CAROLINAS TRANSMISSION COORDINATION ARRANGEMENT (CTCA)

2019 SUMMER PEAK RELIABILITY STUDY

FINAL

September 9, 2013

STUDY PARTICIPANTS

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

Representative	Company
Brian D. Moss, Chair	Duke Energy Carolinas
Bob Pierce	Duke Energy Carolinas (Alternate)
Lee Adams	Duke Energy Progress
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Wade Richards	South Carolina Electric and Gas
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Reviewed by: **CTCA Steering Committee (SC)**

Representative	Company
Samuel Waters, Chair	Duke Energy
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Clay Young	South Carolina Electric and Gas
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Tom Abrams	South Carolina Public Service Authority
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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 ("SCEG"), and South Carolina Public Service Authority ("SCPSA") to ensure that the plans are simultaneously feasible. In addition, this study will evaluate any potential joint alternatives identified by the Steering Committee ("SC") 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") will perform the technical analysis outlined in this study scope under the guidance and direction of the SC.

OVERVIEW OF THE STUDY PROCESS

The scope of the proposed study process will include 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 SC
7. **Potential Alternative Development**
   - Evaluate potential joint alternatives as directed by the SC
8. **Report on the Study Results**
   - Combine the study scope and assessment results into a report

STUDY ASSUMPTIONS

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)

- The year to be studied (study year) will be 2019 for a long term reliability analysis. VC Summer unit 2 has been delayed until late 2017/early 2018 with unit 3 delayed similarly, while the related transmission expansion plans continue to be scheduled for completion prior to 2016. The 2019 summer peak case will be used to evaluate the impact of the VC Summer expansion related transmission plans with two new units coming on-line.
- Generation will be 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 will also provide generation down scenarios for their resources, as requested (e.g., generation outage with description of how generation will be replaced, such as by that Participant's dispatch orders).
- PSS/E and/or MUST will be used for the study.
- Load growth assumptions will be in accordance with each Participant company's practice.
- Generation, interchange, and other assumptions will be coordinated between the Participant companies as needed. The 2013 series LTSG case for 2019 summer will be used as the starting points for study cases and interchange development.
- The PFSG will use the 2019 summer peak cases to analyze the existing transmission expansion plans to determine if any reliability criteria violations are created. Based on this analysis, the PFSG will provide feedback to the SC on the simultaneous feasibility of these plans for ensuring the reliability of service. The results of this analysis will be included in the 2013 study report.

STUDY CRITERIA

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

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

CASE DEVELOPMENT

- The latest LTSG models will be used as a starting point for the study cases to be used by the PFSG in their analyses. Systems external to Duke, Progress, SCEG, and SCPSA will come directly from the LTSG model.
- The study cases will include the detailed internal models for Duke, Progress, SCEG, and SCPSA and will include existing transmission additions planned to be in-service for the given year (i.e. in-service by 2019 summer). The detailed internal models will be based on the latest publicly available data for each system, i.e., data that has been included in the annual FERC 715 filing.
- The Participants will coordinate interchange which will include all confirmed long term firm transmission reservations with roll-over rights applicable to the study year(s).
- Duke, Progress, SCEG, and SCPSA will each create any requested generation down cases from the common study cases and share the relevant cases with each other.

  Generation Down Cases Shared

  - Duke: None requested
  - Progress: Brunswick 1, Robinson 2, and Harris replaced with TRM import
  - SCEG: VC Summer 3, Cope, and Williams replaced with internal generation
  - SCPSA: Rainey CC, Cross 3, and Winyah 4 replaced with internal generation redispatch

STUDY METHODOLOGY

- Initially, power flow analyses will be performed based on the assumption that thermal and voltage limits will be the controlling limits for the reliability plan. Voltage stability, angular stability, short circuit and phase angle studies may be performed if circumstances warrant.
- Duke, Progress, SCEG, and SCPSA will exchange contingency and monitored element files so that each can test the impact of the other systems' contingencies on its transmission system.

