-over rights applicable to the study year(s).
- Duke, Progress, SCE&G, and SCPSA each created any requested generation down cases from the common study cases and shared the relevant cases with each other.

  <u>Generation Down Cases Shared</u>

  - Duke: None requested
  - Progress: Brunswick 1, Robinson 2, Roxboro 4, Harris, Asheville CT 1 (18W), and Asheville CT A (22S) replaced with TRM import; Robinson 2, Roxboro 4, Harris, Asheville CT 1 (18W), and Asheville CT A (22S) replaced with CPLE to CPLW import/internal generation redispatch only
  - SCE&G: VC Summer 1 (18W), VC Summer 3 (22S), Cope, and AM Williams replaced with internal generation
  - SCPSA: Rainey CC, Cross 4 (18W), Cross 3-4 (22S), Winyah 4 (18W), and Winyah 3-4 (22S) replaced with internal generation redispatch

STUDY METHODOLOGY

- Initially, power flow analyses were performed based on the assumption that thermal and voltage limits were the controlling limits for the reliability plan. Voltage stability, angular stability, short circuit and phase angle studies were performed if circumstances warranted.
- Duke, Progress, SCE&G, and SCPSA exchanged subsystem and monitored element files so that each could monitor the impact of their contingencies on the other Participants' transmission systems.

TECHNICAL ANALYSIS AND STUDY RESULTS

The technical analysis was performed in accordance with the study methodology. Results from the technical analysis were reported throughout the study area to identify transmission elements approaching their limits such that all Participants were aware of potential issues and appropriate steps could be identified to correct these issues, including the potential of identifying previously undetected problems.

Duke, Progress, SCE&G, and SCPSA reported results throughout the study area based on:

- Thermal loadings greater than 90%.
- Voltages less than individual company criteria.

Only potential reliability concerns that are located near control area borders or include significant EHV BES facilities were to be reported. Concerns that are already being reported in each company's annual TPL assessment were not to be reported to avoid redundant reporting and sharing internal system projects that would not be of interest to neighboring companies.

ASSESSMENT AND POTENTIAL ISSUES IDENTIFICATION

Duke, Progress, SCE&G, and SCPSA each ran their own NERC TPL-001-4 P0-P7 assessments using their own internal planning processes. Each Participant's reliability criteria was used for their transmission facilities. Duke, Progress, SCE&G, and SCPSA each documented the reliability issues resulting from their assessments. These results were reviewed and discussed among the PFSG and PC to identify potential joint alternatives which might improve the simultaneous feasibility of the Participants' transmission expansion plans through potentially more efficient or cost-effective joint plans.

Each company shared any potential reliability concerns identified on the other Participants' transmission systems produced by their internal planning processes and contingencies. In order to provide group awareness of the impact of any neighboring contingencies on their facilities, each company discussed any potential reliability concerns that were found to be worse in the results identified and shared by their neighbors' TPL analyses as opposed to their internal study results. Discussions addressed any future study and/or facility monitoring needs or explain differences in internal planning practices.

POTENTIAL ALTERNATIVE ASSESSMENT

This study allowed for the sharing of information regarding the respective needs of each of the Participants' transmission systems and potential solutions to those needs, as well as the identification and joint evaluation of alternatives to those needs.

- Any potential joint alternatives were identified based on the potential for improved simultaneous feasibility through more efficient or cost-effective joint plans.
- The PFSG assessed the impact of any potential joint alternatives identified by the PC on the simultaneous feasibility of the Participants' transmission expansion plans.
- Duke, Progress, SCE&G, and SCPSA tested the effectiveness of any potential joint alternatives using the same cases, methodologies, assumptions and criteria described above.
- Based on the study results, the PC did not identify the need to assess any potential joint alternatives based on the study results and a review of the Participants' current transmission expansion plans.
- If an alternative was assessed to be beneficial to the simultaneous feasibility of the Participants' transmission expansion plans, the impacted Participants would perform a more detailed study to evaluate implementing the alternative under their individual Interchange Agreements.

SIMULTANEOUS FEASIBILITY ASSESSMENT

This study allowed the Participants to jointly assess their existing transmission expansion plans in combination with those of their neighbors. By creating a common study case including their existing expansion plans, each company was able to assess a common, coordinated study case using their own internal planning processes. Generation down cases (built from the common study case) were also shared between the Participants to support additional analysis of some significant generation down scenarios which can impact the Participants' neighboring systems. The study team also coordinated a common set of monitor and subsystem files so that each could monitor the impact of their contingencies on the other Participants' transmission systems.