TECHNICAL ANALYSIS AND STUDY RESULTS

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

Duke, Progress, SCEG, and SCPSA will report results throughout the study area based on:

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

ASSESSMENT AND POTENTIAL ISSUES IDENTIFICATION

Duke, Progress, SCEG, and SCPSA will each run their own assessments using their own internal planning processes. Each Participant's reliability criteria will be used for their transmission facilities. Duke, Progress, SCEG, and SCPSA will each document the reliability issues resulting from their assessments. These results will be reviewed and discussed among the PFSG and SC 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.

POTENTIAL ALTERNATIVE ASSESSMENT

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

- The SC will identify potential joint alternatives that will be assessed by the PFSG.
- These alternatives will be based on the potential for improved simultaneous feasibility through more efficient or cost-effective joint plans.
- The PFSG will assess the impact of any potential joint alternatives identified by the SC on the simultaneous feasibility of the Participants' transmission expansion plans.
- Duke, Progress, SCEG, and SCPSA will test the effectiveness of any potential joint alternatives using the same cases, methodologies, assumptions and criteria described above.
- The SC 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 contingency, monitor, and subsystem files to allow each company to analyze their system against contingencies on their neighbors' transmission systems while also monitoring all the Participant systems for potential thermal overloads and voltage concerns.

By comparing the coordinated study's results with the results of their latest set of internal planning studies, each company is 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 are considered simultaneously feasible.

- Study results indicate the Participants' current transmission expansion plans are simultaneously feasible for 2019 Summer Peak conditions with the addition or acceleration of the projects listed in the study results.
- 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.

REPORT ON STUDY RESULTS

The PFSG will compile the study scope and assessment results into a report for the SC's review and approval. The final report will include a comprehensive summary of all the study activities.

TABLE A
DUKE ENERGY PROGRESS
SUMMARY OF POTENTIAL RELIABILITY ISSUES
2019 SUMMER PEAK

	Element	Contingency	Potential Issue	Potential Solution
P01	West End-Central EMC Center Church 230 kV Line 1 (Cape Fear-West End)	Harris Gd (TRM) Cumberland-Richmond 500 kV Line 1	Loading (92.5 %)	Existing Operating Procedure to Open West End Terminal [2025]
P02	Chestnut Hills-Milburnie 115 kV Line 1	Harris Gd (TRM) Falls-Honeycutt and Falls-Neuse 230 kV Lines	Loading (92.3 %)	Relocate Neuse 115 kV Substation to Falls-Method 115 kV Line [2025]
P03	Raeford-Red Springs 115 kV Line 1 (Weatherspoon Plant-Raeford)	Brunswick 1 Gd (TRM) Fayetteville-Hamlet and Raeford-Rockfish 230 kV Lines	Loading (91.0 %)	Loop Richmond-Ft Bragg Woodruff St 230 kV Line Into Raeford 230 kV Sub [Revised Project - 2018]

TABLE B
DUKE ENERGY CAROLINAS
SUMMARY OF POTENTIAL RELIABILITY ISSUES
2019 SUMMER PEAK

	Element	Contingency	Potential Issue	Potential Solution
D01	Cane Creek-Pelham Retail B/W 100 kV Line 1 (Mauldin)	Cliffside 5 Gm Cane Creek-Laurens EC 28 W/B 100 kV Line 1 (Mauldin)	Loading (128.6 %)	Block Swapovers [2019] Accelerated 13 Years
D02	Daniels Retail-Blue Ridge EC 25 Black 100 kV Line 1 (Davidson River)	Belews 1 Gm Pisgah-Shiloh 230 kV Lines Commontower Loss (Caesar)	Loading (102.2 %)	4.66 miles 250 Cu Reconductor [2019] Accelerated 16 Years
D03	Harrisburg-Oakboro B/W 230 kV Line 1/2 (Harrisburg)	Robinson 2 Gd (TRM) Harrisburg-Oakboro W/B 230 kV Line 2/1 (Harrisburg)	Loading (92.8 %)	21.63 miles 954 ACSR Reconductor [2024] Accelerated 12 Years
D04	Pisgah-Blantyre Retail B/W 100 kV Line 1 (Rugby)	Cliffside 5 Gm Asheville-Mills River 115 kV Line 1	Loading (91.5 %)	4.63 miles 477 ACSR Reconductor [2025] Accelerated 7 Years