By comparing the coordinated study's results with the results of their latest set of internal planning studies, each company was able to determine if their neighbors' existing transmission expansion plans would produce potential issues that were previously undetected in their internal planning studies. If the coordinated study results do not show significant, previously undetected issues, then the Participants' current transmission expansion plans were considered simultaneously feasible.

- With the addition or acceleration of the projects listed in the study results and reported in each company's 2016 annual TPL assessments, the study results indicated the Participants' current transmission expansion plans are simultaneously feasible for both 2018/19 Winter and 2022 Summer conditions.
- As the Participant companies develop their future transmission expansion plans, the identified issues and projects will be further evaluated for need and timing of project implementation.

LESSONS LEARNED AND FUTURE WORK

During discussions between the PFSG and the PC, each company emphasized the importance of sharing Generation Down cases from across the CTCA footprint. Each company was able to utilize the Generation Down cases provided by the other participants when running their NERC TPL-001-4 P0-P7 assessments on their system using their own internal planning processes. The assessment results provided the PFSG and PC an increased awareness of the impact of the availability of off-system generation on each company's transmission system reliability. Recognizable impacts in loading on participants' facilities were noted while studying neighbor's Generation Down cases, although none required initiation of additional corrective actions.

The PC has tasked the PFSG with putting together a framework for developing increased coordination between the CTCA companies in preparation for the 2018 NERC TPL assessment process. The framework will include:

1. Producing three coordinated peak base cases (Year 1 or 2, Year 5, and Year 6-10) including the latest available transmission planning models and planned projects for each of the four CTCA companies. The MMWG cases being created at the end of 2017 may be used for the external (non-CTCA) control area modeling. Coordination of interchange for the cases may be able to align with the timing of the SERC LTSG's Databank Update interchange coordination efforts.
2. Producing all requested Generation Down/Alternate Dispatch (e.g. PV all on) scenario cases.
3. Coordinating subsystem, monitor, and contingency files to enable accurate monitoring and analysis of neighboring control areas in support of NERC TPl-001-4 R3.4.1 coordination requirements.

DUKE ENERGY PROGRESS
SUMMARY OF POTENTIAL RELIABILITY ISSUES

Internal Study Results

No new potential project needs were found near DEP borders that are not already being reported in the *DEP 2016 Transmission Planning Assessment* (annual TPL assessment).

Neighboring Companies' Study Results

The study results received from DEC, SCE&G, and SCPSA were reviewed. No new potential project needs were found near DEP borders that are not already being reported in the *DEP 2016 Transmission Planning Assessment* (annual TPL assessment).

DUKE ENERGY CAROLINAS
SUMMARY OF POTENTIAL RELIABILITY ISSUES

Internal Study Results

No new potential project needs were found near DEC borders that are not already being reported in the *DEC TPL-001-4 2016 Planning Assessment Results* (annual TPL assessment).

Neighboring Companies' Study Results

The study results received from DEP, SCE&G, and SCPSA were reviewed. No new potential project needs were found near DEC borders that are not already being reported in the *DEC TPL-001-4 2016 Planning Assessment Results* (annual TPL assessment).

SOUTH CAROLINA ELECTRIC AND GAS
SUMMARY OF POTENTIAL RELIABILITY ISSUES

Internal Study Results

No new potential project needs were found near SCE&G borders that are not already being reported in the *SCE&G NERC Reliability Standard TPL-001-4 Criteria Study November 2016* (annual TPL assessment).

Neighboring Companies' Study Results

The study results received from DEC, DEP, and SCPSA were reviewed. No new potential project needs were found near SCE&G borders that are not already being reported in the *SCE&G NERC Reliability Standard TPL-001-4 Criteria Study November 2016* (annual TPL assessment).

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY SUMMARY OF POTENTIAL RELIABILITY ISSUES

Internal Study Results

Lyles-Columbia 115 kV SCE&G-SCPSA tie line was found to have potential thermal loading concerns. This issue was also found in SCPSA's internal transmission assessment as well as based on the TPL 001-4 standard in later cases. Both SCE&G and SCPSA have identified this potential tie line concern and are actively testing an Operating Procedure to implement in the near future. Potential project may be needed to address this issue.

No other potential project needs were found near SCPSA borders that are not already being reported in the *SCPSA 2016 Annual Transmission System Assessment (2016-2026) December 2016* (annual TPL assessment).

Neighboring Companies' Study Results

The study results received from DEC, DEP, and SCE&G were reviewed. No new potential project needs were found near SCPSA borders that are not already being reported in the *SCPSA 2016 Annual Transmission System Assessment (2016-2026) December 2016* (annual TPL assessment).