TABLE B (continued)
DUKE ENERGY CAROLINAS
SUMMARY OF POTENTIAL RELIABILITY ISSUES
2019 SUMMER PEAK

	Element	Contingency	Potential Issue	Potential Solution
D05	Parkwood 500/230 kV Transformer 5	Harris Gd (TRM) Parkwood 500/230 kV Transformer 6	Loading (101.2 %)	New Operating Procedure [2019] Trips Parallel Bank Accelerated 6 Years
D06	Ashe St-Durham 100 kV Line 1 (Ashe St White)	Harris Gd (TRM) Parkwood-Pleasant Garden 500 kV Line 1 (Parkwood)	Loading (94.3 %)	3.26 miles 477 ACSR Reconductor [2023] Accelerated 5 Years
D07	Morning Star-Newport 230 kV Line 1 (Sandy Ridge)	McGuire 1 Gm Richmond-Richmond Reactor 500 kV Line (Richmond)	Loading (98.7 %)	33.59 miles 954 ACSR Add Second Circuit [2026] Accelerated 5 Years
D08	Glen Raven-Burlington Tap B/W 100 kV Line 1 (Alamance)	Harris Gd (TRM) Glen Raven-Mebane W/B 100 kV Line 1 (Alamance)	Loading (100.9 %)	3.15 miles 2-477 ACSR Reconductor [2022] Accelerated 3 Years

TABLE B (continued)
DUKE ENERGY CAROLINAS
SUMMARY OF POTENTIAL RELIABILITY ISSUES
2019 SUMMER PEAK

	Element	Contingency	Potential Issue	Potential Solution
D09	Horseshoe-Asheville Hwy White 100 kV Line 1 (Echo)	Cliffside 5 Gm Horseshoe-Hendersonville Black 100 kV Line 1 (Echo)	Loading (95.6 %)	5.38 miles 477 ACSR Reconductor [2022] Accelerated 3 Years
D10	Morning Star-Union EMC 9 B/W 100 kV Line 1 (Indian Trail)	Robinson 2 Gd (TRM) Monroe-Morning Star W/B 100 kV Line 1 (Indian Trail)	Loading (90.1 %)	5.40 miles 2-366 ACSR Reconductor or New Switching Station [2026] Accelerated 2 Years
D11	Harrisburg-McGuire White 230 kV Line 4 (Mecklenburg)	Robinson 2 Gd (TRM) Harrisburg-McGuire Black 230 kV Line 3 (Mecklenburg)	Loading (103.0 %)	16.98 miles 1272 ACSR Reconductor or Line Reactors [2027] Accelerated 2 Years
D12	Wylie Hydro-York EC 16 100 kV Line 1 (Weddington)	McGuire 1 Gm Morning Star 230/100 kV Transformer and Morning Star-Newport 230 kV Line 1 (Sandy Ridge)	Loading (90.1 %)	1.47 miles 2-477 ACSR Reconductor or New Switching Station [2026] Accelerated 2 Years

TABLE B (continued)
DUKE ENERGY CAROLINAS
SUMMARY OF POTENTIAL RELIABILITY ISSUES
2019 SUMMER PEAK

	Element	Contingency	Potential Issue	Potential Solution
D13	North Greensboro-Kildare Tap Black 100 kV Line 1 (Graham)	Dan River CC Gm North Greensboro-Glen Raven White 100 kV Line 1 (Graham)	Loading (105.7 %)	3.38 miles 954 ACSR Reconductor [2028]

TABLE C
SOUTH CAROLINA ELECTRIC AND GAS
SUMMARY OF POTENTIAL RELIABILITY ISSUES
2019 SUMMER PEAK

Element	Contingency	Potential Issue	Potential Solution
No Issues Found	-	-	-

TABLE D
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
SUMMARY OF POTENTIAL RELIABILITY ISSUES
2019 SUMMER PEAK

	Element	Contingency	Potential Issue	Potential Solution
C01	Perry Road-Myrtle Beach 115 kV Line 1	Base Case Perry Road-Myrtle Beach 115 kV Line 2	Loading (92.5%)	5.40 miles 556 ACSR Reconductor [2022]

FIGURE A
POTENTIAL PROJECTS